

Use of Accounting and the Efficiency of Microenterprises in Mexico

Denise de la Rosa
Grand Valley State University

Dennis Ortiz
The University of Texas Rio Grande

Rafael Otero
The University of Texas Rio Grande

This study focuses on the technical efficiency of Mexican microenterprises. We estimate a stochastic frontier production with inefficiency effects model to determine the effect on the efficiency of Mexican microenterprises to achieve profits by using data from Mexico's 2010 National Survey of Microenterprises (Encuesta Nacional de Micronegocios, ENAMIN). The findings indicate that about half of the surveyed microenterprises have no accounting system in place, with the majority of those remaining split between using an outside accountant, and an in-house notebook. Microenterprises using an outside accounting service were more efficient at achieving profitability than those firms with no accounting system.

INTRODUCTION

The World Bank Group's mission is to end extreme poverty. In doing so, programs implemented to increase shared prosperity are based on the development of employment growth in countries across the globe. The World Bank's conference on Development Economics 2015 in Mexico City (June 15-16) continued the theme from previous conferences and focused on its mission by exploring finance, productivity, economic development, governance, infrastructure and the development of legal systems as instruments in the fight against poverty. In the center of this economic development is accounting which can serve as an instrument of program success.

Entrepreneurial activity is seen as the engine for change and increased employment world-wide. Micro-, small- and medium-sized entities (MSME) represent an important part of this entrepreneurial activity and their increase in numbers can ameliorate extreme poverty by broadening their scope of economic activities (Ayyagari, et al., 2007; De Soto, 1989). From Canada (Audet and St. Jean, 2007) to Thailand, Malaysia, Singapore, and Taiwan (Wonglimpiyarat, 2012) to Fiji and Tonga (Naidu and Chand, 2011) and Peru (Banerjee and Duflo, 2007; DeSoto, 1989), researchers have examined how firm characteristics and environmental conditions influence economic development and job creation.

Ayyagari, et al. (2007) examine how small and medium-sized entities (SME) contribute to GDP and employment in manufacturing over a wide range of countries. They include not only the size of the SME but an estimate of the informal sector as well. For Mexico, they calculate the informal economy as an

average over the 1990s at more than 38% of gross domestic product (GDP). In contrast, the averages for Mexico's northern neighbors, the United States and Canada, are both about 12% of GDP; but because of measurement difficulties, there really is no consensus on the actual size. Schneider and Enste (2000) estimate 40-60% of economic activities in the 1990s to be part of Mexico's informal sector. Although still high, those estimates later change (1999-2007) to 30% (Schneider, et al., 2010). In 2015, the International Labor Organization estimated that 60% of Mexican workers had informal jobs in spite of efforts by the Mexican government to decrease informal employment.

Business activities are organized to deliver the goods and services that society's members need or desire. These activities provide the basis for economic prosperity and well-being across the globe. A better understanding of the results of business activities in both the formal and informal economy can assist in measuring the success and failures of economic activities and provide the basis for improvement and future employment.

Accounting represents the communication of financial information of business entities. Most introductory accounting texts begin with a discussion of the role of accounting in business (e.g. Warren, et al., 2015; Porter and Norton, 2015). At its essence, accounting is an information system that provides information to users regarding the economic performance and financial condition of the business. Accounting includes the process of identifying, measuring, and conveying the economic information to interested parties. The accounting system allows for the organization and aggregation of financial data into a useful format in determining the profitability of entities. The nature of the information provided by the accounting system can be either mandatory or discretionary depending on the end user of the information (Romney and Steinbart, 2011). For formally established businesses, there is at a minimum the external mandatory accounting information required by government agencies for tax compliance, but all business may require accounting services to satisfy external parties to document routine business transactions and to comply with possible external financing requirements. Discretionary information is produced by the accounting system for internal decision purposes to make the firm more efficient. Since discretionary accounting information is not required, an important consideration to pay for it is that its benefits in performance outweigh its cost.

Our research examines the use of accounting services by formal and informal microenterprises in Mexico and the relationship of the choice of accounting system to technical efficiency and profits. These choices provide insight into the current level of development, profitability and sophistication of these entities. A benefit of the data on which our study is based is the ability to directly compare across broad industry classes. Since both formal and informal firms can benefit from discretionary accounting services, independent of mandatory reporting, the purpose of this study is to identify the use of accounting services and its relationship in producing profits.

This study is organized as follows. First, we provide the literature review related to the use of accounting information by MSME. We then describe the methodology, and a section that discusses the data and the variables used in this study, followed by our results and conclusions.

USE OF ACCOUNTING INFORMATION IN MSME

The Argiles and Sloff (2003, 2001) study of Spanish farms makes an important inroad in terms of understanding the MSME relationship between accounting data and firm performance. The authors found that although the use of accounting reports in the decision-making process by farmers was not the primary influence in the firm's performance, they did find a significant relationship between the use of those financial reports by farm managers and improved business performance, and that this link was persistent across three performance measures: output, efficiency and profitability. It seems that when the accounting information is available, farmers were more likely than not to use it for decision-making and tax filing (Argiles and Sloff, 2001). The authors, however, question why it is that if accounting information is believed to be useful as a decision tool, firms that are not required to produce financial statements don't do so voluntarily.

Jay and Schapter (2003) study Australian microbusinesses and the advisory services that they choose to use. Their survey provides evidence that the most important advisors that these entrepreneurs seek are accountants and bankers. Although the importance of the role of accounting has been documented many times in the value relevance literature to varying degrees (Jones and Smith, 2011; Suijs, 2008; Lev and Zarowin, 1999; Francis and Schipper, 1999), the research is focused on publicly traded companies where the ability of earnings to explain returns as the appropriate measure of the usefulness of accounting is underscored. The main reason for accounting researchers to study listed firms is the availability of accounting and financial information as a result of statutory requirements. The transfer of the value relevance research to microenterprises is impeded by the lack of market returns and the availability of accounting information; however, the usefulness of accounting should be appropriately the same. Financial statements should be able to explain the credit-worthiness, liquidity and solvency of microenterprises and assist in the decision-making process (Porter and Norton, 2015); however, microenterprises are difficult to study in any context because of the lack of financial data. In many cases, gaining access to reliable financial data is impossible (Ceballos-Santamaria and Villanueva-Alvaro, 2014). Nevertheless, Ceballos-Santamaria and Villanueva-Alvaro (2014) obtained the 2006 balance sheet and the income statement of 1,354 microenterprises in the province of Cuenca (Spain). This was possible because in some countries formal businesses must file their financial reports with the government. In Spain, these companies file with the Register of Companies, and the government allows researcher access to this information. Ceballos-Santamaria and Villanueva-Alvaro (2014) obtained the information from a database provided by Informa, S.A. After examining the statements, the authors concluded that the profits of these microenterprises were “too low,” representing a meager 0.67% of sales. The authors attributed the low level of profits to tax strategies and managing payments to the general social security system.

Another study, measuring microenterprise profits, determined that asking two survey questions, one about revenues minus expenses, and the second about income, produces two different results (de Mel, et.al., 2009). The authors find that the reported profit is considerably higher than the commensurate measure of income based on the revenues minus expenses. They attribute the gap between the two measures of success to recall errors and a deliberate underreporting of revenues and overstatement of expenses. Another issue that clouds the measurement results is the comingling of resources. De Mel, et al. (2009) include 618 enterprises in the retail and manufacturing industries with no employees and find that the line becomes blurred between the two economic entities, the owner and the business.

While very little research has been conducted on accounting's role in microenterprises, the relationship of microenterprises and credit institutions has received credible treatment that provides us with certainty that the lack of financing sources is a barrier to success for existing microenterprises and the creation of new ones. One of USAID's major tenets around the world is to encourage the development of local channels of financing in developing countries for entrepreneurs. Access to financing is seen as a major barrier to reducing poverty and increasing employment potential that is self-sustaining.

De Mel, et al. (2008) provide evidence of how important access to financing can be. The authors conduct an experiment with Sri Lankan microenterprises that demonstrates how random cash or in-kind grants increase profits of these microenterprises by 5% per month. A similar experiment was conducted in Mexico (McKenzie and Woodruff, 2008). Results demonstrated similar patterns in the increase in profits to those microenterprises receiving the cash or in-kind grants. Hernandez-Trillo, et al. (2005) find that technical efficiency increases when microenterprises have access to bankers, bank loans, and adequate start-up capital.

METHODOLOGY

Translog Production Function

This study utilizes two data analysis methods. In order to determine technical efficiency effects, we use a translog production model. To facilitate interpretation of coefficients in order to discuss effects in practical terms, we employ a simple OLS regression model.

In general, there are two models normally considered appropriate for this type of cross-sectional analysis, the more restrictive Cobb-Douglas production function with inefficiency effects and the translog production function with inefficiency effects. The Cobb-Douglas for the i th firm is specified as:

$$\ln\text{PROFIT}_i = \beta_0 + \beta_1 \ln K_i + \beta_2 \ln L_i + \theta' X_i + v_i - u_i \quad (1)$$

and the stochastic frontier production function with inefficiency effects described by Battese and Coelli (1995) for the i th firm can be expressed as:

$$\ln\text{PROFIT}_i = \beta_0 + \beta_1 \ln K_i + \beta_2 \ln L_i + \beta_3 \ln^2 K_i + \beta_4 \ln^2 L_i + \beta_5 \ln K_i \ln L_i + \theta' X_i + v_i - u_i \quad (2)$$

In both equations (1) and (2), $\ln\text{PROFIT}$ is the log of the monthly profit (PROFIT) in Mexican pesos; $\ln K$ is the log of the estimated 2010 market value in Mexican pesos of the total capital equipment used in production (K), such as tools, machines, equipment, furniture, vehicles, land, and buildings; $\ln L$ is the log of the sum of the number of hours worked per week by the owner and employees (L); β s are parameters to be estimated; X is a vector of control dummy variables for geographic regions and industries of Mexico with its estimated θ vector of parameters.

The v_i is a random error term, independent of u_i , and we assume $v_i \sim \text{iid } N(0, \sigma_v^2)$. v_i accounts for measurement error as well as variables missing from the production function. Finally, for u_i we assume $u_i \sim N(\mu_u, \sigma_u^2)$, where the mean of the distribution is given by a set of firm-related variables to be analyzed for technical inefficiency ($\mu_u = \delta' Z_i$). The variance parameters are estimated replacing σ_v^2 and σ_u^2 with $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$ (Battese and Corra 1977).

In order to investigate the technical inefficiency of different accounting system options for microenterprises, as well as other sources of technical inefficiency, u_i is specified in equations (1) and (2) above as:

$$u_i = \delta' Z_i + w_i \quad (3)$$

where Z represents a vector with the variables we intend to analyze for technical inefficiency with δ as a vector of inefficiency parameters estimated in the model, and w as the error with a truncated normal distribution with mean of zero, variance of σ^2 , and truncated at $-\delta' Z_i$ (De Vries, 2010; Coelli et al., 2005). Equation (3) is also expressed as follows:

$$u_i = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \dots + \delta_{15} Z_{15i} + w_i \quad (4)$$

The stochastic frontier translog production function coefficients (β s and θ s) and the technical efficiency parameters (δ s) in equations (2) and (4) above are estimated jointly using the maximum likelihood method with variance parameters σ^2 and γ as specified above (Battese and Coelli, 1995; Kumbhakar and Lovell, 2000; Diaz and Sanchez, 2008). We discuss our choice of stochastic profit frontier, as well as technical inefficiency effects variables in the Data and Variables in the following section of this paper.

Our methodology uses observations in the sample that produce the optimal level of output (i.e., profits for the given inputs) to create the production frontier. Microfirms achieving optimal output are technically efficient and are on the frontier. Less efficient firms do not reach the frontier, and their inefficiency is measured by the distance between the observed output of the individual firm and its potential output point (based on resources/inputs). Although not used in this analysis, technical efficiency has been measured by the individual firm's observed output divided by the corresponding (efficient) output on the frontier (Diaz and Sanchez, 2008).

OLS Model

Although results are not used (and thus, not reported), we also use the following multivariate model to estimate an OLS regression:

$$\text{PROFIT} = \beta_0 + \beta_1 \text{CAPVAL} + \beta_2 \text{LABOR} + \beta_3 \text{CAPVAL}^2 + \beta_4 \text{LABOR}^2 + \beta_5 \text{CAPVAL} * \text{LABOR} + \beta_6 \text{NORTHERN} + \beta_7 \text{CENTRAL} + \beta_8 \text{SERVICE} + \beta_9 \text{COMMERCE} + \beta_{10} \text{CONSTRUC} + \beta_{11} \text{EDUC} + \beta_{12} \text{YRSINBUS} + \beta_{13} \text{TRAINING} + \beta_{14} \text{FEMALE} + \beta_{15} \text{AGE} + \beta_{16} \text{MARRIED} + \beta_{17} \text{FORMAL} + \beta_{18} \text{ACCOUNT1} + \beta_{19} \text{ACCOUNT2} + \varepsilon.$$

In this model, our variables of primary interest are the indicators of accounting service type with ACCOUNT1 representing use of an outside accounting service, and ACCOUNT2 representing use of an accounting notebook by the microbusiness. Multivariate analysis allows us to observe the impact of accounting services on firm profits partialling out the effect of the other control variables.

DATA AND VARIABLES

This study uses data from the 2010 National Survey of Microenterprises (*Encuesta Nacional de Micronegocios*, ENAMIN). When the Mexican federal government conducts the National Employment and Occupation Survey (*Encuesta Nacional de Ocupación y Empleo*, ENOE), it includes information about each household member twelve years of age or older. Every household member declaring to be self-employed or to own a microenterprise (i.e. a non-farming business employing up to 15 workers in the manufacturing sector or up to 10 workers in construction, commerce, or service, that person completes the ENAMIN questionnaire (INEGI 2010a).

A definite advantage of the ENAMIN survey using the household as the original sampling unit is that it facilitates the collection of information regarding microenterprises which operate in the informal sector and which may operate from a home without a separate business location. According to INEGI (2010b) in 2010, there were estimated to be 8,353,649 microbusinesses in Mexico employing some 13.6 million people. The full 2010 ENAMIN sample of 26,826 microenterprises includes basic economic, financial, and demographic data. Of these, (after excluding unusable observations) we end up with 11,856 microfirms in our sample representing microenterprises from all parts of Mexico. The year 2010 was the first time that INEGI included rural households in their survey of microfirms. Prior to 2010, only those in large metropolitan areas had been surveyed.

Table 1 provides the mean and standard deviation for variables used to estimate our model. Listed first are the variables used to create the stochastic frontier. Listed next are variables analyzed for technical efficiency effects.

Descriptive Statistics of Variables Used to Create the Stochastic Frontier

Microbusinesses in our sample report their average monthly *Profit* for 2010 in Mexican pesos. *Capital* reports the value of productive assets of the business at the time of the survey in Mexican pesos. *Number of Workers* includes the owner.

Most of the microbusinesses in the sample were located in the *Central States* (which includes Mexico City). Although not noted in the descriptive statistics shown in Table 1, the *Southern States* have a larger proportion of microbusinesses in the informal sector than in the formal sector. These informal firms are associated with lower profits and productivity, as well as increased poverty levels.

In terms of industry, most microbusinesses in the sample were in the *Service Industry* and *Commerce Industry*. Although once again not noted in Table 1, a disproportionately large percentage of firms in these two sectors are formal.

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TABLE 1
DESCRIPTIVE STATISTICS

<i>Variable</i>	<i>Mean</i>	<i>s. d.</i>
Profit (in Mexican pesos)	5,674	8,513
Capital Valuation (in Mexican pesos)	68,390	304,631
Number of Workers	1.75	1.25
Northern States (1=Yes; 0=No)	0.29	0.45
Central States (1=Yes; 0=No)	0.43	0.49
Southern States (1=Yes; 0=No)	0.29	0.45
Service Industry (1=Yes; 0=No)	0.43	0.49
Commerce Industry (1=Yes; 0=No)	0.31	0.46
Construction Industry (1=Yes; 0=No)	0.10	0.30
Manufacturing Industry (1=Yes; 0=No)	0.17	0.37
Years of Schooling of Owner	8.95	4.60
Years in Current Business of Owner	10.17	9.95
Training in 2010 (1=Yes; 0=No)	0.12	0.33
Female Owner (1=Yes; 0=No)	0.39	0.49
Age of Owner	44.33	12.83
Married Owner (1=Yes; 0=No)	0.75	0.43
Formal Sector (1=Yes; 0=No)	0.37	0.48
Accounting Services (1=Yes; 0=No)	0.23	0.42
Notebook Only (1=Yes; 0=No)	0.18	0.38
No Accounting Records (1=Yes; 0=No)	0.60	0.49
N	11,856	

Descriptive Statistics of Variables Analyzed for Technical Efficiency Effects

Variables analyzed for technical efficiency effects represent the following general aspects of the microenterprise: human capital variables, personal characteristics of owner, formal versus informal sector, and accounting system/method. Human capital of microbusiness owners and workers is represented by *Years of Education of Owner*, *Years in Business of Owner*, and *Training Received by Owner and Workers* during the year of the survey.

The microenterprise owner's personal characteristics modeled here are gender (*Female Owner*), *Age of Owner*, and marital status (*Married Owners*). Where the literature is clear regarding the expected effect of gender (female owned firms are expected to be less efficient), the expected effect of age could depend on the context/age range (for example, where one might generally associate experience/age with greater profitability, for some work, and over an upper age range, being younger/physically stronger might be advantageous). Similarly, marital status could work in either direction depending on the circumstance.

In the present study, the *Formal Sector* variable is coded 1 if the microenterprise is registered with the government, or 0 otherwise. In our sample, 37% of firms operate in the formal sector compared with 41% according to official second quarter 2013 ENOE survey results conducted by the INEGI. This proportion varies widely across states with the poorer southern states being far less formal (for example the southern state of Oaxaca's labor force is 39.5% formal, while that of the northern state of Nuevo Leon is more than 81% formal (INEGI 2013a; 2013b). Even though the Mexican government does not collect taxes from informal firms, unlike the United States, informality is largely tolerated in Mexico for practical as well as political reasons.

In terms of accounting records, close to 60% of microfirms in Mexico do not keep any accounting record. Only about 20% use a notebook, and another 20% use professional accounting services. A primary purpose of this study is to gain insight into how the form of accounting recordkeeping might be tied to microfirm profitability.

RESULTS

Likelihood-Ratio Test

In order to test the null hypothesis that there are no technical inefficiency effects ($H_0: \gamma = 0$) we compute the variance parameter gamma (γ). Utilizing a generalized likelihood ratio (LR) tests (Coelli et al., 2005), we are able to reject H_0 at the 1% significance level. γ provides the proportion of the total error term due to inefficiency effects. Our model produced a γ value of .649 indicating a statistically significant proportion of the total error term due to inefficiency effects. From this, we are able to conclude that in our sample, approximately 64.9% of the total residual variation in firm profitability is related to technical inefficiency, and the remaining 35.1% ($100\% - 64.9\% = 35.1\%$) is due to unspecified influences such as measurement error and other random forces or unforeseen events not specified in our model (Hernández-Trillo et al., 2005). In addition, rejecting this null hypothesis indicates that the stochastic frontier function with inefficiency effects is a better representation of the frontier profit function than a regular OLS estimate (Diaz and Sanchez, 2008).

Translog Stochastic Frontier Function

In Table 2, we see the translog stochastic frontier models with technical inefficient effects estimated using our sample of microenterprises. With the exception of the interaction of natural log of labor with natural log of capital, each of the other variables used to construct the frontier (*Ln Capital*, *Ln Labor*, *Ln Capital Squared*, *Ln Labor Squared*, the set of regional dummies with southern states as the reference group, and the set of industry dummies with manufacturing as the reference group) is individually highly significant.

Translog Technical Inefficiency Effects

Having established our stochastic frontier, we proceed with analysis of our technical inefficiency effects variables. Of the potential factors effecting firm efficiency, the literature (including, for example, Hernandez-Trillo, et al., 2005) identifies several variables which we have available and include in the second stage of our analysis. Interpreting coefficients on the variables included in the technical inefficiency effects part of the model warrants some explanation at the outset. The reader should keep in mind that as the name indicates, these variables represent inefficiency effects, and as such, a positive coefficient is interpreted as increasing inefficiency. This may be confusing because these signs are opposite of those in the first stage of the analysis (i.e., the translog stochastic frontier) where a positive sign indicates the magnitude of the coefficient increases as firm efficiency also increases. In other words, the concept of "inefficiency" is somewhat counterintuitive, and requires the reader to remember this interpretation.

TABLE 2
TRANSLOG STOCHASTIC FRONTIER FUNCTION

	<i>Coeff.</i>		<i>s. e.</i>
<i>Frontier</i>			
Constant	6.871	***	0.112
Ln Capital	0.232	***	0.024
Ln Labor	0.261	***	0.072
Ln Capital Squared	-0.004	***	0.001
Ln Labor Squared	0.112	***	0.026
Ln Capital x Ln Labor	-0.011		0.008
Northern States (1=Yes; 0=No)	0.110	***	0.019
Central Sates (1=Yes; 0=No)	0.090	***	0.018
Service Industry (1=Yes; 0=No)	0.204	***	0.021
Commerce Industry (1=Yes; 0=No)	0.116	***	0.023
Construction Industry (1=Yes; 0=No)	0.553	***	0.030
<i>Technical Inefficient Effects</i>			
Constant	0.370	***	0.126
Years of Schooling of Owner	-0.041	***	0.004
Years in Current Business of Owner	-0.011	***	0.002
Training in 2010 (1=Yes; 0=No)	-0.174	***	0.053
Female Owner (1=Yes; 0=No)	0.862	***	0.053
Age of Owner	0.011	***	0.001
Married Owner (1=Yes; 0=No)	0.051		0.032
Formal Sector (1=Yes; 0=No)	-0.157	***	0.039
Accounting Services (1=Yes; 0=No)	-0.700	***	0.070
Notebook Only (1=Yes; 0=No)	-0.221	***	0.040
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	0.941		0.039
$\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$	0.649		0.020
Log likelihood function	-14,131		
n	11,856		

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

Technical Efficiency Effects of Human Capital Variables

We include *Years of Schooling of Owner*, *Years in Current Business of Owner*, and *Training 2010* in the model as human capital variables to analyze their technical efficiency. These training and experience factors are generally expected to affect firm efficiency positively. Hernández-Trillo et al. (2005) found the owner's level of education, owner's years of experience, as well as the amount of training received by the owner and workers to all be positively correlated with technical efficiency of Mexican microfirms.

Table 2 indicates that all three of our human capital variables are statistically significant with negative signs. Interpreting this result, we conclude that training, education, and experience are negative technical inefficiency factors, or in other words, are positive technical efficiency factors. Therefore, microfirms whose owners have more years of formal education, whose owners have more years of experience in the

current business, or whose owners received training in 2010, are more technically efficient at making the firm profitable.

The coefficient for *Years of Schooling of Owner* (-.041) indicates that for each additional year of schooling for the business owner, firm profitability increased by 4.1%. The coefficient for *Years in Current Business of Owner* (-.011), indicates that for each additional year of owner's experience in the current business, firm profitability increases by 1.1%. Finally, we interpret the coefficient for *Training in 2010* (-.174) as indicating that firms whose owner received training during 2010 were 17.4% more profitable than those firms whose owners did not receive such training.

Technical Efficiency Effects of Owner's Personal Characteristics

To determine the effect of personal characteristics of the owner on firm efficiency, we include in the model gender (*Female Owner*), age (*Age of Owner*), and marital status (*Married Owner*). Female owned microbusinesses have been shown throughout the literature to be associated with increased technical inefficiency. Hernández-Trillo et al. (2005) found reduced efficiency in Mexican microbusinesses owned by females, which is consistent with the Bruhn (2009) study. Although studies show female gender as being associated with negative efficiency effects, this relationship result has been mixed across the literature depending on the context. For example, in the context of small Nepalese rice farming operations, Dhungana et al. (2004) found female management to be associated with increased efficiency measures. The study cites other studies with similar and conflicting results.

Our coefficient for *Female Owner* (.862) is large, positive, and statistically significant. This result indicates that a firm with a female owner tends to be 86.2% less technically efficient than one owned by a male holding all other factors in the model constant.

Although Hernández-Trillo et al. (2005) chose not to include age of owner as a variable in their model, Coelli and Battese (1996) find age of the primary decision-maker/owner positively correlated with small firm efficiency.

The coefficient for *Age of Owner* (-.011) indicates that for each additional year of age, older owners tend to be 1.1% more efficient at making their microfirms more profitable. A more detailed examination of this variable might be expected to reveal efficiency effects which vary across the age spectrum. Further, the result might show an interaction with the variable *Years in Business of Owner* as well as *Years of Schooling of Owner*.

The coefficient on the variable *Married Owner*, did not prove to be statistically significant. Thus, marital status of the business owner is not a significant factor in the overall sample, but is a mildly significant factor among formal sector firms only.

Technical Efficiency Effect of Formal Sector Operation

Whether the microbusiness operates in the formal or informal part of the economy is a key factor. We measure formality based on the business owner's registration of the firm with the appropriate government authorities. In our sample, just over 62% of microbusinesses report operating informally. McDonald (2005) and others discuss the important role that informal businesses have in the Mexican economy. Hernández-Trillo et al. (2005) find the formal/informal sector to be statistically significant in its effect on Mexican microfirm technical efficiency with formal sector firms tending to be more efficient. We follow the established convention of coding the variable 1 for formal sector firms, and 0 for informal.

The coefficient for the variable *Formal Sector* (-.157) indicates that, as predicted, controlling for all other factors in the model, microfirms in the formal sector of the economy are 15.7% more technically efficient at achieving profitability than microbusinesses in the informal sector.

Technical Efficiency Effects of Accounting System/Method

Our variable of primary interest is the type of accounting system employed by the microbusiness. ENAMIN survey participants are asked how and whether accounting records are kept. The range of possible responses is: (1) use the services of an accountant or professional to keep the accounts, (2) only use a notebook to keep the accounts, (3) use the cash register of the Secretary of Finance, (4) accounting

is not done, or (5) decline to answer. About half of survey responses indicated no accounting system in place, with the majority of those remaining split between using an outside accountant, and an in-house notebook. Using no accounting system as our reference group, we create two dummy variables, one for *Accounting Service* and another for *Notebook only*.

The coefficient for *Accounting Service* (-.700) indicates that, compared with firms using no accounting system, those using the services of an accountant are 70% more efficient at producing a profit. Although not as dramatic a difference, the coefficient for *Notebook Only* (-.221) indicates that, compared with firms using no accounting system, those using their own notebook are 22.1% more efficient at producing a profit. The use of accounting services or notebook system is more efficient than no accounting at all. Based on the magnitudes of the two coefficients, use of an accountant's services is significantly more effective than the owner keeping her own notebook in terms of producing a profit.

CONCLUSION

This study focuses on the effect of accounting system on technical efficiency of microenterprises in Mexico. We use data from Mexico's 2010 National Survey of Microenterprises (ENAMIN) to estimate a stochastic production frontier with inefficiency effects model to determine the effect of microenterprise accounting system on its efficiency in achieving profits. The accounting system options of either an outside accounting service or an internally prepared accounting notebook are compared with no accounting system in place.

Descriptive statistics indicate that while 23% of sample firms use an outside accounting service, and 18% use their own notebook, the majority (60%) of microenterprises in Mexico use no formal accounting system. In terms of the effect of accounting system on firm profitability, after partialling out other known factors impacting profitability, microenterprises using an outside accounting service were 70% more efficient at achieving profitability than those firms with no accounting system, and those utilizing an internally prepared notebook for their accounting records were 23% more efficient at achieving profitability than the no-system group. This result leads us to the important conclusion that although the issue needs further study, it appears that the more formalized the accounting system, the more profitable the microenterprise.

Future research should attempt to further isolate the effect of accounting system on microenterprise profitability. This might include examining the differential effect of accounting system choice on various types of microenterprise. The bottom line appears to be that in general, the accounting system is a worthwhile investment for microenterprises.

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