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Microenterprise Origins and Efficiency in Mexico

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Abstract

This study focuses on the technical efficiency of microenterprises. We use data from Mexico's National Survey of Microenterprises to estimate a stochastic frontier production model, and we find that the reason the owner started the business is significant in explaining variations in the levels of technical efficiency. Those who inherited the business or started it because of family tradition initially ran more efficient operations. These owners may have benefited from better knowledge and contacts. Over time, however, those who started their businesses to increased their income or, because they could not find a job, became more efficient. We argue that these owners benefited from greater motivation to be successful.

Key words: microenterprises; technical efficiency; ENAMIN; Mexico

JEL classification: M13; L26

1. Introduction

The ability of a firm to use its resources efficiently can generally be traced to characteristics internal to the firm. In a microenterprise—where the main driving force is the owner of the business—the capacity to attain the optimum level of efficiency (i.e., output maximization) is primarily embodied in the owner. Therefore, both the human capital characteristics of the owner and his/her motivation associated with entrepreneurial activities play a key role in the success of the firm.

A microenterprise is classified as technically efficient if it is able to produce maximum output given available resources. Although there are several studies that have analyzed technical efficiency in different contexts (e.g., Kumbhakar et al., 1991;

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Battese and Coelli, 1995; Coelli and Battese, 1996), we are not aware of any studies that have analyzed the effect of motivation of the owner to start a business venture on technical efficiency. Most studies analyzing motivation concentrate on whether there is a link between motivation and competency, but they do not directly evaluate the motivation to start a business and its effect on efficiency. In order to understand the linkages between the motivation of the owner to establish a new business and the efficiency of his/her microenterprise, this paper estimates a stochastic frontier production model with inefficiency effects using data from Mexico's National Survey of Microenterprises.

The translog production function employed here includes capital equipment and labor as inputs, including higher order and interaction terms, and controls for sector and region. The possible sources of productive inefficiency included are the schooling of the owner, years in business, whether the firm operates in the formal or informal part of the economy,[1] the need for outside financing, and the motivation or reasons to start the business.

The paper is organized as follows. Section 2 discusses conceptual issues related to the theories of motivation, the learning curve, and microenterprise operations and efficiency. Section 3 introduces the methodology used for the analysis, and Section 4 discusses the data and empirical results. Section 5 provides concluding remarks.

2. Motivation, Learning Curve, and Microenterprise Operations

2.1 Motivation

Motivation, or lack thereof, has long been accepted to be an important cause of efficient and inefficient production (Leibenstain, 1966). The theory of motivation in the literature of industrial psychology is quite extensive. It includes the two-factor theory (Herzberg et al., 1959), intrinsic motivation theory (Deci, 1972, 1975), equity theory (Adams, 1963), expectancy theory (Vroom, 1964), and need theory (Maslow, 1943, 1954), among others (Kanfer, 1990).

Maslow (1943, 1954) first proposed that behavior is driven by a hierarchical set of needs: physiological needs, safety needs, needs for belongingness and love, esteem needs, and self-actualization needs. The most basic needs have to be satisfied before a person develops higher needs. Once the lower need is satisfied, its importance as a motivator of behavior declines. On the other hand, unfulfilled needs increase the level of effort to satisfy the desire. We can conclude, then, that individuals who have a greater need for income will exercise more effort and will likely be more productive (Goldsmith et al., 2000). This logic provides us with a model to explain the level of effort placed in a business endeavor based on the individual's initial state of need for success.

2.2 The Learning Curve

Firms increase their skills through the repetition of an activity (Tirole, 1988). This learning-by-doing effect has been positively linked to a firm's success in the

market (Fundenberg and Tirole, 1983, 1986), and the know-how acquired through experience has as much value as technological investments (Fundenberg and Tirole, 1983; Spence, 1981, 1984). The learning effect allows firms with experience to achieve lower per-unit production costs than competitors, giving them an early advantage. Over time, the firm increases output for the given inputs with the additional experience, but at a declining rate. As a result, the gains to experience occur faster initially. At the same time, the rate at which the learning-by-doing occurs has been shown to differ by industry (Mixon, 1993; Fundenberg and Tirole, 1986).

2.3 Microenterprise Operations

Microenterprises are usually defined in the development economics literature as firms employing a small number of workers (e.g., six or fewer employees). Edgcomb and Klein (2005) report that in the US in 2001 there were 20.7 million microenterprises employing more than 27 million individuals, or 16.6% of total private non-farm employment. In Mexico, the setting for this study, most urban microenterprises are owner-operated and employ an average of 1.4 workers (Hernández et al., 2005). Many microentrepreneurial activities are household and family based, and about half of these businesses operate in the informal part of the economy (Roubaud, 1995). 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 their scale of operation. Microenterprises are characterized by low productivity in developing countries, where microenterprises employ from 50% to 75% of the manufacturing workforce, yet only contribute about 25% of the value added (Perkins et al., 2001). Yet, microenterprises represent a vibrant segment of economies (Castro et al., 2004), providing jobs to the poor (De Soto, 1989; Schumacher, 1974), contributing to technological progress and the revitalization of economies (Zahra, 2005), and the creation of value for customers (Hitt et al., 2001).

Mexico provides an ideal setting for testing the determinants of the technical efficiency of microenterprises. These businesses have grown in number and importance in Mexico since the mid-1980s. Employment in firms with five or fewer workers increased from 38.6% of total urban employment in 1987 to 44.6% in the late 1990s (INEGI, 2000). As a result of this expansion, policymakers and international organizations are paying more attention to the promotion of microenterprises given the role these firms have in providing alternative employment opportunities and fueling economic growth. Supporting microentrepreneurship has become a cornerstone of domestic economic policy in Mexico. Therefore, gaining an understanding of the factors that are associated with microenterprise productivity is policy relevant, particularly since many developing countries have targeted programs devoted to small firm formation and development as an alternative form of employment generation (Wilson and Adams, 1994).

3. Methodology

To study the role that motivation to start a business could have on technical efficiency, a stochastic frontier production function with inefficiency effects proposed by Battese and Coelli (1995) was used. Specifically, the translog production frontier for firm *i* is given by:

$$lnQ_i = \beta_0 + \beta_1 lnK_i + \beta_2 lnL_i + \beta_3 lnK_i^2 + \beta_4 lnL_i^2 + \beta_5 lnK_i lnL_i + \delta' X_i + v_i - u_i, \quad (1)$$

where *lnQ* is the log of the value in Mexican pesos of monthly output, *lnK* is the log of the value in Mexican pesos of total capital equipment used in production (tools, equipment, machinery, vehicles, and other miscellaneous capital expenses), *lnL* is the log of the total number of workers, the β's are the parameters to be estimated, X_i is a vector of sector of the economy and geographical region controls, the δ's are the corresponding parameters, the v_i's are random errors assumed to be normally distributed with a zero mean and variance σ_v^2 and independent of the u_i's, and the u_i's are the non-negative technical inefficiency effects in the model, assumed to be random and to have a truncated normal distribution with mean μ_u and variance σ_u^2. The sector controls are included because the rate of learning through experience has been shown to differ by sector (Mixon, 1993; Fundenberg and Tirole, 1983, 1986).

The inefficiency effect (u_i) in (1) above can be made a function of business motivation as well as other factors:

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

where Z_i captures all the factors related to technical inefficiency for firm *i* and θ represents the parameters of the inefficiency effect equation. The error term *w* has a truncated normal distribution, just like the error term *u* in (1). The model parameters are obtained using the maximum likelihood method (Battese and Coelli, 1995; Kumbhakar and Lovell, 2000).[2]

Several factors have already been identified in the literature to be related to technical efficiency/inefficiency. Two of these factors include the number of years that the microenterprise owner has been in business and the years of schooling of the owner (Seyoum et al., 1998). A third is whether the business operates in the formal or informal part of the economy, measured here by whether the business is registered with the *Secretaría de Hacienda y Crédito Público* (SHCP), Mexico's federal agency in charge of fiscal issues. McDonald (2005) maintains that informal businesses are especially important in Mexico. A fourth factor is whether the business resorted to outside start-up financing (Hernández et al., 2005).

In this study we also include a set of different motivations or reasons to start a business. We argue that motivation factors could drive behavior because individuals with higher needs are likely to exercise more effort and, thus, become more productive (Maslow, 1954, 1943; Goldsmith et al., 2000). These different motivations are interacted with the owner's experience in the business to observe the effect that different motivations to succeed and the learning curve process have on the owner's technical efficiency.

4. Data and Results

We use firm-level data from the 1998 National Survey of Microenterprises (Encuesta Nacional de Micronegocios, ENAMIN). The sampling unit of the ENAMIN is the household. The Mexican federal agency Instituto Nacional de Geografía e Informática (INEGI) conducts a national survey of urban employment using a stratified random sample of households selected by socioeconomic status. If a member of the household is declared to be self-employed or to be the owner of a non-farming business that employs five or fewer employees, that person is selected for an additional personal interview using the ENAMIN questionnaire. Having a survey that uses the household as the sampling unit allows the interviewer to collect information from owners of microenterprises that operate in the informal sector (not registered with the Secretaría de Hacienda y Crédito Público, SHCP, Mexico's fiscal authority) and who may operate from home without a physical business place. The ENAMIN includes basic economic, financial and demographic data for 14,030 microenterprises in Mexico. After excluding observations with missing values in any of the variables, the sample falls to 9,719 firms. The sample is representative of microenterprises in all urban areas in Mexico with more than 100,000 inhabitants. 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. This data set is unique in that it has information on whether the business is formal or informal and on the motivation of the owner to establish the business: to become independent, due to inheritance or family tradition, as an additional source of income, or because the individual could not find another job.

Table 1 presents descriptive statistics for the sample employed to estimate the stochastic frontier model. Many of the businesses in the sample come from the group of states located in central Mexico (38.9%), but significant numbers were located along the US-Mexico border or in northern or southern states. Slightly more than half of the firms were in the service sector, 32.4% in commercial activities, and 14.9% in the manufacturing sector. The microenterprise owners had been in business on average for 8.4 years and their mean educational attainment was 7.6 years. About 75% of firm owners started their businesses to increase their income, 6.3% did so to continue with the family business, 15.6% because they could not find a job, and 3.6% started the microenterprise to become independent.[3] Only about 39% of urban microenterprises operated in the formal part of the economy in the sense that they were registered with the SHCP.

Most microentrepreneurs (66%) used their own resources or savings for start-up capital. The remaining 34% used outside sources such as credit from savings and 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 service, manufacturing, and commerce sectors reveals that service sector microenterprises produced the most output, but the commerce sector used the most capital and labor. Service sector firms' owners had more education

and experience, which may help explain their higher monetary output. We can infer from this that the human capital of the owner is a key component for the success of a microenterprise.

Table1. Descriptive Statistics

	Full Sample		Services		Manufacturing		Commerce	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Output	1,492.19	240.33	1,711.29	247.33	1,169.11	217.47	1,335.42	229.53
Capital	5,913.54	1,781.89	5,420.81	1,591.94	5,250.09	1,522.44	7,186.79	2,270.96
Labor	1.397	2.040	1.338	2.156	1.453	2.168	1.471	1.814
Northern States	0.143	0.350	0.148	0.355	0.151	0.358	0.132	0.339
Central States	0.389	0.480	0.369	0.482	0.395	0.489	0.421	0.494
Southern States	0.184	0.388	0.179	0.384	0.235	0.424	0.169	0.375
Border States	0.214	0.410	0.242	0.429	0.156	0.363	0.195	0.396
Years of Schooling of Owner	7.636	4.716	7.955	4.992	7.190	4.265	7.320	4.405
Years in Business	8.352	9.090	9.329	9.474	8.907	9.893	6.509	7.682
Registered with SHCP	0.389	0.488	0.355	0.479	0.272	0.445	0.498	0.500
Outside Financing	0.341	0.474	0.361	0.480	0.307	0.460	0.250	0.468
Family Tradition	0.063	0.243	0.051	0.226	0.081	0.273	0.070	0.255
Increase Income	0.745	0.436	0.732	0.443	0.764	0.425	0.750	0.429
No Other Job	0.156	0.363	0.172	0.378	0.123	0.329	0.144	0.352
Manufacturing	0.149	0.560						
Commerce	0.324	0.468						
n	9,719		5,123		1,444		3,152	

Table 2 reports the results of estimating the stochastic frontier model with inefficiency effects using (1) and (2). Four specifications were estimated. The first included the full sample, and the second, third, and fourth were for the service, manufacturing, and commerce sectors in order to account for the possibility of biases due to differences across sectors. The model was estimated using FRONTIER. 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.[4]

All four models reject the null hypothesis of no technical inefficiency effects.[5] Therefore, the value of γ is concluded to be greater than zero. The variance parameter estimate for the full sample (γ=0.845) suggests that a relatively large portion of the residual variation in the output of firms is related to technical inefficiency and only about 15% is due to random error, such as measurement error and other random factors not incorporated in the variables included here (luck, weather, unforeseen events, etc.). The proportion of residual variation due to technical inefficiency is even larger in the service (92%) and manufacturing sectors (90%). Inefficiency is not as bad in the commerce sector (36%).

The results for the technical inefficiency effects suggest that years of schooling are negatively related to inefficiency in all three sectors. That is, owners with more education have a higher ability to use resources efficiently. The years in business (experience) seems to be beneficial only in the services sector of the economy; it is not statistically significant for the manufacturing and commerce sectors. Formal microfirms are more efficient than those in the informal part of the economy. This is especially true for microenterprises in the manufacturing sector. In the full sample, we observe that business owners who inherited or established their business because of family tradition ran more technically efficient operations initially than those with other motivations to start their businesses. But we can also observe that that initial advantage dissipated faster for those who inherited their business than for the other entrepreneurs. The interaction term for "years in business" by "family tradition" is positive and the largest.

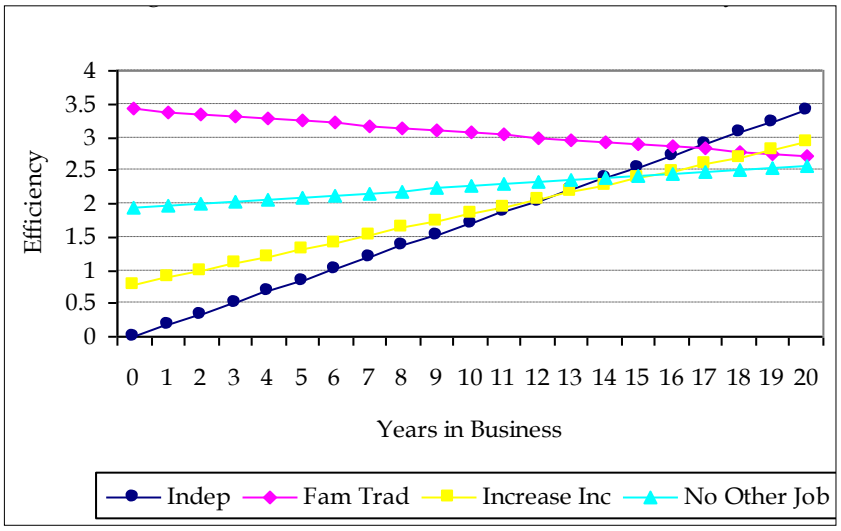
Table 2. Stochastic Frontier Results with Years in Business Interaction Effects

	Full Sample		**Services**		**Manufacturing**		**Commerce**	
Frontier	**Coeff.**	**SE**	**Coeff.**	**SE**	**Coeff.**	**SE**	**Coeff.**	**SE**
Constant	6.047***	0.091	6.244***	0.123	4.858***	0.210	6.322***	0.208
Ln Capital	0.318***	0.016	0.266***	0.024	0.422***	0.042	0.325***	0.028
Ln Labor	−0.291***	0.093	−0.074	0.127	0.468***	0.202	−0.864***	0.174
Ln Capital Squared	−0.011***	0.001	−0.008***	0.001	−0.014**	0.002	−0.013***	0.001
Ln Labor Squared	0.186***	0.044	0.186***	0.063	−0.052***	0.087	0.295***	0.093
Ln Capital x Labor	0.053***	0.009	0.126**	0.013	0.023	0.022	0.092***	0.017
Northern Stares (1=Yes; 0=No)	0.086*	0.045	0.114*	0.058	0.124	0.118	0.012	0.083
Central States (1=Yes; 0=No)	0.004	0.040	0.017	0.053	0.127	0.110	−0.069	0.071
Southern States(1=Yes; 0=No)	0.010	0.044	0.079	0.057	0.049	0.114	−0.088	0.079
Border States (1=Yes; 0=No)	0.356***	0.043	0.383***	0.055	0.566***	0.119	0.241***	0.077
Manufacturing (1=Yes; 0=No)	−0.331***	0.029						
Commerce (1=Yes; 0=No)	−0.213***	0.022						
Technical Inefficient Effects								
Constant	0.505	0.510	−0.417***	1.139	−5.094***	1.973	2.008***	0.327
Years of Schooling of Owner	−0.246***	0.062	−0.239**	0.077	−0.124***	0.037	−0.102***	0.017
Years in Business	−0.170***	0.049	−0.228***	0.092	0.002	0.091	−0.078	0.060
Registered with SHCP (1=Yes;0=No)	−1.191***	0.306	−1.713*	0.602	−8.026***	2.576	−0.201***	0.076
Outside Financing (1=Yes;0=No)	−0.219***	0.082	−0.243***	0.129	0.628***	0.239	−0.070	0.087
Family Tradition (1=Yes;0=No)	−3.420***	0.946	−3.438**	1.290	−4.674**	2.198	−0.724*	0.386
Increase Income (1=Yes;0=No)	−0.744***	0.282	−2.306***	1.001	0.944	0.638	−0.100	0.290
No Other Job (1=Yes;0=No)	−1.937***	0.590	−3.305	1.251	−2.831***	1.703	−0.353	0.312
Years in Business X Family Tradition	0.205***	0.062	0.086	0.074	0.198	0.137	0.082	0.062
Years in Business X Increase Income	0.063**	0.031	0.112*	0.062	−0.103	0.080	0.047	0.057
Years in Business X No Other Job	0.138***	0.049	0.159**	0.075	0.142	0.130	0.068	0.059
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	3.790***	0.836	5.568***	1.751	6.126***	1.807	1.200***	0.097
$\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$	0.845***	0.033	0.918***	0.025	0.900***	0.031	0.355***	0.095
Log Likelihood Function	−13,532		−6,769		−2,035		−4,561	
n	9,719		5,123		1,444		3,152	

Notes: *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Figure 1 shows that microentrepreneurs who began their business to continue with a family tradition were more efficient initially, probably because they were ahead on the learning curve relative to those who started their businesses to become independent, to increase their income, or because they lost their job.

Figure 1. Years in Business and Technical Efficiency



5. Conclusion

Our results suggest that those microenterprises in which the owners inherited the business or established it to continue a family tradition were more efficient than those microenterprises that started because the owners were unable to find a job, wanted to increase their income, or sought to become independent. However, these efficiency advantages of microenterprises that began as a "family tradition" disappeared rather quickly as owners with other motivations to start their business accumulated more business experience. Graphically, this is represented with a steeper efficiency curve, which may over time surpass the efficiency of those owners with a family business (see Figure 1).

We argue that those who had the initial business knowledge because of family traditions and connections also had initial skills in the use of resources, markets, etc. From the start of operations, those continuing a family tradition know who are their suppliers and customers, tend to have a better knowledge of the workings of the market, and probably inherit pre-established contacts and connections. This is particularly relevant in Mexico, where family and business connections are especially important.

However, those who start a business to increase their income or to become independent eventually become more efficient than those begun via family traditions. These operators have taken advantage of opportunities they have found themselves

(Eckhardt and Shane, 2003; Shane, 2003), and they are likely to be more proactive and to take greater risks (Stewart and Roth, 2001; Wiklund and Shepherd, 2003). They have the motivation to become successful once they make up their early deficiency or lack of initial business skills. While owners inheriting their business are likely to have an early advantage, the higher motivation to succeed of those without a job, those trying to increase their income, and those attempting to become independent forces them to put more dedication in their endeavors. Those individuals with a higher need for income will apply more effort to become more productive.

Notes

1. Formally constituted businesses are registered with Mexico's fiscal agency, the *Secretaría de Hacienda y Crédito Público*. Informal businesses are not officially registered and do not generally pay taxes.
2. See Battese and Corra (1977) and Battese and Coelli (1993) for more information about statistical model specification and estimation approach.
3. 1−(0.745+0.156+0.063).1−(0.745+0.156+0.063).
4. A likelihood ratio test was conducted and the result shows that the translog model is a more appropriate specification than the Cobb-Douglas production function.
5. H_0: $\gamma=0$ versus H_1: $\gamma>0$.

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