

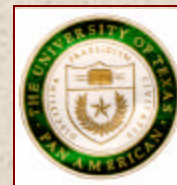
# Motivation, Learning-by-doing and Technical Efficiency in the Microenterprise Sector in Mexico



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**Working Paper #2002-18**  
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# **Motivation, Learning-by-doing and Technical Efficiency in the Microenterprise Sector in Mexico**

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**Abstract:** The paper analyzes the effects of motivation to start-up a business and learning-by-doing on the technical efficiency of microenterprises in Mexico. A stochastic frontier translog production function with inefficiency effects is estimated using data from the 1998 ENAMIN. The results show that 'family tradition' businesses are more efficient than those started up due to poor employment opportunities, to increase income or to become independent. However, efficiency advantages disappear as owners acquire more business experience. The results suggest that initial business knowledge resulting from family traditions/ connections provide an efficiency edge; however, disadvantages can be overcome by learning-by-doing and motivation.

JEL Classification: D21; L25; M13

*Keywords:* Motivation; Learning-by-doing; Microenterprises; Efficiency; Mexico

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## **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 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, Ghosh, and McGuckin, 1991; 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-up a business venture on technical efficiency. Most studies analyzing motivation concentrate on whether there is a link between motivation/commitment and competency or survival, but they do not directly evaluate the motivation to start-up a business and its effect on efficiency (e.g., ?stebro and Bernhardt, 2003). 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 microdata 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

industry 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 sector of the economy, the need for outside financing, and the motivation or reasons to start up the business (to be independent, due to family tradition, to increase income or because the individual could not find another job).

The paper is organized as follows. Section 2 discusses conceptual issues related to the theories of motivation, learning-by-doing and microenterprise efficiency. Section 3 introduces the methodological framework and Section 4 discusses the data and empirical results. Section 5 provides some concluding remarks.

## **2. Motivation, the learning curve and microenterprise operations**

### *2.1 Motivation*

Motivation, or lack thereof, has long been accepted to be an important determinant of efficient/inefficient production (Leibenstein, 1966). The academic literature on the theory of motivation is quite extensive. It includes the two-factor theory (Herzberg, Mausner and Snyderman, 1959), intrinsic motivation theory (Deci, 1972), equity theory (Adams, 1963), expectancy theory (Vroom, 1964) and the need theory (Maslow, 1943), among others (Kanfer, 1990).

Maslow (1943) first proposed that behavior is driven by a hierarchical set of needs (i.e., physiological needs, safety, belongingness and love, esteem and self-actualization). The most basic needs—e.g., eating—have to be satisfied before a person develops higher needs. Once the lower needs are satisfied, their importance as motivators of behavior declines. On the other hand, unfulfilled needs increase the

level of effort exerted to satisfy desire. Thus, individuals who have a relatively higher need for income will exercise more effort and will likely be more productive (Goldsmith, Veum and Darity, 2000).

The discussion above suggests that the level of effort exerted in a business endeavor is directly related to the individual's initial state of need for success. While many studies have analyzed the effects of employee motivation on the productivity of the firm, researchers have not determined the effects that motivation to start-up a microenterprise could have on the efficiency of the firm.

### *2.2 The learning curve*

Firms become more competitive 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. The know-how acquired through experience has as much value to the firm as investments in, for example, technology or capital (Fundenberg and Tirole, 1983; Spence, 1981).

The learning effect allows firms with experience to achieve lower per-unit production costs faster than its competition and, thus, firms gain an early advantage in the market. Over time, the firm increases its output for given inputs as a result of the additional experience acquired, but at a declining rate. Therefore, the gains to experience are relatively high initially but they diminish over time. At the same time, the rate at which the learning-by-doing occurs has been shown to differ by industry so productive advantages induced by the learning effect will initially vary across sectors (Mixon, 1993; Fundenberg and Tirole, 1986).

### *2.3 Microenterprise operations*

Microenterprises are usually defined in the development economics literature as a firm employing a small number of workers—typically six or fewer including the owner. In Mexico, most urban microenterprises are owner-operated and employ an average of 1.4 workers (Sánchez and Pagán, 2001). Many microentrepreneurial activities are household and family based, and about half of these businesses operate in the informal sector (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 its scale of operation.

Microenterprises are characterized by low productivity in developing countries, where the microenterprise sector employs from 50 to 75 percent of the manufacturing workforce, yet only contributes about 25 percent of the value added. Some argue though that microenterprises—particularly those in the informal sector—represent a vibrant segment of the economy that provides jobs to the poor (de Soto, 1989; Schumacher, 1974).

Mexico provides an ideal setting for testing the role of motivation and learning-by-doing on technical efficiency since the sector has grown in size and importance since the mid-1980s. Employment in firms with five or fewer workers increased from 38.6 percent of total urban employment in 1987 to 44.6 percent in the late 1990's (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 (Goldmark, 2001; Schreiner and Woller, 2003; Woolcock, 2001).

Supporting microentrepreneurship has become a cornerstone of domestic economic policy in Mexico as stated in President Fox's six-year plan. For example, Mexico's 2001-2006 National Development Plan clearly points out that the government should "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). Therefore, gaining a basic 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-up a business could have on technical efficiency, the stochastic frontier production function with inefficiency effects proposed by Battese and Coelli (1993) was used. Specifically, the translog production frontier for firm  $i$  is given by:

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

$v_i - u_i,$

where  $\ln Q$  is the log of the value of monthly output (in pesos);  $\ln K$  is the log of the value in pesos of total capital equipment used in production (tools, equipment, machinery, vehicles and other miscellaneous capital expenses);  $\ln L$  is the log of the

total number of workers; the  $\beta$ 's are the parameters to be estimated;  $X_i$  is a vector of industry and region controls with an associated vector of parameters ( $\gamma$ ); the  $v_i$ 's are random errors assumed to be normally distributed with a zero mean and variance  $s_v^2$  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 follow a truncated normal distribution with mean  $\mu_u$  and variance  $s_u^2$ . The industry controls are included because the rate of learning through experience has been shown to differ by industry (Mixon, 1993; Fundenberg and Tirole, 1986). Likewise, regional dummies are included to capture region-specific structural differences in production.

To analyze business motivation as well as other sources of technical inefficiency, the inefficiency effect,  $u_i$ , in the stochastic frontier translog production function [Equation (1)] can be specified as:

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

where  $Z_i$  represents a vector of explanatory variables related to technical inefficiency for the  $i$ th firm, the  $\gamma$ '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. The variance parameters are estimated as  $s^2 = s_v^2 + s_u^2$  and  $\gamma = s_u^2/(s_v^2 + s_u^2)$  (Battese and Coelli, 1995; Kumbhakar and Lovell, 2000).

Several factors have already been identified in the literature to be related to technical efficiency/inefficiency. These factors include the number of years that the microenterprise owner has been in business, the years of schooling of the owner

(Seyoum, Battese and Fleming, 1998), whether the business operates in the formal or informal sector. Informality is 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, and whether the business used outside start-up financing (Hernández, Pagán and Paxton, 2002).

The vector of factors related to inefficiency is augmented by including a set of different motivations or reasons to start-up a business (to be independent, due to family tradition, to increase income or because the individual could not find another job). As argued above, motivation factors could drive behavior because individuals with higher needs are likely to exercise more effort and, thus, become more productive (Maslow, 1943; Goldsmith, Veum and Darity, 2000). These different motivations are interacted with the owner's experience in the business to examine the learning-by-doing process and technical efficiency.

#### **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 and it is representative of all the urban areas of the country with more than 100,000 inhabitants. After excluding observations (firms) with missing values in any of the variables employed, the sample size falls to 9,719 firms. 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. The data set is quite 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), among other indicators.

Table 1 presents some descriptive statistics for the sample employed to estimate the stochastic frontier model. 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, 32.4 percent in commercial activities and 14.9 percent in the manufacturing sector. Microenterprise owners have been in business on average for roughly 8.4 years and their mean educational attainment is 7.6 years. About 75 percent of firm owners stated that they joined the sector to primarily increase their income, 6.3 percent did so to continue with the family business, 15.6 percent began their business because they could not find a job, and merely 3.6 percent started the microenterprise to become independent. Only about 39 percent of urban microenterprises operate in the formal sector in the sense that they are registered with the SCHP, Mexico's fiscal authority (Pagán and Tijerina-Guajardo, 2000).

When it comes to the different sources of start-up capital, microentrepreneurs mostly use their own resources/savings (66 percent). The remaining 34 percent comes from outside sources such as credit from savings and loans, friends/relatives, moneylenders, credit from suppliers/clients and less than one percent from banks.

**Table 1: Descriptive Statistics**

| <b>Variable</b>             | <b>Full Sample</b> |              | <b>Services</b> |              | <b>Manufacturing</b> |              | <b>Commerce</b> |              |
|-----------------------------|--------------------|--------------|-----------------|--------------|----------------------|--------------|-----------------|--------------|
|                             | <b>Mean</b>        | <b>s. d.</b> | <b>Mean</b>     | <b>s. d.</b> | <b>Mean</b>          | <b>s. d.</b> | <b>Mean</b>     | <b>s. d.</b> |
| ln Output                   | 7.308              | 1.177        | 7.445           | 1.076        | 7.064                | 1.314        | 7.197           | 1.237        |
| ln Capital                  | 8.685              | 2.617        | 8.598           | 2.525        | 8.566                | 2.484        | 8.880           | 2.806        |
| ln Labor                    | 0.334              | 0.488        | 0.291           | 0.469        | 0.374                | 0.558        | 0.386           | 0.476        |
| ln Capital Squared          | 82.271             | 49.200       | 80.304          | 47.373       | 79.540               | 46.380       | 86.720          | 52.941       |
| ln Labor Squared            | 0.350              | 0.651        | 0.304           | 0.607        | 0.452                | 0.877        | 0.376           | 0.590        |
| ln Capital x Labor          | 3.350              | 5.216        | 2.900           | 4.937        | 3.811                | 6.207        | 3.872           | 5.093        |
| Northern State              | 0.143              | 0.350        | 0.148           | 0.355        | 0.151                | 0.358        | 0.132           | 0.339        |
| Central State               | 0.389              | 0.488        | 0.369           | 0.482        | 0.395                | 0.489        | 0.421           | 0.494        |
| Southern State              | 0.184              | 0.388        | 0.179           | 0.384        | 0.235                | 0.424        | 0.169           | 0.375        |
| Border                      | 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                | 0.462        | 0.325           | 0.468        |
| Family Tradition            | 0.063              | 0.243        | 0.054           | 0.226        | 0.081                | 0.273        | 0.070           | 0.255        |
| Increase Income             | 0.745              | 0.436        | 0.732           | 0.443        | 0.764                | 0.425        | 0.757           | 0.429        |
| No Other Job                | 0.156              | 0.363        | 0.172           | 0.378        | 0.123                | 0.329        | 0.144           | 0.352        |
| Become independent          | 0.036              | 0.187        | 0.042           | 0.200        | 0.032                | 0.176        | 0.029           | 0.167        |
| Services                    | 0.527              | 0.499        |                 |              |                      |              |                 |              |
| Manufacturing               | 0.149              | 0.356        |                 |              |                      |              |                 |              |
| Commerce                    | 0.324              | 0.468        |                 |              |                      |              |                 |              |
| n                           | 9,719              |              | 5,123           |              | 1,444                |              | 3,152           |              |

A comparison of means across the service, manufacturing and commerce sectors reveals that service sector microenterprises produce the most output, but the commerce sector uses the most capital and labor. Service sector business owners have more education and experience than their counterparts in manufacturing and commerce.

Table 2 reports the results of estimating the stochastic frontier model with inefficiency effects [equations (1) and (2)]. Four specifications were estimated: the first one includes the full sample and the second, third and fourth sets of results are for the service, manufacturing and commerce samples. These sector-specific models are estimated to deal with the possibility of biases due to differences across industries.

The translog production function parameters have reasonable signs and magnitudes, and the statistical significance of the parameters for the interaction and higher order terms suggest that the translog specification is preferable to the Cobb-Douglas model. This was formally tested using a likelihood ratio test where the Chi-squared test statistic rejects the Cobb-Douglas specification in favor of the translog model.

All four models reject the null hypothesis of no technical inefficiency effects. The variance parameter estimate for the full sample ( $\gamma=0.849$ ) suggests that a relatively large portion of the residual variation in the output of firms is related to technical inefficiency and only about 15 percent is due to random error, such as measurement error and other random factors not incorporated in the variables included here (e.g., bad luck, unanticipated events, etc.). The proportion of residual variation due to

**Table 2: Stochastic Frontier with Technical Inefficient Effects**

|  | Full Sample |       | Services   |       | Manufacturing |       | Commerce   |       |
|--|-------------|-------|------------|-------|---------------|-------|------------|-------|
|  | Coeff.      | s. e. | Coeff.     | s. e. | Coeff.        | s. e. | Coeff.     | s. e. |
| <b>Frontier</b>                          |             |       |            |       |               |       |            |       |
| Constant                                 | 6.050 ***   | 0.091 | 6.241 ***  | 0.115 | 4.828 ***     | 0.217 | 6.341 ***  | 0.214 |
| Ln Capital                               | 0.317 ***   | 0.017 | 0.266 ***  | 0.024 | 0.428 ***     | 0.043 | 0.322 ***  | 0.029 |
| Ln Labor                                 | -0.284 ***  | 0.092 | -0.074     | 0.126 | 0.475 **      | 0.200 | -0.850 *** | 0.175 |
| Ln Capital Squared                       | -0.011 ***  | 0.001 | -0.008 *** | 0.001 | -0.015 ***    | 0.002 | -0.013 *** | 0.001 |
| Ln Labor Squared                         | 0.184 ***   | 0.045 | 0.186 ***  | 0.064 | -0.052        | 0.088 | 0.287 ***  | 0.092 |
| Ln Capital x Labor                       | 0.053 ***   | 0.009 | 0.026 **   | 0.013 | 0.023         | 0.022 | 0.091 ***  | 0.017 |
| Northern State (1=Yes; 0=No)             | 0.087 *     | 0.045 | 0.114 *    | 0.058 | 0.128         | 0.120 | 0.012      | 0.085 |
| Central State (1=Yes; 0=No)              | 0.002       | 0.040 | 0.016      | 0.053 | 0.128         | 0.108 | -0.076     | 0.073 |
| Southern State (1=Yes; 0=No)             | 0.013       | 0.044 | 0.078      | 0.057 | 0.059         | 0.114 | -0.087     | 0.081 |
| Border State (1=Yes; 0=No)               | 0.355 ***   | 0.043 | 0.383 ***  | 0.054 | 0.573 ***     | 0.119 | 0.233 ***  | 0.079 |
| Manufacturing (1=Yes; 0=No)              | -0.334 ***  | 0.029 |            |       |               |       |            |       |
| Commerce (1=Yes; 0=No)                   | -0.216 ***  | 0.023 |            |       |               |       |            |       |
| <b>Technical Inefficiency Effects</b>    |             |       |            |       |               |       |            |       |
| Constant                                 | 0.074       | 0.658 | -1.176     | 1.546 | -7.379 ***    | 2.863 | 1.791 ***  | 0.227 |
| Years of Schooling of Owner              | -0.254 ***  | 0.065 | -0.253 **  | 0.103 | -0.172 ***    | 0.053 | -0.102 *** | 0.018 |
| Years in Business                        | -0.088 ***  | 0.023 | -0.123 **  | 0.053 | -0.023 *      | 0.013 | -0.025 *** | 0.007 |
| Registered with SHCP (1=Yes; 0=No)       | -1.218 ***  | 0.295 | -1.842 *   | 0.971 | -10.281 ***   | 3.032 | -0.205 **  | 0.096 |
| Outside Financing (1=Yes; 0=No)          | -0.217 ***  | 0.072 | -0.245 **  | 0.124 | 0.652 ***     | 0.253 | -0.068     | 0.063 |
| Family Tradition (1=Yes; 0=No)           | -1.513 ***  | 0.459 | -3.312 **  | 1.433 | -0.110        | 0.605 | -0.215     | 0.220 |
| Increase Income (1=Yes; 0=No)            | -0.525 **   | 0.207 | -1.834 **  | 0.873 | 0.373         | 0.559 | 0.088      | 0.176 |
| No Other Job (1=Yes; 0=No)               | -1.224 ***  | 0.350 | -2.558 **  | 1.117 | -2.038 **     | 0.789 | -0.045     | 0.186 |
| $s^2 = s_v^2 + s_u^2$                    | 3.887 ***   | 0.858 | 5.870 **   | 2.293 | 8.307 ***     | 2.336 | 1.204 ***  | 0.101 |
| $\hat{\sigma} = s_u^2 / (s_v^2 + s_u^2)$ | 0.849 ***   | 0.032 | 0.922 ***  | 0.030 | 0.927 ***     | 0.022 | 0.357 ***  | 0.095 |
| Log likelihood function                  | -13,542     |       | -6,770     |       | -2,041        |       | -4,567     |       |
| n  | 9,719       |       | 5,123      |       | 1,444         |       | 3,152      |       |

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

technical inefficiency is even larger in the service and manufacturing industries (92 and 93 percent, respectively), and it is relatively low in the commerce sector (36 percent).

The results for the technical inefficiency effects suggest that years of schooling and years in business are both negatively related to inefficiency in all three industries. That is, owners with more education and business experience have a higher ability to use resources efficiently. Microenterprises operating in the formal sector are more efficient than those in the informal sector. This is especially true for firms in the manufacturing industry. In the full sample, we observe that business owners who inherited or established their business due to a family tradition are initially more technically efficient than those with other motivations to start up their businesses. However, Table 3 shows that this initial advantage dissipates over time faster for those who inherited their business than for all other entrepreneurs. The interaction term for “years in business x family tradition” is positive and statistically significant.

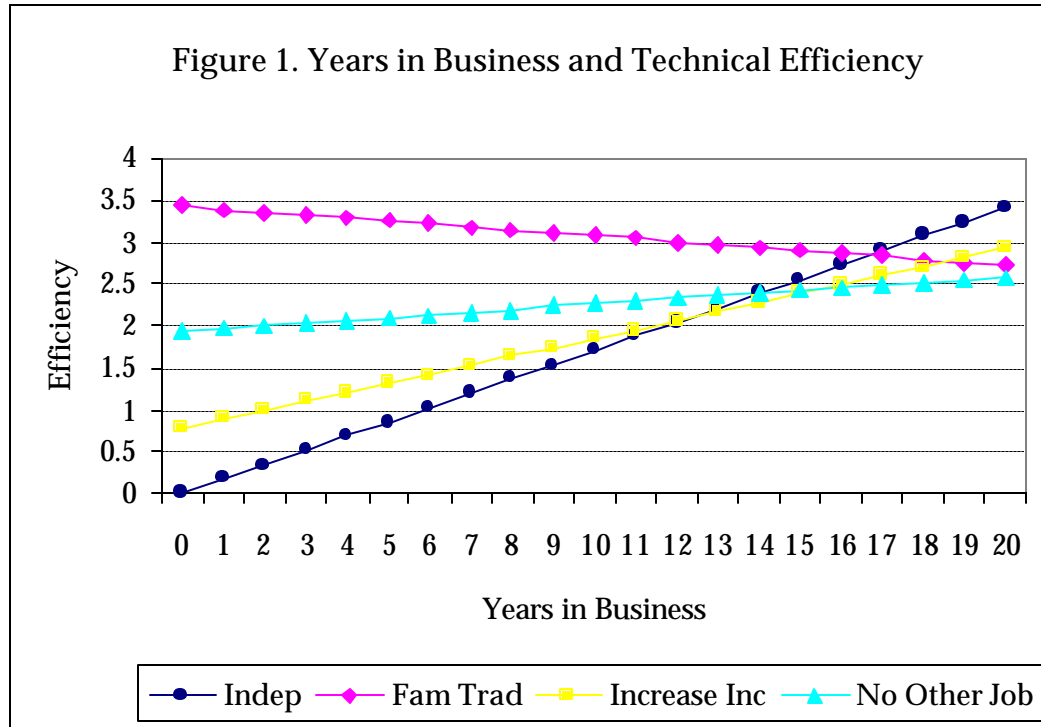
Figure 1 shows that microentrepreneurs who started up a business to continue with a family tradition are more efficient initially, probably because they are ahead in the learning curve relative to those who started their business to become independent, to increase their income, or because they lost their job and could not find one. For example, at the beginning of operations, those continuing a family tradition have relatively stable suppliers and customers, they tend to have a better knowledge on how markets work, and many times inherit pre-established contacts and connections.

**Table 3: Stochastic Frontier Results with Years in Business Interaction Effects**

|                                       | Full Sample |       | Services   |       | Manufacturing |       | Commerce   |       |
|---------------------------------------|-------------|-------|------------|-------|---------------|-------|------------|-------|
|                                       | Coeff.      | s. e. | Coeff.     | s. e. | Coeff.        | s. e. | Coeff.     | s. e. |
| <b>Frontier</b>                       |             |       |            |       |               |       |            |       |
| 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 | 0.026 **   | 0.013 | 0.023         | 0.022 | 0.092 ***  | 0.017 |
| Northern State (1=Yes; 0=No)          | 0.086 *     | 0.045 | 0.114 *    | 0.058 | 0.124         | 0.118 | 0.012      | 0.083 |
| Central State (1=Yes; 0=No)           | 0.004       | 0.040 | 0.017      | 0.053 | 0.127         | 0.110 | -0.069     | 0.071 |
| Southern State (1=Yes; 0=No)          | 0.010       | 0.044 | 0.079      | 0.057 | 0.049         | 0.114 | -0.088     | 0.079 |
| Border State (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 |            |       |               |       |            |       |
| <b>Technical Inefficiency Effects</b> |             |       |            |       |               |       |            |       |
| 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)         | -0.774 ***  | 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 * Family Tradition  | 0.205 ***   | 0.062 | 0.086      | 0.074 | 0.198         | 0.137 | 0.082      | 0.062 |
| Years in Business * Increase Income   | 0.063 **    | 0.031 | 0.112 *    | 0.062 | -0.103        | 0.080 | 0.047      | 0.057 |
| Years in Business * No Other Job      | 0.138 ***   | 0.049 | 0.159 **   | 0.075 | 0.142         | 0.130 | 0.068      | 0.059 |
| $s^2 = s_v^2 + s_u^2$                 | 3.790 ***   | 0.836 | 5.568 ***  | 1.751 | 6.126 ***     | 1.807 | 1.200 ***  | 0.097 |
| $? = s_u^2 / (s_v^2 + s_u^2)$         | 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      |       |

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

This is particularly relevant in Mexico because family and business connections provide competitive advantages that many times are definite keys to success.



Owners inheriting their business are more likely to know how firms operate from the beginning and, thus, have an early advantage over everyone else. However, 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 be more diligent in their endeavors. Those individuals with a higher need for income are more likely to put forth more effort to become more productive. Graphically, this is represented with a steeper efficiency curve, which overtime surpasses the efficiency of those owners with a family business (see Figure 1). However, convergence across different motivating factors occurs after 13 to 17 years in business.

## **5. Conclusion**

When it comes to an owner's motivation to start-up a microenterprise, our results suggest that those businesses where the owner started the business due to a 'family tradition' are more technically efficient than those microenterprises started due to the lack of employment opportunities, to increase income or to become independent. However, these efficiency advantages disappear as owners accumulate more business experience.

We argue that Mexican microenterprise owners that had initial business knowledge because of family traditions and connections also have initial skills on the use of resources, market information, etc. Nonetheless, those who start-up a business to increase their income or to become independent have the motivation to become successful once they make up their deficiency of lack of initial business skills. Overtime, these types of businesses eventually become more efficient than those begun via family traditions.

The results suggest that the microenterprise sector in Mexico is very dynamic and that over time any potential entrepreneur can become relatively efficient and successful. However, there are clear market advantages to those inheriting a business that can be rooted in family connections, better market information and market imperfections. Future research should explore potential processes that can speed up convergence in efficiency across different motives to start-up a business.

## References

- Stepbro, T., Bernhardt, I., 2003. Start-up financing, owner characteristics, and survival. *Journal of Economics and Business* 55, 303-319.
- Adams, J.S., 1963. Toward an understanding of inequity. *Journal of Abnormal and Social Psychology* 67, 422-436.
- Battese, G.E., Coelli, T.J., 1995. A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics* 20, 325-332.
- Battese, G.E., Coelli, T.J., 1993. A stochastic frontier production function incorporating a model for technical inefficiency effects. Working Papers in Econometrics and Applied Statistics, No. 69, Department of Econometrics, University of New England, Armidale.
- Battese, G.E., Coelli, T.J., 1977. Estimation of a production frontier model: with application to the pastoral zone of Eastern Australia. *Australian Journal of Agricultural Economics* 21, 169-179.
- Coelli, T.J., Battese, G.E., 1996. Identification of factors which influence the technical efficiency of Indian farmers. *Australian Journal of Agricultural Economics* 40, 19-44.
- Deci, E.L., 1972. Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology* 18, 105-115.
- de Soto, H. , 1989. *The Other Path*. Harper and Row, New York.
- Fundenberg, D., Tirole, J., 1983. Learning-by-doing and market performance. *Bell Journal of Economics* 14, 522-530.
- Goldmark, L., 2001. Microenterprise development in Latin America: towards a new flexibility. *Journal of Socio-Economics* 30, 145-149.
- Goldsmith, A.G., Veum, J.R., Darity, W., 2000. Working hard for the money? Efficiency wages and worker effort. *Journal of Economic Psychology* 21, 351-385.
- Hernández, F., Pagán, J.A., Paxton, J., 2002. Start-up capital, microenterprises and technical efficiency in Mexico. Working Paper No. 2002-4, Center for Border Economic Studies, The University of Texas-Pan American.

- Herzberg, F., Mausner, B., Snyderman, B.B., 1959. *The Motivation to Work*. Wiley, New York.
- INEGI, 2000. *Encuesta Nacional de Empleo Urbano*. Instituto Nacional de Estadística, Geografía e Informática, Aguascalientes, México.
- Kanfer, R., 1990. Motivation theory and industrial and organizational psychology, in: Dunnette, M.D., Hough, L.M. (Eds.), *Handbook of Industrial and Organizational Psychology*, Vol. 1, Consulting Psychologists Press, Palo Alto, pp. 75-170.
- Kumbhakar, S.C., Ghosh, S., McGuckin, J.T., 1991. A generalized production frontier approach for estimating determinants of inefficiency in U.S. dairy farms. *Journal of Business and Economic Statistics* 9, 279-286.
- Kumbhakar, S.C., Lovell, C.A.K., 2000. *Stochastic Frontier Analysis*. Cambridge University Press, Cambridge.
- Leibenstein, H., 1966. Allocative efficiency vs. x-efficiency. *American Economic Review* 56, 392-412.
- Maslow, A.H., 1943. A theory of human motivation. *The Psychological Review* 50, 370-396.
- Mixon, F.G., 1993. Estimating learning curves in economics: evidence from aerial combat over the Third Reich. *Kyklos* 46, 411-419.
- Pagán, J.A., Tijerina-Guajardo, J.A., 2000. Explaining the changes in relative employment and wages in Mexico's urban informal sector, 1987-1993. *Applied Economics* 32, 335-347.
- Poder Ejecutivo Federal, 2001. *Plan Nacional de Desarrollo: 2001-2006*. Presidencia de la República, México.
- Roubaud, F., 1995. *La Economía Informal en México*. Fondo de Cultura Económica, México.
- Sánchez, S., Pagán, J.A., 2001. Explaining gender differences in earnings in the microenterprise sector, in: Correia, M., Katz, E. (Eds.), *The Economics of Gender in Mexico*, The World Bank, Washington, DC, Chapter 5.
- Schrenier, M., Woller, G., 2003. Microenterprise development programs in the United States and in the developing world. *World Development* 31, 1567-1580.

Schumacher, E.F., 1974. *Small is Beautiful*. Sphere Books, London.

Seyoum, E.T., Battese, G.E., Fleming, E.M., 1998. Technical efficiency and productivity of maize producers in eastern Ethiopia: a study of farmers within and outside the Sasakawa-Global 2000 Project. *Agricultural Economics* 19, 341-348.

Spence, M., 1981. The learning curve and competition. *Bell Journal of Economics* 12, 49-70.

Tirole, J., 1988. *The Theory of Industrial Organization*. The MIT Press, Cambridge.

Vroom, V.H., 1964. *Work and Motivation*. Wiley, New York.

Wilson, S., Adams, A.V., 1994. Self-employment for the unemployed: experience in OECD and transitional economies. *World Bank Discussion Paper No. 263*, Washington, DC.

Woolcock, M., 2001. Microenterprise and social capital: a framework for theory, research, and policy. *Journal of Socio-Economics* 30, 193-198.