

Informality and nano-businesses in perimetropolitan areas of Mexico City

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Abstract

This article aims to study the variables that influence the preference for nano-businesses operating under a formal or informal status in the perimetropolitan area of Milpa Alta, Mexico City. For this purpose, a controlled experiment was carried out on 122 individuals, in which the advantages of a formal business status were highlighted in order to obtain a transition matrix and three Logit models. The results indicate that 27% of entrepreneurs are willing to transition to a formal business operation. Furthermore, as the initial investment increases, the preference for informality decreases, while the preference for formality increases when the individual has completed a bachelor's or engineering degree. Finally, the lower the initial investment, the more complex the informal-formal transition becomes.

Keywords: nano-businesses; perimetropolitan; Logit model; informal business status; transition to a formal business.

1. INTRODUCTION

According to the National Institute of Statistics and Geography (INEGI, 2010), the Metropolitan Zone of the Valley of Mexico (MZVM) comprises 1,714 localities with less than 2,500 inhabitants. 54% live in localities known as satellites, while 46% live in dispersed localities.¹ The former are characterized by their invasion of conservation land and destruction of forests or farmland. Settlements located far from an urban center (outside a radius of more than four kilometers) are known as "dispersed localities" and include rural farms, small towns, real estate developments, and tourist areas.

Based on INEGI's (2020) update of the main results by locality (ITER) 2020, Mexico City has 599 localities with less than 2,500 inhabitants, of which 39% correspond to localities in the municipality of Milpa Alta and 26% to human settlements in the municipality of Tlalpan. In Milpa Alta, the selected study site, only two localities have populations of between 1,000 and 2,499 inhabitants; three have populations of between 500 and 999 inhabitants; 19 between 250 and 499 inhabitants; while 210, i.e., 89% are settlements with between 1 and 249 inhabitants.

In Milpa Alta, the population continues to participate in agricultural activities; however, this municipality is also undergoing a process of urbanization characterized by the transition from primary production activities to industry, commerce, and services. In economic terms, farmers from Milpa Alta, mainly cactus producers, operate in a dual context because they receive other income apart from their agricultural activities (Bonilla, 2009; Larroa and Rodas, 2016; Rodríguez *et al.*, 2021).²

These socio-demographic conditions result in Milpa Alta's commerce sector flourishing due to its relative isolation from the MZVM, which facilitates the creation of small businesses, such as grocery stores, beauticians, poultry sellers, typical Mexican cafeterias and fast food outlets, among others (Rodríguez, 2021).³ In general, these establishments are informal and are managed by a single person; the latter is a characteristic associated with the concept of nano-business.

Thus, these enterprises have unique qualities that make them different from micro, small, medium, and large enterprises because the actions of a single person implicitly carry with them the effects of hierarchical processes and interrelationships in the organization's core activities, such as management, administration, and marketing. In this respect, Ljungberg (2011) points out that individuals manage their time by using their professional career, work, or skills and techniques for the service of their own business.

Therefore, the creation of usually informal nano-businesses is the result of the entrepreneurship of individuals, either unemployed and who have difficulties in accessing employment or who consider that the jobs available are poorly paid and decide to run the business independently. Consequently, their income is based on their performance as managers, salespeople, advertisers, or entities that identify and generate opportunities for themselves (Alvarado, 2021; Rodríguez, 2021).

In this context, nano-businesses are responsible for participating in a relevant way on a daily basis in the economic setting, especially the perimetropolitan localities of our country, as is the case of Milpa Alta.

This research aims to quantify the factors that motivated individuals to change their preference for formal or informal status and the transition from one to the other based on initial status. Furthermore, components related to decisions are essential for creating economic units of this size in the perimetropolitan localities of Mexico City. This research consists of five sections. The first section narrows down the study into nano-businesses that operate in the perimetropolitan localities; the second explains the procedure for describing and quantifying the behavior of nano-entrepreneurs in these types of localities; the penultimate section presents and discusses the results of the econometric estimations and the transition matrix; and finally, the fourth section provides the conclusion.

2. REVISION OF LITERATURE

Perimetropolitan localities

Urbanization processes modify and determine the interaction between the metropolis and peripheral territories. The expansion and growth of the city consume the land and resources of adjacent areas, while services and infrastructure are concentrated in the main cities. In this context, localities or settlements with less than 2,500 inhabitants⁴ are categorized as rural, without considering their socio-territorial processes (Fernandez and De la Vega, 2017).

For Conti and Tinoco (2016), perimetropolitan spaces are essential in terms of the positioning of the metropolis within a spatial structure on a regional scale. In this respect, a peri-urban space is an area that serves as a bidirectional interconnection and is determined by the type of land between the countryside and the city. It should also be noted that rural not only refers to the provision of food of agro-livestock origin but also identifies some localities dedicated to purely industrial, commercial, service, and even agro-industrial activities (Pérez, 2001; Fernández, 2011; Barsky, 2013; Fernández and De la Vega, 2017).

INEGI (2007) associates the agricultural sector of the MZVM with low productivity processes based on traditional agricultural smallholdings since increases in labor productivity in the economy are based on the dynamism of the service sector (Espinosa and Rodríguez, 2022), while Delgadillo (2019) detects relationships of geographic and relational proximity between rururban producers in Milpa Alta and metropolitan consumers in emerging areas of the big city.

Nano-businesses in perimetropolitan localities

In localities with less than 2,500 inhabitants, a socioeconomic structure of precarious employment prevails, together with high levels of poverty, lack of access to drinking water and health services, as well as marginalization and informality caused by the centralization of workplaces in urban areas; all of which are a symptom of low productivity and poor development (Alvarado *et al.*, 2016; Fernandez and De la Vega, 2017; Robles and Martinez, 2018). This means that the population in these areas is more likely to generate subsistence mechanisms, which can hardly be considered part of the formal sector.

In turn, managing, creating, and maintaining economic units of any size and country is vital in terms of employment. However, it is essential to consolidate them so that they also generate consumption. In this regard, sole proprietorships, i.e., those in which a single individual carries out management, administration and decision-making activities, and which are generally informal, are responsible for providing employment in the economy and for the supply and demand of goods and services to other economic units, both formal and informal. However, when starting operations, these businesses need to be given more incentive to become formal businesses.

Likewise, the cash flow generated by these businesses helps to boost the exchange of goods (inputs, materials, instruments and tools, in addition to other goods for resale) and services (electricity, fuel, telephony and internet) of formal companies, as well as to informal companies; in other words, these flows are an effective mechanism for generating employment and constitute a socioeconomic pillar in developing and emerging economies (Rodríguez, 2021).

On the other hand, small companies operating informally are excluded from the financial system because the characteristics of the services provided by commercial banks make access to financing difficult due to their high-interest rates, in addition to the fact that informality itself prevents banks from efficiently measuring credit risk. In this respect, traditional funding restricts the economic activity required to create a formal enterprise, and the population of human settlements in perimetropolitan localities takes advantage of the available resources they obtain on their behalf to start a business (González, 2015; Cotler, 2015).

According to the Office of the Head of Government (2011), for several years, the agrarian-rural structure of Milpa Alta has been transitioning towards economic activities that are not necessarily related to the primary sector. This diversification includes nano-businesses associated with activities such as retail trade, food products, and professional services. Therefore, verifying the propagation of informal nano-businesses in this locality and identifying the aspects that influence the decision to maintain this status or to opt for a more formal status is relevant once these nano-businesses are provided with information on the advantages of the latter.

3. METHODOLOGY

The procedure for describing and quantifying the behavior of the entrepreneurs of the Milpa Alta municipality in Mexico City consisted of recording idiosyncratic, social, and economic characteristics, among others, of establishing whether some of them are determining factors for these entrepreneurs to work either formally or informally. Based on the foregoing, and once they were provided with information and training regarding the costs and benefits of belonging to the formal sector, it was possible to describe the preferences for one of the two statuses and the option of moving from informal to formal status.

Since there is no formal registry of nano-businesses in the municipality in question, the sample size needed to be calculated considering that the population is infinite. The selection of participants establishes that the success rate is 50%, i.e., $p=0.5$, with a confidence level and sampling error of 95% and 0.05, respectively, as stated by Alvarado (2021). This exercise was conducted during the period from November 2021 to January 2022 and was applied in two phases. The type of sampling required under these conditions was snowball sampling based on the following criteria: *i*) be of legal age, *ii*) of any gender, and *iii*) individually offer any product or service for its individual sale in the municipality of Milpa Alta.

During the first phase, 379 nano-entrepreneurs interested in participating in an experiment associated with informality and the transition to a formal scheme were invited via social networks (Facebook). Each of them accepted the invitation; however, at the time of the survey and training, only 122

responded. On this basis, the first phase began, which consisted of obtaining the fundamental characteristics of the 122 sole proprietorships to which the "Survey for nano-businesses in Milpa Alta, 2021-2022" was applied.⁵ The advantages, virtues, and costs involved in becoming a formal economic unit were emphasized during its application.⁶

The second stage was called experimental manipulation and aimed to identify why nanoentrepreneurs prefer and choose to be informal. During this phase, the interviewer made sure to clearly explain to the participants the different processes in procedures, formal operating strategies, how to access private and government credit, and solutions to problems they experience in the informal sector.

Finally, the survey addressed perception issues regarding the participants' preference to belong to the formal or informal sector and the reasons why they would transition to formality or maintain their economic activity in the informal sector of the economy.

Transition matrix

Escobedo and Moreno (2020) point out that "formal-informal mobility" labor transitions can be analyzed according to the methodology used and the treatment of "persistence" and "transit". For example, Bosch and Maloney (2010) use a transition matrix (TM) to analyze formal and informal flows in Mexico from 1988-2004 by decomposition.

In this respect, a TM was applied to identify the number of individuals with a single-person business activity in the municipality in question who, depending on the specific value of the effects of a random variable X , i.e., informal or formal, prefer a value of the random variable Y , i.e., to maintain the current status (formal or informal) or to transition towards the other option, as the case may be (Budnick, 2007; Alvarado, 2021).

There are two categories (D) for nano-businesses: *i*) formal or *ii*) informal. Thus, it is possible to define the TM as a structure of i rows (preference or condition at the beginning of the period) and j columns representing the preference at the end of the period (Alvarado, 2021). For example, the matrix shows the probability that each element (nano-enterprise) thereof, located in the informal sector during period $t-1$, decides to transition to the formal sector in period t based on a set of conditions.⁷

Logit Model

When using the simple probability and MT methods, one or a pair of transitions must be chosen for the analysis, and all other transitions experienced by the individual must be ignored (Escobedo and Moreno, 2020). Meanwhile, the use of a Logit model allows us to evaluate and quantify the behavior of a binary response variable; in this case in question, the effects of being informed and trained regarding the costs and benefits of working in the formal sector in relation to the intention to maintain or change the preference of nano-businesses in the perimetropolitan locality of Milpa Alta.

A logistic model is a test whose response variable is binary, 0, and 1; i.e., the likelihood of the outcome being 1 depends on the value of one or more independent variables.⁸ Logistic regression iteratively identifies the strongest linear combination of variables with the highest probability of detecting the observed outcome.⁹ A logistic function was used to describe the choice of nano-businesses in the municipality in question to either remain informal or to transition towards the formal sector.

Thus, it is possible to predict the probability of a nano-company preferring any of these conditions, similar to Silva and Guataquí (2011). For example, the expectation that a nano-business i will prefer formality (y_i^*) is a linear function of the characteristics of the nano-business itself and the individual running it (z_i), plus an unobserved random component (ε_i):

$$y_i^* = a' z_i + \varepsilon_i \quad (1)$$

It should be clarified that the status of the nano-business, defined by the variable (y_i^*), is not determined at the beginning. What is observable is whether the individual carries out their economic activity formally or informally:

$$\begin{aligned} Y_i &= 1 \text{ if the nano-business is formal} \\ Y_i &= 0 \text{ if the nano-business is informal} \end{aligned} \quad (2)$$

Thus, if nano-business i prefers to be formal (p_o), it can be expressed as follows:

$$\begin{aligned} p_o &= \text{prob}(y_i = 1 | z) = \text{prob}(y_i^* > 0) = \text{prob}(a' z_i + \varepsilon_i > 0) \\ &= \text{prob}(\varepsilon_i > -a' z_i) = 1 - F(-a' z_i) = F(a' z_i) \end{aligned} \quad (3)$$

Where F is the cumulative distribution function of e_j since the functional form of F is assumed to be logistic, then the econometric specification is as follows:

$$F(-a' z_i) = \frac{e^{-a' z_i}}{1 + e^{-a' z_i}} = \frac{1}{1 + e^{a' z_i}} \quad (4)$$

This means that the probability that a nano-business prefers formality is:

$$p_o = \frac{e^{a' z_i}}{1 + e^{a' z_i}} \quad (5)$$

The application of the "Survey for nano-businesses in Milpa Alta, 2021-2022" made it possible to extract the information to construct the variables that explain the probability of whether or not a nano-business is formal (z_i). Based on equation 5, three models were constructed: *i*) the first one evaluates the effect of the independent variables on the decision to remain informal, *ii*) the second one does the same but to remain in the formal sector, and *iii*) the third one, to verify the preference for the transition between the informal and formal sector.

Each of the models uses four groups of independent variables that are classified by type of information: *i*) socioeconomic: data such as age (age of the participant), gender (binary variable that identifies the individual as 1 if male), level of education (on a scale from 1 to 7, where 1 corresponds to incomplete/no studies and 6 to a bachelor's/engineering degree), income (profit margin of the nano-business over six periods), investment (amount in thousands of pesos to set up the business), profit (profit margin as a percentage); *ii*) environment: information regarding location (denotes whether the nano-business is located in a family infrastructure, with proximity to customers or if it depends on the cost of renting premises), surface area (square meters of the premises), start of operations (year in which it was founded), financing (indicates the source of financing on a scale of 1 to 4, where 1 corresponds to own resources; 2 to banks; 3 to family loans and 4 to government support); *iii*) economic reasons: refers to whether the entrepreneur decided to start the business for reasons such as family tradition, improving/supplementing income, not finding employment, low-paying jobs, investment opportunity, exercising their trade/career, seeking independence, or retired or lost their job; and *iv*) current status and preferences. Current status refers to being in the formal or informal sector. Preferences are grouped with the options of remaining in the current sector, indecision, or transitioning to the opposite situation.

4. RESULTS

The results of the applied experiment provide a glimpse, in its first stage, of the socioeconomic information of the environment and the economic reasons for entrepreneurship. Once the information was provided to the participants regarding the advantages and virtues of belonging to the formal sector, in the second phase, it was possible to identify the factors that influence the preferences for transitioning from informality to formality or remaining in the current sector, using the information gathered during the first phase.

The main characteristics of one-person entrepreneurs in the municipality in question are that about 70% of the total are in the informal sector, and 57% of participants are men. It is also possible to detect that women are more likely to be in the formal sector since women manage only 40% of informal nano-businesses. In terms of age, 79% of one-person entrepreneurs are over the age of 30.

As for the academic level of nanoentrepreneurs, 46.7% have completed secondary and/or high school. However, those with a bachelor's or engineering degree is significant, at 24%. At the same time, 47% of the informal sector has managers who have completed secondary and/or high school. However, 30% of those with a bachelor's degree or a finished or incomplete engineering degree are also in the informal sector.

The main reasons participants started their business activities were family tradition and to improve or supplement their income, with 24% and 35%, respectively, regardless of whether the nano-businesses were formal or informal. 73% of all businesses (formal and informal) operate full-time. As far as the informal sector is concerned, 68% operate full-time, while 84% of the formal sector work full-time in their nano-business. Meanwhile, 32% of informal and 16% of formal businesses operate part-time.

Regarding setting up the nano-businesses, the majority are new businesses because 65% have entered into operation from 2008 to date. This increases to 68% and decreases to 57% in cases of informal and formal nano-businesses, respectively. Furthermore, slightly more than 50% of businesses required less than MXN \$20,000 as an initial investment, and 73% required up to MXN \$50,000.

The primary sources of financing for these economic units are their own since only 30% requested resources from options such as bank loans, family loans, and government support. Seventy percent of these businesses only accept payment in cash, whereas nearly 40% of formal businesses receive and accept credit and debit cards, checks, bank transfers, and food vouchers.

67% of nano-businesses implement a commercial strategy, such as offers, advertising on social networks, and searching for new distribution channels and markets to improve their income. Continuing with (monthly) income, 27% of the businesses surveyed generate between MXN\$2,700 and MXN\$6,790, and 29% generate between MXN\$6,791 and MXN\$11,599. Only 14% of informal and 24% of formal nano-businesses can generate monthly revenues of more than MXN \$15,000 (see Table 1).

Table 1. Profile of nanoentrepreneurs in Milpa Alta, Mexico City, Mexico, 2022

| | Features | Total | | Informal | | Formal | |
|---|--|-----------|-------|-----------|-------|-----------|-------|
| | | Frequency | % | Frequency | % | Frequency | % |
| Gender | Female | 53.0 | 43.4 | 33.0 | 38.8 | 20.0 | 54.1 |
| | Male | 69.0 | 56.6 | 52.0 | 61.2 | 17.0 | 45.9 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Age | Under 21 years of age | 5.0 | 4.1 | 4.0 | 4.7 | 1.0 | 2.8 |
| | Between 21 and 29 years old | 21.0 | 17.2 | 14.0 | 16.5 | 7.0 | 18.9 |
| | 30 to 40 years old | 44.0 | 36.1 | 32.0 | 37.6 | 12.0 | 32.4 |
| | 41 years old or older | 52.0 | 42.6 | 35.0 | 41.2 | 17.0 | 45.9 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Schooling | No education | 4.0 | 3.3 | 2.0 | 2.4 | 2.0 | 5.4 |
| | Primary | 9.0 | 7.4 | 8.0 | 9.4 | 1.0 | 2.7 |
| | Secondary | 29.0 | 23.8 | 20.0 | 23.5 | 9.0 | 24.4 |
| | High School | 28.0 | 23.0 | 20.0 | 23.5 | 8.0 | 21.6 |
| | Technical baccalaureate | 14.0 | 11.5 | 10.0 | 11.8 | 4.0 | 10.8 |
| | Bachelor's degree/ incomplete engineering degree | 9.0 | 7.4 | 9.0 | 10.6 | 0.0 | 0.0 |
| | Bachelor's degree/ engineering degree | 29.0 | 23.8 | 16.0 | 18.8 | 13.0 | 35.1 |
| Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 | |
| Reason for starting-up business | Family tradition | 29.0 | 23.8 | 17.0 | 20.0 | 12.0 | 32.5 |
| | Enhance/ supplement income | 43.0 | 35.2 | 31.0 | 36.4 | 12.0 | 32.4 |
| | Unable to find employment | 14.0 | 11.5 | 11.0 | 12.9 | 3.0 | 8.1 |
| | Low paid jobs | 4.0 | 3.3 | 2.0 | 2.4 | 2.0 | 5.4 |
| | Investment opportunity | 13.0 | 10.7 | 10.0 | 11.8 | 3.0 | 8.1 |
| | Exercise a trade or career | 12.0 | 9.8 | 9.0 | 10.6 | 3.0 | 8.1 |
| | Search for independence | 7.0 | 5.7 | 5.0 | 5.9 | 2.0 | 5.4 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Time dedicated to business ^a | Part-time | 33.0 | 27.0 | 27.0 | 31.8 | 6.0 | 16.2 |
| | Full-time | 89.0 | 73.0 | 58.0 | 68.2 | 31.0 | 83.8 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Established | 2008 to date | 79.0 | 64.8 | 58.0 | 68.2 | 21.0 | 56.8 |
| | Before 2008 | 43.0 | 35.2 | 27.0 | 31.8 | 16.0 | 43.2 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Initial investment | Up to MXN\$20,000 | 63.0 | 51.6 | 46.0 | 54.2 | 17.0 | 45.9 |
| | Between MXN\$21,000 and MXN\$50,000 | 26.0 | 21.3 | 20.0 | 23.5 | 6.0 | 16.3 |
| | Between MXN\$51,000 and 100,000 | 19.0 | 15.6 | 12.0 | 14.1 | 7.0 | 18.9 |
| | More than MXN\$100,000 | 14.0 | 11.5 | 7.0 | 8.2 | 7.0 | 18.9 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Source of financing ^b | Other | 36.0 | 29.5 | 25.0 | 29.4 | 11.0 | 29.7 |
| | Own resources | 86.0 | 70.5 | 60.0 | 70.6 | 26.0 | 70.3 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Methods of payment ^c | Cash only | 85.0 | 69.7 | 62.0 | 72.9 | 23.0 | 62.2 |
| | Other including cash | 37.0 | 30.3 | 23.0 | 27.1 | 14.0 | 37.8 |
| | Total | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Monthly income | Up to MXN\$2,699 | 11.0 | 9.0 | 7.0 | 8.2 | 4.0 | 10.8 |
| | Between MXN\$2,700 and MXN\$6,790 | 33.0 | 27.0 | 22.0 | 25.9 | 11.0 | 29.8 |
| | Between MXN\$6,791 and MXN\$11 599 | 35.0 | 28.8 | 28.0 | 32.9 | 7.0 | 18.9 |
| | Between MXN\$11,600 and MXN\$14,900 | 22.0 | 18.0 | 16.0 | 18.9 | 6.0 | 16.2 |
| | More than MXN\$15 000 | 21.0 | 17.2 | 19.0 | 22.4 | 2.0 | 5.4 |

| | | More than MANS 15,000 | 21.0 | 17.2 | 12.0 | 14.1 | 9.0 | 24.3 |
|--------------------------------|---------------------------|-----------------------|-------|-------|------|-------|------|-------|
| Total | | | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Profitability | Equal to or less than 50% | | 63.0 | 51.6 | 38.0 | 44.7 | 25.0 | 67.6 |
| | Greater than 50% | | 59.0 | 48.4 | 47.0 | 55.3 | 12.0 | 32.4 |
| | Total | | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |
| Business strategy ^d | No | | 40.0 | 32.8 | 28.0 | 32.9 | 12.0 | 32.4 |
| | Yes | | 82.0 | 67.2 | 57.0 | 67.1 | 25.0 | 67.6 |
| | Total | | 122.0 | 100.0 | 85.0 | 100.0 | 37.0 | 100.0 |

Notes: ^a Full-time or part-time and weekends; ^b Own resources or loans from banks, relatives and government support; ^c Only cash or credit and debit cards, checks, electronic transfers, and grocery vouchers; ^d None or offers, advertising, social networks and search for new marketing and market channels.

Source: own creation.

Variations in nanoentrepreneurs' preferences for formality

The TM reports combinations of i rows and j columns that allow us to identify the current situation of the individuals who participated in the experiment (first stage), as well as their decision following their training and information received (second stage), i.e., to maintain their current situation or change their preference.¹⁰

When reviewing the case of the set of nano-entrepreneurs in cell $i = 1$ and $j = 1$, 52 individuals were currently informal and indicated their preference for maintaining that status.¹¹ It is worth noting that the status of individuals in cells $i = 2$ and $j = 2$ suggests that none of the 37 entrepreneurs whose initial status was formal decided to become informal after the experiment.

The status of the individuals in $i = 2$, $j = 1$ implies that 100% of formal entrepreneurs currently prefer to maintain this status, which means that 30.3% of the total number of nanoentrepreneurs are informal. On the other hand, 38.8% of the nanoentrepreneurs located in $i = 1$ and $j = 2$, whose initial status was informal, decided to become formal after learning about the benefits of belonging to this sector, meaning that 27% of the individuals who participated in this exercise decided to no longer work in the informal sector (see Table 2).

Table 2. Informal-formal transition matrix of nano-entrepreneurs Milpa Alta, Mexico City, 2022^a

| Current situation (Phase I) | Post-experiment preference Phase (II) | | |
|--------------------------------|--|---|--------|
| | Maintain initial preference | Informal-formal transition ^b | Total |
| Informal | 52 | 33 | 85 |
| | 61.2% | 38.8% | 100.0% |
| | 42.7% | 27.0% | 69.7% |
| Formal | 37 | 0 | 37 |
| | 100.0% | 0.0% | 100.0% |
| | 30.3% | 0.0% | 30.3% |
| Total | 89 | 33 | 122 |
| | 73.0% | 27.0% | 100.0% |
| | 73.0% | 27.0% | 100.0% |

Notes: ^a The value of the second percentage in each cell refers to the total number of individuals in the sample; ^b The data in cells $i=2$ and $j=2$ indicate that the 37 nanoentrepreneurs whose initial status was formal preferred to remain as such after the experiment.

Source: own creation.

Logit Models

The results of the econometric estimations take precedence over the influence of the factors considered in the first stage in relation to the preferences of nano-entrepreneurs, based on their current status. The first model uses informality as a dependent variable and tests the probability that the participant will maintain such status. The second model does the same for formal businesses. Finally, the third verifies the probability of a transition from informal to formal.¹²

In general terms, the average probability of a nano-entrepreneur deciding to remain in the informal sector is 40%; of staying in the formal sector, on average, 23% and, finally, the probability of an informal-formal transition is, on average, 24%. Table 3 shows the marginal effects of each model.

Table 3. Marginal effects of preference models for the informal and formal sectors and for the transition of nanoentrepreneurs Milpa Alta, Mexico City, 2022

| Variables | dy/dx | | |
|---|------------------------------------|----------------------------------|----------------------------|
| | Preference for the informal sector | Preference for the formal sector | Informal-formal transition |
| Male | NA | -0.178 (0.056) | 0.133 (0.110) |
| No education | NA | 0.713 (0.000) | NA |
| Primary | NA | NA | 0.404 (0.030) |
| Secondary | NA | 0.524 (0.020) | NA |
| High School | NA | 0.577 (0.008) | NA |
| Baccalaureate | NA | 0.603 (0.006) | NA |
| Bachelor's/engineering degree | NA | 0.649 (0.000) | NA |
| Incomplete Bachelor's/ engineering degree | 0.346 (0.033) | 0.649 (0.000) | NA |
| Family tradition | -0.149 (0.183) | 0.116 (0.332) | NA |
| Becoming independent | -0.372 (0.000) | NA | 0.497 (0.006) |
| Dedication | NA | 0.232 (0.001) | -0.125 (0.223) |
| Set-Up | -0.152 (0.141) | 0.169 (0.110) | NA |
| Up to MXN\$20,000 | -0.116 (0.017) | 0.065 (0.092) | NA |
| Between MXN\$21,000 and MXN\$50,000 | NA | NA | -0.205 (0.018) |
| Methods of payment | NA | NA | 0.121 (0.257) |
| Income | NA | NA | -0.057 (0.109) |
| Between MXN\$2,700 and MXN\$6,790 | -0.186 (0.077) | NA | NA |
| Profitability | 0.188 (0.054) | -0.174 (0.037) | 0.078 (0.384) |
| Y=Pr(y) (predict) | 0.406 | 0.228 | 0.235 |
| McFadden's R2 | 0.133 | 0.212 | 0.135 |
| Correctly classified | 63.11% | 76.2% | 73.8% |
| Hosmer-Lemeshow | 10.300 [0.245] | 5.030 [0.754] | 5.160 [0.741] |
| Mean VIF | 1.050 | 1.46 | 1.120 |

Notes: * (P>|t|) · ** [Prob > chi2] means that in the model the associated variable was not included as

... means that, in the model, the associated variable was not included as an explanatory variable. Furthermore, no model includes a constant.

Source: own creation.

The specifications regarding econometric estimates are correct, given that in all three cases, the coefficients are jointly significant in explaining the probability of nano-entrepreneurs maintaining their informal status, preferring the formal sector, and transitioning to the formal sector. Furthermore, McFadden's pseudo R²s indicate relative improvements to the models with regressors with respect to estimates that consider only the intercept of 13.3, 21.2, and 13.5%, respectively.

For example, the values of each model are correctly classified since the models predict 63.1, 76.2 and 73.8%, respectively, of the observations. The Hosmer-Lemeshow test provides evidence that the predicted probabilities do not deviate from the observed probabilities. Finally, the averages of the Variance Inflation Factor values for each model indicate values of 1.

In the case of the model of preference for the informal sector, if the nano-employee has a bachelor's degree or engineering degree, the probability of maintaining such status increases by 35 percentage points. Likewise, when the primary motivation for starting an informal business is to achieve independence, the probability of remaining informal decreases by 37 percentage points, which means that individuals try to stay in the market, and even a particular aversion to the informal sector may be observed.

Finally, when the monthly income of nano-businesses in Milpa Alta is between MXN\$2,700 and MXN\$6,790, the probability of the business preferring the informal sector is reduced by 19 percentage points, and when profitability is more than 50%, this probability increases by 18 percentage points. However, it should be noted that when the initial investment increases, there is a reduction of 11.6 percentage points in the probability of the business preferring the informal sector.¹³

As far as the model of preference for the formal sector is concerned, it was particularly interesting that as an individual increases the number of years of study from secondary school through high school and up to studies equivalent to a bachelor's or engineering degree, an increase of 52 to 65 percentage points is reported in the probability of preferring the formal sector.¹⁴ Likewise, when there are increases in the initial investment, the probability of remaining in this sector rises on average by 6.5%. At the same time, the time spent in the business (full-time) positively affects the probability of preferring to be formal by 23 percentage points.

Finally, the main result of the analysis of the marginal effects of the model of nano-entrepreneurs in this perimetropolitan locality of Mexico City, with a preference for transitioning from the informal to the formal sector, is that there is a negative variation in the probability of 21 percentage points in the choice of enterprises whose initial investment was less than MXN\$20,000. Likewise, if the primary motivation for informal entrepreneurship was to achieve economic independence, increases in the probability of transition of 50 percentage points were registered. Another interesting finding is that the participants who had completed primary school at the time of the experiment were the only ones willing to make this transition, and this is because those with higher levels of education are already in the formal system.¹⁵

5. CONCLUSIONS

The localities of the municipality of Milpa Alta, in Mexico City, are subject to the urbanization processes of the MZVM due to the low productivity of economic activities (rural and agricultural). At the same time, the socioeconomic structure of the municipality is located in a context of precarious employment, high levels of poverty, low coverage of basic services, and informality. As a result, the population is prone to develop subsistence mechanisms which translate into the creation of economic units that are difficult to find in the formal sector.

In the first stage of this study, information was collected from participants, such as gender, age, level of education, the year the business was founded, and monthly income, among others. In the second phase, it was possible to identify the current status of the entrepreneurs and compare it with their preference to maintain such status (informal or formal) or change their preference. The initial finding was that 47% of businesses in the informal sector were companies whose managers had completed secondary or high school.

Likewise, the TM carried out for this study indicates that 61.2% of informal entrepreneurs in the first phase decided to maintain that status. At the same time, the rest opted for the possibility of transitioning to the formal sector. For example, for the model in which participants belong to the informal sector, the main factors influencing their preference to maintain this status are not having completed professional studies and a monthly income of less than 39 minimum wages. It should also be noted that as the initial investment in the business increases, the probability of carrying it out in the informal sector is reduced.

With regard to preference for the formal sector, the main finding was that the higher the individual's level of education, the greater the probability they would choose the formal sector, and the higher the individual's initial investment, preferences for this scheme also increased. Finally, the informal-formal transition model revealed that the lower the initial investment, the less probability of making this transition.

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¹ Satellite localities are settlements with less than 2,500 inhabitants and are located within a radius of less than four kilometers from an urban center or a town with a larger number of inhabitants. The municipalities of Chalco, Huixquilucan and Texcoco in the State of Mexico, and the municipalities of Milpa Alta, Xochimilco and Tlalpan in Mexico City, have the highest number of satellite localities.

² 42% of these producers receive other income, in addition to their income from the production of nopal. This situation is associated with the fact that 20% of them reported having a bachelor's or engineering degree, as well as the reduction in prices during the high cactus production season, caused by competition with the municipality of Tlalnepantla, in the state of Morelos (Rodríguez et al., 2021; Rodríguez et al., 2022).

³ According to the 2019 Economic Censuses, in Milpa Alta in 2018 there were 3,900 economic units in the Commerce subsector (INEGI, 2019). Authors such as García and Fernández (2005) point out that these economic units are not necessarily inserted in the informal sector.

⁴ Leveau (2009) points out that in Argentina, peri-metropolitan localities are those with a population of less than 2,000 inhabitants adjacent to large agglomerations or in remote areas with respect to large urban centers.

⁵ The selection of the individuals in the sample was carried out through personalized visits to the workplaces, i.e., to the premises where the nano-entrepreneurs offer their goods and services.

⁶ One section of the survey is designed to emphasize scenarios in which, under a formal scheme, their one-person businesses would operate, such as success stories of nano-businesses that transitioned to the formal sector, as well as the current circumstances for remaining in the informal sector. The average duration of the survey was 40 minutes.

⁷ Some additional characteristics are that the values of the MT diagonal correspond, in percentage terms, to those nano-entrepreneurs who at the end of the period decided to remain in the sector in which they were at the beginning; and those cells below and above the diagonal represent in percentages, those nano-entrepreneurs who changed their preference, either from informal to formal or vice versa.

⁸ Logit models are used in fields such as economics and market research, politics, finance, among others (Greene, 1951).

⁹ The basic assumptions that must be fulfilled for logistic regression are independence of the errors, linearity in the Logit (for continuous variables), absence of multicollinearity and lack of highly influential atypical values (Cox, 1958).

¹⁰ The change in preference could be informal-formal or formal-informal. The transition from formal to informal is possible given the economic conditions caused by the sanitary contingency measures implemented during the last two years. This would mean that some nano-entrepreneurs would make the decision to leave the formal sector due to the reduction of their income as a result of social confinement.

¹¹ These 52 people represent 42.7% of the total number of individuals surveyed.

¹² In each case, the dependent variable is binary (1 = if the category in question is preferred).

¹³ In the Initial Investment categories, not all classes are presented because they are not statistically significant in any model. Therefore, they are not reported in Table 3.

¹⁴ If the person running the nano-company is a man, the probability of preferring formality decreases, on average 18%.

¹⁵ With respect to the schooling variable, the same happens as with the initial investment variable, i.e., some academic degrees are not statistically significant, so they were not considered in the estimation.