

International Journal of Public Law and Policy

ISSN online: 2044-7671 - ISSN print: 2044-7663

<https://www.inderscience.com/ijplap>

Proposing a predictive model of individual micro-entrepreneurship in Brazilian metropolitan areas through multiple linear regression

Gabriel Marcuzzo do Canto Cavalheiro

DOI: [10.1504/IJPLAP.2022.10050569](https://doi.org/10.1504/IJPLAP.2022.10050569)

Article History:

Received:	16 May 2022
Accepted:	05 August 2022
Published online:	02 December 2023

Proposing a predictive model of individual micro-entrepreneurship in Brazilian metropolitan areas through multiple linear regression

Gabriel Marcuzzo do Canto Cavalheiro

Universidade Federal Fluminense (UFF),
Rua Mário Santos Braga s/n, Campus do Valonguinho,
Prédio 2 da Faculdade de Administração, 7o andar,
Centro, 24020-140, Niterói, RJ, Brazil
Email: gabrielmarcuzzo@id.uff.br

Abstract: Entrepreneurship is widely acknowledged to be a phenomenon of central importance in our society. Within the arena of entrepreneurship policy, a more specific trend has been an increase in recent years in individual micro-entrepreneurship. However, although a period of more than ten years has passed since the implementation of the Individual Micro Entrepreneur Act in Brazil, which became known as MEI's Law 128/2008, literature remains silent on patterns regarding the relationship between the registration of individual micro-entrepreneurs, as one-person companies, with data related to the educational attainment of the population, income, and level of regional economic activity. Therefore, this article seeks to contribute to filling the knowledge gap in the entrepreneurship literature using empirical evidence integrated from the Brazilian Tax Authority (RFB) and the Brazilian Institute of Geography and Statistics (IBGE). In total, data was collected corresponding to 234 municipalities located in urban areas. The result shows that the regression model provides a good fit concerning model assumptions. The number of individual micro-entrepreneurs in metropolitan areas in Brazil could be predicted on a city level based on independent variables associated with population size and educational level of the population.

Keywords: individual micro-entrepreneurship; multiple linear regression; public policy; regional development; Brazil.

Reference to this paper should be made as follows: do Canto Cavalheiro, G.M. (2024) 'Proposing a predictive model of individual micro-entrepreneurship in Brazilian metropolitan areas through multiple linear regression', *Int. J. Public Law and Policy*, Vol. 10, No. 1, pp.17–31.

Biographical notes: Gabriel Marcuzzo do Canto Cavalheiro is an Adjunct Professor in the Department of Entrepreneurship and Management of Universidade Federal Fluminense (UFF). His PhD was awarded in Business Administration from the Fundação Getulio Vargas (FGV), Brazil, and obtained both his BSc and MSc in Production Engineering from Delft University of Technology, TU Delft in the Netherlands. His research interests lie on intellectual property, patents, patent analytics, patent management, and patent indicator development for competitive intelligence.

1 Introduction

Over the past years, informal entrepreneurship has an increasingly important topic in management and entrepreneurship literature (Ketchen et al., 2014; Webb et al., 2013). In essence, informal entrepreneurship refers to activities carried out on a regular basis aiming at earning an income, while informal income can be described as a remuneration for occasional informal activities associated with the delivery of products or services without the existence of contractual obligations (Welter et al., 2008).

According to Welter et al. (2015), informal activities are generally strongly characterised by a short-term duration. Additionally, informal activities are usually executed to both provide a single income for a family, or to provide an additional and varying income. Such activities are performed in a wide variety of business segments by attending the demand of both formal and informal enterprises (Blanchflower et al., 2007).

Fundamentally, the informal economy takes place outside existing legal boundaries, but, at the same time, within tolerated societal boundaries depending on the particular circumstances of different countries (Puente et al., 2019). Since informal entrepreneurs tend to operate partially or fully outside rules and regulations, employers, paid employees, and the self-employed also tend to attempt to reduce their costs by evading taxation and social contributions, especially in the context of developing countries with less strict government controls (Webb et al., 2013).

Given the noted negative impact of informal entrepreneurship on taxation and social contribution, public policy makers are constantly looking for instruments for preventing such growth. As a matter of fact, entrepreneurship policy is confronted with the world's most pressing challenges, which include creating jobs, strengthening communities, and generating social and economic value simultaneously (Mintrom and Maurya, 2020). In this way, most countries have implemented public policies aimed at reducing informal entrepreneurship by facilitating conditions for opening one-person companies (OPCs) representing individual micro-entrepreneurship initiatives. Accordingly, Williams (2021) identifies four entrepreneurship policy options toward the informal sector, including doing nothing, eradicating informal entrepreneurship, eradicating formal entrepreneurship and formalising informal entrepreneurship.

Therefore, the most simple and common form of business ownership type can be identified in many countries. For instance, well-established examples of such legal entity include the 'sole proprietorship' in the USA and Canada, 'OPC' in India, 'eenmanszaak' in the Netherlands, or 'einzelunternehmen' in Germany. In this context, following this international debureaucratisation trend led by developed countries, the Brazilian Federal Government has implemented the law of the Individual Micro Entrepreneur in 2008, which became known as MEI's Law 128/2008 and came into force in 2009.

At present, the total number of registered business entities in that format exceeded twelve million. As such, the growing number of individual micro-entrepreneurs in the Brazilian society has motivated the development of a wide variety of studies with different research objectives. For instance, Benatti et al. (2021) examined the contribution of individual micro-entrepreneurs to the socio-economic development of municipalities in the state of São Paulo in the period from 2010 to 2014. Sousa and Carvalho (2019), in turn, conducted a survey on the main reasons motivating the formalisation of individual micro-entrepreneurs in Brazil. Beyond this, Souza et al. (2022) examined how individual micro-entrepreneurs in Brazil are being affected by the burnout syndrome. Moreover, Oliveira and Souza (2020) have conducted a literature review on major trends regarding

individual micro-entrepreneurship in Brazil. However, although a period of more than 13 years has passed since the implementation of the Individual Micro Entrepreneur Act in Brazil, literature remains silent on patterns regarding the relationship between the registration of individual micro-entrepreneurs, as OPCs, with data related to the educational attainment of the population, income, and level of regional economic activity in the main metropolitan areas of the country.

As such, in this research, the number of registered individual micro-entrepreneurship entities was chosen as dependent variable, and ordinary least squares (OLS) analysis was used to explore the explanatory variables. Thus, the aim of this study is to improve understanding of main factors influencing the registrations of individual micro-entrepreneurs in urban areas in Brazil. Therefore, in our study, we will attempt to provide an answer to the following research question: what are the main variables that can predict the number of registered individual micro-entrepreneur in Brazilian metropolitan areas?

The structure of this paper is as follows. First, the literature on topics central to this research such as informal entrepreneurship and entrepreneurship policy are explained, and hypothesis and our research model are proposed-based. Subsequently, the research method is discussed. The empirical setting of this study is then provided by executing a multiple linear regression analysis on data corresponding to municipalities located in the main metropolitan areas in Brazil. In the following section, the findings are then presented and related to the extant literature. Finally, the conclusions drawn are put forward.

2 Literature review

Prior to present and assess data related to the individual micro-entrepreneurs in Brazilian metropolitan areas, we provide an overview of mainstream literature on micro-entrepreneurship and entrepreneurship policy.

2.1 Micro-entrepreneurship

As stated by Damayanthi (2016), micro-entrepreneurship holds a strong potential for generating inclusive growth in developing countries. In this regard, according to Verdugo (2018), the implementation of training or coaching programs can contribute to increase cognitive complexity micro-entrepreneurs and improve their ability to incorporate new ideas and adopt innovations. In this regard, most scholars held a consistent view that there is a positive relationship between micro-entrepreneurship and the level of education of entrepreneurs (Verdugo, 2018; Bhuiyan and Ivlevs, 2019).

However, the success of micro-enterprises is not only dependent of the ability of the micro-entrepreneur, but also on other factors, such as socio-demographic circumstances, cultural environment and age (Vial, 2011). Besides, DasGupta (2018) points out that non-monetary factors that are also motivators for micro-entrepreneurs include recognition, self-esteem, and respect. In this way, Bhuiyan and Ivlevs (2019) argue that micro-entrepreneurs can experience an increase in satisfaction with financial security and achievement in life through micro-credit. Espitia and Cervilla (2019), in turn, identified three types of entrepreneurial motivation based on the analysis of the Global

Entrepreneurship Monitor (GEM) data for Latin American countries. The motivations include: necessity, opportunity and transition. Additionally, Jarrodi et al. (2019) claim that the political vision of entrepreneurs, which includes anti-statists, reformist and neoliberal, contribute to shape their motivations. Furthermore, as claimed by Vial (2011), micro-entrepreneurship in developing countries is characterised by a combination of high level of informality and low degree of technology use.

The informal economy can be currently considered a widespread phenomenon that is intensely present throughout the world, regardless of the level of economic prosperity of the country (Williams and Nadin, 2010). According to Webb et al. (2013), the informal economy consists of business activities that occur outside of formal institutional boundaries but within the boundaries of informal institutions. Beyond this, Mahadea and Khumalo (2020) argue that the formalisation of individual micro-enterprises remains a challenging task due to both the internal constraints of these enterprises as well as external growth constraints. Rahou and Taqi (2021) examined the determinants of the willingness of informal micro-entrepreneurs in Morocco to enter the formal sector. Mukorera (2019), in turn, argues that the willingness to formalise by informal entrepreneurs in Zimbabwe is determined by institutions imperfections of bureaucracy associated with the registration process, lack of access to technology, market and financial constraints, as well as lack entrepreneurial and managerial skills.

Moreover, informal entrepreneurship is a phenomenon that is not just restricted to developing countries, but is also present in the most developed economies in the world. For instance, Welter et al. (2015) claims that a prosperous economy, such as the UK, strongly depends on informal activities in order to promote job opportunities and income generation, especially when it comes to their immigrant communities. As stated by Kosta and Williams (2020), Italy is another example of a developed country, in which formal and informal enterprises collaborate intensively. As such, in developed countries, despite the existence of rigid labour market regulations, there are many economic, such as cleaning, that are dominated by informal activity (Blanchflower et al., 2007).

Typically, informal entrepreneurship is motivated by economic necessity, rather than opportunity identification (Vial, 2011). However, Puente et al. (2019) claim that necessity-driven entrepreneurship does not necessarily indicate the absence of high growth aspirations. Recent research on informal entrepreneurship has continuously emphasised that the boundaries between formal and informal entrepreneurship is blurred (Welter et al., 2008). For instance, in developed economies, a large number of individuals are formally registered as individual entrepreneurs and pay all relevant taxes. However, at the same time, part of those individuals trade with products that are both illegal and non-certified (Welter et al., 2008). In this way, scholars observed a positive relationship between the individual micro-entrepreneurship and the total size of the population (Williams and Nadin, 2010; Webb et al., 2013). They argue that individual micro-entrepreneurship is likely to become more common in large urban areas.

2.2 Entrepreneurship policy

As described by Mintrom and Maurya (2020), entrepreneurship policy should address the most significant political, social and economic factors. Since income inequality has a negative impact on economic growth (Aiyar and Ebeke, 2020), poverty eradication has been one of the primary objectives of entrepreneurship policy (Malerba, 2020). As such,

Bruce et al. (2020) argue that policy makers tend to create tax mechanisms to encourage small business activity due to its potential impact on employment and economic growth.

According to Gilbert et al. (2004), traditional policy instruments were generally implemented at the federal level, while entrepreneurship policies are implemented at all levels of government. Accordingly, as argued by Mintrom and Maurya (2020), most studies of entrepreneurship policy have explored the pursuit of policy change at all levels of government, including national, state, and local, while only a few have explored the dynamics between these levels of government. In this way, Naldi et al. (2020) claims that initiatives of local governments to promote public or private investments to improve the economic conditions for a place or region have a very long history, as the efforts of a local government are important for the development of vulnerable small and medium-sized towns (SMSTs). For instance, as described by Rogers et al. (2020), local governments in China employ different strategies to promote employment, such as offering free training programs, provision of employment guidance and the indication for community jobs such as security, gardening, and maintenance. As such, empirical studies have shown that education has a positive effect on the level of entrepreneurship activity (Naldi et al., 2020). Furthermore, governments also play an important role in creating adequate conditions to support the growth of businesses. Consequently, Lugaric (2019) points out that a growing number of tax administrations are attempting to provide incentives to cooperate by creating a trust-based relationship that leads to voluntary tax compliance.

Gilbert et al. (2004) suggest that entrepreneurship public policies tend to focus increasingly on promoting entrepreneurial activity by supporting the creation of new enterprises and reducing bureaucratic requirements for entrepreneurial firms. In this way, Karpunina et al. (2021) claim that there is a growing trend toward digitalisation of government services. Regulating self-employment is a challenge faced by public policymakers throughout the world. For instance, according to Fritsch and Kublina (2015), between 1991 and 2009, Germany experienced a strong rise in the level of self-employment in the first two decades following unification. In this way, political motivations are commonly seen as the driving force behind the creation of policy instruments towards small business preservation (Gilbert et al., 2004). Additionally, research has shown that regions with a higher level of economic activity present more opportunities for individual micro-entrepreneurs (Puente et al., 2019).

Additionally, in response to the COVID-19 pandemic, it is possible to observe a number of trends regarding individual micro-entrepreneurship. In this way, Kaltenborn (2020) explains that several countries have introduced new social programs or expanded existing ones in response to the COVID-19 pandemic.

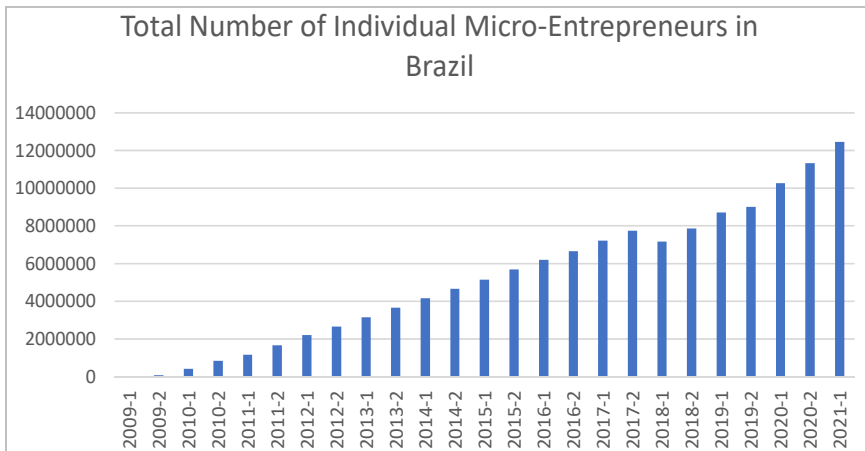
2.3 Overview of the Individual Micro-entrepreneur Act in Brazil

The individual micro-entrepreneur is a business entity resulting from an adjustment of the Brazilian legislation regarding the regulation of business ownership. The Complementary Law No. 128/2008 that amended the General Law on Micro and Small Enterprises (Complementary Law No. 123/2006) created the figure of the individual micro-entrepreneur. As such, the first individual micro-entrepreneurs started to be registered in 2009. To this end, an e-government portal was created, which is named

Portal do Empreendedor. This portal allows for the creation of a sole proprietorship enterprise without any costs or the need to hire an account.

The Complementary Law No. 128/2008 established that an individual micro-entrepreneur should have an annual revenue of less than 81 thousand Brazilian reais, which corresponds to approximately 15,000 USD during the time of this study. Additionally, the owner of the company can hire one employee. Although creating a OPC is free, a monthly contribution is required amounting between 50.90 and 55.90 Brazilian reais depending upon the occupational area, which corresponds to approximately 10 USD. This contribution includes both local taxes as well as a public pension contribution. Figure 1 provides a longitudinal overview of the registrations and demonstrates a steady increase in the number of individual micro-entrepreneurs. In July 2021, the total number of registered business entities in that format exceeded twelve million. According to the Brazilian Institute for Geography and Statistics, Brazil has a population of 210 million and an active working population of 110 million (IBGE, 2020). As Hunter et al. (2021), the Brazilian economy is characterised by the existence of substantial social and economic disparities, which motivated the introduction of large-scale income transfer programs and, therefore, policy instruments to reduce long-term dependence on such policy instruments are highly sought. At present, it is possible to observe that a little bit less than 10% of the Brazilian working population has created a one-person enterprise. Moreover, Azevedo et al. (2021) have examined the profile of the individual micro-entrepreneurs and observed a greater level informality among women.

Figure 1 Longitudinal analysis of the number of registered individual micro-entrepreneurs in Brazil (see online version for colours)



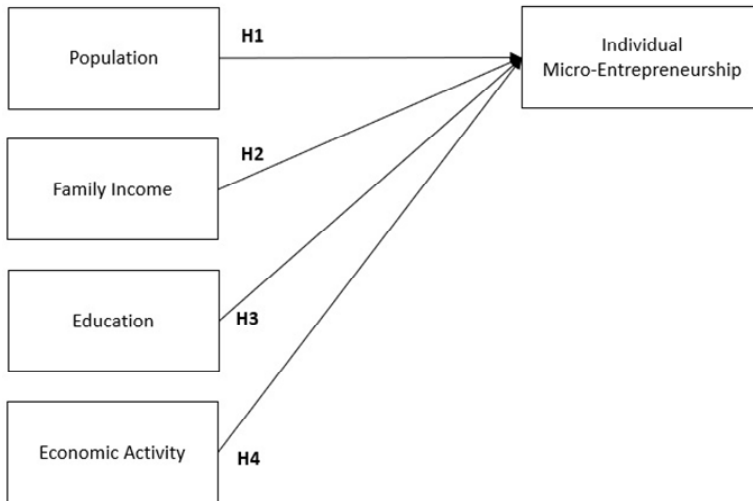
Source: The authors

2.4 Model construction and hypotheses

In response to the pressing need for a model to assess the dynamics of individual micro-entrepreneurs in Brazil, this section is dedicated to proposing a conceptual framework to represent the relationship among the number of registered individual micro-entrepreneurs and population, demographic and socio-economic data. In this way,

this paper is an attempt to understand how individual micro-entrepreneurship can be predicted. Figure 2 presents the research model proposed in this paper, and summarises the following hypotheses which are to be explored. Based on the above literature, the following hypotheses were put forward.

Figure 2 Correlations among the number of individual micro-entrepreneurs and population, demographic and socio-economic data



Source: The author

First, it is possible to assume a positive relation between the number of registered individual micro-entrepreneurs and the population size of a municipality (Williams and Nadin, 2010; Webb et al., 2013). Based on these considerations, we formulate the following hypothesis:

Hypothesis 1 The number of registered individual micro-entrepreneurs is directly affected by the total population of the city.

Moreover, a higher average monthly income suggests a prosperous city with more entrepreneurial activity (Naldi et al., 2020; Rogers et al., 2020). Therefore, we predict the following:

Hypothesis 2 The number of registered individual micro-entrepreneurs is directly affected by the average monthly income.

Besides, education seems to play a role in the level of formal entrepreneurship (Verdugo, 2018; Bhuiyan and Ivlevs, 2019). Thus, we predict the following:

Hypothesis 3 The number of registered individual micro-entrepreneurs is directly affected by the level of education of citizens.

Finally, we assume that regions with a higher level of economic activity present more opportunities for individual micro-entrepreneurs (Puente et al., 2019). Accordingly, the fourth hypothesis is stated as follows:

Hypothesis 4 The number of registered individual micro-entrepreneurs is directly affected by the GDP per capital of a municipality.

3 Research method

In essence, we adopt a multiple regression process for exploring the relationship of three independent variables as they relate to the dependent variable of this quantitative study, the number of registered individual micro-entrepreneurs on a city level in metropolitan areas in Brazil. According to Cohen and Cohen (1983), regression analysis is a statistical technique used to explore the relationship between metrically measured independent and dependent variables. As pointed out by Chatterjee and Hadi (2012), this statistical technique, commonly used for prediction and forecasting, has become one of the most used statistical tools for determining the correlation between two or more variables. As such, linear regression models are considered simple and effective solutions for creating prognostic capabilities. Linear regression analysis belongs to the quantitative analysis methods, which is widely used in the statistical analysis of a wide variety of data. Essentially, the application of this method can determine the correlation between two or more variables (Khaled et al., 2019).

More specifically, we carry out an OLS regression, which estimates the parameters in a linear model by minimising the vertical distances between responses that are observed and the responses that are predicted by the linear estimate (Dismuke and Lindrooth, 2006). According to Wang and Jain (2003), OLS is the most widely used approach to conducting a multiple regression analysis. As a consequence, OLS was used to test our hypotheses.

We collected secondary data on the total number of registered individual-micro-entrepreneurs per municipality from the e-government portal of the Brazilian Tax Authority (RFB) – <http://www22.receita.fazenda.gov.br/inscricaoem/privado/pages/relatorios/opcoesRelatorio.jsf>. Our queries concerned total number registered individual micro-entrepreneurs per municipality. In addition, we also collected population, demographic, and socio-economic data from the website of the Brazilian Institute of Geography and Statistics (IBGE) – <https://cidades.ibge.gov.br/>. Our sample includes data from municipalities located in the 12 largest metropolitan areas in Brazil, including Belém, Belo Horizonte, Campinas, Curitiba, Fortaleza, Goiânia, Manaus, Porto Alegre, Recife, Rio de Janeiro, Salvador and São Paulo. In total, data was collected corresponding to 234 municipalities located in urban areas.

4 Results

This section is aimed at presenting and analysing secondary data corresponding to the registration of Brazilian individual micro-entrepreneurs, population, demographic and socio-economic data. As such, we present the results contrasting the proposed research model and the hypotheses on which it is based.

4.1 Descriptive comparison of the variables

Prior to conducting the linear multiple regression, the descriptive statistics for the variables are presented in Table 1, while the correlation matrix is presented in Table 2. We have described the variables, as well as the source of data. Our study variables include number of registered individual micro-entrepreneurs, total population of the municipality, average monthly income per family, number of students enrolled in elementary school, number of students enrolled in high school, GDP per capita of the municipality, and annual budget of the municipality.

Table 1 Description, mean, and standard deviation of model's variables

<i>Variable's names</i>	<i>Description</i>	<i>Source</i>	<i>Mean</i>	<i>Standard deviation</i>
<i>Y</i>	Number of registered individual micro-entrepreneurs in Brazil – measured in number of individuals	Portal do Empreendedor (2020)	20,466	81072
<i>X₁</i>	Population of the municipality – measured in number of citizens	Brazilian Institute of Geography and Statistics (IBGE, 2020)	324,909	1,079,797
<i>X₂</i>	Average monthly income per family – measured in Brazilian reais	Brazilian Institute of Geography and Statistics (IBGE, 2020)	2,754	796
<i>X₃</i>	Number of students enrolled in elementary school – measured in number of students	Brazilian Institute of Geography and Statistics (IBGE, 2020)	34,612	1,100,679
<i>X₄</i>	Number of students enrolled in high school – measured in number of students	Brazilian Institute of Geography and Statistics (IBGE, 2020)	10,454	32,922
<i>X₅</i>	GDP per capita of the municipality – measured in Brazilian reais	Brazilian Institute of Geography and Statistics (IBGE, 2020)	37,240	40,021
<i>X₆</i>	Annual budget of the municipality – measured in millions of Brazilian reais	Brazilian Institute of Geography and Statistics (IBGE, 2020)	1,040	4,218

Table 2 Correlation matrix

<i>Variables</i>	<i>Y</i>	<i>X₁</i>	<i>X₂</i>	<i>X₃</i>	<i>X₄</i>	<i>X₅</i>	<i>X₆</i>
<i>Y</i>	1.0000	0.9239	0.3088	0.9841	0.9816	0.0457	0.9612
<i>X₁</i>	0.9239	1.0000	0.2937	0.9269	0.9249	0.0410	0.9738
<i>X₂</i>	0.3088	0.2937	1.000	0.3171	0.3277	0.6991	0.3159
<i>X₃</i>	0.9841	0.9269	0.3171	1.0000	0.9945	0.0466	0.9537
<i>X₄</i>	0.9816	0.9249	0.3277	0.9945	1.0000	0.0454	0.9409
<i>X₅</i>	0.0457	0.0410	0.6991	0.0466	0.0454	1.0000	0.0837
<i>X₆</i>	0.9612	0.9738	0.3159	0.9537	0.9409	0.0837	1.0000

By examining correlations between independent variables, as listed in the correlation matrix in Table 2, it is possible to identify the need to remove two independent variables

from our model in order to reduce the risk of collinearity. As Elementary_School (X_3) presents 0.9841 correlation with High_School (X_4), we decided to maintain only High_School as this independent variable represents a higher level of education of citizens in a municipality. Similarly, we decided to remove total-budget (X_6), as this independent variable presents a correlation of 0.9738 with population (Y).

4.2 Multiple linear regression analysis

The final step is to develop a multiple linear regression model for the registration of individual micro-entrepreneurs. In order to see the causal link between the number of registered individual micro-entrepreneurs in urban Brazilian municipalities and population, demographic and socio-economic data, a multiple linear regression model has been performed. To this end, we have applied the following multiple linear regression equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_4 X_4 + \beta_5 X_5 + \epsilon_i$$

In our multiple regression equation, we have the following:

- Dependent variable:
 Y number of registered individual micro-entrepreneurs in Brazil.
- Independent variables:
 $\beta_1 X_1$ population of the municipality
 $\beta_2 X_2$ average monthly income per family
 $\beta_4 X_4$ number of students enrolled in high school
 $\beta_5 X_5$ GDP per capita of the municipality
 ϵ_i residual (error).

The results of our multiple linear regression are show below. In Table 3, a summary is provided of the main parameters of our model. The F-value statistics test the overall significance of the regression model. This tests the full model against a model with no variables and with the estimate of the dependent variable being the mean of the values of the dependent variable. In this case, the p-value attained for F-value test was below 0.001. Thus, the regression model provides a consistent estimate for our sample.

Table 3 Summary of the model

<i>Model parameters</i>	<i>Values</i>
Model	Ordinary least squares (OLS)
R-squared	0.966
Adjusted R-squared	0.965
F-statistic	1,617
Prob. (F-statistic)	1.58e-166
Durbin-Watson	1.91
Number of observations	234

Table 4 summarises the coefficients necessary for the construction of our multiple regression model, including both the constant and independent variables. Beyond this, we have observed $p < 0.05$ for X_1 and X_4 , which indicates that our data is statistically significant for those independent variables. Additionally, we can see that population size, number of enrolled students in high school, and GDP per capita positively affects the number of registered individual-micro-entrepreneurs, while the average monthly income of families has a negative impact on registrations of individual micro-entrepreneurs. As such, we have refined our model adopting X_1 and X_4 and independent variables.

Table 4 Overview of the multiple linear regression results

<i>Model</i>	<i>Coefficient</i>	<i>Standard error</i>	<i>T</i>	<i>p</i>
const	16,547.490	4,374.579	0.378	0.006
X_1	0.0082	0.002	3.391	0.001
X_2	-30.482	1.912	-1.594	0.112
X_4	21.906	0.081	27.096	0.000
X_5	0.0441	0.036	1.226	0.221

As such, we have refined our model adopting X_1 and X_4 as the statistically significant independent variables. Consequently, we executed another run of our multiple linear regression model and the results are listed in Table 5.

Table 5 Overview of the refined multiple linear regression results

<i>Model</i>	<i>Coefficient</i>	<i>Standard error</i>	<i>T</i>	<i>p</i>
Const	-4,689.2049	973.011	4.819	0.000
X_1	-0.006	0.002	2.718	0.007
X_4	0.6682	0.023	29.682	0.000

The refined multiple linear regression equation became the following:

$$Y = \beta_0 + \beta_1 X_1 + \beta_4 X_4 + \epsilon_i$$

where

$$Y = -4689.2049 + 0.0062 X_1 + 0.6682 X_4 + 2.916.$$

5 Discussion

We have provided a rich description of the Brazilian arena for individual micro-entrepreneurship 13 years after the implementation of the Individual Micro Entrepreneur Act in Brazil, which became known as MEI's Law 128/2008 and created this legal business legal type. Clearly, the introduction of the legal entity of the individual micro-entrepreneur can be regarded as an attempt to create a new tax mechanism to encourage small business activity in Brazil (Bruce et al., 2020). The data exposed and analysed through the regression model, allow us to observe that in Brazil the existing trend between 2009 and 2021, shows a steady increase in the number of registered individual micro-entrepreneurs.

In this paper, the application of multiple linear regression models was proposed based on literature review to predict the individual micro-entrepreneurship in urban areas in Brazil. In the following, we applied the model to analyse secondary data collected from Brazilian e-government websites concerning municipalities located in the main metropolitan areas in Brazil. More specifically, data was collected from the Brazilian e-government portal for individual micro-entrepreneurs, which administered by the RFB, as well as from the IBGE.

The results demonstrate that the number of individual micro-entrepreneurs can be predicted by two independent variables on a municipality level, including population size and number of students enrolled in high school, as these variables were considered statistically significant ($p < 0.05$). Therefore, the results demonstrate that, for individual micro-entrepreneurship, the multiple linear regression model is an acceptable model to predict the number of registered individual micro-entrepreneurs.

Additionally, we have demonstrated that population size has a moderate negative impact on the number of registered individual micro-entrepreneurs ($\beta_1 = -0.006$, $p < 0.05$), the number of students enrolled in high school ($\beta_4 = 0.6682$, $p < 0.05$) has a stronger positive impact on the number of registered individual micro-entrepreneurs, thereby providing evidence to support H3. As such, the higher the number of students enrolled in high school, it is possible to conclude that there will be more opportunities for individual-micro-entrepreneurs. However, Hypothesis 1 which predicted a positive relationship between number of registered individual micro-entrepreneurs and population was rejected, as the relationship was negative. Furthermore, our H2 was also not supported, as we observed that the average monthly income in a municipality could not be considered a significant independent variable ($\beta_2 = -30.482$, $p > 0.05$). Besides, average monthly income did not add to the explanatory power of the model. Following, Puente et al. (2019), one possible explanation is that higher average monthly income suggests the availability of higher salaries offered by existing companies. In this way, the availability of higher paying jobs could be an incentive for intra-entrepreneurship, rather than individual micro-entrepreneurship.

Moreover, we opted to remove the variables concerning number of students enrolled in elementary school and total annual budget of the municipalities to avoid the risk of multicollinearity. The results of the correlation analysis show that the number of students enrolled in elementary and higher education are strong correlated. Therefore, we opted to maintain only the number of high school enrolments. Similarly, total annual budget of the municipalities and GDP per capita are also strongly correlated. As such, we opted to keep just GDP per capita in our multiple regression model.

6 Conclusions

Public entrepreneurship policies should contribute to prepare entrepreneurs to maximise the creation of economic and social value everywhere. As such, the challenge of measuring the impact of public policy addressing entrepreneurial activity is becoming increasingly important. In this study, we used a multiple linear regression process for exploring the relationship of predictive variables as they relate to the dependent variable of this quantitative study, which regards the number of registered individual micro-entrepreneurs. Our research also revealed that individual micro-entrepreneurship can be predicted by independent variables, including population size and the number of

students enrolled in high school. The proposed model indicates that due to the behaviour of registrations of individual micro-entrepreneurs in Brazilian metropolitan areas this instrument can be used to make projections and reflections, allowing the generation of strategies to promote entrepreneurship. As such, public policy makers can benefit from this study by understanding the importance of education as an enabling condition of entrepreneurial activity. Moreover, we observed that the number of registered individual micro-entrepreneurs is strongly correlated with the annual budget of the municipality, which indicates that municipalities attracting more individual micro-entrepreneurs are also the ones with more intensive economic activities.

However, there are still some limitations to the research process. First, although we believe unemployment could add explanatory power to our model, it is not possible to obtain reliable unemployment data from all municipalities in the main Brazilian metropolitan areas that comprise our sample. Hence, the selection of independent variables is not yet comprehensive and systematic. The third limitation regards the sample limited to municipalities located in the twelve largest metropolitan areas in Brazil. Therefore, caution should be applied when the results are used for more general purposes. These aspects need to be strengthened in the future.

Finally, our analysis provides a blueprint to guide future research and facilitate knowledge accumulation concerning the factors affecting individual micro-entrepreneurs in urban areas of developing countries. We also recommend more research into the factors affecting individual micro-entrepreneurship in urban areas of other developing countries.

References

- Aiyar, S. and Ebeke, C. (2020) 'Inequality of opportunity, inequality of income and economic growth', *World Development*, Vol. 136, p.105115.
- Azevedo, F.E.C., Ferreira, K.S., Moreira, M.Z. and Ferreira, A.V. (2021) 'Women's participation in the microentrepreneur individual program: an analysis at a Sebrae Service Station', *REGEA*, Vol. 10, No. 3, pp.108–121.
- Benatti, L.N., Silva, E.E. and Prearo, L.C. (2021) 'Individual microentrepreneurs and economic development in the municipalities of São Paulo from 2010 to 2014', *REGPEPE*, Vol. 10, No. 2, pp.1–11.
- Bhuiyan, M.F. and Ivlevs, A. (2019) 'Micro-entrepreneurship and subjective well-being: evidence from rural Bangladesh', *Journal of Business Venturing*, Vol. 34, No. 4, pp.625–645.
- Blanchflower, D.G., Saleheen, J. and Shadforth, C. (2007) *The Impact of the Recent Migration from Eastern Europe on the UK Economy*, IZA Discussion Paper No. 2615.
- Bruce, D., Gurley-Calvez, T.J. and Norwood, A.A. (2020) 'Taxes and entrepreneurship: a literature review and research agenda', *Foundations and Trends in Entrepreneurship*, Vol. 16, No. 5, pp.393–443.
- Chatterjee, S. and Hadi, A.S. (2012) *Regression Analysis by Example*, 5th ed., Wiley, New York.
- Cohen, J. and Cohen, P. (1983) *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, NJ Erlbaum, Hillsdale.
- Damayanthi, B.W.R. (2016) 'Analyzing the determinants of entrepreneurial activity level in urban micro enterprises in Sri Lanka', *Proceedings of the 13th International Conference on Business Management (ICBM)*, University of Sri Jayewardenepura, Sri Lanka.
- DasGupta, M. (2018) 'Literature review on micro entrepreneurship development and quality of life improvement', *International Journal of Multidisciplinary*, Vol. 3, No. 3, pp.54–60.

- Dismuke, C. and Lindrooth, R. (2006) 'Ordinary least squares', *Methods and Designs for Outcomes Research*, Vol. 93, pp.93–104.
- Espitia, C.G.G. and Cervilla, M.A. (2019) 'Necessity entrepreneurship in Latin America: it's not that simple', *Entrepreneurship & Regional Development*, Vol. 31, Nos. 9–10, pp.953–983.
- Fritsch, M. and Kublina, S. (2015) *Entrepreneurship, Growth, Regional Growth Regimes*, Jena Economic Research Papers 2015-002, Friedrich-Schiller-University Jena.
- Gilbert, B.A., Audretsch, D.B. and McDougall-Covin, P.P. (2004) 'The emergence of entrepreneurship policy', *Small Business Economics*, Vol. 22, Nos. 3/4, pp.313–323.
- Hunter, W., Patel, L. and Sugiyama, N.B. (2021) 'How family and child cash transfers can empower women: comparative lessons from Brazil and South Africa', *Global Social Policy*, Vol. 21, No. 2, pp.258–277.
- IBGE (2020) *Projeção da população do Brasil e das unidades da federação*.
- Jarrodi, H., Byrne, S. and Bureau, S. (2019) 'A political ideology lens on social entrepreneurship motivations', *Entrepreneurship and Regional Development*, Vol. 31, Nos. 7–8, pp.583–604.
- Kaltenborn, M. (2020) 'Social protection floors as an investment in the future', *International Journal of Public Law and Policy*, Vol. 6, No. 4, pp.312–325.
- Karpunina, E.K., Irina V. Kosorukova, I.V., Dubovitski, A.A., Galieva, G.F. and Chernenko, E.M. (2021) 'State policy of transition to Society 5.0: identification and assessment of digitalisation risks', *International Journal of Public Law and Policy*, Vol. 7, No. 4, pp.334–350.
- Ketchen, D.J., Ireland, R.D. and Webb, J.W. (2014) 'Toward a research agenda for the informal economy: a survey of the strategic entrepreneurship journal's editorial board', *Strategic Entrepreneurship Journal*, Vol. 8, No. 1, pp.95–100.
- Khaled, O., Tan, Y.C. and Yap, P.S. (2019) 'Analysis of the human health damage and ecosystem quality impact of the palm oil plantation using the life cycle assessment approach', *IOP Conference Series Earth and Environmental Science*, Vol. 268, p.012036.
- Kosta, B. and Williams, C.C. (2020) 'Evaluating the effects of the informal sector on the growth of formal sector enterprises: lessons from Italy', *Journal of Developmental Entrepreneurship*, Vol. 25, No. 3, p.2050019.
- Lugaric, T.R. (2019) 'The cooperative compliance model in taxation', *International Journal of Public Law and Policy*, Vol. 6, No. 2, pp.170–186.
- Mahadea, D. and Khumalo, S. (2020) 'Entry and exit from informal microenterprise entrepreneurship in a South African municipality: a tale of resilience', *Journal of Developmental Entrepreneurship*, Vol. 25, No. 3, p.2050020.
- Malerba, D. (2020) 'Poverty alleviation and local environmental degradation: an empirical analysis in Colombia', *World Development*, Vol. 127, p.104776.
- Mintrom, M. and Maurya, D.A.J. (2020) 'Policy entrepreneurship in Asia: the emerging research agenda', *Journal of Asian Public Policy*, Vol. 13, No. 1, pp.1–17.
- Mukorera, S.Z.E. (2019) 'Willingness to formalize: a case of the informal and small-scale enterprises in Zimbabwe', *Journal of Developmental Entrepreneurship*, Vol. 24, No. 1, pp.1–14.
- Naldi, L., Larsson, J.P. and Westlund, H. (2020) 'Policy entrepreneurship and entrepreneurial orientation in vulnerable Swedish municipalities', *Entrepreneurship & Regional Development*, Vol. 32, Nos. 7–8, pp.1–19.
- Oliveira Jr., J.P. and Souza, A.A. (2020) 'O empreendedorismo e o crescimento do microempreendedor individual', *Revista Científica Eletrônica de Ciências Aplicadas da FAIT*, Vol. 9, No. 1, pp.1–11.
- Portal do Empreendedor (2020) *Portal do Empreendedor do Ministério da Economia* [online] <https://www.gov.br/empresas-e-negocios/pt-br/empreendedor>.
- Puente, R., Espitia, C.G.G. and Cervilla, M.A. (2019) 'Necessity entrepreneurship in Latin America: it's not that simple', *Entrepreneurship & Regional Development*, Vol. 31, Nos. 9–10, pp.953–983.

- Rahou, E.H. and Taqi, A. (2021) 'The conversion from informality to a formal entity: links to the nature of the owner-manager', *Journal of Developmental Entrepreneurship*, Vol. 23, No. 4, p.2150027.
- Rogers, S., Li, J., Guo, H. and Li, C. (2020) 'China's rapidly evolving practice of poverty resettlement: moving millions to eliminate poverty', *Development Policy Review*, Vol. 38, No. 5, pp.541–554.
- Sousa, E.M.T. and Carvalho, H.A. (2019) 'Individual micro entrepreneur: why formalize', *REGMPE*, Vol. 4, No. 2, pp.128–147.
- Souza, B.F., Martins, L.N. and Resende, C.M.A. (2022) 'A síndrome de burnout no âmbito de microempreendedores individuais', *Relatos Históricos*, Vol. 13, No. 1, pp.329–357.
- Verdugo, G.A.B. (2018) 'Innovative self-concept of micro-entrepreneurs: perception of barriers and intention to invest', *Brzilian Administration Review*, Vol. 15, No. 2, pp.1–23.
- Vial, V. (2011) 'Micro-entrepreneurship in a hostile environment: evidence from Indonesia', *Bulletin of Indonesian Economic Studies*, Vol. 47, No. 2, pp.233–262.
- Wang, G.C. and Jain, C.L. (2003) *Regression Analysis: Modeling & Forecasting*, Institute of Business Force.
- Webb, J.W., Bruton, G.D., Tihanyi, L. and Ireland, R.D. (2013) 'Research on entrepreneurship in the informal economy: framing a research agenda', *Journal of Business Venturing*, Vol. 28, No. 5, pp.598–614.
- Welter, F., Smallbone, D. and Pobol, A. (2015) 'Entrepreneurial activity in the informal economy: a missing piece of the entrepreneurship jigsaw puzzle', *Entrepreneurship & Regional Development*, Vol. 27, Nos. 5–6, pp.292–306.
- Welter, F., Trenttin, L. and Neumann, U. (2008) 'Fostering entrepreneurship in distressed urban neighbourhoods', *International Entrepreneurship and Management Journal*, Vol. 4, No. 2, pp.109–28.
- Williams, C.C. (2021) 'Policy approaches toward informal sector entrepreneurship: an overview', *Journal of Developmental Entrepreneurship*, Vol. 26, No. 2, pp.1–18.
- Williams, C. and Nadin, S. (2010) 'Entrepreneurship and the informal economy: an overview', *Journal of Developmental Entrepreneurship*, Vol. 15, No. 4, pp.361–378.