Informal labor and poverty in the metropolitan region of Rio de Janeiro, Brazil

Trabalho informal e pobreza na região metropolitana do Rio de Janeiro, Brasil

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ABSTRACT
Poverty in Brazil persists as a significant challenge for society, addressing not only fundamental moral concerns but also the need to promote conditions conducive to economic and social development. The complexity of the problem, characterized by multiple factors beyond income, includes historical inequalities, unequal economic structures, and limited access to resources and public services. Despite advancements in recent decades, the increase in poverty between 2014 and 2016, driven by growing income inequality, underscores the fragility of these advances. The rise in poverty rates in the Metropolitan Region of the state of Rio de Janeiro, where affluent areas coexist with deprived communities, becomes a cause for concern, exacerbated by factors such as lack of decent employment, educational precarity and socio-economic impacts of the pandemic. Confronting these issues, a detailed analysis using data from the Continuous National Household Sample Survey (Continuous PNAD) of 2012, 2016 and 2020.
highlights the formality of employment as a crucial factor in poverty reduction in the region. The transition from informality to formality is associated with significant gains in poverty reduction, surpassing even the impact of the educational level of the head of the household. Results from Bayesian logistic regression show that formality decreases the likelihood of individuals and their families having per capita household income below the poverty line. This research emphasizes the need for comprehensive public policies in the state of Rio de Janeiro, aiming to promote economic opportunities, improve the quality of education and invest in infrastructure, underscoring the importance of enhancing employment ties as an effective strategy in the fight against poverty.

**Keywords:** poverty, formal employment, Rio de Janeiro, Bayesian logistic regression.

**RESUMO**
A pobreza no Brasil persiste como um desafio significativo para a sociedade, abordando não apenas preocupações morais fundamentais, mas também a necessidade de promover condições propícias ao desenvolvimento econômico e social. A complexidade do problema, caracterizada por múltiplos fatores para além do rendimento, inclui as desigualdades históricas, as estruturas econômicas desiguais e o acesso limitado aos recursos e aos serviços públicos. Apesar dos avanços nas últimas décadas, o aumento da pobreza entre 2014 e 2016, impulsionado pela crescente desigualdade de rendimentos, sublinha a fragilidade destes avanços. O aumento das taxas de pobreza na Região Metropolitana do Estado do Rio de Janeiro, onde as áreas ricas coexistem com as comunidades carentes, torna-se motivo de preocupação, exacerbado por fatores como falta de emprego digno, precariedade educacional e impactos socioeconômicos da pandemia. Confrontando estas questões, uma análise detalhada, utilizando dados do Inquérito Nacional por Amostra de Agregados Domésticos Contínuos (PNAD Contínuo) de 2012, 2016 e 2020, destaca a formalidade do emprego como um fator crucial na redução da pobreza na região. A transição da informalidade para a formalidade está associada a ganhos significativos na redução da pobreza, superando até mesmo o impacto do nível educacional do chefe de família. Resultados da regressão logística bayesiana mostram que a formalidade diminui a probabilidade de indivíduos e suas famílias terem renda familiar per capita abaixo da linha de pobreza. Esta pesquisa enfatiza a necessidade de políticas públicas abrangentes no Estado do Rio de Janeiro, visando promover oportunidades econômicas, melhorar a qualidade da educação e investir em infraestrutura, ressaltando a importância do fortalecimento dos vínculos empregatícios como estratégia eficaz na luta contra a pobreza.

**Keywords:** pobreza, emprego formal, Rio de Janeiro, regressão logística Bayesiana.
1 INTRODUCTION

The problem of poverty poses challenges to society that involve moral considerations and obstacles to be overcome by countries in order to achieve full economic and social development.

History shows that measuring income poverty involves risks and choices. One of the earliest discussions on the subject (BOOTH, 1892) identified the importance of regionalization in defining poverty among the neighborhoods of London, England. Rowntree (1901) was among the first to consider individuals as poor if they did not generate a weekly income equal to or above the amount needed to purchase a food basket (measured in caloric value) for an adult to maintain weight. According to Soares (2009):

“(...) this method has been particularly popular in Latin America, with even more noteworthy mention in Brazil. The poverty lines established by ECLAC (United Nations Economic Commission for Latin America and the Caribbean) for Latin America have, for three decades, all been calculated using the indirect calorimetric method.”

In Brazil, the eradication of poverty is one of the fundamental objectives enshrined in the Constitution of 1988 (Article 3, III). The discussion on poverty gained greater relevance from the 1990s onwards, especially after the Real Plan, which paved the way for the issue to be widely debated. At this point, it became increasingly evident that many Brazilians were unable to meet basic needs within their households. Consequently, income redistribution began to be considered to expand social rights and thereby directly improve the well-being of families. In this context, there was an update to income transfer programs that were previously limited in scope. In 2003, the consolidation process of income transfer programs led to the creation of the well-known Bolsa Família Program (ROCHA, 2019).

Despite the effectiveness of programs created to assist in poverty reduction, as discussed in IBGE (2020), their contribution to reducing income inequality is much more limited. In 2018, for instance, the Gini index for Brazil was 0.539, according to the World Bank, highlighting the social contrast within the national territory.
It is worth noting that this significant social demand aligns with the ongoing international discourse, wherein eradicating global poverty becomes one of the central points of the United Nations’ 2030 Agenda for Sustainable Development Goals.

For all these reasons, this work seeks to contribute to the necessary debate on poverty reduction in Brazil by identifying population characteristics that can guide policymakers in the development of public policies aimed at poverty reduction. To achieve this, we chose the Metropolitan Region of the state of Rio de Janeiro and compared and identified various socio-economic characteristics of individuals in poverty to assess the effects of formality, education, place of residence, gender and race of these individuals.

Considering the low-income accumulation in a significant portion of the population, identifying individual, socio-economic and geographical factors and quantifying their impacts on poverty is essential to prioritize the needs of the population. In this regard, it becomes possible to adopt preventive measures to improve the quality of life of individuals. According to Cobo et al. (2014), the representation of ‘absolute’ monetary poverty lines distinguishes between extreme poverty or destitution, which focuses on the minimum for sustenance and poverty or the necessary means to live a dignified life, where other needs such as housing, transportation, hygiene, etc., are measured. The discussion by experts over the last two decades supports the relevance of the analysis that will be developed in this study.


This paper is divided into four sections, including the Introduction. Section 2 outlines the methodology, describing the study area, databases and statistical analyses. Section 3 presents the findings. Finally, the last section discusses the main results found.
2 MATERIALS AND METHODS
2.1 STUDY AREA

The delimited region for the study is the Metropolitan Region of the state of Rio de Janeiro, established in the 1970s. The region underwent changes in laws and decrees, as well as the subdivision of municipalities, resulting in its current formation with 21 out of the 92 municipalities in the state, as shown in Figure 1.

![Figure 1 Municipalities of the Metropolitan Region of the state of Rio de Janeiro, Brazil.](source)

According to estimates from the Brazilian Institute of Geography and Statistics (IBGE), the population of the Metropolitan Region of the state of Rio de Janeiro was 12.2 million people in 2012. In 2016, it increased to 12.5 million, and by 2020, the population estimate reached 12.7 million individuals. Meanwhile, the state capital had 6.4 million inhabitants in 2012, 6.5 million in 2016, and, in 2020, it reached 6.7 million.

The city of Rio de Janeiro represents over 50% of the population residing in the Metropolitan Region and exhibits distinct socioeconomic characteristics. The Metropolitan Region of Rio de Janeiro still requires further urban, social and economic development. In this study, the focus is on evaluating individuals residing in the Metropolitan Region of the state of Rio de Janeiro, dividing them into two groups: residents of the
capital (city of Rio de Janeiro) and residents of the Metropolitan Region, excluding the capital.

2.2 DATA

The Continuous National Household Sample Survey (Continuous PNAD) was instituted in 2012 by IBGE with the aim of producing basic information for the study of the country's socioeconomic development. The target population of Continuous PNAD consists of individuals residing in occupied permanent private households. Its geographical coverage spans the entire national territory, divided into census tracts of the Geographic Operational Base of the 2010 Census, and is distributed in the following geographical breakdown: Brazil, Regions, Federative Units, Metropolitan Regions containing Capital Municipalities, Integrated Development Region (RIDE) and Capital Municipalities. Continuous PNAD has a quarterly collection frequency, meaning that part of the total household sample is collected over a period of three months, and at the end of this cycle, estimates of the desired indicators are produced. In this study, data from the fourth quarter of the years 2012, 2016 and 2020 were used.

2.3 POVERTY THRESHOLD

The term income poverty or labor poverty is adopted to classify household residents based on the values of actual income from work during the reference week. In this sense, given a poverty line, it is possible to classify everyone as poor or non-poor. In this section, the aim is to understand monetary cutoff levels for defining the poverty threshold.

According to IBGE (2020), the concept of poverty can be defined as deprivations of various levels: cultural, social, educational, economic, etc. This concept is increasingly interpreted as a multidimensional phenomenon (ALKIRE; FOSTER, 2008; ATHIAS; OLIVEIRA, 2016). In the context of classifying poverty, there are various adopted poverty lines. Relative lines are typically used in countries with a prosperous society and low-income inequality, such as Nordic countries. On the other hand, absolute poverty lines are calculated values that divide the population into poor and non-poor, enabling the definition of a poverty incidence indicator. This configuration is explored mainly in
economically unequal countries to identify the population facing issues related to hunger and lack of quality of life (ROCHA, 1996).

In the international context, the European Union and the Organization for Economic Cooperation and Development (OECD) adopt relative poverty lines, set at 50% or 60% of the national average income. Another relevant measure is the cutoff for the international extreme poverty line, calculated by the World Bank and constructed from the 15 poorest countries. This threshold is established as a global poverty indicator. According to the World Bank, currently, an individual is in extreme poverty if their income is less than 2.15 dollars per day, according to the purchasing power parity between countries updated by the organization in 2017.

In Brazil, there are various definitions of poverty lines, known as administrative, and used by government policies. There are the lines of the Brazil Without Extreme Poverty Program (PBSM), which defines the extreme poverty and poverty threshold at values of R$ 89.00 and R$ 178.00, respectively; and the line of the Continuous Cash Benefit Programme (BPC), calculated as per capita household income below 1/4 of the minimum wage. These lines are defined by law - like the BPC, Law nº 8,742, dated 07/12/1993, adhering to the constitutional principle that people should live and age with dignity - or by administrative decisions used by government policies, such as the Bolsa Família Program (PBF) that assists families in situations of poverty and extreme poverty, characterized by a monthly family income below the lines defined by PBSM.

Although there is no official poverty threshold in Brazil, this study opted for a well-known line officially used in federal government income transfer programs. In this regard, the values to classify individuals as poor or non-poor follow the cutoff in the ordered distribution of per capita household income from the Bolsa Família Program. Thus, individuals are classified as poor if their per capita household income from work is below R$ 140.00 in 2012, R$ 170.00 in 2016 and R$ 178.00 in 2020.
2.4 STATISTICAL ANALYSES

2.4.1 Preliminary Stages

For the modeling and analysis of the data, it was necessary to perform a data cleaning and manipulation procedure. Households where no resident declared having occupation in the reference week were excluded from the analyses. Additionally, households with indigenous or yellow residents were also removed, as they represent a very small portion of the dataset. From the variable 'Household Condition,' residents whose situation in the reference week was aggregated, pensioner, domestic employee, or family member of the domestic employee were excluded from the datasets.

"After cleaning the databases, the following variables were constructed for each analyzed year: 1) Formal: indicates whether the individual belongs to the formal labor market. This variable was constructed based on the 'Occupation Position' and 'Contributor' variables, indicating whether the individual has a signed work job or contributes to social security; 2) Education of the head of the household: classifies the level of education of the head of the household as no education or less than 1 year of study, incomplete elementary education, complete elementary education or incomplete high school, complete high school or undergraduate incomplete and, finally, undergraduate complete or more; 3) Poverty: classifies the individual as poor or non-poor based on per capita household income (per capita household income below the poverty threshold, as presented in Section 2.3, classifies the individual as poor; per capita household income equal to or above the poverty threshold classifies the individual as non-poor); 4) Race: classifies the individual as white or black/brown; 5) Type of occupation: classifies the residents of households according to the formality of their employment. When there are only formally employed individuals in the formal labor market, the residents of that household are classified as formal. On the other hand, they are classified as informal when all household residents are informally employed. Finally, if there are both formal and informal workers

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1 Formal: position in private sector employment with a signed job card, domestic worker with a signed job card, public sector employee with a signed job card, military and statutory servant, contributing employer, and self-contributor. Informal: position in private sector employment without a signed job card, domestic worker without a signed job card, public sector employee without a signed job card, family helper, non-contributing employer and non-contributing self-contributor.
in the household, all residents are classified as formal/informal; 6) Area: identifies the residence location, Rio de Janeiro City (state capital) or Metropolitan Region, excluding the capital. Table 1 presents all indicators used in the modeling procedure.

| Table 1. Individual and socioeconomic indicators constructed from the Continuous PNAD database. |
|---------------------------------|---------------------------------|----------------|
| **Indicator** | **Description** | **Values** |
| Area | Residence location | Capital* Metropolitan Region (excluding capital) |
| Sex | Individual's gender | Female* Male |
| Race | Race of individuals | White* Black or brown |
| Education | Education of the head of the household | 1. No education* 2. Incomplete elementary education 3. Complete elementary education 4. Complete high school 5. Complete undergraduate or more |
| Occupation | Type of occupation of employed individuals in the household | OI - only informal* OF - only formal FI - formal and informal |

* Reference categories used in the modeling process. Source: Authors

### 2.4.2 Bayesian Logistic Model

The proposed logistic model can estimate the odds of individuals in the population of interest being classified below the poverty line according to their individual, socioeconomic, educational and geographical characteristics. We estimated a model for each evaluated year 2012, 2016 and 2020. For the construction of the model, consider \( y_{it} \) as a binary variable for each individual \( i = 1, ..., n_t \), at time \( t = 2012, 2016, 2020 \), identifying whether the individual is classified as poor (below the poverty threshold, \( y_{it} = 1 \)) or non-poor (above the poverty threshold, \( y_{it} = 0 \)). Let \( X_{it} \) be the vector of independent variables encompassing individual socioeconomic, educational and geographical indicators for individual \( i \) at time \( t \). Thus, the model for each individual \( i \) can be described as follows:
\[ y_{it} \sim \text{Bernoulli}(\pi_{it}) \]
\[ \log \left( \frac{\pi_{it}}{1 - \pi_{it}} \right) = X_{it} \boldsymbol{\beta}_t, \tag{1} \]

For

\[ i = 1, \ldots, n_t, t = 2012, 2016, 2020, \] where \( \boldsymbol{\beta}_t \) is the vector of factors associated with the indicators at each time \( t \). The indicators that form the \( X_t \) matrix are presented in Table 1. The inference procedure was carried out under the Bayesian approach and the prior distribution adopted for \( \boldsymbol{\beta}_t \) was MVN(\( \mathbf{0}, 1000I_q \))^2, with \( I_q \) being the identity matrix of dimension \( q \times q \) (where \( q \) is the number of indicators).

The sampling process of the posterior distribution of \( \boldsymbol{\beta}_t \) was carried out using the Markov Chain Monte Carlo (MCMC) stochastic simulation methods through the JAGS software (PLUMMER, 2017). The implementation was developed using the rjags package in the R software (R CORE TEAM, 2021). The convergence of the generated chains was assessed using the coda package (PLUMMER et al., 2006) in R.

3 RESULTS
3.1 GENERAL CHARACTERISTICS OF THE STUDY POPULATION

The results presented in this section explore the profile of the population through descriptive analyses. The profile of individuals in the Metropolitan Region of Rio de Janeiro, in the years 2012, 2016 and 2020, is assessed based on information such as the education of the head of the household, characteristics of the labor market, place of residence and poverty status.

Table 2 presents the distribution of the study population in all evaluated years according to the area of residence, poverty status and type of occupation. There is a reduction in the incidence of poverty among individuals residing in households with only formal workers, both in the capital of Rio de Janeiro and in the rest of the Metropolitan Region of the state. The percentage of people in households with all individuals employed in the informal labor market varied between 68.1% and 84.3% in the Metropolitan

\(^2\) MVN = Multivariate Normal Distribution.
Region, and from 59.6% to 72.3% in the Capital. It is also noted that the majority of individuals whose per capita household income from labor is below the poverty threshold reside in households with informally employed individuals, both in the Metropolitan Region and Capital. On the other hand, individuals with income above the poverty line mostly reside in households where workers hold formal positions with signed job cards.

Table 2. Distribution of individuals according to the area of residence, poverty status and type of occupation for 2012, 2016 and 2020.

<table>
<thead>
<tr>
<th>Area</th>
<th>Type of occupation</th>
<th>2012</th>
<th>2016</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>poor</td>
<td>non-poor</td>
<td>poor</td>
</tr>
<tr>
<td>Metropolitan Region (excluding Capital)</td>
<td>Only formal</td>
<td>29.6</td>
<td>54.9</td>
<td>18.0</td>
</tr>
<tr>
<td></td>
<td>Only informal</td>
<td>68.1</td>
<td>20.0</td>
<td>81.2</td>
</tr>
<tr>
<td></td>
<td>Formal and informal</td>
<td>2.3</td>
<td>25.1</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Capital</td>
<td>Only formal</td>
<td>35.7</td>
<td>62.4</td>
<td>32.2</td>
</tr>
<tr>
<td></td>
<td>Only informal</td>
<td>59.6</td>
<td>15.3</td>
<td>67.8</td>
</tr>
<tr>
<td></td>
<td>Formal and informal</td>
<td>4.7</td>
<td>22.3</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Continuous PNAD, fourth quarter of the years 2012, 2016 and 2020.

In the educational context, Figure 2 presents the distribution of individuals according to the education level of the head of the household. There is an evolution in the education level of the heads of households in both groups, poor and non-poor individuals. In the capital, in 2012, 18.8% of poor individuals had the head of the household with a complete high school education. By 2020, this number increased to 44.3%. In the group of non-poor individuals, there is a noticeable growth in heads of households with a complete undergraduate, increasing from 19.6% in 2012 to 42.7% in 2020.

Evaluating individuals residing in the metropolitan region, excluding the capital of the state of Rio de Janeiro, the same pattern is observed in the rates, albeit with less expressiveness. Still in Figure 2, it can be seen that poor individuals residing in households where the head had a complete undergraduate increased from 5.0% in 2012 to 7.0% in 2020. The difference between these rates for non-poor individuals was more...
significant, 8.4% (in 2012) to 21.5% (in 2020). The reduction in the poor population residing in households with a head without education was small, from 9.5% in 2012 to 9.0% in 2020. In the non-poor population, it decreased from 2.9% (2012) to 2.0% (2020).

Figure 2. Distribution of poor and non-poor individuals according to the education level of the head of the household, year and area.

From Figure 3, it can be observed that the percentage of employed individuals among the non-poor is close to 50% for all years in both areas. When this percentage is observed among the poor, there is a growth in employment over time, reaching its highest value in 2020, both in the metropolitan region (33.1%) and in the capital (32.6%).

After an initial assessment of the occupation data, it was possible to observe that the self-employed occupation position represents a large portion of poor workers. Among the 32.6% of poor workers in 2020 in the capital, more than 3/5 (63%) work as self-employed. In the metropolitan region, of the 33.1% employed, 21.9% (66%) are in the self-employed position. The data also show that, among the group of poor individuals, the percentage of those employed in the self-employed position increased between the
studied periods for both areas. In the capital, for example, in 2012, among the group of poor workers, 35.6% declared themselves self-employed. In 2020, this number increased to 62.9%.

Figure 3. Distribution of poor and non-poor individuals, according to employment status, year and area.

Following this context, the analysis focusing on formality corroborates the results described earlier regarding the increase in poor individuals employed in the self-employed position. Figure 4 presents the distribution of the poor and non-poor population in the capital and metropolitan region of the state of Rio de Janeiro, according to the formality classification of individuals employed in the household. Evaluating the findings, it is noted that over the years, the percentage of residents in households with only formal workers remained stable among the non-poor. On the other hand, among the poor, the proportion of residents in households with only formal workers decreased. In the Capital, between 2012 and 2020, this reduction was approximately 10 percentage points, and in the metropolitan region, it was 19 percentage points.

Source: Continuous PNAD, fourth quarter of the years 2012, 2016 and 2020.
The informal worker category encompasses at least 60% of the poor throughout the study period and areas. In the metropolitan region, both in 2016 and 2020, the percentage of poor individuals in the informal worker category exceeded 80%.

Figure 4. Distribution of poor and non-poor individuals, according to the type of occupation, year and area.

Source: Continuous PNAD, fourth quarter of the years 2012, 2016 and 2020.

3.2 ESTIMATION OF THE BAYESIAN LOGISTIC MODEL

50,000 MCMC samples of the model parameters were simulated for the years 2012, 2016 and 2020. After checking for convergence, the first 1,000 samples were discarded and jumps of size 20 were applied, resulting in a final effective posterior sample size of 2,450.

From the posterior sample, point estimates and interval estimates of the odds ratios for each indicator were calculated and presented in Table 3. Analyzing the results of the estimated models for each year, it is observed that in 2012, individuals residing in

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3 For 2016, the sample of the formal and informal employed category, for the poor, represents 0.024% of the observations, with no observations in the Capital.
households where workers are formal have 81.4% lower odds of being poor than individuals residing in households with workers in the informal market. In 2020, this odds ratio increased to 91.6%, indicating that formality is an important factor in poverty reduction.

Note that the credibility interval of the area variable contains the unit value; however, in all evaluated years, there is a higher posterior probability for odds greater than one. In 2020, residing in the Metropolitan Region increased the odds of an individual being poor by 9.4% compared to an individual with similar characteristics in the Capital, with a probability of 0.81. This interpretation, considering the posterior probability of the odds ratio being greater than one, is also applied to the variables Sex and Race. In 2012, individuals of black or brown color had 78.6% higher odds of being poor than white individuals, regardless of their place of residence. Over time, this odds ratio decreased, and in 2020, with a probability of 0.7, it indicated a subtle reduction in poverty compared to white individuals.

Evaluating the education level of the head of the household, there is a reduction in the likelihood of poverty in households where the head has higher education. In 2012, residing in a household whose head had completed higher education indicated a nearly 80% reduction in the odds of being poor compared to households where the head was illiterate. In 2016, this reduction in the odds of being poor increased to over 85%, and in 2020, it returned to the 2012 level.

Table 3. Pontual and interval estimation of the odds ratio of the estimated Bayesian models and respective posterior probabilities of the odds ratio assuming values greater than one.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2012 OR (CI 95%)</th>
<th>p</th>
<th>2016 OR (CI 95%)</th>
<th>p</th>
<th>2020 OR (CI 95%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>0.990 (0.878;1.127)</td>
<td>0.54</td>
<td>1.051 (0.896;1.234)</td>
<td>0.74</td>
<td>1.094 (0.886;1.323)</td>
<td>0.81</td>
</tr>
<tr>
<td>Sex</td>
<td>0.942 (0.835;1.062)</td>
<td>0.17</td>
<td>0.852 (0.726;1.000)</td>
<td>0.02</td>
<td>0.951 (0.787;1.150)</td>
<td>0.30</td>
</tr>
<tr>
<td>Race</td>
<td>1.786 (1.553;2.075)</td>
<td>1.00</td>
<td>1.284 (1.083;1.537)</td>
<td>1.00</td>
<td>0.932 (0.756;1.150)</td>
<td>0.25</td>
</tr>
<tr>
<td>Education_2</td>
<td>0.549 (0.436;0.698)</td>
<td>0.00</td>
<td>0.705 (0.507;0.990)</td>
<td>0.02</td>
<td>0.719 (0.399;1.363)</td>
<td>0.14</td>
</tr>
<tr>
<td>Education_3</td>
<td>0.419 (0.326;0.538)</td>
<td>0.00</td>
<td>0.440 (0.310;0.631)</td>
<td>0.00</td>
<td>0.346 (0.186;0.670)</td>
<td>0.00</td>
</tr>
<tr>
<td>Education_4</td>
<td>0.235 (0.179;0.304)</td>
<td>0.00</td>
<td>0.206 (0.142;0.298)</td>
<td>0.00</td>
<td>0.399 (0.219;0.748)</td>
<td>0.00</td>
</tr>
<tr>
<td>Education_5</td>
<td>0.210 (0.147;0.298)</td>
<td>0.00</td>
<td>0.135 (0.079;0.228)</td>
<td>0.00</td>
<td>0.237 (0.125;0.472)</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Occupation_FI  0.043  (0.031;0.058)  0.00  0.121  (0.100;0.145)  0.00  0.084  (0.063;0.108)  0.00  
Occupation_OF  0.186  (0.162;0.212)  0.00  0.009  (0.003;0.020)  0.00  0.038  (0.020;0.066)  0.00

OR: odds ratio. CI 95%: 95% credibility interval. p: posterior probability of the odds ratio being greater than one, associated with the presence of factors in the regressor.

4 DISCUSSION AND CONCLUSION

The issue of poverty in Brazil is still a challenge to be overcome, given the high and persistent level of this social problem. The expected reduction of poverty in our country responds, above all, to basic moral principles of civilized societies, in addition to being justified by creating better conditions for our economic and social development.

The multidimensional nature makes it challenging to achieve more consistent changes towards the reduction and stability of poverty rates. Thus, in addition to the income issue, other factors contribute to making the problem of poverty even more complex, including historical inequalities, unequal economic structures, lack of access to basic resources, precarious public services, among others. Although the country has experienced significant progress in recent decades, with the reduction of extreme poverty and increased access to basic social services, since the period between 2014 and 2016, poverty in Brazil has been gradually increasing, mainly fueled by the growing income inequality (SOUZA; HECKSHER; OSÓRIO, 2022).

Although the topic has been widely debated in Brazil, its relevance has been revived in recent years due to the increase in poverty rates in the country. In this study, we attempted various simulations to identify variables that would impact the reduction of poverty using Continuous PNAD data from the fourth quarter of 2012, 2016 and 2020, related to the Metropolitan Region of Rio de Janeiro.

It is known that the scarcity of income for basic sustenance is particularly evident in this region, where affluent urban areas coexist with communities characterized by a lack of basic resources and limited access to public services. Several factors contribute to the persistence of poverty in the region: the lack of opportunities for decent employment, the precariousness of the educational system in some areas, the absence of adequate infrastructure in more vulnerable communities, and urban violence. Moreover, events such
as economic crises and the COVID-19 pandemic have intensified the socioeconomic vulnerability of the poorer populations.

Different sociodemographic and economic factors of resident workers were analyzed to assess changes that occurred during the period. The results showed that, among the variables that would impact the reduction of poverty in the region, employment formality stands out. It is known that labor market variables are crucial to explaining positive changes in poverty rates (IPEA, 2012). The increase in formality regarding poverty rates appears to be a consensus in the literature. The transition from informality to formality brings significant gains that have a relevant impact on reducing poverty.

From a Bayesian logistic regression model, the results showed that formal individuals have lower odds of being impacted by poverty, as well as reducing the likelihood of the individual having per capita household income below the poverty line. The positive effect of formality on poverty reduction proved to be more relevant than the effect of the level of education of the head of the household, for example, which has traditionally been pointed out as one of the factors that reduces the odds of the individual remaining poor (BARROS; FRANCO; MENDONÇA, 2006; MENEZES-FILHO; FERNANDES; PICCHETTI, 2006a).

In this regard, the education level of the head of the household, the work corroborates with findings in the literature and shows that with each level of education achieved, there is an increase in the reduction in the likelihood of being poor. That is, the head of the household who completes elementary school contributes to a reduction of more than 50% in the odds of them and their dependents remaining poor, compared to residents of households whose head has no education. The odds of poverty among white and black or brown individuals decreased over the evaluated period. Finally, given the robust impact of formality on poverty reduction in this region and during the analysis period, the study suggests that, to effectively combat poverty in the state of Rio de Janeiro, especially in the Metropolitan Region, it is essential to implement comprehensive public policies aimed at promoting economic opportunities, improving the quality of education, investing in infrastructure, and implementing social programs that address the specific needs of the region. The idea of comparing households with formal and informal workers in terms
of poverty status is to support public policies that seek to increase employment ties and expand the academic discussion on the subject.
REFERENCES


BOOTH, C. Life and labour of the people in London. London/New York, 1892.


