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Heterogeneous Impacts of Covid-19 on Youth Employment: A Study for Brazilian Regions

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Abstract: *This paper seeks to identify differences in unemployment among Brazilian youth during the Covid-19 pandemic using the least squares method and PNAD data. Among the results obtained, it is observed that the loss of occupation of youth decreases with income, being significant for the three lower per capita income groups, up to 2 minimum wages. This is true both for the general sample and for the subgroups considered, divided by gender and by large regions of the country. Another relevant fact is that women suffered a greater impact than men, characterised by an additional loss of 7 percentage points in occupation. These results show the importance of inclusion programs in the labour market to focus on socially vulnerable populations, giving greater support to the youth people from low-income families and considering the gender issues.*

Keywords: *labour market, youth unemployment, heterogeneity, social exclusion, Covid-19, income family.*

JEL Classification: *R11, R23, J63, J23.*

1. Introduction

Young people begin the transition process to adulthood, breaking the economic dependence of their parents, grandparents, or close family to start the journey of economic and social independence in which they will, from that moment onwards, create responsibilities and their own identity. However, to continue the progress of this project, regardless their origins, it is necessary to have an educational curriculum to prepare them to face a labour market in the midst of changes that has been spreading, since 1970, through information technologies and communication (ICTs).

In a developing country like Brazil, with the increased complexity of production processes, natural to this development, challenges for entering

the labour market are ever increasing. The number of years of study of formal workers in Brazil have shown an expansion of 19.3% between 2003 and 2017. The quality of available occupations, however, has not kept up with this growth. The population is increasingly educated, but this did not translate into jobs that require better skills (Maciente 2019).

These issues became even more relevant during the pandemic period. Measures to prevent the spread of Covid-19 viruses have helped to preserve millions of lives on a global scale however, these extremely positive actions have had their costs expressed in several dimensions. One of them was the increase in unemployment. Between the last quarter of 2019 and the first quarter of 2021, the Brazilian unemployment rate grew from 11.0% to 14.7%, making the already complex task of inserting young people into the labour market even more difficult.

The need for efficiency in public spending is now more important than it was in recent periods. To hope for efficiency in programs for the inclusion of young people in the labour market, it is important to understand the heterogeneity of impacts on different demographic groups. It is important, therefore, to recognise that the demographic group of young people is not homogeneous, and this study seeks to understand some aspects of this heterogeneity. This understanding helps to focus on policies to be implemented.

Thus, this work aims to analyse the insertion of young people in the Brazilian labour market between 14 and 29 years old, which represents 49.1 million young people or 25% of the total population, according to the National Household Sample Survey (PNAD) of Brazilian Institute of Geographical and Estastistics in 2011, focusing on changes registered as a result of the Covid-19 pandemic.

The objective is, then, to describe the impact of the pandemic on youth occupation rate. For this purpose, it is intended to determine the change in the employment conditions of young people in the labour market in the pre-pandemic and pandemic scenarios of Covid-19, with a focus on evaluating the impacts on households from different income groups. With this, it is intended to estimate the existence of difference between the impacts observed on the occupation of young people in different social groups and, thus, allow the best focus and determine the nature of political potentials to be implemented to mitigate these effects.

In this work, data from the Continuous National Household Sample Survey (PNADc) of Brazilian Institute of Geography and Statistics (IBGE) was used to compare the variation in the level of occupation of the population between the third quarter of 2019, representing the pre-pandemic

period, and the third quarter of 2020,[1] representing the period after the shock of the pandemic, hereinafter referred to as the post-pandemic period, for the sake of simplification.

To analyse the impacts of the pandemic, it was decided to verify whether the effects on the occupation of young people in this age group were different for different household's income groups, different regions or different genders.

The results obtained indicate a relevant dispersion of impacts on the different groups analysed. For example, young people in the household's income group of up to half the minimum wage had a reduction in the occupancy rate 3 times greater than the reduction observed for the family income range between 2 and 3 minimum wages. In this way, it is clear the potential gain in efficiency that focused programs for the inclusion of young people in the labour market may have. Such results are useful for the scientific literature that investigates unemployment among young people by bringing empirical evidence to Brazil and for public policymakers who need to make decisions about unemployment in times of crisis and extreme shocks in the economy.

The present work is structured in four more sections besides this introduction. In section 2, the concepts covered in this study and a review of the relevant literature have been presented. Section 3 reports the data, samples and methodological strategy used. Section 4 presents the results obtained, in addition to its descriptive analysis identifying the groups most impacted by the pandemic, thus offering a focus for further studies and for the formulation of public policies. Finally, section 5 brings the conclusions of the work.

2. Theoretical Reference

National governments must prepare for the post-pandemic Covid-19 recovery and actions must be taken in order to bring economic activity back to levels that allow for the inclusion of our youth in the labour market. It should be noted, however, that the difficulties in managing national public budgets are much greater for this recovery, as countries have considerably increased their expenditures to implement measures to contain the pandemic.

The International Monetary Fund has been tracking the policies of several countries in the fight against the Covid-19 pandemic and its effects. For example, Argentina announced measures amounting to about 6.5% of GDP in 2020, 4.5% in the budget and 2% off budget, Chile presented in March 2020 a package of fiscal measures of up to US$ 11.75 billion (about

4.7% of GDP), Mexico committed to fiscal measures in the year 2020 an amount that it represents, above the line, 0.7% of the GDP, while the measures below the line represented about 1.2% of the GDP.

In March 2021, the United States of America sanctioned the American Rescue Plan with an estimated cost of US$ 1,844 billion (about 8.8% of GDP in 2020). Previously, other financial measures were implemented, such as in December 2020 the release of US$ 868 billion (about 4.1% of GDP), and in August the contribution of US$ 44 billion to the Disaster Relief Fund, in addition to US $483 billion for the paycheck protection program and the health care improvement law. For small businesses, an additional $321 billion was earmarked for loans and guarantees to help those who retain workers in their jobs and $62 billion for grants and loans to help small businesses without the previous conditionality. For health, US$ 75 billion was directed to hospitals and US$ 25 billion to the expansion of virus tests. In total, a fiscal boost of US$2.3 trillion is estimated, around 11% of the American GDP.

Germany, to combat the COVID-19 crisis and subsequently support the recovery process, adopted three budget supplements: €156 billion (4.7% of GDP) in March 2020, €130 billion (3.9% of GDP) in June 2020 and €60 billion (1.7 percent of GDP) in March 2021. In Israel the parliament approved a package of £80 billion[2] (about 6.1% of GDP in 2020), which includes £ 11 billion for health expenses. This package supports the social safety net (£20 billion), financing a reduction in requirements for unemployment benefits and grants for self-employed workers.

Brazil announced a series of fiscal measures in 2020 that amounted to 12% of GDP, of which the direct impact on the primary deficit was 7.2% of GDP. Congress declared a state of "public calamity" at the start of the pandemic, lifting the government's obligation to meet the 2020 primary balance target. Emergency measures were taken in a separate budget for 2020. Fiscal measures included increasing spending on health and temporary income support for vulnerable families – cash transfers for low-income households and informal workers. Public banks extended credit lines for companies and families, with the focus on supporting working capital (credit lines added up to 4.5% of GDP), and the government supported them with more than 1% of GDP in credit lines for SMEs and microenterprises to cover payroll, working capital and investment costs. Most of the measures expired at the end of 2020, but the Emergency Aid, Employment Support Program and SME credit support were renewed in the second quarter of 2021.

Yet regarding Brazil, according to a report by the Instituição Fiscal Independente - IFI, affiliated to the Brazilian Senate, impacts on the economy, due to the increased uncertainty associated with the coronavirus crisis, will

be significant and may affect the trajectory of GDP permanently and also the public debt until 2030.

More than one reason makes the current moment fundamental in preparing young Brazilians for their role in the job market. The last wave of the demographic transition in Brazil is reaching its peak and to that are added the expectations of moderate economic growth in the medium term" that "add a new urgency to the issue of the insertion of young people and the improvement of their skills for the job market. Equipped with solid and adequate skills and employment policies, especially for young people, Brazil can surpass the middle-income position by riding this wave. The alternative is for this wave to break, and to undermine the country's prospect of reaching new levels of shared prosperity (World Bank 2018).

Faced with the lack of material resources, households are forced to promote the entry of young people with deficient training in the labour market, at the risk of creating an underemployment trap for them. This cost mainly impacts those families in a situation of greater vulnerability, especially in developing countries such as Brazil, where the low quality of education favours the entry into the labour market of many children and young people (Gonzaga et al. 2012).

Another point of great relevance for the analysis of the insertion of young people (aged between 14 and 29 years) in the labour market is the total dismay of a portion of this population. Analysing the interrelationships between school and work based on data from the 2010 Demographic Census, the growth in the number of young male Brazilians who were not studying, working or looking for work between 2000 and 2010 stands out. It is important to understand why a significant portion of Brazilian youth does not participate in either of these two spaces. Which factor predominates? Discouragement in the search for a job, lack of income or prospects to encourage training or, on the contrary, families guarantee the basics until they reach a satisfactory position in the labour market. Different explanations imply different public policies that seek to rescue the active participation of young people for our society (Corseuil & Franca 2020).

In addition to these structural problems and despite the importance of this agenda, other urgent needs took over the Brazilian economic agenda, aggravating the employment situation like important measures taken to contain the spread of the Sars-COV-2 virus in Brazil had consequences on the economy. In relation to the labour market, a specificity of the current crisis was the increase in the number of discouraged young people, who gave up looking for a job because they had no hope that they would find one (Corseuil & Franca 2020).

The pandemic crisis interrupted not only employment, but also the training process, preventing the acquisition of skills by the continuity of education and professional training. On the one hand, this phenomenon aggravated the Brazilian situation, which already had a considerable number of young people who were not studying, not working and not in training and, on the other hand, it hampers the preparation of young people for their professional relocation at the end of the crisis. In the long term, this period can lead to significant and persistent losses of income that compromise their working trajectories throughout their lives (Corseuil & Franca 2020).

To avoid, or mitigate, the impact of lasting effects, it is important to understand the shortcomings caused by the pandemic to design "public policies that can break the vicious circle present in the lives of these individuals that leads them to transit, indefinitely, between long periods of inactivity and of precarious insertion in the labour market (Corseuil & Franca 2020).

Understanding all these factors and their interrelationships is of fundamental importance for the design of public policies that serve this age group. It is important to emphasise that, given the complexity of the problem, there will not be one policy that meets all needs and, therefore, the focus on the application of the proposed policies will help to determine the success in improving the well-being of the targeted populations.

Not only in emerging economies, but also in advanced ones, the difficulty of participating in the labour market has important impacts on the well-fare of the population and particularly on the youth. Kieselbach (2003) describes a comprehensive theoretical definition of social exclusion, based on the French terminology and also on the concept of subclass used in the US He claims that the rising unemployment rate has become a permanent social reality in the European Union with consequences that more and more people with fewer skills cannot lead a life that meets social standards of material and social well-fare.

Social exclusion can be understood not only by focusing on what it means to be excluded or included, but also on how each of these circumstances increases or decreases individual's vulnerability. Kieselbach (2003) also reports Kronauer's (1998) argument that social exclusion arises from the sum and interaction of six types of exclusion:

- Labour market exclusion: lack of some skills creates barriers and, thus, cause failures to enter or re-enter the labour market, inducing feelings of marginality and the personal notion of having little value to the society, which is the focus of this work.

- Economic exclusion: poverty induced or sustained by exclusion from the labour market leads to financial dependence on the well-fare state and loss of capacity to financially support its household according to social standards.

- Institutional exclusion: the poor and unemployed do not have access to private institutions (e.g. banks, insurance companies) that others can turn to for help in reducing life's uncertainties. Unemployed people must resort to institutions that serve marginalised people, generating feelings of embarrassment and dependency, which leads to passivity.

- Social isolation: the circumstances described above can lead the individual to the loss of or withdrawal from, its social network and the decrease of social contacts.

- Spatial exclusion: all of the above circumstances lead to geographic concentration and segregation of people with limited financial possibilities, forcing them to resort to housing in areas with lacking infrastructure (e.g. transport, shops and cultural events).

Kieselbach (2003) further argues that these concepts of social exclusion describe young people who have suffered long-term unemployment in the European Union. The YUSEDER project tried to determine whether this argument would have empirical support. The study was based on 300 interviews (50 interviews in each of the six countries surveyed)[3], with respondents between 20-24 years old and officially registered as unemployed for at least 12 months. The gender distribution of the national samples, which ranged from 54% female in Germany to 66% in Greece, was the same as the distribution among the long-term unemployed in the country. Each national sample also had the same proportion of people with lower versus higher qualifications[4], as well as those exposed or not to long-term unemployment within the country. As for qualification, the percentages ranged from 14% with lower qualifications in Greece to 58% in Belgium.

Except for Sweden, there were wide disparities in unemployment rates between regions. The national samples were, therefore, taken from areas of high and low unemployment. Although the European Union cannot dictate the content of plans aimed at social inclusion, their monitoring of member states is carried out through the Target Socio-Economic Research Program (TSER), of which the YUDESER project is a part.

The third phase of the YUDESER project focused on institutional responses to youth unemployment and social exclusion in participating countries. For example, in Sweden, every young person who remains unemployed for at least 100 days is, by law, given an offer of employment

or training. Swedes see training as key to reducing youth unemployment. Projects and initiatives that focus on professional counseling and supervision are emphasised for unemployed youth. The aim is to introduce young people to the work through practical experience.

The German Government provides, in addition to funds for regular programs aimed at the labour market, funds for initiatives focused on the development of three characteristics: i) working skills and qualification, ii) cooperation and networking between mediators and organisations, iii) individual psychosocial stabilisation and development of the personality of those affected.

In Belgium, concrete actions against youth unemployment and social exclusion have been carried out mainly at the regional level. Regional efforts share a common view that personal support is the most important component to the success of these programs.

In Spain, the reports emphasise that projects focused merely on training unemployed young people do not achieve their goals. Successful programs are those in which basic skills and qualifications are taught and young people are encouraged to achieve more independence and self-confidence in structuring their vocational future.

In general, innovative approaches to avoiding youth unemployment and the risks of social exclusion consider that training and qualification alone are not enough to ensure long-term integration to unemployed youth. Measures are needed such that, first, the young people receive help with their personal life and emotional development. Only after a phase of personality stabilisation and improvement in their social situation they seem to make significant efforts towards their integration into the labour market.

In the US, the Great International Financial Crisis of 2008 strongly affected the entire American population, but its young people were the ones who suffered the most. While other groups were slowly returning to work in 2013, the unemployment rate for 16- to 24-year-old Americans stood at 16.2%, more than double the national unemployment rate. And even after they start paid activities, the impact of that period will follow them for years. According to an analysis by the Center for American Progress, young Americans have lost \$20 billion in earnings over the past decade. This generation of young Americans – known as millennials – will increasingly be forced to delay moving out of their parents' home, struggle to make payments on growing student loan debt and fail to save enough for retirement. Because of extended millennial unemployment, the US economy will feel the loss of aggregate demand in the form of slower growth and lower job creation.

Since the 1980s, the proportion of employment in relation to the teenage and young population has declined, with the sharpest drops occurring in the last decade. During this period, employment among teenagers has declined the most, falling from 50% in 1978 to just 25.8% today. Employment among Americans at the best working age (25 to 54 years old) is currently 75.9%, about the same as in the mid-1980s.

In addition, youth unemployment creates an additional burden for taxpayers in the form of lost income, the need for government-provided health care, increased crime rate, and additional welfare payments. In a survey commissioned by the White House Community Solutions Council, researchers estimated in 2013 that the fiscal cost of the 6.7 million Americans between ages 16-24 who were neither working nor attending school was $1.6 trillion over their lifetime. Failure to create jobs for unemployed youth leaves taxpayers a huge bill in the future.

In addition to these factors that suggest the need for public actions of social nature and aimed at fighting unemployment must be well focused Shapiro & Stiglitz (1984) present unemployment or job rationing as a device for aligning incentives. The authors develop a theoretical model where they argue that when it is expensive to monitor individuals, the competitive equilibrium will be characterised by unemployment, but that the resulting natural rate of unemployment will not, in general, be optimal from a social perspective.

The argument is based on the idea that companies that do not take into account the consequences of their actions on the level of monitoring and definition of wages do not internalise potential social costs incurred in their actions. Although these externalities are very similar to pecuniary externalities, they are still important, even in economies with a large number of companies.

As a result, there is room for government intervention, both in establishing unemployment insurance programs and in setting taxes or subsidies on monitoring and labour turnover which can (if properly designed) lead to Pareto improvements. This type of unemployment, the authors argue, can be a significant factor in the observed level of unemployment, especially in lower-skilled, lower-wage occupations, raising the need to assess the heterogeneity of the impact of factors that affect occupation in different income strata.

Given this scenario, the present work seeks to contribute to the literature by presenting empirical evidence from a country with continental extensions like Brazil for heterogeneity between unemployment among young people during a strong shock in the labour market. With this, the example used as

an extreme event in the labour market is the Covid-19 pandemic that devastated all countries in the world with supply shocks in economies due to social distancing measures.

3. Methodology

3.1. Data

Based on PNADc data, the descriptive research methodology was adopted in this work, analysing the evolution of the occupation of the target age group before and after the onset of the Covid-19 pandemic crisis, stratified by family income,[5] region of residence[6] and gender[7].

Therefore, it is important to review some concepts related to work definitions used in the literature and in this text. The underutilisation of the workforce is a concept built to complement the monitoring of the labour market, in addition to the unemployment measure, which aims to provide the best possible estimate of the demand for work in occupation.

Three mutually exclusive components are defined, with two components comprising the workforce: i) those underemployed due to insufficient hours worked and ii) unemployed; to these are added those that make up the iii) potential workforce. This work is focused on components ii and iii.

According to the ILO – International Labour Organisation, it is recommended that countries adopt indicators aimed at providing a more complete picture of the underutilisation of the workforce. In order to clarify this, in this work, we will follow the concepts and main indicators below:

1) Unemployed: Persons available for work and without a job or other paid occupation in the reference week and who took effective action to search for a job in the reference period of 30 days, and who were available to take it on in the reference week. Are also considered unemployed unoccupied people in the reference week who has a job contract or work promise expected to start in more than four months after the last day of the reference week, even if they did not take effective action to search for a job in the reference period of 30 days.

   This concept of unemployed persons, adopted from the second quarter of 2016, is already adjusted to Resolution I of the 19th International Conference of Labour Statisticians – ICLS. Previously there was no fixed time limit to take on the job contract or work referred in the previous paragraph.

2) Potential workforce: The potential workforce is defined as a group of persons 14 years old or more who were neither occupied nor

unemployed in the reference week, but who had the potential to become a workforce. This contingent is formed by two groups:

(i) people who carried out an effective job search but were not available to work in the reference week;

(ii) people who did not carry out an effective job search but would like to have a job and were available to work in the reference week.

(3) Discouraged worker: person out of the workforce in the reference week who were available to take a job in the reference week but did not take action to get a job in the 30-day reference period because they did not get adequate work, lack professional experience or qualification, there was no work in the place where they lived or unable to work because they were considered too young or too old.

With these concepts in hand, let us move on to describe the data used. The PNADc is carried out through a sample of households and is intended to produce continuous information on the insertion of the population into the workforce, associated with demographic and educational characteristics, and also for the study of the country's socioeconomic development, to the following geographic levels: Brazil, Major Regions, Federation Units, Metropolitan Regions that contain the cities of the capitals, cities of the capitals and the Integrated Development Region of Grande Teresina[8].

The survey sample was designed with the aim of producing quarterly information, so its analysis could be carried out by comparing one quarter with another. Three factors weighed in the choice of frequency for the survey: the cost of carrying out the survey nationwide; the operational complexity that involves the collection of information and the steps to verify and analyse the data; and the fact that the Monthly Employment Survey – PME does not show frequent significant variations in the labour market indicators.

As stated in Lila and Freitas (2007), the calculations of confidence intervals for the time difference of a certain set of PME indicators for each metropolitan region and for the total of the six regions show that the significant differences regarding estimates occur with greater frequency when the comparison is conducted for longer periods.

3.2. Quantitative Technique

As explained by Yue *et al.,* (2018), Ordinary Least Squares – OLS is the most common of all regression techniques, being a method to estimate the unknown parameters in a linear regression specification. Its objective is to

find parameters of a linear function on a set of explanatory variables, or regressors, in order to minimise the sum of squares of the differences between the result of this linear function and the observed responses – dependent variable or regressand – in the data set.

Intuitively, the OLS problem seeks to minimise the sum of squares of the vertical distances between each data point in the set and the corresponding point in the regression line. That is, deviations above or below the regression line are treated the same and the smaller the differences, the better the model fits the data. The regression equation is also the mathematical formula applied to explanatory variables to better predict the dependent variable, in which each explanatory variable is associated with a regression coefficient that describes the strength and sign of the relationship of this variable with the dependent variable – Yue et al. (2018).

Mathematically, the OLS problem seeks to minimise the sum of squared deviations between the returning regressand y_i, scalar, and a linear function of K regressors

$X_i = [x_{1,i} \, x_{2,i} \, ... \, x_{K,i}]$, according to the following expression:

$$\sum_{i}^{n} (y_i - X_i \beta)^2$$

Where X is a column vector of coefficients with K rows and the sum is defined over the N observations available in the data set.

To solve this problem, it is convenient to write the sum of squares in the form of an inner product, which allows us to determine its solution using linear algebra. In its matrix form the problem becomes:

$$\min_{\beta} (y - X\beta)'(y - X\beta)$$

Where y and X stack y_i and X_i, $1 \le i \le N$, and have dimensions N x 1 e N x K, respectively.

From its first order condition results $\hat{\beta} = (X'X)^{-1}X'y$, and with additional hypotheses about variables involved and modeling errors an estimate for the covariance matrix for this estimator is obtained, given by $\widehat{\Sigma}_{\hat{\beta}} = \hat{\sigma}_\varepsilon^2 (X'X)^{-1}$, where $\hat{\sigma}_\varepsilon^2$ is an estimate of the mean square error resulting from the minimisation problem[9]

For the specific case used in this work, the matrix of regressors X is formed by dummy variables I_k, $1 \le k \le K$, indicating K mutually excluding subsets, corresponding to the income groups investigated. That is, for each individual, represented in the line of the column vector I_k, there will be a

value of 1 in the indicator variable corresponding to their household per capita income range, and zero in the same line for other indicator variables

Thus, each variable I_k represented in the column of the matrix X will have a value different from zero only for the individuals, lines that belong to the income range indicated by it. That is, the sum of the columns of X for the same row (X_i) is 1 for each row. And the sum of the lines of X for the same column (I_k) is the number of observations in the income range for the range represented by the column.

In this way we can denote:

$$X = [I_1, I_2, \cdots I_K], \quad X' = \begin{bmatrix} I_1' \\ I_2' \\ \vdots \\ I_K' \end{bmatrix}$$

Therefore:

$$X'X = \begin{bmatrix} I_1' \\ I_2' \\ \vdots \\ I_K' \end{bmatrix} [I_1, I_2, \cdots I_K] = \begin{bmatrix} \#I_1 & 0 & 0 & 0 \\ 0 & \#I_2 & 0 & 0 \\ 0 & 0 & \ddots & 0 \\ 0 & 0 & 0 & \#I_K \end{bmatrix}, \quad X'y = \begin{bmatrix} I_1' \\ I_2' \\ \vdots \\ I_K' \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{bmatrix} = \begin{bmatrix} \sum_{I_{1,i}=1} y_i \\ \sum_{I_{2,i}=1} y_i \\ \vdots \\ \sum_{I_{K,i}=1} y_i \end{bmatrix}$$

Where $\#I_k$ represents the number of non-zero elements in I_k and the sums are done over the values of i such that $I_{k,i} = 1$, $1 \leq k \leq K$. Thus, the solution of the least squares problem in this specific case becomes:

$$\hat{\beta} = (X'X)^{-1}X'y = \begin{bmatrix} \#I_1 & 0 & 0 & 0 \\ 0 & \#I_2 & 0 & 0 \\ 0 & 0 & \ddots & 0 \\ 0 & 0 & 0 & \#I_K \end{bmatrix}^{-1} \begin{bmatrix} \sum_{I_{1,i}=1} y_i \\ \sum_{I_{2,i}=1} y_i \\ \vdots \\ \sum_{I_{K,i}=1} y_i \end{bmatrix} = \begin{bmatrix} \frac{1}{\#I_1} \sum_{I_{1,i}=1} y_i \\ \frac{1}{\#I_2} \sum_{I_{2,i}=1} y_i \\ \vdots \\ \frac{1}{\#I_K} \sum_{I_{K,i}=1} y_i \end{bmatrix}$$

$$\widehat{\Sigma}_{\hat{\beta}} = \hat{\sigma}_\varepsilon^2 (X'X)^{-1} = \begin{bmatrix} \frac{\hat{\sigma}_\varepsilon^2}{\#I_1} & 0 & 0 & 0 \\ 0 & \frac{\hat{\sigma}_\varepsilon^2}{\#I_2} & 0 & 0 \\ 0 & 0 & \ddots & 0 \\ 0 & 0 & 0 & \frac{\hat{\sigma}_\varepsilon^2}{\#I_K} \end{bmatrix}$$

That is, the estimated coefficients are the means of the regressand for each subset used and the covariance matrix is diagonal.

The weighted least squares case, that will take into account individuals' weights resulting from the survey process, is analogous to OLS, where $w_i \geq 0$ represents weight of the ith observation:

$$\min_{\beta} \sum_i w_i (y_i - X_i \beta)^2$$

In matrix form, denoting by W, the diagonal matrix that has w^i as i^{ts} ith diagonal:

$$\min_{\beta} (y - X\beta)'W(y - X\beta)$$

Resulting on:

$$\hat{\beta} = (X'WX)^{-1}X'Wy$$

Similarly, in the case of the present work:

$$\hat{\beta} = \begin{bmatrix} \frac{1}{\#I_1}\sum_{I_1,i=1} \frac{w_i}{\Sigma_{I_1,j=1} w_j} y_i \\ \frac{1}{\#I_2}\sum_{I_2,i=1} \frac{w_i}{\Sigma_{I_2,j=1} w_j} y_i \\ \vdots \\ \frac{1}{\#I_k}\sum_{I_K,i=1} \frac{w_i}{\Sigma_{I_K,j=1} w_j} y_i \end{bmatrix}$$

In this case, the estimated coefficients become the average of the regression weighted by the weight of each observation.

4. Results

The analysis presented in this paper uses quarterly data starting in the third quarter of 2019 and ending in the first quarter of 2021. Occupancy before the initial shock of the Covid-19 pandemic (pre-pandemic period) is then compared. This shock is considered to have occurred in the second quarter of 2020, with occupation after the shock (post-pandemic period)[10].

As occupancy measures contain a strong seasonal component, comparisons are based on the same quarter in the pre-pandemic period and in the post-pandemic period. Thus, the main results presented in the study correspond to cohort 1 in Table 2, where occupancy data of 2019Q3 is compared to that of 2020Q3. The other cohorts employed lend themselves to robustness analysis.

Table 2: Analysed Cohorts

	2019		*2020*				*2021*
	Q3	Q4	Q1	Q2	Q3	Q4	Q1
	Pre	shock	post				
cohort 1	2019Q3				2020Q3		
cohort 2		2019Q4				2020Q4	
cohort 3			2020Q1				2021Q1

Source: Prepared by the authors.

As the objective of this work is to identify potential heterogeneities of the impacts of the Covid-19 pandemic on the occupation of young people between 14 and 29 years old, the chosen strategy was to compare the occupation situation of the same individual in the two quarters of interest. In PNADc, each individual can remain in the sample for up to 5 periods, exactly the period necessary for the proposed analysis. However, the microdata does not contain an individual identifier. That information would make it simpler to compare the evolution individual's variables over the quarters.

- To solve this problem, demographic information for each individual was concatenated in order to generate an identifier. Using Pnadc's variable nomenclature the information used was:

  - UPA: Primary Sampling Unit – UF + Seq. + DV

  - V1008: House selection number – type 01 to 14;

  - V1014: Sample group panel – type 01 to 99;

  - V2007: Sex – type 1 male, 2 female;

  - V2008: Day of birth – 99 not informed;

  - V20081: Month of birth – 99 not informed;

  - V20082: Year of birth – 9999 not informed.

Table 3 shows a significant drop in the number of observations present in the survey after the shock of the pandemic. It is therefore appropriate to ask whether the fact that the individual left the sample would be endogenous to the household's income conditions. It is possible to think of the case in which changes related to the variable – such as change or loss of a job or in the occupation condition – cause an individual to drop out of the sample, biasing the work results. In the specific case of the pandemic crisis, many families have changed addresses, which would make it difficult for them to remain in the sample.

Table 3: Population's share between 14 and 29.

	2019		2020				2021
	Q3 Pre	Q4 shock	Q1 post	Q2	Q3	Q4	Q1
Total	207,386	210,131	187,056	130,736	125,119	117,298	108,327
Young	50,387	51,083	44,592	289,44	277,976	261,833	239,184
	24.3%	24.3%	23.8%	22.1%	22.2%	22.3%	22.1%
Income*							
up to ½	12.4%	11.8%	14.2%	12.8%	12.7%	12.9%	13.3%
½ to 1	25.9%	25.5%	27.5%	28.4%	30.0%	30.2%	33.0%
1 to 2	43.4%	43.8%	44.3%	44.1%	42.9%	42.5%	40.3%
2 to 3	10.29%	10.63%	8.35%	8.36%	8.10%	8.30%	7.55%
3 to 5	5.46%	5.72%	3.71%	4.22%	4.00%	4.21%	4.01%
5 to 10	1.86%	1.87%	1.25%	1.51%	1.43%	1.23%	1.46%
10 to 20	0.31%	0.36%	0.30%	0.29%	0.38%	0.22%	0.25%
more than 20	0.43%	0.41%	0.42%	0.37%	0.48%	0.37%	0.10%

Source: Prepared by the authors.

Note: * - shares referring to the participation of household per capita income groups, measure in national minimum wages, in the occupation of the young population, weighted by the sample weight.

However, except for the income range between ½ and 1 minimum wage, this sample loss appears to have been approximately uniform across all income groups, as shown in Table 3. Thus, there is no clear evidence of bias in estimates computed in this work.

Table 4 presents the total number of young individuals present over the five-quarters period starting on the date specified in the cohort column. It is observed that of the total of almost 120,000 individuals, around 11,000 were paired over the 5-quarter period. It is observed that, due to the lack of information regarding the occupation of part of these individuals, the useful sample for the regressions performed was around 5,000 observations.

Table 4: Population's share between 14 and 29 paired over the 5-quarters period

Sample			
Cohort	Total	Paired	
2019Q3	120,433	11,822	9.8%
2019Q4	121,279	11,256	9.3%
2020Q1	109,486	9,329	8.5%

Source: Elaborated by the authors.

4.1. Variables of interest

After filtering the sample by age group[11] and matching individuals over the quarters using the identification variable created according to the procedure described above, the variables of interest were summarised to:[12]

- VD4002: occupancy condition, type 1 (occupied) or 2 (unoccupied);
- V403311: income bracket, type 1 to 8, respectively describing the ranges, in minimum wages – up to half; more than half and up to one; more than one and up to two; more than two and up to three; more than three and up to five; more than five and up to ten; more than ten and up to twenty; or more than twenty;
- V2007: gender, type 1 (male) or 2 (female);
- UF: federal unit, type 11 to 53[13].

In order to facilitate the procedures for testing the hypothesis of different impacts for different family income groups, variations of occupation (?occupation) were regressed against mutually exclusive indicator variables, corresponding to the defined income brackets (dummy variables, I_k, where k indicates the income bracket, from 1 to 8).

Table 5: Average of variations in the occupancy condition for the population aged 14 to 29 years between 2019Q3 and 2020Q3

	Dependent Variable		
	Change in occupancy status		
	General	*Man*	*Woman*
Up until ½	-0,298***	-0,265***	-0,336***
	(0,023)	(0,030)	(0,035)
In between ½ and 1	-0,189***	-0,178***	-0,203***
	(0,014)	(0,017)	(0,022)
In between 1 and 2	-0,130***	-0,113***	-0,156***
	(0,010)	(0,013)	(0,017)
In between 2 and 3	-0,081***	-0,081***	-0,082**
	(0,020)	(0,024)	(0,034)
In between 3 and 5	-0,048*	-0,064*	-0,019
	(0,029)	(0,035)	(0,053)
Larger 5	0,000	0,000	0,000
	(0,044)	(0,048)	(0,096)
Observations	5138	3058	2080
R^2	0,096	0,083	0,115
Adjusted R^2	0,095	0,081	0,112
Std. Dev. Residuals	9264	8938	9718
F Statistic	90,780***	45,966***	44,826***

Note: *p<0,1; **p<0,05; ***p<0,01
Source: Elaborated by authors.

The regression method, when applied to regressors exclusively in the form of mutually exclusive indicator variables, gives as estimated coefficients

the mean of the regressand for the subsample where the indicator variable is 1. In addition, the method calculates all other test statistics implemented for the OLS method.

Using the method described, it can be seen in Table 5 that the impact was considerably stronger in lower income groups. The estimated numbers, by income bracket, correspond to the percentage of young people in each bracket who in 2020Q3 had lost the employment status they had in 2019Q3. Thus, for the young population, the loss of employment status for the group with the lowest per capita family income (up to half the minimum wage), which occurred for 29.8% of the members of this group, was considerably greater than the loss verified for the group in the 2-3 minimum wage income bracket, reached by 8.1% of its members[14].

Table 6: Average of variations in employment status for the population aged 14 to 29 between 2019Q3 and 2020Q3

	Dependent Variable					
	Change in occupancy status					
	General	*North*	*Northeast*	*South*	*Southeast*	*Midwest*
Up until ½	-0,298***	-0,101**	-0,289***	-0,327***	-0,349***	-0,410***
	(0,023)	(0,041)	(0,031)	(0,061)	(0,052)	(0,076)
In between ½ and 1	-0,189***	-0,201***	-0,165***	-0,100***	-0,204***	-0,263***
	(0,014)	(0,030)	(0,022)	(0,034)	(0,027)	(0,040)
In between 1 and 2	-0,130***	-0,104***	-0,112***	-0,102***	-0,147***	-0,129***
	(0,010)	(0,030)	(0,030)	(0,017)	(0,018)	(0,032)
In between 2 and 3	-0,081***	0,000	-0,096	-0,096***	-0,084**	-0,061
	(0,020)	(0,059)	(0,061)	(0,035)	(0,033)	(0,060)
In between 3 and 5	-0,048*	0,000	-0,071	-0,006	-0,075	-0,028
	(0,029)	(0,080)	(0,085)	(0,047)	(0,053)	(0,087)
Larger 5	0,000	0,000	0,000	0,000	0,000	0,000
	(0,044)	(0,083)	(0,144)	(0,074)	(0,079)	(0,162)
Observations	5138	596	1176	1107	1689	570
R^2	0,096	0,098	0,122	0,067	0,096	0,138
Adjusted R^2	0,095	0,089	0,117	0,062	0,093	0,129
Std. Dev. Residuals	9,264	5,972	7,657	7,459	12,05	8,703
F Statistic	90,780***	10,729***	26,984***	13,280***	29,910***	15,111***

Note: *p<0,1; **p<0,05; ***p<0,01
Source: Elaborated by authors

When considering the issue of gender, although the profile of job loss is similar, there are signs that women were even more impacted. Going from 33.6% in the lower income bracket to 8.2% in the 2-3 minimum wage bracket,

while for men these numbers go from 26.5% to 8.1%. Showing very similar behaviour in this last bracket.

For income brackets above 3 minimum wages there is no statistical significance to discern the observed variation from zero, except at the 10% level for the general group and for men.

In the analysis of the large regions North, Northeast, South, Southeast and Midwest, in general, the pattern is similar in all regions except the North region, where the maximum impact occurs in the second income group. The impacts observed in the Midwest region were considerably greater in bands 1 and 2 than observed for other regions. For the first range, while the national average is at 29.8%, the impact for the Midwest was 41.0%. However, the impact is again similar to the national average for the range between 2 and 3 salaries.

Another relevant observation is regarding the impact on the range of half a salary, estimated for the South region. Table 6 presents an estimate of 10.0%, about half of the estimated impact for the national average of 18.9%

5.   Conclusions

Efficiency in public spending is essential to meet the needs of the population. With the pandemic, the challenging moment of entering the labour market has become even more traumatic, with potential long-term repercussions on the social exclusion of groups of young people most impacted by the health crisis.

To hope for efficiency in programs for the inclusion of young people in the labour market, it is important to understand the heterogeneity of impacts on different demographic groups. This study recognises that the demographic groups of young people are not homogeneous and explores aspects that correlate with this heterogeneity. Having this information helps to guide policies to be implemented in the post-pandemic period, in order to rescue those most affected from lasting impacts.

Among the results obtained in this work, the patterns of impact on job loss stand out, which corroborate the perception that the most socially vulnerable groups were also the most impacted by the pandemic. In general, occupation losses are relevant and significant at 1% for income groups up to 2 minimum wages. For the other ranges, the statistical effect may be different from zero, probably due to the lower number of observations in these income brackets. For the bracket between 2 and 3 minimum wages, the estimate obtained was also significant at 1% in the general sample and in the sample formed by men.

Among the results obtained for the three lower income brackets, going up to 2 minimum wages, the impacts are decreasing, with the lower income suffering the greatest impact. This is true both for the general sample and for the subgroups considered, divided by gender and by large regions of the country. Another relevant fact is that women suffered a greater impact than men, characterised by a loss of occupation 7 percentage points in excess of that observed for men.

From a regional point of view, the impact in the Midwest was the greatest in the reference cohort. However, in the Southeast, where the impact was high in the main cohort, this result persists in the cohorts used for the robustness analysis. Moreover, it features more persistent effects than that observed in other regions, this results an attenuated impact on the robustness cohorts.

The importance of focusing socially vulnerable populations on inclusion programs in the labour market is evidenced by these results. It is important to give greater support to young people from households with lower per capita income and also to take into account the gender issue in the implementation of these policies. As topics for future research, the dynamics of unemployment among young people during the Covid-19 pandemic for other Latin American countries could be evaluated.

Notes

1. In addition to the comparison between the third quarter of 2019 (2019Q3) and the third quarter of 2020 (2020Q3), as a robustness analysis, comparisons are also made between 2019Q4 and 2020Q4; and between 2020Q1 and 2021Q1.

2. The symbol of the Israeli currency – the National Israel Shekel, or NIS – is ₪.

3. Belgium, Germany, Greece, Italy, Spain and Sweden.

4. The term "lower qualifications" refers to school drop-offs and people without (vocational) training, while "higher qualifications" describes people with a high level of education and/or full vocational training. Immigrants were excluded for linguistic reasons.

5. The ranges of effective household income per capita, measured in terms of the national monthly minimum wage, used were: up to half; from half to one; from one to two; from two to three; from three to five; and greater than five minimum wages. In the last group, three available income groups – from five to ten; from ten to twenty and more than twenty – were aggregated in order to increase the number of observations in that bracket.

6. North, Northeast, South, Southeast and Midwest.

7. Whether the individual identifies as male or not.

8. According to the Pnadc – IBGE dictionary, Teresina (PI) – even though a capital of state – does not form a metropolitan region, but the Integrated Administrative Region for the Development of Greater Teresina.

9. For the OLS problem this estimate is given by $\hat{\sigma}_\varepsilon^2 = (N - K)^{-1}(y - X\hat{\beta})'(y - X\hat{\beta})$.

10. For simplicity, the period after the initial shock of the pandemic is referred to simply as the "post-pandemic" period.

11. Defined by the variable V2009, from 0 to 130, in years.

12. As this is a sample survey, the weight (V1028) of each individual is essential for the data's statistical analysis, so this variable was maintained and considered in the calculations presented.

13. Large regions can be calculated based on the UF variable: north (11 to 16), northeast (21 to 29), southeast (31 to 35), south (41 to 43), midwest (50 to 53).

14. The appendix of this work presents, as a robustness analysis, similar regressions made for cohorts 2 and 3, starting in 2019T4 and 2020T1, respectively. The pattern of impact observed in cohort 1, Table 5, is repeated in Tables A.1 and A.3 of the appendix, however with an attenuated impact.

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Appendix

Table A.1: Average of variations in the occupancy condition for the population aged 14 to 29 years between 2019Q4 and 2020Q4

	Dependent Variable		
	Change in occupancy status		
	General	*Man*	*Woman*
Up until ½	-0,250***	-0,222***	-0,278***
	(0,021)	(0,028)	(0,032)
In between ½ and 1	-0,182***	-0,139***	-0,237***
	(0,012)	(0,015)	(0,020)
In between 1 and 2	-0,094***	-0,077***	-0,120***
	(0,009)	(0,011)	(0,016)
In between 2 and 3	-0,053***	-0,052**	-0,056*
	(0,018)	(0,021)	(0,032)
In between 3 and 5	-0,034	-0,028	-0,041
	(0,024)	(0,030)	(0,039)
Larger 5	-0,047	-0,046	-0,050
	(0,040)	(0,047)	(0,072)
Observations	5.037	2.986	2.051
R^2	0,087	0,062	0,121
Adjusted R^2	0,086	0,060	0,119
Std. Dev. Residuals	8,292	7,803	8,926
F Statistic	79,609***	32,776***	46,972***

Note: *p<0,1; **p<0,05; ***p<0,01

Table A.2: Average of variations in the occupancy condition for the population aged 14 to 29 years between 2019Q4 and 2020Q4

	Dependent Variable					
	Change in occupancy status					
	General	North	Northeast	South	Southeast	Midwest
Up until ½	-0,250***	-0,152***	-0,193***	-0,150***	-0,404***	-0,276***
	(0,021)	(0,041)	(0,031)	(0,055)	(0,048)	(0,080)
In between ½ and 1	-0,182***	-0,148***	-0,143***	-0,129***	-0,211***	-0,234***
	(0,012)	(0,030)	(0,023)	(0,031)	(0,022)	(0,042)
In between 1 and 2	-0,094***	-0,052*	-0,058**	-0,073***	-0,109***	-0,133***
	(0,009)	(0,030)	(0,025)	(0,016)	(0,016)	(0,029)
In between 2 and 3	-0,053***	-0,000	-0,072	-0,069**	-0,050*	-0,035
	(0,018)	(0,087)	(0,061)	(0,029)	(0,030)	(0,053)
In between 3 and 5	-0,034	0,000	-0,215**	-0,022	-0,025	-0,013
	(0,024)	(0,120)	(0,091)	(0,037)	(0,040)	(0,072)
Larger 5	-0,047	0,000	-0,119	0,000	-0,056	-0,000
	(0,040)	(0,176)	(0,115)	(0,085)	(0,063)	(0,112)
Observations	5.037	607	1.16	1.077	1.672	521
R^2	0,087	0,063	0,074	0,047	0,115	0,112
Adjusted R^2	0,086	0,054	0,069	0,042	0,111	0,101
Std. Dev. Residuals	8,292	6,418	7,611	6,387	10,313	7,679
F Statistic	79,609***	6,776***	15,410***	8,816***	35,960***	10,782***

Note: *p<0,1; **p<0,05; ***p<0,01

Table A.3: Average of variations in the occupancy condition for the population aged 14 to 29 years between 2020Q1 and 2021Q1

	Dependent Variable		
	Change in occupancy status		
	General	Man	Woman
Up until ½	-0,246***	-0,196***	-0,304***
	(0,020)	(0,025)	(0,032)
In between ½ and 1	-0,173***	-0,133***	-0,226***
	(0,013)	(0,016)	(0,022)
In between 1 and 2	-0,084***	-0,082***	-0,088***
	(0,010)	(0,012)	(0,018)
In between 2 and 3	-0,032	-0,026	-0,042
	(0,022)	(0,027)	(0,038)
In between 3 and 5	-0,024	-0,028	-0,018
	(0,034)	(0,040)	(0,058)
Larger 5	0,000	0,000	0,000
	(0,055)	(0,073)	(0,085)
Observations	4.348	2.547	1.801
R^2	0,083	0,064	0,108
Adjusted R^2	0,081	0,062	0,105
Std. Dev. Residuals	9,085	8,382	9,965
F Statistic	65,074***	29,057***	36,200***

Note: *p<0,1; **p<0,05; ***p<0,01

Table A.2: Average of variations in the occupancy condition for the population aged 14 to 29 years between 2019Q4 and 2020Q4

	Dependent Variable					
	Change in occupancy status					
	General	North	Northeast	South	Southeast	Midwest
Up until ½	-0,246***	-0,279***	-0,317***	-0,079	-0,404***	-0,276***
	(0,020)	(0,048)	(0,030)	(0,058)	(0,048)	(0,080)
In between ½ and 1	-0,173***	-0,093***	-0,117***	-0,141***	-0,211***	-0,234***
	(0,013)	(0,034)	(0,024)	(0,024)	(0,022)	(0,042)
In between 1 and 2	-0,084***	-0,048	-0,085***	-0,031**	-0,109***	-0,133***
	(0,010)	(0,036)	(0,029)	(0,014)	(0,016)	(0,029)
In between 2 and 3	-0,032	-0,096	0,000	-0,010	-0,050*	-0,035
	(0,022)	(0,083)	(0,056)	(0,031)	(0,030)	(0,053)
In between 3 and 5	-0,024	-0,000	0,000	-0,008	-0,025	-0,013
	(0,034)	(0,170)	(0,082)	(0,042)	(0,040)	(0,072)
Larger 5	0,000	0,000	0,000	0,000	-0,056	-0,000
	(0,055)	(0,134)	(0,507)	(0,078)	(0,063)	(0,112)
Observations	4.348	550	1.044	838	1.672	521
R^2	0,083	0,074	0,121	0,046	0,115	0,112
Adjusted R^2	0,081	0,064	0,116	0,039	0,111	0,101
Std. Dev. Residuals	9,085	6,945	8,120	5,910	10,313	7,679
F Statistic	65,074***	7,283***	23,838***	6,710***	35,960***	10,782***

Note: *p<0,1; **p<0,05; ***p<0,01