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Effects of Unemployment on Economic Sectors: A Proposal for Behavior Analysis with Brazilian Municipalities

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Abstract

Although determined municipal public policies focus on the unemployment rate, to understand its determinants, one must assess how the main employment sectors in the country work, and how they affected by unemployment. In view of these facts, it is possible to raise the following research question: what is the influence of the main employment sectors on the unemployment present in Brazilian municipalities? Thus, this research will aim to analyze the effects of unemployment in the main employment sectors in Brazil. The study used data from 5.631 Brazilian municipalities, performing quantitative descriptive analysis procedures, in addition to the development of a linear regression model and a Tobit regression model. The Services sector appears with a positive highlight in relation to the others. Mineral Extractivism, on the other hand, presented a worrying unemployment estimate, being the sector that suffers the greatest impact in relation to unemployment. Among the economic sectors that also presented worrying coefficients are the Transformation industry (0.80) and Business (0.77). The results presented in the research can serve as a basis for decision-making, not only for public sector managers, but also for managers in the private sector.

Keywords: work shutdown, distribution, Linear regression, Tobit regression

1. Introduction

The global and Brazilian economy, in recent years, has faced considerable challenges, especially because of the current monetary crisis. Among the problems caused by economic crises are unemployment and loss of population income. Focusing on the national level, Brazil has been in a state of economic recession since 2014. From that period to the present day, there has been an increase in the unemployment rate, rising food costs, devaluation of the national currency and cuts in the budgets of social programs. Among other circumstances that may interfere with the daily life of the population (Costa et al., 2017; Rhoden et al., 2017).

The impacts arising from the economic recession can hide existing inequalities in society, with different exposures and negative consequences of these recessions. The economic alterations resulting from the productive restructuring, fiscal adjustments and economic liberalization that occurred in the last 30 years, changed the economic organizational structure. As a result, a new characterization of the Brazilian workforce seen, especially marked by significant changes in the average unemployment period (Arruda et al., 2018; Hone et al., 2019).

This rise in unemployment culminated in the growing marginalization of workers, with considerable waste of the workforce and the expansion of one of the cruelest forms of social exclusion. The duration and existence of unemployment, in addition to reducing the basic conditions of survival, may imply the loss of forms of knowledge in contemporary society. When the unemployment status quo kept, this environment may aggravate two issues. In the first question, it may reduce the probability of reintegration into the labor market, while in the second, it may lead the unemployed person to determined precarious occupation in the informal sector, eventually triggering an increase in poverty and crime (Alderete & Bacic, 2018; Arruda et al., 2018).

Even though the unemployment rate is an important indicator of economic activity, it alone presents an incomplete view about the distinction of jobs. Arruda et al. (2018) explain that a given unemployment rate may show at least two possibilities. The first possibility will present a circumstance in which the workforce will be unemployed for few days. In this situation, the labor market presents an intense flow of job losses and gains. In

another possibility, it will present a stagnation of the workforce, standing for permanent unemployment, with distorted demands for labor.

A greater problem for society seen if groups of individuals stay unemployed for longer periods than if they quickly go through unemployment (Arruda et al., 2018). Although determined public policies focus on the unemployment rate, to understand its determinants, one must assess how the main employment sectors in the country work, and how they affected in the trajectory from employment to unemployment.

According to Alderete and Bacic (2018) each sector has a different economic relevance. Since the development of these activities, from agriculture and industry to Business and Services, are present in most cities. With this, it is possible to see which economic sectors are more relevant in terms of employment in cities. In view of these findings, it is possible to raise the following question: what is the influence of the main employment sectors on the unemployment present in Brazilian municipalities? Therefore, this research will aim to analyze the effects of unemployment in the main employment sectors in Brazil. The result of this research could serve as a basis to support possible public policies that could reduce unemployment, focusing on the disparities of the work shutdown of workers with the main sectors.

To conduct this study, data from the General Register of Employed and Unemployed (CAGED), made available by the Program for the Dissemination of Labor Statistics (PDTE), will used, using a quantitative analysis with the data. Therefore, this research will aim to analyze unemployment along the categories present in CAGED, considering information from all federal municipalities in Brazil, which included in the database (Ministério da Economia, 2015). Next, an understanding of the municipalities and the issue of unemployment will be present.

2. Understanding Municipalities and the Issue of Unemployment

The smallest administrative layers in Brazil are the municipalities, which encompass both urban and rural areas. The concept of local development can apply to distinct types of small territories and human groups, from small towns to large municipalities. Local development not just limited to municipal development. Sometimes the regional scope includes cities with similar economic, labor and environmental aspects. Thus, the borders of regional employment sectors do not necessarily have to coincide with municipal borders (Alderete & Bacic, 2018; Costa et al., 2017).

The relationship between socioeconomic development and employment sectors depends on the particularities of the municipality. Socioeconomic improvements, measured by the average variations of the Human Development Index (HDI), are, on occasions, stronger in small and medium-sized cities than in large ones. Medium municipalities have attracted more investments due to their prerogatives for industrial centralization and their grouping economies. In large metropolises, industrial clustering can improve average income, but not the quality of life. In small and medium-sized cities, there are advantages in terms of operational cost (Alderete & Bacic, 2018; Mori-Clement & Bednar-Friedl, 2019).

Most cities have different economic activities, from industry to agriculture, to the provision of services, whether in the public or private sector, to Business in general. However, each sector shows a different economic relevance. In such a way that a city can assigned to a particular economic sector, the one that is most relevant in terms of employability (Alderete & Bacic, 2018). Regardless of the size or size of the employment sector or city, lately, an increase in unemployment rates has seen in the country.

According to Costa et al. (2017) the economic crisis raised unemployment in the country, and actions triggered by the current management could put Brazil back on the UN hunger map. Arruda et al. (2018) reported in their study that, lately, studies have analyzed the permanence of unemployment in Brazil and in the world. Determined examples of academic research on the issue of unemployment reported that men get work in a shorter time than women. Another study, according to the authors, weighted long-term unemployment in the context of the current economic recession, concluding that among the various age groups, individuals aged between 55 and 64 years had the highest unemployment rates and unemployment durations.

Both the duration of unemployment and issues related to the gender and age of unemployed individuals are important for understanding the phenomenon. However, other factors may corroborate with a greater scope and understanding of the phenomenon (Usman & Elsalih, 2018). One of these factors is related to the employment sector, and the participation of each sector in unemployment. Based on the high amount of information obtained from the CAGED data, it is necessary to use a robust statistical model that is capable of estimating results about the understanding of the phenomenon. One of these models is the linear regression.

2.1 Linear Regression Model

Linear regression statistical models commonly used for data modeling. The model is quite popular in academic

studies, used for various purposes in the scientific field. In short, the linear regression model is an equation to estimate an expected value called the Y variable, given the values of other variables, independent variables X. The commonly disseminated format of the equation is Yi = βo + βnXni + ui, where o Yi is the dependent variable, β1 is where the linear regression line cuts the Y axis, called the intercept, βn are the partial angular coefficients of the independent variables, Xni are the independent variables and ui is the estimated error, that is, the when the equation was not able to assertively estimate (Brown & Dunn, 2011).

These models normally fitted using the least squares approach, but can constructed in other ways, such as rearranging the fit, or by reducing a least squares penalty. However, the method of least squares may adjust to models that not considered linear. Although the linear model and least squares strongly connected, they are not synonymous (Brown & Dunn, 2011).

According to Brown and Dunn (2011), linear regression models shielded, due to their robustness, therefore, they tolerate determined transgressions of normality assumptions. In determined cases, the model may present normality distortions, resulting in distributions considered non-normal (biased distributions).

As a result, the estimates resulting from biased distributions will present anomalous trends to a normality model. In practice, this may mean that the model will present a good fit for the estimated values, but it may also result in unadjusted values and contradictory predictions for Y when the most extreme values (censored values) of the variables considered (Brown & Dunn, 2011). An alternative to this problem will be to collaborate with a model that can directly manage censorship along with the data.

2.2 Censored Regression and Tobit Regression Model

The equation Yi = max (0, X'iβ + ui) gives the estimate of the censored regression model, where Yi, Xi, β and ui are the same variables of the model. The differential of the model is that if the distribution is manifest up to a finite-dimensional vector of parameters, then the probabilistically based estimators can used to estimate the angular coefficients of β (Honoré & Powell, 1994).

For Honoré and Powell (1994), in the case of censorship in Yi , an asymmetry in the distribution induced. In this case, the symmetry will be reestablished in the artificial censoring along the residues of on X'iβ. Transforming the censored model into a model like the one graphically illustrated in Figure 1. The censored model, on the other hand, presents a non-normalized distribution effect, see the following illustration. By artificially cutting censoring, independent and identically distributed residuals obtained (conditioned to Xi and Xj).

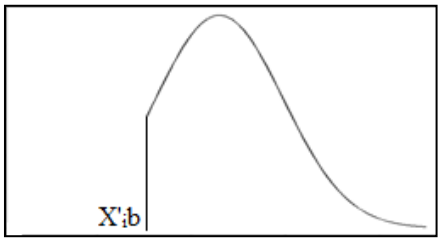

Figure 1. Censored distribution

Note. Adapted from Honoré and Powell (1994).

Honoré and Powell (1994) point out that without the censorship seen in the figure above, the distribution would be symmetric around the line X'iβ. Censorship blocks comments. Unless X'iβ = X'jβ, this will result in a skewed distribution of (Yi, Yj). A model capable of dealing with the asymmetry arising from the censored distribution is the Tobit regression model.

The Tobit regression model designed to deal with circumstances in which the dependent variable Y seen for values greater than zero, but not seen or censored for values less than or equal to zero. This implies that the censored values here simulate an unverified value of the underlying latent variable which, would be less than zero. The latent variable Yi* will found as a normally distributed random variable, following traditional linear regression models (Brown & Dunn, 2011; Dar et al., 2021). However, the Tobit model admits that the observed random variable Yi defined, according to Brown and Dunn (2011).

$$Y_i = \begin{cases} Y_i^* \; if \; Y_i^* > 0 \\ O \; if \; Y_i^* \leq 0 \end{cases} \quad (1)$$

from i=1,...,n. It is noteworthy that the observed dependent variable Yi will only be analyze above the censoring

value of zero. The latent variable Yi* in the context of a linear regression model, explained as the willingness to achieve a certain activity; once the disposition reaches a certain threshold, the action performed. The Tobit model is then Yi* =XTiβ + ui, where the error ui will have a normal distribution. This implies that Yi* will also present a normal distribution (Brown & Dunn, 2011; Dar et al., 2021).

When opting for the Tobit model over the traditional linear regression, it is important to pay attention to determined details. The first refers to the interpretation of the model. Three conditional forms considered in the interpretation of the Tobit model. These are the mean of the latent variable Y*, E(Y*|X); the average of the observed values that extrapolate the zero value E (Y|X & Y > 0); and the average of the observed values E(Y | X). The two conditional forms are of primary importance (Boarnet & Wang, 2019; Brown & Dunn, 2011).

The mean of the latent variable comes from the raw model coefficients. These shapes will underestimate the observed time for the traditional linear regression model. The conditional mean of the observed dependent variable is the most informative, as it adjusts the mean to reflect censoring and produces a non-negative result. Although both conditional methods can achieve from the notion of estimated regression coefficients, and the estimated error variance, the estimate of the deviation, most the time, not reported (Boarnet & Wang, 2019; Brown & Dunn, 2011).

The second detail concerns the presumption that the zeros found in the traditional linear regression model are truly censored. Despite the structural zeros resulting from a certain sample selection process considered as censored. For most activities, the proportion of structural zeros will be small and difficult to find. As an example of this detail, it would be difficult to evaluate people who do not watch TV, or who never read. Most the zeros, in this case, will be from the sample of zeros that not censored, as they are real observations, recommending that determined individual did not take part in the research on the day of registration (Brown & Dunn, 2011).

One last detail of the application of Tobit is that the model is sensitive to transgressions of the assumption of normality. One of Tobit's assumptions is that the normality of the latent variable is decisive for the asymptomatic distribution of the β parameter estimates. In any case, despite the significant deficiencies of the Tobit models and linear regression, they still have positive points, and will continue to use in various research for a long time (Brown & Dunn, 2011). The use of Tobit models to analyze censored dependent variables has become common in applied social science studies in recent years (Smith & Brame, 2003). Further details on the data and variables that will used in the study will present, as well as a model that can meet the intended demands of the study will be discuss and proposed.

2. Method

The research will use in its descriptive analysis, secondary data collected from a sample available in the General Register of Employed and Unemployed (CAGED). This registration is the responsibility of the Special Secretariat for Social Security and Labor of the Ministry of Economy of the Brazilian government. CAGED developed with the aim of constantly recording the admissions and dismissals of formal workers who regularly registered by the Consolidation of Labor Laws (CLT). The CAGED database serves as support for studies, programs and projects aimed at public policies that are related to the scope of the labor market, supporting decision-making, whether governmental or private (Ministério da Economia, 2015) .

Due to an update in the CAGED system between the years 2019 and 2020. The samples available to the public from the year 2020 onwards do not present information relevant to the main employability sectors in the country. Displaying only total information about the admission and dismissal of workers, without considering the sectors. Based on this analysis, it decided to use sample data referring to the period from January to December of 2019.

The choice of the 2019 sample is justified by the fact that this was the last period for which there are records in the base that display information on admissions and dismissals of the eight main sectors of employability, according to CAGED itself, these sectors are: Mineral extractive; Transformation industry; Public Utility Industrial Services; Construction; Business; Services; Public Administration; Agriculture, plant extract, hunting and fishing (Ministério do Trabalho, 2019).

Another factor that corroborated the choice to use the CAGED database is that the database presents information relevant to 5.631 municipalities throughout the national territory, covering all states of the federation, plus the federal district. The sample taken from the link http://pdet.mte.gov.br/images/ftp//dezembro2019/nacionais/6-saldomunicipioajustado.xls. This presents the balance of formal employment by each municipality, as well as positive or negative information about the sectors of economic activity across the country (Ministério do Trabalho, 2019).

To help the analysis, three adjustments made. These did not change the essence of the information contained in

the database. Initial adjustments made with the support of Microsoft Excel 365 spreadsheet software. The information bases collected in CAGED are compatible with this software, easing data organization.

The first adjustment refers to the nomenclature of the economic sectors. The variable "1 - Mineral extractive" had its name changed to "MnrlExtract", the variable "2 - Transformation industry" changed to "TransfInd", the variable "3 - Public Utility Industrial Services" changed to "PUIS", the variable " 4 - Construction" is now "Constr", the variable "5 - Business" is now "Bsnss", the variable "6 - Services" has been named "Srvcs", the variable "7 - Public Administration" is now "PublicAdm" and the variable "8 - Agriculture, plant extract, hunting and fishing" was named as "APEHF".

The second adjustment was more at the discretion of correction with the CAGED base. It seen that between one state and another there was always the creation of a municipality with the name "Ignorado," this fed with a value of 0 for all fields. It then decided to remove all municipalities called "Ignored" that had a value of 0 for all fields in the sample.

The third adjustment refers to the creation of the dependent variable of the study (explanation about the dependent variable and independent variables will present in the following topics), this will present only the total work shutdowns of each of the municipalities. How work shutdowns displayed with negative values on employability for each of the sectors. A software function capable of adding only values smaller than 0 used. The SOMASE function able to perform the sum of all sectors in the table.

As the name of the variable is already "work shutdown," it would not make sense to keep the negative values, so multiply the result obtained in the function by -1, just to put the negative values in a positive way. Illustratively, the function will look like this: =SUMIF(MnrlExtract: APEHF;"<0")*-1. With this, the function will add all the negative values of the eight sectors, multiplying the result by -1. The table below will present the nomenclatures of the fields as they were before the treatment, and as they were after the treatment. Also presenting the variable "work shutdown" that inserted in the database.

Table 1. Search database fields

Field name before treatment	Field name before treatment	Data type	Description
County	County	Text	Name of each municipality along with its federative unit.
1 - Mineral extractive	MnrlExtract	Numeric	Employability accounting in the sector. Collection sector of natural products of mineral origin.
2 - Transformation industry	TransfInd	Numeric	Employability accounting in the sector. Sector that classifies the production systems that transform a raw material into a finished product.
3 - Public Utility Industrial Services	PUIS	Numeric	Employability accounting in the sector. Sector refers to common-use industrial services.
4 - Construction	Constr	Numeric	Employability accounting in the sector. Construction sector of works such as houses, buildings, bridges, dams, machine foundations, roads, airports and other infrastructures, where civil engineers and architects take part in collaboration with specialists and technicians.
5 - Business	Bsnss	Numeric	Employability accounting in the sector. Sector of activity that consists of exchanging, selling or buying products, goods.
6 - Services	Srvcs	Numeric	Employability accounting in the sector. Sector that includes a product of human activity that satisfies a need, without taking the form of a material good.
7 - Public Administration	PublicAdm	Numeric	Employability accounting in the sector. Sector that employs professionals focused on the management of the State, which includes the legislative, executive and judiciary powers, through their bodies. In addition to other institutions essential to the nation.
8 - Agriculture, plant extract, hunting and fishing	APEHF	Numeric	Employability accounting in the sector. Sector accommodates what they call the primary sector of the economy. This can consider as the branch of human activities that produces raw materials, which, in turn, are goods and products extracted directly from nature (except minerals).
Total	Total	Numeric	It presents the subtraction of admissions by total dismissals of all sectors in each municipality.
-	work shutdown	Numeric	Added variable that presents only the total work shutdown of the sectors. Values obtained from the function: =SOMASE(MnrlExtract: APEHF;"<0")*-1

Note. prepared by the author based on Ministério do Trabalho. (2019).

After a brief understanding of the data that will used in the study, its sources and necessary adaptations for research. Next, the analysis procedure proposed for the study will present, as well as found preliminary results and limitations.

3. Results

For the data analysis procedure, the study initially intends to use the linear regression model. The model widely used in scientific research in the most diverse areas. According to Brown and Dunn (2011) the model defined from an equation capable of estimating an expected value based on a dependent variable (Yi), given the values of other variables considered independent (Xi). The description of the equation, as well as the representation of each model variable described in the topic, 2.1 Linear Regression Model.

In an eventual detection of censorship in the data distribution, it will be necessary to implement the Tobit regression model. Brown and Dunn (2011) point out that the Tobit regression model developed to accommodate situations in which the dependent variable Y captures values greater than zero, but does not capture, or presents censorship for values less than or equal to zero. The censored values will simulate from an unverified value of the underlying latent variable, which would be a value less than zero.

How the study intends to analyze the effects of unemployment in the main employment sectors in Brazil. The workers' work shutdown adopted as a dependent variable, and as independent variables, those corresponding to the main Brazilian economic sectors. The independent variables that will be analyze are: MnrlExtract; TransfInd; PUIS; Build; Bsnss; Srvcs; PublicAdm and APEHF. The statistical program used to calculate the analyzes was STATA in its version 16.1. In a step prior to modeling, a descriptive analysis conducted, both explanatory variables and the dependent variable.

Variable	Obs	Mean	Std. Dev.	Min	Max
MnrlExtract	5,631	.8888297	18.35892	-365	606
TransfInd	5,631	3.257148	159.6664	-3366	3188
PUIS	5,631	1.141893	86.43735	-982	6063
Constr	5,631	12.6292	236.5528	-3208	10481
Bsnss	5,631	25.83467	180.5494	-731	7820
Srvcs	5,631	67.93198	924.2096	-7271	62108
PublicAdm	5,631	.1459776	28.90388	-1153	473
APEHF	5,631	2.551234	64.83129	-1314	1231

Figure 2. Summary of descriptive statistics of explanatory variables

Understanding the figure presented in the tool, in the Variable column the variables are displayed, the Obs column presents the observations, the Mean column presents the average of each variable, the Std Dev column presents the standard deviations of the variables in the sample, the Min column presents the minimum record in each variable, and the Max column presents the maximum record. It seen that for all variables, 5.631 observations computed. The sector with the highest average of registered jobs was the Services sector, with an approximate average of 68 jobs.

The sector that presented the lowest average was Public Administration, with an average of less than 1 job, this phenomenon can be explained by the fact of stability and the scarcity of selective processes for admission of new employees in the public initiative, considering that the procedure most of the time it is presented in a selection process in the public sector, many times it seems bureaucratic. However, innovative studies needed for a better understanding of this specific phenomenon in this sector. Next, the descriptive analysis of the dependent variable seen.

Variable	Obs	Mean	Std. Dev.	Min	Max
Shutdown	5,631	65.05665	268.436	0	11790

Figure 3. Summary of descriptive statistics of the dependent variable

Using the same nomenclature as in Figure 2 to define the columns, an average of 65 work shutdowns can see, that is, an average of 65 people who lost their jobs. With a minimum of 0 work shutdowns and a maximum record of 11.790 work shutdowns.

Since we look to understand the effects of unemployment in the main employment sectors in Brazil. An equation

can modeled from the linear regression modeling method, implementing this together with the research data. Rescuing the fields from the research database, based on the linear regression modeling proposed by Brown and Dunn (2011). The work shutdown field will stand for the dependent variable Y. MnrlExtract, TransfInd, PUIS, Constr, Bsnss, Srvcs, PublicAdm and APEHF will stand for the explanatory variables X, these will have their values multiplied by the coefficients that will present their estimate after the implementation of the STATA software. The proposed equation for the linear regression model will be

$$work\ shutdown = \beta_0 + \beta_1 * MnrlExtract + \beta_2 * TransfInd + \beta_3 * PUIS + \beta_4 * Constr + \beta_5 * Bsnss + \beta_6 * Srvcs + \beta_7 * PublicAdm + \beta_8 * APEHF + u_i \quad (2)$$

Complementing the structuring of the model and executing the command in the STATA software. The following return obtained:

Source	SS	df	MS	Number of obs	=	5,631
				F(8, 5622)	=	590.33
Model	185207379	8	23150922.4	Prob > F	=	0.0000
Residual	220478572	5,622	39217.1063	R-squared	=	0.4565
				Adj R-squared	=	0.4558
Total	405685951	5,630	72057.8954	Root MSE	=	198.03

Shutdown	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
MnrlExtract	1.144198	.1467877	7.79	0.000	.8564376	1.431959
TransfInd	-.7507332	.0168015	-44.68	0.000	-.7836706	-.7177958
PUIS	-.2303829	.053443	-4.31	0.000	-.3351519	-.1256139
Constr	-.2425295	.0129981	-18.66	0.000	-.2680108	-.2170483
Bsnss	.7673696	.0202749	37.85	0.000	.7276229	.8071164
Srvcs	-.0356714	.0062558	-5.70	0.000	-.0479351	-.0234076
PublicAdm	-.6637576	.1074443	-6.18	0.000	-.8743899	-.4531253
APEHF	-.5859393	.0409223	-14.32	0.000	-.6661627	-.5057159
_cons	54.00118	2.677878	20.17	0.000	48.7515	59.25085

Figure 4. Results of the model implemented using linear regression

It seen that the determination coefficients R^2 (R-squared) and adjusted R^2 (Adj R-squared) did not present a satisfactory level of explanation for the model, only 0.4565 for R^2 and 0.4558 for adjusted R^2. However, the t-statistic (t) and p-value (P>|t|) of all independent variables showed significance at a 1% level (0.01>0.000). The overall F test (Prob > F) showed statistical significance at a 1% level (0.01>0.0000). The model was able to estimate the results using all 5631 observations present.

Honor éand Powell (1994) warn that if there is a censorship seen with the data distribution, that is, a symmetrical distribution. The linear regression model will estimate observations in a sample that will be censor at one or both observed ends. Resulting in a skewed distribution. To verify the existence or not of censored data, using the STATA tool, the histogram seen together with the dependent variable "work shutdown."

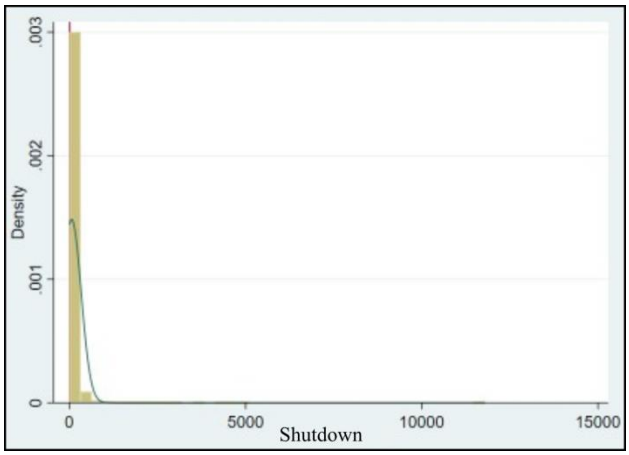

Figure 5. Histogram of the work shutdown dependent variable

From the histogram illustrated above, a strong censorship can see, where the distribution has a significant bias to the left side. The values to the left of the distribution are the minimum values, while the values to the right of the distribution are the maximum values. In the case above, the minimum value of the dependent variable "work shutdown" must found. This value already presented in figure 3, and the minimum value of the dependent variable was 0.

According to Brown and Dunn (2011), one of the models capable of dealing with the asymmetry arising from the censored distribution is the Tobit regression model. Using the STATA software, the Tobit regression model implemented, considering the censorship with a distribution bias to the left, a censorship that pointed to the value 0 at its end, presented by the dependent variable "work shutdown" according to the analyzed criteria. Using the commands in STATA, as a result, the figure below shows the Tobit regression, implementing the same variables used in the linear regression.

Tobit regression — Number of obs = 5,631; Uncensored = 4,968; Left-censored = 663; Right-censored = 0

Limits: lower = 0; upper = +inf

LR chi2(8) = 3141.41; Prob > chi2 = 0.0000; Pseudo R2 = 0.0440

Log likelihood = -34125.72

Shutdown	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
MnrlExtract	1.096669	.1569349	6.99	0.000	.7890162	1.404322
TransfInd	-.7975309	.0183703	-43.41	0.000	-.8335437	-.7615181
PUIS	-.2397475	.0571339	-4.20	0.000	-.3517519	-.1277431
Constr	-.2404201	.0139138	-17.28	0.000	-.2676965	-.2131437
Bsnss	.7687206	.0217132	35.40	0.000	.7261544	.8112869
Srvcs	-.0367967	.0067057	-5.49	0.000	-.0499425	-.0236509
PublicAdm	-.7233805	.1160755	-6.23	0.000	-.9509332	-.4958278
APEHF	-.6358054	.0440832	-14.42	0.000	-.7222255	-.5493852
_cons	34.93671	2.920046	11.96	0.000	29.21229	40.66113
var(e.shutdown)	44560.36	899.0364			42832.3	46358.14

Figure 6. Results of the model implemented using Tobit regression

It was possible to see in the figure above that of the 5.631 observations, only 4.968 of them not censored (Uncensored), while 663 observations were left-censored. Comparing the coefficients presented in the Tobit regression model with the linear regression model, variations in the values of the coefficients seen, even if minimal in determined cases (Boarnet & Wang, 2019) .

The Pseudo R^2 seen to be 0.0440, which shows that approximately 4.44% of the model efficiency can or cannot be explain from the linear combination of predictors. Just considering Pseudo R^2, the model showed low explanatory power. However, all explanatory variables show significance (P>|t|) at a 1% level (0.01>0.000). The model (Prob > chi2) also showed statistical significance at a 1% level (0.01>0.0000) (Dar et al., 2021). For a better understanding, the correlation between the dependent variable "work shutdown," the Y variable estimated in the linear correlation model and the Y variable estimated in the Tobit regression model will be present below.

	Shutdown	y_reg	y_tobit
Shutdown	1.0000		
y_reg	0.6757	1.0000	
y_tobit	0.6754	0.9995	1.0000

Figure 7. Correlation between the variables estimated in linear regression and Tobit regression and the dependent variable work shutdown

The results of Pearson's correlation between the estimated Y variables and the work shutdown dependent variable showed statistically positive and moderately significant correlations with the work shutdown dependent variable (WS). The work shutdown variable and the variable estimated in the linear regression (y_reg) showed a

correlation of 0.6757. The work shutdown variable and the variable estimated in the Tobit regression (y_tobit) presented a correlation of 0.6754. The estimated models presented, among themselves, a statistically positive and strongly significant correlation, with a correlation of 0.9995. This high correlation between the estimated models can see together with the low variation between the coefficients of the explanatory variables (Dar et al., 2021).

Due to the proximity found in the analyzes between the models estimated together with the sample, and the identification of 663 censored observations, it decided to use the estimates present in the Tobit regression model. It should note that the interpretations of the β coefficients in the Tobit model are not as direct as those performed in the linear regression model. Despite such limitations, the high correlation existing between both models (0.9995) should highlighted. With the model choice, and in possession of the aforementioned information, it is possible to estimate an approximation for the following equation:

$$\widehat{\text{work shutdown}} = 34.93671 + 1.096669 * \text{MnrlExtract} + 0.7975309 * \text{TransfInd} + 0.2397475 * \text{PUIS} + 0.2404201 * \text{Constr} + 0.7687206 * \text{Bsnss} + 0.0367967 * \text{Srvcs} + 0.7233805 * \text{PublicAdm} + 0.6358054 * \text{APEHF} \quad (3)$$

If the other interferences on employability remained constant for the following analyses. It is possible to see that workers linked to the mineral extraction sector were the ones who proportionally suffered the most from unemployment, when compared to the other sectors. It seen that for each work shutdown in all sectors the coefficient for Mineral Extraction will present a loss estimate of 1.1, that is, it is possible to see that the sector presents an estimate of loss of employability even higher than the total of all united sectors. According to Costa et al. (2017), the economic crisis raised unemployment in the country. With the estimates in hand, it is possible to look for other factors that have aggravated unemployment, especially in this sector that presented a negative behavior related to employability.

Next, the Transformation industry and Business sectors present high unemployment estimates, when compared to the other sectors. For each work shutdown, the sector coefficient will give a rough estimate of 0.8 Transformation industry workers laid off from their jobs. As for Business, for each work shutdown, the sector coefficient will present an estimate of 0.77 workers eventually losing their jobs. Municipal managers who have the municipality's economy concentrated in the Business or Transformation industry sectors should stick to these numbers. Alderete and Bacic (2018) report that a city can assigned to the sector that is most relevant in terms of employability.

The Public Administration is the fourth sector that presents the most worrying estimates about unemployment. It estimated that for each dismissed worker, the sector coefficient presents an approximate estimate of 0.7 civil servants dismissed from their duties. Despite all the complications arising, and the detailed accountability conducted by municipal managers that correspond to the hiring or work shutdown of professionals. In small and medium-sized cities, there are advantages in relation to operating costs, these advantages may favor eventual justifications for hiring in municipalities with this profile, logically the manager should distribute professionals in areas that present determined demand (Alderete & Bacic, 2018).

It also noted that for each work shutdown registered in the Agriculture, plant extract, hunting and fishing sector, the coefficient presents an approximate estimate of 0.6 workers directed to the informal sector. The Public Utility Industrial Services and Construction sectors had moderate impacts on unemployment. For each work shutdown, the coefficients for both presented an approximate estimate of 0.24 workers losing their jobs. It is important that municipal managers perceive and act together with public policies, both for the maintenance of the sectors that present a greater employability, or maintenance of jobs, and for the elaboration of policies aimed at the promotion of the sectors that suffer a greater impact related to unemployment. Arruda et al. (2018) recall that there are studies that address the issue of unemployment.

The Services sector presented, in the analyzed period, the smallest impact in relation to unemployment. For each work shutdown recorded, the industry coefficient had a rough estimate of 0.04 losing your job. This is an estimate close to 0. Attempting to understand "why?" this sector has the lowest impact on unemployment compared to other sectors, it is something of interest not only to public managers, but also to the private sector related to other sectors. Other issues such as the length of stay of the unemployed, if possible in each sector, would also corroborate with a greater understanding of the disparities between sectors, in relation to this phenomenon (Usman & Elsalih, 2018). In the final sections of the study, the final considerations and limitations seen in the research will be present, as well as the references used in the theoretical foundation.

4. Discussion

As much as determined government public policies use unemployment rates to understand their motivations, it is important that the public and private sectors evaluate not only the admission and dismissal rates, but also understand, along with these rates, which are the main sectors country's employees affected by unemployment. The study used data on the balance of formal employment by municipality and sector of economic activity, from January to December 2019, collected from CAGED. Econometric methods used to analyze the association between unemployment generated in the main economic sectors in Brazilian municipalities, looking to see which sectors have a greater or lesser impact in relation to unemployment in the country.

Based on a sample that included 5.631 Brazilian municipalities, based on nine variables. Having the work shutdown as a dependent variable and each of the eight economic sectors of the country as explanatory variables. With the data in hand, it was possible to conduct a descriptive analysis of these data, as well as the implementation of a linear regression model and a Tobit regression model (for censored data). Among the models, it decided to use the Tobit regression model together with the analyses. Even though this has shown a low explanatory power in Pseudo R^2, it found during the analyzes that, of the 5.361 observations, 4.968 of them did not have censorship, but 663 had censorship on the left. Another motivating factor for choosing the Tobit model was the high correlation it presented with the linear regression model (0.9995), believing that the generated estimates, in general, could present results with a satisfactory approximation.

Among the eight sectors analyzed, two presented antagonistic highlights. The Mineral Extractivism sector and the Services sector. The first presented an unemployment estimate even higher than the sum of all sectors together, presenting an approximate coefficient of 1.1 professionals eventually losing their jobs, for each overall work shutdown accounted for. Despite all the problems reported in relation to the economic crisis and the rise of unemployment, municipalities and private companies that have this sector as their main economic activity, must implement, as soon as possible, policies that have the increase in layoffs. Among the economic sectors that also presented worrying coefficients are the Transformation industry (0.80) and Business (0.77).

The sector that stands out positively is Services. For each work shutdown registered in the period, this presents an approximate coefficient of 0.04 professionals eventually losing their jobs, that is, the estimate of layoffs in the sector is close to zero. Another interesting data about the Services sector comes from the descriptive analysis of the variables. It seen that this was the sector that presented the highest average of admissions in the period, approximately 68 admissions. In-depth studies with the sector may collaborate not only to keep good estimates, but also to serve as a basis for economic sectors that do not present the same performance as the sector. It is important to remember that the model's explanatory variables showed significance ($P>|t|$) at a level of 1% ($0.01>0.000$). The Tobit regression model (Prob > chi2) also showed statistical significance at a 1% level ($0.01>0.0000$).

It should note that the results may serve as a basis for decision-making not only by public sector managers, but also by private sector managers. Considering that they can serve as support for changes related to economic recovery, based on policies aimed at job creation in each sector. Comparisons with other surveys conducted nationwide may corroborate the research findings. It should note, however, determined limitations of the research. Despite tries to find the most proper regression model for the sample, in this case the Tobit regression model. A low explanatory power seen, not presenting a satisfactory Pseudo R^2 from a theoretical point of view. It suggested that the research replicated along with other statistical models, the readjustment of determined variables, the suggestion of building models with other variables such as the balance of employment (Total) or focusing on a model that targets admissions instead of jobs shutdown. Such implementations could eventually suppress or alleviate the problems perceived in the study.

The use of other time series, or even the replication in municipalities of other nations, not just in Brazilian municipalities, could present new explanations about the phenomenon of unemployment in the sectors. Other economic sectors not considered could present other perspectives to the research. It seen that there is a wide spectrum for implementing methods or increasing added information for the study. The initiative of other studies that can analyze the effects of employability in the municipalities along with the economic sectors is relevant since the theme is of paramount importance for remediation of the crisis along with the economy.

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