RBGDR

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ANÁLISE DA ESTRATÉGIA DE AQUISIÇÃO E DISTRIBUIÇÃO DE EQUIPAMENTOS PARA A PROVISÃO DE INFRAESTRUTURA PRODUTIVA PARA A PROMOÇÃO DO DESENVOLVIMENTO REGIONAL ENTRE OS ANOS DE 2021 E 2022

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ABSTRACT

This article aims to analyze the distribution of heavy machinery carried out by the Ministry of Regional Development between the years 2021 and 2022, within the scope of the implementation of the Strategy for the Acquisition and Distribution of Equipment for the Provision of Productive Infrastructure, established by Portaria MDR/SMDRU nº 3.071/2020. During this period, 661 heavy machines were distributed to 572 low and middle-income municipalities across the entire national territory, resulting in budget execution of more than R$ 303 million. The analysis of the distribution was carried out based on the classification of municipalities' income as low or middle-income, by region, by state, around the amount of budgetary resources distributed, and the party orientation of the mayors covered, in order to verify the alignment of the distribution of equipment with the objectives of the National Regional Development Policy It was found that there was no priority in serving low-income municipalities over middle-income municipalities, and that the distribution of financial resources was not proportional among low and middle-income municipalities between states and macro-regions. No objective criterion was found that determined the different averages for the different geographical scales analyzed. It was found that the party alignment of the municipal mayor with the government's base in the National Congress influenced the choice of the recipient municipality, highlighting the Brazilian political context at that time, of using the federal budget as an instrument of political negotiation between the Executive and Legislative Powers.

Keywords: Regional Development. National Regional Development Policy. Federal Budgetary Resources. Federal Budget. Political Support.

RESUMO

Busca-se analisar a distribuição de máquinas pesadas realizada pelo Ministério do Desenvolvimento Regional entre os anos de 2021 e 2022, no bojo da execução da Estratégia de Aquisição e Distribuição de Equipamentos para a Provisão de Infraestrutura Produtiva, instituída pela Portaria MDR/SMDRU nº 3.071/2020. Neste período, foram distribuídas 661 máquinas pesadas, para 572 municípios de baixa e de média renda de todo o território nacional, resultando na execução orçamentária de mais de R$ 303 milhões. A análise da distribuição foi realizada a partir da classificação de renda dos municípios como de baixa ou de média renda, por região, por estado, em torno do montante de recursos orçamentários distribuídos e da orientação partidária dos prefeitos contemplados, a fim de verificar o alinhamento da distribuição dos equipamentos aos objetivos da Política Nacional de Desenvolvimento Regional. Verificou-se que não houve prioridade no atendimento de municípios de baixa renda sobre municípios de média renda, que a distribuição dos recursos financeiros não foi proporcional nos municípios de baixa e média renda entre estados e entre macrorregiões. Não se evidenciou um critério objetivo que determinasse as diferentes médias para as diferentes escalas geográficas analisadas. Verificou-se que o alinhamento partidário do prefeito municipal à base do governo no Congresso Nacional influenciou a escolha da prefeitura destinatária, evidenciando o contexto político brasileiro daquele momento, de uso do orçamento federal como instrumento de negociação política entre o Poder Executivo e o Poder Legislativo.

Palavras-chave: Desenvolvimento Regional. Política Nacional de Desenvolvimento Regional. Recursos Orçamentários Federais. Orçamento Federal. Apoio Político.

INTRODUCTION

This work presents an analysis of the Strategy for the Acquisition and Distribution of Equipment for the Provision of Productive Infrastructure, from the Ministry of Regional Development, between the years 2021 and 2022. In 1999, Tânia Bacelar de Araújo published the text "For a National Regional Development Policy," in which she outlined the suggestion for the creation of a classification of sub-regions within the national territory to enable the definition of priority regions for regional development policies.

In 2019, the Ministry of National Integration was merged with the Ministry of Cities, creating the Ministry of Regional Development (MDR). In the same year, the Second National Regional Development Policy (PNDR II) was instituted through Decree No. 9.810 of May 30, 2019. Based on this policy framework, the Ministry implemented the Strategy for the Acquisition and Distribution of Equipment for the Provision of Productive Infrastructure to Promote Regional Development between 2021 and 2022. From the analysis of the distribution of the equipment delivered across the national territory, it was possible to draw inferences regarding the relationship between the beneficiary municipalities and the political party affiliation of their respective mayors, which constitutes the main motivation for the development of this article.

The following sections present the public policy implemented through this Strategy, the three hypotheses that guide the analysis, the results of the hypothesis tests, and the conclusions derived from them.

THE STRATEGY FOR ACQUISITION AND DISTRIBUTION OF EQUIPMENT FOR THE PROVISION OF PRODUCTIVE INFRASTRUCTURE

On December 8, 2020, through Portaria MDR/SMDRU nº 3.071/2020, the National Secretariat for Mobility and Regional and Urban Development of the Ministry of Regional Development, MDR, established the Strategy for the Acquisition and Distribution of Equipment for the Provision of Productive Infrastructure. Through this Strategy, the MDR acquired the four types of heavy machinery provided for in the ordinance: backhoe loaders, wheel loaders, hydraulic excavators, and motor graders. Throughout the years 2021 and 2022, the procurement and acquisition of 661 pieces of heavy machinery were carried out, distributed to 572 low- and middle-income municipalities across the national territory, resulting in a budget execution of R$ 303,303,752.58, in federal resources. The heavy machinery was donated to low- and middle- income municipalities through the signing of Donation Terms. It is worth noting that of the 3,363 eligible municipalities, 572 received the equipment, necessitating the definition of selection criteria, which is the subject of this study.

The technical variables for the selection of municipalities eligible for the donation of heavy machinery, which aimed to achieve the objectives of the PNDR, were defined according to the PNDR sub-regional typology classifying micro-regions into low, medium, and high income.

SUB-REGIONAL TYPOLOGY OF THE PNDR

The National Regional Development Policy establishes territorial scales of action at the macroregional level (North, Northeast, Midwest, Southeast, and South) and at the sub-regional level (mesoregions and subregions), defined “for the purpose of identifying potentialities and vulnerabilities that guide the formulation of socioeconomic, cultural, political-institutional, and environmental objectives” (Brazil, 2007). In fact, Annexes I and II of the PNDR Decree provide a typology for classifying subregions of the national territory according to income level (low, medium, and high) and economic dynamism

(low, medium, and high). In 2017, ten years after the establishment of the first PNDR, the Regional Development Secretariat (SDR) of the Ministry of National Integration updated the sub-regional typology, presenting a classification of 571 subregions, covering all 5,570 municipalities in the national territory. The typology classifies all municipalities within these subregions according to income level (low, medium, or high) and economic dynamism (low, medium, or high). The combination of these income and economic dynamism classifications allows for nine possible categories for each subregion, as shown in the table below.

Table 1 | Number of Low- and Medium-Income Municipalities Covered

INCOME	COVERAGE	TOTAL	%
LOW INCOME	78	600	13%
MEDIUM INCOME	494	2.763	18%
TOTAL	572	3.363	17%

Author's elaboration

Based on these combinations, the sub-regional typology of the PNDR serves as a tool for identifying priority regions for reducing regional inequalities, to be taken into account in the formulation of sectoral and cross-cutting public policies. The variables used to construct the typology were based on determinants of regional inequalities: the occupational structure of the regions (population density, urbanization, etc.); the productive base (gross domestic product, GDP per capita); the relationship of households within this productive base (per capita household income); and economic dynamics (geometric growth rate of GDP and income growth). For the construction of the typology, the spatial scale of microregions (MRGs) defined by the Brazilian Institute of Geography and Statistics (IBGE) was adopted. This scale is not as detailed as the municipal level, but it is also not as broad as the macroregional level (Macedo and Porto, 2020).

All microregions classified as "low income" or "middle income" were considered priorities for the PNDR. Although these microregions are concentrated mainly in the North and Northeast regions, they are also dispersed across all Brazilian states. It is noteworthy that, among the 20 microregions classified as having the "highest income," 18 are located in the South and Southeast regions, which allows the conclusion that income concentration persists in these regions, reflecting the historical pattern of regional inequality in Brazil. Although they still conceal internal differences within them, microregions provide a

more detailed picture than macroregions and offer greater flexibility by going beyond state boundaries (Macedo and Porto, 2020). After this brief presentation of the PNDR typology, the next section presents observations regarding the limits and difficulties observed in the implementation of the PNDR since its establishment.

METHODOLOGY

THEORETICAL FRAMEWORK

Macedo and Porto (2020) observed the limited governance surrounding Brazil's National Regional Development Policy. This situation occurs through the absence of coordination among the three levels of government, the lack of coordination among ministries and their policies that directly influence the territory, and the failure of subnational governments to incorporate the PNDR into their policy agendas. The PNDR did not rely on concrete policy instruments or evaluation mechanisms, nor did it gain prominence on the federal government's agenda, remaining largely restricted to the financing provided by constitutional funds and regional development funds.

When proposing the creation of a National Regional Development Policy, Tânia Bacelar de Araújo—under the influence of Celso Furtado, the main figure responsible for institutionalizing regional development within the Brazilian state, observed that the historical regional inequalities resulting from the uneven distribution of state investment in regions historically exploited by patrimonialist interests could be aggravated if regional dynamics were left solely to market decisions. Such a situation would tend to exacerbate the selective character of this type of development, widening the historical fractures already present in national development (Araújo, 1999). Tânia Bacelar argued for active state intervention in regions where the free market does not operate effectively, precisely to counterbalance the selective effects generated by private initiative, which has traditionally preferred to invest in the South and Southeast regions.

The overall picture presented by the analysis of the three hypotheses examined in this study allows for the reflection that the results are not entirely consistent with the propositions advanced by Celso Furtado and Tânia Bacelar regarding regional development, particularly as expressed through the National Regional Development Policy. This situation reflects a pronounced political bias as

a criterion for defining the municipalities that received benefits, to the detriment of an equitable and proportional distribution of resources and machinery among all states and regions of the national territory. This situation reveals the persistence of longstanding political bargaining practices that historically occur between the Federal Executive Branch and the Federal Legislative Branch. As Celso Furtado consistently argued in his studies, the objective of regional development policies has always been to reduce regional disparities through the physical and productive integration of the national territory. This involves the pursuit of balance in the distribution of financial resources and in the geographical distribution of agricultural and industrial sectors. However, despite these efforts, regional development plans have often been relegated to a secondary role due to events related to the global dynamics of capitalism, influenced by internal and external economic and political interests that reduced the priority given to national integration plans (Portugal and Da Silva, 2020).

THE HYPOTHESES

Prior to presenting the methods, techniques, and procedures to be used in this study, it is necessary to introduce the research problem, which can be summarized as follows:

"How did the quantitative distribution of heavy machinery contribute to the fulfillment of the National Regional Development Policy, and to what extent was it influenced by the party affiliation of the Municipal Mayor?"

This research problem is divided into three hypotheses, and the methodology will be used to seek answers to two technical hypotheses and one political hypothesis, as detailed below.

TECHNICAL HYPOTHESES

Two technical hypotheses are being tested, whose confirmation would indicate the achievement of the objectives of the National Regional Development Policy:

i. There is a priority in serving low-income municipalities over medium-income municipalities, as provided for in Annex II of the PNDR;

ii. The distribution of financial resources was proportional among low- and medium- income municipalities across states and macro-regions (north, northeast, center-west, southeast, south), as provided for in Portaria MDR/SMDRU nº 3.071/2020.

POLITICAL HYPOTHESIS

Regarding the political hypothesis to be analyzed, the party affiliation of the mayors of the municipalities receiving the donated heavy machinery acquired through Portaria MDR/SMDRU nº 3.071/2020 is a variable that allows for a series of relevant interpretations:

i. The party alignment of the municipal mayor with the government's base in the National Congress influences the choice of the recipient municipality.

For grouping purposes, all party affiliations that had elected mayors in 2021 and 2022 were classified into three groups in relation to the federal government in office at the time, namely, the government under President Jair Messias Bolsonaro. The classification of parties was based on 2022 data from the Congress Radar Platform, which analyzed the votes of political parties for or against the positions of the Federal Executive Branch on different matters:

Table 2 | Covered Municipalities x Alignment of the Municipal Mayor's Party

ALIGNMENT OF THE MUNICIPAL MAYOR'S PARTY
GOVERNMENT PARTY
DC, DEM, MDB, NOVO, PATRIOTA, PL, PP, PSC, PSD, PSDB, PSL, PTB, PRTB, PMB, PMN, PTC, REPUBLICANOS
SWING PARTY
AVANTE, CIDADANIA, PROS, PODEMOS, SOLIDARIEDADE, PV
OPPOSITION PARTY
PCdoB, PDT, PSB, PSOL, PT, REDE

Plataforma Radar Congresso 2022; organization by the author.

Having presented the three hypotheses of this study, each will be analyzed using different data analysis techniques, as enumerated below: for the analysis of the two technical hypotheses, this study employs chi-square tests for testing the association between categorical variables (McHugh 2013); variance tests to test the discrepancy between distributions among low- and middle-income groups (Arnold 1981); Pearson correlation test and simple linear regression to investigate correlations between numerical variables (Altman & Krzywinski 2015); T-test for comparing pairs of means (Daya 2003); and 95% confidence interval inference (Kirkwood & Sterne 2003). The normality of the data is checked using the Shapiro-Wilk and Kolmogorov-Smirnov tests (Kirkwood & Sterne 2003).

For the analysis of the political hypothesis, this study uses: logistic regression model to find the odds ratio to determine if there is a higher probability that a municipality receiving heavy machinery belongs to a government base party, or if there is a relationship based on the type of income of the municipality (Lever & Altman 2016).

Regarding the multiple logistic regression model, it can be written using the following formula:

$$\hat{p}=\frac{exp(b_0+b_1X_1+b_2X_2+\ldots+b_PX_P)}{1+exp(b_0+b_1X_1+b_2X_2+\ldots+b_PX_P)}$$

For the above formula, p is the probability of success of the event being modeled, that is, the probability of the municipality receiving heavy machinery. The letters X_1, X_2,..., etc., are the variables studied (opposition party, swing party, government party). Therefore, the regression seeks to provide data for analyzing the probability of a municipality receiving heavy machinery based on the classification of the mayor's party as opposition, swing, or government, among the municipalities covered.

Additionally, a general linear model for ANOVA is used, with correction for heterogeneous variances, in the comparison of mean values between political parties, regions, and states (Bancroft 1968), with Tukey's post hoc test to find significance when ANOVA indicates there is a difference to be investigated (Krzywinski & Altman 2014). For all analyses, the software used are SPSS 26 and Statistica 12, with a significance level alpha of 5%, standard in the global scientific literature (Krzywinski & Altman 2013).

For all analyses, the software used were SPSS 26 and Statistica 12, with an alpha significance level of 5%, which is the standard adopted in the international scientific literature (Krzywinski & Altman, 2013).he choice of analysis through the statistical solutions presented aims to observe the probability of occurrence of the events predicted in the hypotheses, which were formulated to verify the alignment of the public policy under study with the National Policy for Regional Development (PNDR). If only the technical hypotheses were confirmed, it would be possible to conclude that the implementation of the Strategy prioritized and directed resources and results in accordance with the assumptions of Tânia Bacelar and with the National Policy for Regional Development. If they were not confirmed, the opposite would be true. On the other hand, the analysis of the political hypothesis would allow one to conclude whether the political affiliation of the municipal mayor (government coalition, swing/independent, or opposition) had any influence on the fulfillment or non-fulfillment of the two technical hypotheses and, consequently, on the fulfillment or non-fulfillment of the PNDR.

RESULTS

In this section, the three hypotheses mentioned in the methodology of this study will be analyzed:

HYPOTHESIS 1: THERE IS A PRIORITY IN SERVING LOW-INCOME MUNICIPALITIES OVER MEDIUM- INCOME MUNICIPALITIES, AS PROVIDED FOR IN ANNEX II OF THE PNDR.

Using the chi-square test, and considering the physical delivery of heavy machinery among the total of 3,363 low- and medium-income municipalities as a comparative variable, the delivery of heavy machinery between the medium-income and low-income groups is compared. The result is shown below:

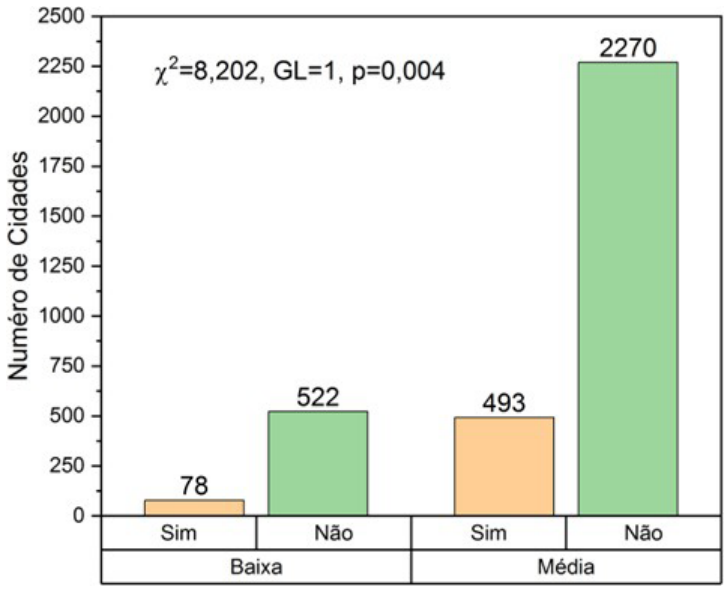
Table 3 | Chi-square test for distribution of heavy machinery by income

		Heavy Machinery		
		No	Yes	
Income	Low	522	78	15%
	Medium	2270	493	22%
Result: c^2=8,202; GL=1; p=0,004				

Author's elaboration

The graphical summary of the data can be presented as follows:

Figure 1 | Chi-square test for distribution of heavy machinery by income



Author's elaboration

The interpretation of the data allows us to conclude that there are significant differences (p=0.004) in the proportional distribution between low- and medium-income municipalities, with the distribution of heavy machinery benefiting more the medium-income group (493) compared to the low-income group (78).

The table below presents the frequency comparison of the occurrence by type of heavy machinery based on income. From the data, it is possible to see that the donation of wheel loaders is predominant, especially for medium-income municipalities. For all types of heavy machinery, the number of donated heavy machines is always greater for medium-income municipalities compared to low-income municipalities (p<0.00001 for all categories). It should be noted that, during the calculation of the chi-square statistics, there was an error in the counting of one middle-income municipality fewer, resulting in a total of 493. The table conducted a chi-square test to verify the association between the variables type of heavy machinery and type of income:

Table 4 | Comparison of frequency of occurrence by type of heavy machinery based on income

	Low Income	Medium Income	χ^2	GL	p
HYDRAULIC EXCAVATORS	3	55	46.621	1	<0.000001
MOTOR GRADERS	25	141	81.06	1	<0.000001
WHEEL LOADERS	46	270	158.78	1	<0.000001
BACKHOE LOADERS	4	27	17.065	1	<0.000001

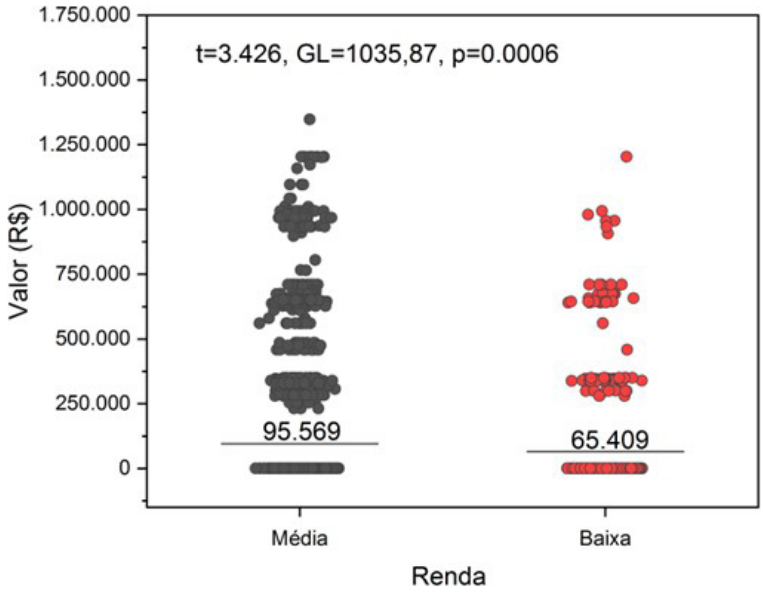
Author's elaboration

If the previous table presented a chi-square test with only a single p-value, it would not be significant (and the values would be X^2=4.0492, p=0.256). However, the focus is on demonstrating that medium-income municipalities received more heavy machinery for all four categories of donated heavy machinery compared to low-income municipalities. To do this, the differences for each type of heavy machinery were tested individually, resulting in four p- values, as there are four statistical tests. The values remain consistent despite this, due to the use of the Bonferroni Correction criterion: even with the execution of four different tests, one for each type of heavy

machinery, dividing alpha by 4 (i.e., alpha of 0.05/4) would result in 0.0125, which would require considering only p-values smaller than 0.0125 as significant (instead of 0.05, the general rule). This happens because four tests were conducted instead of just one, hence the higher chance of error, highlighting the importance of using the Bonferroni Criterion. Still, the p-values remain consistent, as they are all much smaller than 0.0125, maintaining the differences as consistently significant.

Focusing on the analysis of resource distribution among the total of 3,363 low- and medium-income municipalities, a comparison of the average values received by these municipalities was conducted. The results are shown in the graph below:

Figure 2 | Comparison of average values received by low- and medium-income cities



Author's elaboration

The table above shows that medium-income municipalities receive on average more resources than low-income municipalities (p=0.0006), and the difference between the averages is R$ 30,106.00. In the graph illustration, each gray or red circle represents a municipality. The graph shows that there are many circles that received resources well above the average, indicating that there are clearly low- or medium-income municipalities that receive significantly more resources than others. For better understanding: the two bars within the graph are positioned at the height of the respective average distributed resources, and the value above them (R$ 95,569.00 and R$

65,409.00) are the averages for the two income types.

In numbers, the table below presents the averages, with standard deviations in parentheses, and the values for the t-test statistics, Degrees of Freedom (DF), and p-value, along with sample sizes (N, i.e., the number of cities) for both groups:

Table 5 | Averages, standard deviations, t-test statistics, Degrees of Freedom (DF), and p-value

	Medium Income (N=2763)	Low Income (N=600)	t	GL	p
Values	R$ 95.569,23 (R$ 23.0577,9)	R$ 65.409,96 (R$ 18.6894,9)	3,426782	1035,872	0,000635

Author's elaboration

Below, the disparities (variances) between the two groups are compared through a simple test to determine in which of the two groups there are more disparities, that is, in which of the two groups there are more municipalities receiving values far from the average. For this purpose, a variance comparison test between the two groups was conducted. The result is shown below:

Table 6 | Comparison of variation between the two groups

Comparison of variation between the two groups						
Variable	N Medium	N Low	DP. Medium	DP Low	F	p
Values	2.763	600	R$ 23.0577,9	R$ 18.6894,9	1,522090	<0,000001

Author's elaboration

The variation (standard deviation - SD) is greater in the medium-income group, with a higher standard deviation value (R$ 23,057.9) compared to the low-income group ($p<0.000001$). The F-value, known as Fisher's F-statistic, represents a ratio between the variances: the further it is from the value of 1, the more different the variances of the groups are. The comparison of the variation between the two groups allows us to conclude that not only does the medium-income group receive more resources, but there are also more municipalities favored in this group, where "favored" means the municipalities receiving values well above the average.

Regarding the response to the first hypothesis formulated, it is statistically concluded that there was no priority given to low-income municipalities over medium-income municipalities, as provided for in Annex II of the PNDR, either in the number of municipalities covered or in the distribution of heavy machinery or budgetary resources. The PNDR sub- regional typology established the classification of municipalities in such a way that the prioritization between low- and medium-income municipalities could occur incrementally: from the municipality with the lowest income and low dynamism to the one with higher income and dynamism. Given the proven prioritization of medium-income municipalities both proportionally and in the type of heavy machinery distributed, it is concluded that the prioritization indicated by the PNDR sub-regional typology was not the primary guideline for defining the covered municipalities. Next, we will present the analysis of the two remaining hypotheses to deepen the investigation.

HYPOTHESIS 2: THE DISTRIBUTION OF BUDGETARY RESOURCES WAS PROPORTIONAL IN LOW- AND MEDIUM-INCOME MUNICIPALITIES AMONG STATES AND MACRO-REGIONS (NORTH, NORTHEAST, CENTER- WEST, SOUTHEAST, SOUTH), AS PROVIDED FOR IN PORTARIA MDR/ SMDRU Nº 3.071/2020

The following table presents the average, standard deviation, and maximum and minimum values distributed by region:

Table 7 | Distribution of resources by region for low- and medium-income municipalities

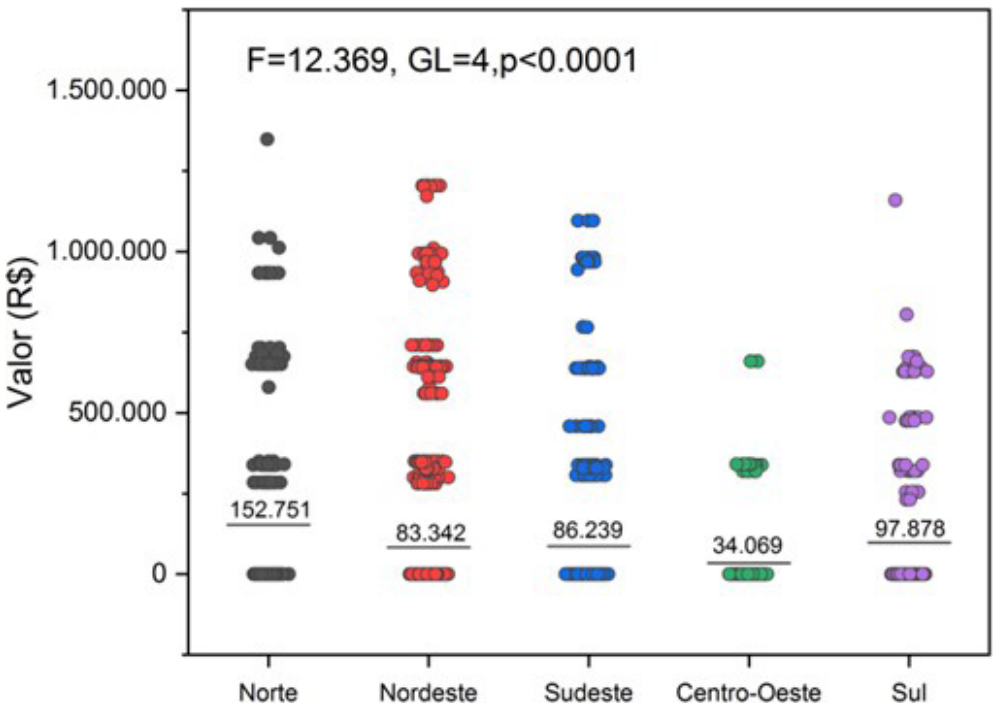
F=12.369, p<0.0001		Resources distributed (R$)			
		Average	Standard Deviation	Maximum	Minimum
REGION	North	R$ 152.751,00	R$ 270.788,80	R$ 1.347.932,00	R$ -
	South	R$ 97.878,00	R$ 209.715,00	R$ 1.158.500,00	R$ -
	Southeast	R$ 86.239,00	R$ 214.143,30	R$ 1.095.794,00	R$ -
	Northeast	R$ 83.342,00	R$ 226.114,00	R$ 1.203.818,00	R$ -
	Center-West	R$ 34.069,00	R$ 110.060,10	R$ 659.300,00	R$ -

Author's elaboration

From the data above, it is noticeable that there is a discrepancy in the distribution of resources between regions, considering that the North region received 4.5 times more than the Center-West region, and the South region, the most developed in the country, occupies the second position in the distribution of resources through the donation of heavy machinery. The standard deviation and the maximum value received by the Center-West region are also discrepant compared to other regions. All regions have municipalities that did not receive heavy machinery, hence the minimum value is zero.

The analysis of resource distribution by region shows that the region whose low- and medium-income municipalities received the most resources is the North region, followed by the South and Southeast regions. The Center-West region received the least resources on average among the municipalities. In all regions, as shown in the image below, it is possible to observe the existence of isolated municipalities or groups of isolated municipalities that stand out significantly from the average for having received resource values much higher than the average.

Figure 3 | Analysis of the average distribution of resources by region



Author's elaboration

Regarding the response to the second formulated hypothesis, it is concluded that the distribution of financial resources was not proportional in low- and medium-income municipalities among states and macro-regions (North, Northeast, Center-West, Southeast, South), as had been provided for in Portaria MDR/SMDRU nº 3.071/2020. This conclusion is supported by the previous statistical tests, which demonstrate the disparity in the average resources distributed among regions, states, and covered municipalities. There is no evidence of an objective criterion determining the different averages for the different geographical scales analyzed (regional, state, municipal).

HYPOTHESIS 3: THE PARTY ALIGNMENT OF THE MUNICIPAL MAYOR WITH THE GOVERNMENT BASE IN THE NATIONAL CONGRESS INFLUENCES THE SELECTION OF THE RECIPIENT MUNICIPALITY.

First, we sought to analyze the incidence of government-aligned, swinging, and opposition municipalities among low- and medium-income municipalities, and thus test if there would be a correlation with the fact that medium-income municipalities have more swinging or government-aligned parties. To do this, a chi-square test was conducted comparing the frequency of party type between the two groups, and the result is shown below:

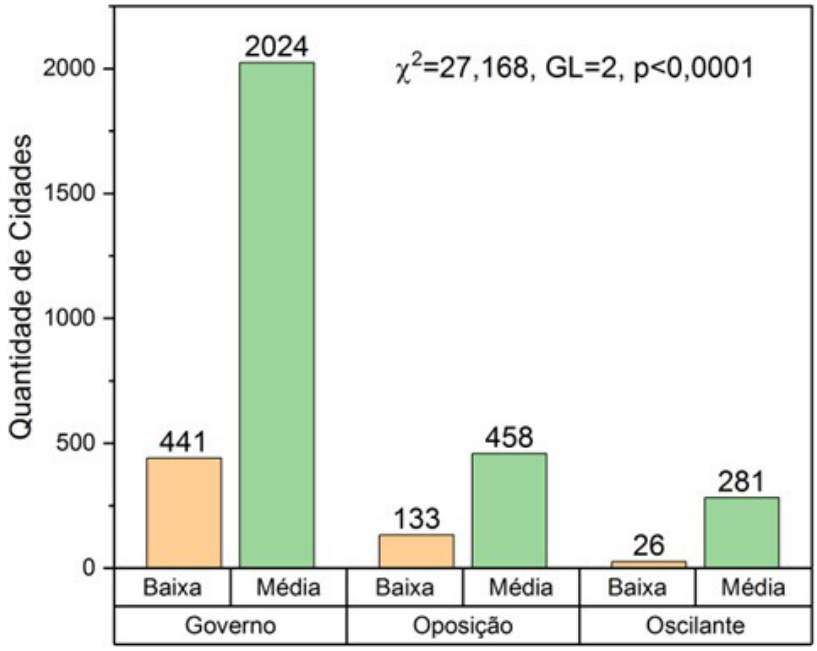
Table 8 | Municipality Income x Mayor's Party

		Income	
		Low	**Medium**
Mayor's Party	**Government**	441	2024
	Opposition	133	458
	Swing	26	281
c2=27,168, GL=2, p<0,0001			

Author's elaboration

The table shows that there are significant differences (p<0.0001) between the income of the municipalities and the party classification of the mayors: medium-income municipalities have more mayors from government-aligned parties. It is evident that medium-income municipalities are favored because they have more mayors belonging to government-aligned political parties. The graphical summary is presented below:

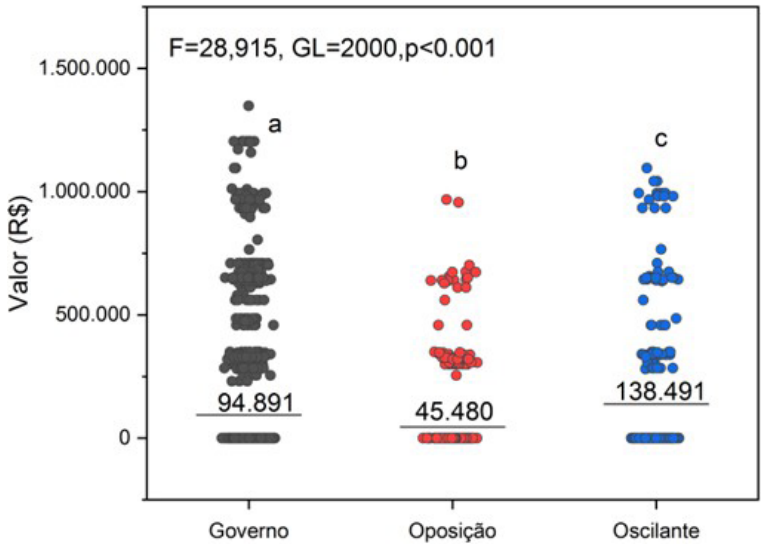
Figure 4 | Municipality Income x Mayor's Political Party



Author's elaboration

Therefore, it can be suspected from this information that medium-income municipalities have a greater number of mayors belonging to government-aligned parties and were more favored in the distribution of heavy machinery. Below, the ANOVA technique with Welch's correction for heterogeneous variances was used to analyze the average distribution of resources among the municipalities of each of the three party groups. The image below shows significant differences: swinging parties received the highest average amount of resources, followed by government-aligned parties. Opposition parties received, on average, less than half of what government-aligned parties received, and about three times less than swinging parties. The letters a, b, and c in the image represent the differences in Tukey's post hoc test: groups with different letters are statistically distinct, meaning the three groups differ from each other.

Figure 5 | Resources Received x Municipalities of Opposition, Swinging, and Government Parties



Author's elaboration

The table below complements the information:

Table 9 | Resources received by municipalities from opposition party, swinging, and government

		Resouces (R$)			
		Mean	Standard deviation	Maximum	Minimun
Mayor's Party	**Government**	R$ 94.891,72	R$ 230.324,70	R$ 1.347.932,00	R$ -
	Opposition	R$ 45.480,21	R$ 144.364,50	R$ 967.881,70	R$ -
	Swing	R$ 138.491,40	R$ 275.668,70	R$ 1.095.794,00	R$ -

Author's elaboration

The standard deviation of the swinging group is twice as large as that of the opposition group, and it is 20% greater than the standard deviation of the government group, even though this group received a maximum value 23% higher than the swinging group.

In a statistical test, particularly in methods such as analysis of variance (ANOVA) or in tests of mean comparison (such as the Student's t-test), equality of variances among groups is one of the fundamental assumptions. However, for the studied case, the variances were found to be heterogeneous. Variance heterogeneity, in a statistical test, refers to the situation where the variances of the underlying populations are not equal across the groups being compared.

This can occur in studies where groups have different levels of dispersion or variability in their data. To deal with variance heterogeneity, various approaches can be adopted, including the use of robust statistical techniques that do not rely on the assumption of equal variances, such as the Welch's test for mean comparison.

Based on this, the model with Welch correction for heterogeneous variances was used. Two situations were reported in the table below, one without correction and the other with correction, and the only significant difference between them occurred in the Fisher's F statistic, which was significant for both cases:

Table 10 | Model with Welch's correction for heterogeneous variances

Variable	Correction for heterogeneous variances	SQ	DF	SMQ	F	p
Mayor's Party	**No**	$1.952x10^{12}$	2.000	$9.761x10^{11}$	19.725	<0 .001
Mayor's Party	**Welch**	$1.952x10^{12}$	2.000	$9.761 x10^{11}$	28.915	<0 .001

Author's elaboration

SQ=Sum of squares
DF= Degrees of freedom
SMQ= Sum of Mean Squares
F= Fisher's F statistic, the further from 1, the more significant the model
p= statistical p, significant whenever less than 0.05

The Fisher's F statistic in the Welch's correction Model is an important tool for comparing means of different groups, taking into account variance heterogeneity, and it is essential in conducting robust statistical inferences in experimental and observational studies. When the p-value associated with the F statistic in the Welch's correction Model for heterogeneous variances is less than 0.05, it indicates a significant difference between the group means. This means that at least one of the group means is significantly different from the others. When the statistical p-value is less than 0.05, the alternative hypothesis is generally accepted, indicating that there is at least one significant difference between the group means. Thus, it can be concluded that at least one of the means of the heavy machinery distribution for the three political groups to which the municipalities belong is different, and the Welch's correction Model demonstrates that this difference is robust.

Below are the values of the Tukey post hoc tests, which compare the means of the three groups. It can be verified through the last column (Tukey p) that the three groups differ statistically.

Table 11 | Tukey Tests – Comparison of the Means of the 3 Groups

IC 95% for the difference between the means					
Comparison	**Mean Difference (R$)**	**Lower (R$)**	**Upper(R$)**	**SE (R$)**	**p Tukey**
Government - Opposition	49.411.509,00	25.522.449,00	73.300.569,00	10.188.354,00	< 0.001
Government - Swing	-43.599.692,00	-75.167.437,00	-12.031.948,00	13.463.207,00	0.003
Opposition - Swing	-93.011.202,00	-56.316.799,00	15.649.656,00	15.649.656,00	< 0.001

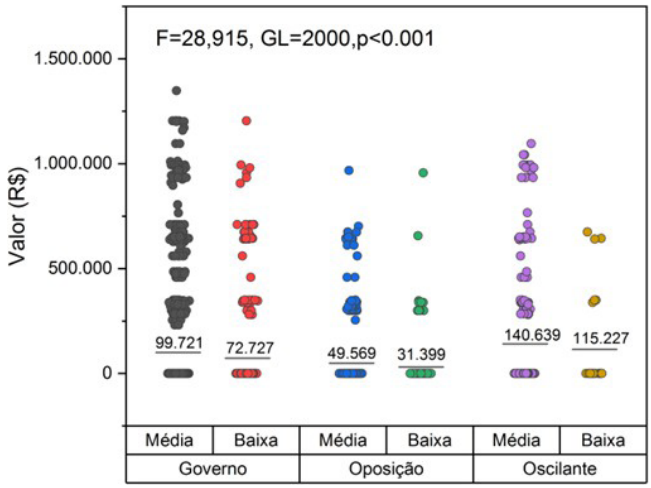
Author's elaboration

CI = Confidence Intervale
SE= Standard Error

The Tukey test is a statistical technique used to compare the means of multiple groups. Specifically, when it comes to comparing the means of three groups, the Tukey test is used to determine if there are significant differences between their means. Its application for comparing the means of three groups generally involves the following interpretation: if the Tukey test shows that there is no significant difference between the means of two groups, then these two groups are considered statistically equal; if the Tukey test shows a significant difference between the means of two groups, then these two groups are considered statistically different. In this sense, the differences in means between the groups are robust, and thus, it is possible to demonstrate that there is a significant difference between the political party of the municipal mayor and the distribution of heavy machinery and resources among the three political groups defined in this study.

Below, the image illustrates the average value of resource distribution, taking into account the classification of municipalities as low and medium income and the political parties of the mayors:

Figure 6 | Resources Distributed x Political Party x Low or Medium Income



Author's elaboration

The image presents the same pattern as the previous analyses: for the 3 groups of political parties, medium-income municipalities receive more resources. It is important to note that for the swing party groups, the two subgroups of low and medium income receive proportionally more resources than the subgroups of government and opposition municipalities. Low-income opposition municipalities receive on average almost 4.5 times less than medium- income swing municipalities. The table below details the numbers:

Table 12 | Resources distributed x political party x low or medium

Party	Income	Resources distributed (R$)		F=28,915, GL=2000, p<0,0001	
		Mean	Standard Deviation	Maximum	Minimum
Government	Low	R$ 72.727,00	R$ 198.560,90	R$ 1.203.818,00	R$ -
	Medium	R$ 99.721,00	R$ 236.449,30	R$ 1.347.932,00	R$ -
Opposition	Low	R$ 31.399,00	R$ 124.300,90	R$ 956.311,80	R$ -
	Medium	R$ 49.569,00	R$ 149.563,50	R$ 967.881,70	R$ -
Swing	Low	R$ 115.278,00	R$ 227.478,30	R$ 673.965,90	R$ -
	Medium	R$ 140.639,00	R$ 279.955,10	R$ 1.095.794,00	R$ -

Author's elaboration

Despite swing municipalities receiving a higher average value for the three groups, it was the government municipalities that showed the highest maximum value of distributed resources, both for the low and medium-income groups, with a lower standard deviation compared to swing municipalities. On the other hand, opposition municipalities showed the lowest average distributed value and the smallest standard deviation.

An analysis of the distribution of heavy machinery among the states was also conducted to verify the distribution of machinery by state according to government parties, swing parties, and opposition parties. First, it was tested whether there is indeed an interaction between the state and the political party of the mayor, meaning if the mayor's party influences the distribution of resources within the states. As shown by the bold line in the table below, "State

* Mayor's Party," there is a significant p-value, less than 0.0001, testing the interaction between the two terms, state and political party, demonstrating that there is a relationship between the states and a particular political group to which the mayor belongs. When p is significant, there is a real indication of the relationship between the state and the incidence of a particular political group in that state.

Table 13 | Correlation: states and municipalities & mayor's political party

Source	Sum of Squares	DF	Mean Square	F	p
Corrected Model	2,83 x 1013	73	3,87 x 1011	9,098	<0,0001
Intercept	4,17 x 1012	1	4,17 x 1012	98,021	<0,0001
State	6,00 x 1012	25	2,40 x 1011	5,643	<0,0001
Mayor's Party	3,38 x 1011	2	1,69 x 1011	3,972	0,019
State * Mayor's Party	4,18 x 1012	46	9,09 x 1010	2,136	<0,0001
Error	1,40 x 1014	3289	4,26 x 1010		
Total	1,96 x 1014	3363			
Corrected Total	1,68 x 1014	3362			

Author's elaboration

Above, formal statistics are presented, such as the sum of squares, which represents the amount of variance in each term of the model; degrees of freedom (DF); mean square, which represents the sum of squares divided by the degrees of freedom; F, which represents Fisher's F-statistic: the further from 1, the more significant the model is.

Returning to what was mentioned earlier, if the p-value for the interaction "State*Mayor's Party" were not significant, it would not make sense to create the table below, which compares resources by state based on political parties, as there would be no significant difference.

Next, to better understand the distribution of heavy machinery among low and medium-income municipalities, logistic regression was performed to test whether there is a higher chance of an opposition or swing party receiving machinery compared to a government party, as well as to test whether low-income municipalities have a higher chance of receiving heavy machinery. The beta coefficient below, in bold in the table, reflects this. If the beta is positive, there is a higher chance; if the beta is negative, there is a lower chance.

Table 14 | Logistic Regression for Heavy Machinery

Logistic regression for heavy machinery						95% CI for OR		
Variables in the equation	**b**	**SE**	**Wald**	**DF**	**P**	**OR**	**Lower**	**Upper**
Mayor's Party			26,383	2	<0.0001			
Opposition	-0,591	0,144	16,717	1	<0.0001	0,544	0,417	0,735
Swing	0,366	0,144	6,455	1	0,011	1,442	1,087	1,912
Low Income	-0,323	0,132	5,986	1	0,014	0,74	0,559	0,938
Constant	-1,488	0,056	694,94	1	<0.0001	0,226		

Author's elaboration

Legend:

OR = Odds Ratio, or odds ratio

SE = Standard Error
Wald = Wald Statistic, used to estimate significance, the higher, the greater the weight of a variable.
P = P-value, whenever it is less than 0.05 there is significance
95% CI = 95% Confidence Interval for OR, with lower and upper limits.

The data in Table 14, using "government party" and "medium income" as reference categories, show that the model is statistically significant ($p<0.0001$). A negative beta coefficient means there is a lower probability of receiving heavy machinery, and a positive beta coefficient means there is a higher probability of receiving heavy machinery. That is, when belonging to the opposition party, there is a lower chance of being provided with machinery compared to being in the government party ($b=-0.591$). On the other hand, belonging to a swing party represents a higher chance of receiving heavy machinery compared to being in the government party ($b=0.366$). It is worth noting that low-income municipalities have a lower chance of receiving machinery compared to medium-income municipalities ($b=-0.323$).

The presentation of the data shows that being in the opposition party decreases the chances of receiving heavy machinery. Additionally, low-income municipalities are not more favored compared to medium-income municipalities; on the contrary, low-income municipalities have a lower chance of receiving machinery compared to medium-income municipalities.

Regarding the response to the third hypothesis formulated, it is concluded that the municipal mayor's party alignment with the government's base in the National Congress influences the choice of recipient municipality. It was observed that at the time, among the total low and medium-income municipalities, there were more medium-income municipalities governed by mayors affiliated with government parties, followed by swing parties, and lastly, by opposition parties. Therefore, it is possible to conclude that medium-income municipalities have a higher number of mayors belonging to the government party and were more favored in the distribution of heavy machinery. For the three groups of political parties, medium-income municipalities receive more resources.

The analysis of the three hypotheses corroborates the historical scenario of the implementation of regional development policies in Brazil: from its institutionalization in the early 20th century to the present day, the cooptation of governmental bodies by political interests is notable (Portugal and Da Silva, 2020).

CONCLUSIONS

The overall panorama presented by the analysis of the three hypotheses studied in this work allows for the conclusion that the results do not fully align with the propositions of Celso Furtado and Tânia Bacelar for regional development, primarily manifested through the National Policy for Regional Development. Despite the distribution of machinery having effectively occurred for low and medium-income municipalities, there is a noticeable disproportion in the distribution to the detriment of low-income municipalities and opposition parties to the current government.

This situation reflects a pronounced political bias as a criterion for selecting the beneficiary municipalities, at the expense of an equitable and proportional distribution of resources and machinery among all states and regions of the national territory. Regarding the response to the technical hypotheses, it is clear that there was no technical planning in the distribution of heavy machinery to prioritize low-income municipalities, as the analysis of Hypothesis 1 proves that medium-income municipalities were prioritized over low-income municipalities, and the analysis of Hypothesis 2 proves that the distribution of federal resources through the delivery of heavy machinery did not adhere to a distribution that considered regional or state criteria. Thus, it is understood that the fulfillment of geographic distribution criteria prioritized by the PNDR was not necessarily followed in the execution of the distribution of heavy machinery.

Regarding the response to the third hypothesis formulated, that the political alignment of the municipal mayor with the government's base in the National Congress influences the selection of the recipient municipality, it is concluded that the political alignment of the municipal mayor with the government's base in the National Congress did influence the selection of the recipient municipality. It was observed that at the time, among the total low and medium-income municipalities, there were more medium-income municipalities governed by mayors affiliated with government parties, followed by swing parties, and lastly, by opposition parties. Therefore, it is possible to conclude that medium-income municipalities have a higher number of mayors belonging to the government party and were more favored in the distribution of heavy machinery. For the three groups of political parties, medium-income municipalities received more resources.

Another relevant issue is observed in the fact that the average resources received by municipalities are higher for swing parties, even though this is the smallest group in terms of the number of affiliated mayors. This situation suggests the intention to attract these municipalities to the government base by allocating resources. In the adjusted regression, it was found that opposition municipalities had the lowest average distributed value for their municipalities. Another conclusion from the analysis is that being in the opposition party decreases the chance of receiving heavy machinery compared to being in the government party. Conversely, belonging to a swing party represents a higher chance of receiving heavy machinery than being in the government party. It is worth noting that low-income municipalities have a lower chance of receiving machinery compared to medium-income municipalities.

As limitations of this work and suggestions for future studies, it is recommended to conduct studies with a longer coverage period and to carry out this analysis with other public policies.

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