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SPATIAL ANALYSIS OF TRANSFERS FROM THE STATE OF PARANÁ TO MUNICIPALITIES FROM 2017 TO 2021

Paulo Guilherme Alarcon Fernandes

Universidade Estadual de Maringá - UEM

Larissa Paula Stachio

Universidade Estadual de Maringá - UEM

ABSTRACT

Seeking to provide quality services and greater coverage for their population, municipalities have financial difficulties in carrying out their projects, which is why they try to increase the budget through taxes and not rely solely on state and federal transfers. The aim of this study was to understand how Brazilian municipalities, especially those in Paraná, collect taxes, and to show how to increase collections without having to resort to unpopular actions. The data used was obtained from the transparency portal of the national treasury and the state of Paraná and inflated to 2021 based on the IPCA. Exploratory Spatial Data Analysis (ESDA) was applied to identify any spatial autocorrelation in the data. It was identified that including means of control and inspection reduces the chances of omission of services or activities by agents, avoiding non-collection of the amounts due, increasing monetary collection.

Keywords: Public spending. Budget revenue. Spatial econometrics. Taxes. Regional economy.
JEL Code: R10. H71. R50

SUMMARY

1. INTRODUCTION

Part of the federal revenues collected by the Union are transferred to the states, federal district and municipalities, as a mechanism for reducing regional inequalities and aiming to promote socio-economic balance. Transfers are made by the National Treasury in accordance with legal deadlines (National Treasury, 2022). Regions with a smaller population receive proportionally more money from the transfers due to the low collection power of small municipalities. Prediger et al. (2022) state that the social rights provided for in the Federal Constitution are more efficient in these smaller locations, especially in terms of health services.

Transfers represent the largest source of budget revenue for Brazilian municipalities, according to Baião, Cunha and Souza (2017). The authors classify three types of transfers: legal, voluntary and the Bolsa Família program. The group of legal transfers is made up of the Municipal Participation Fund (FPM), the Tax on Operations related to the Circulation of Goods and on the Provision of Interstate and Intermunicipal Transportation and Communication Services (ICMS), the Fund for the Maintenance and Development of Basic Education and the Valorization of Education Professionals (Fundeb), the Unified Health System (SUS), financial compensation and others. The criteria for determining the volume of transmission varies according to factors such as production performance, demographic density and political alignment. The amount coming from state and federal agents influences the inequality between municipalities and the social well-being of these regions.

Historical, political and technical approaches are discussed by the authors Soares and Melo (2016), who highlight the relevant changes that have taken place since 1980: the return to democracy, the strengthening of the federation, monetary stabilization and positive social policies. These changes are separated into two moments: decentralization in 1980 and centralization in the mid-1990s. Some forms of tax collection are highlighted, such as constitutional transfers (TC) - amounts passed on compulsorily and defined by the constitution from one federative entity to another. Of the taxes collected by the state, ICMS and Motor Vehicle Property Tax (IPVA), the municipalities receive 25% and 50% respectively. There are also two types of legal transfers: unconditional, represented by oil royalties, and conditional, which are automatic. Discretionary and/or negotiated transfers and Voluntary Transfers from the Union (TVU) have their amounts defined by agreements and contracts. The study exposed the difficulty of individual municipalities in collecting tax and the positive relationship between agreements and treaties between federative agents.

The number of people working, as well as the interaction between the primary, secondary and tertiary sectors, influence municipal revenues. Scheren, Silva Júnior and Galante (2018) show that, in the selected area, the added value of agriculture had a greater impact, showing an interactive characteristic with the other sectors. The National Development Bank (BNDES, 2001) highlights the importance of the municipal council, fees, improvement contributions, inspection, collection management, active debt management and financial revenues in the composition of the monetary value obtained by the public administration.

The aim of this paper is to analyze the dynamics of tax collection in Brazilian municipalities, with a focus on those in Paraná, using Exploratory Spatial Data Analysis (ESDA). We sought to answer the following questions: What are the unpopular measures that regions can use to increase their tax collection? How can localizations reduce their dependence on state and federal transfers? Is there any spatial relationship in the state of Paraná's transfers to municipalities?

The research will be divided into three parts: in addition to the introduction and conclusion, the first stage consists of a theoretical and bibliographical reference on the subject, then the methodology and method will be presented and, finally, the results of the research will be commented on.

2. LITERATURE REVIEW

A municipality - regardless of its size - with the potential to raise taxes, provides the necessary subsidy to improve the management of town halls. Santos et al. (2008) argue that resources from the BNDES, allocated to PMAT projects (Modernization of Tax Administration and Management of Basic Social Sectors) provide greater social welfare through administrative performance, making the locality that has made good use of the line of financing a model for those with a similar profile. PMAT is a BNDES program that encourages investment projects aimed at improving the efficiency, quality and transparency of tax collection and spending by Brazilian municipalities to provide basic services (BNDES, 2022). The existence of the PMAT exposes the central agent's attempt to optimize municipal spending and citizens' quality of life in an educational format - for municipal managers - without compromising public accounts.

Categorized as federative entities, municipalities participate in national tax collection, although their own collection may not be satisfactory for public accounts. The insufficiency of municipalities - generally small and medium-sized ones - generates financial dependence on the superior entities, the state and the union. Government transfers come into play to alleviate this

situation, where tax transfers are primarily earmarked for education, health and sanitation, with no aid for other activities designed by the administrative power (Silva, Quintela and Vieira, 2018).

The importance of the optimized tax collection of Brazilian municipalities is presented by Castro et al. (2018). The level of revenue received was related to the Municipal Human Development Index (MHDI), to see if there was any relationship, and it was confirmed that there is a positive correlation between revenue collection and social development, i.e. the higher the revenue derived from tax policy, the higher the municipal development and, consequently, the quality of life of the population.

The increase in IPTU results in an increase in revenue. In a case study, Santos (2014) shows that between 1995 and 2012 there were fluctuations in tax collection, the best year being 1998, when there was an increase of almost 50% in property tax. The author does not highlight the negative effects that can result from this fiscal adjustment, since it can drive away businesses in the region due to the new operating costs incurred by the regulation. Statistical models are recommended to ascertain the cost-benefit of the fiscal policy applied.

The method of tax collection can vary depending on the tax. For the Tax on Services (ISS), this method facilitates control and inspection by assigning the tax authorities to the first participant in the production chain, simplifying situations in which there may be sequential incidences due to the extensive production dynamics, such as the ICMS. Gonzaga and Bagrichevsky (2016) argue that the strategy is legal, avoids tax evasion and increases tax collection. In the municipal context, the companies that take on the services are responsible for withholding tax, showing that the system has been improved, with a consequent increase in the monetary value collected, occurring only with systematic adjustment, not resorting to the increase or reduction of rates.

Infrastructure works that condition greater commercial flow appear to be the means used in the strategy to increase revenue, mostly from ISS. The impact of Campinas airport in São Paulo from 1988, at a time of national tax decentralization, recovered the region's public accounts between 1995 and 2013. The work by Cappa and Souza Filho (2017) describes other ways of modernizing the mechanics of receipt without financially damaging any agent in the territorial space.

Complementary Law 116/2003 sought to increase tax collection without adjusting rates or creating new taxes, extending the number of services that could be subject to ISS, such as electricity distribution. Laruccia et al. (2013) used a multiple regression model with qualitative

variables and applied significance tests, confirming the assumption that increasing taxable services is valid for expanding revenue.

In an attempt to acquire more money for the implementation of projects, some municipalities decide to raise taxes and municipal tax rates. However, the expected effect may not occur. Cupertino et al. (2014) investigated the case in which the public administration raised the IPTU, which compromised agents' income and caused defaults, and the loss of revenue was close to 25%. Thus, the lack of supervision and inefficient management justify what happened.

The effort to bring in companies and promote entrepreneurial projects is financially beneficial, but the internal stimulus, within the municipal territory, is less complex to carry out and just as positive. Intra-budgetary revenue has an impact on the local economy, as does current revenue, which is made up of taxes, assets, transfers, services, social contributions and capital contributions. Paes and Portugal (2019) confirm the internal incentive argument, whereby a municipality with a favorable net profit record can considerably supplement public revenue.

The IPTU stands out for medium-sized and large localities, since these more populous regions have more commercial interaction than those with smaller populations. The constant updating of the Planta de Valores Genéricos (PVG), which is based on information from the municipal cadastre and together with the real estate cadastre forms the basis for calculating the IPTU, ITBI and improvement contribution, supports the level of collection of this tax, according to Silva et al. (2018). Constantly regulating the values has a negligible impact on the agent's income, avoiding social discontent.

Inconsistencies and failures in tax collection often negatively affect the monetary estimate that the municipality will receive, jeopardizing the execution of plans and activities scheduled by the administration. By joining the Register of Companies Providing Services in Other Municipalities (CEPOM), it is possible to adjust the tax paid by companies that are based in one city but provide services in others, as the occurrence raises doubts about the place of incidence, as Branco and Moura (2021) state. Being effective in combating tax evasion avoids the practice of false establishment of companies in municipalities with lower tax rates.

A robust tax system is essential for maximizing the revenue of any federal entity, but a modern model without inspection becomes inefficient. D'agostin and Catapan (2020) found that the Superintendence of the National Institute for Colonization and Agrarian Reform (INCRA) inspected several rural properties in the north of Paraná in order to confirm payment of the Rural Land Tax (ITR). The cities visited by INCRA showed a significant percentage increase in the amount of tax received. A favorable situation is required for the perfect receipt of tax amounts.

The federal interaction between the state and the municipality can enable practices that boost the capacity of municipalities to raise revenue without profound changes to the fiscal structure. In the American context, the state of Illinois has allowed gaming terminals in cities, improving the fiscal health of governments. Wagner and Walker (2021) used the difference-in--differences strategy to ratify the argument that the policy applied has been effective. However, it was found that the collection from gaming terminals only competes with other services, re-allocating economic activities, which has done little to improve the regions' finances.

Moments of economic disruption, as in the case of COVID-19, jeopardize the development of projects. The financial impact on the players is reflected in the public accounts. As an alternative to finance proposed activities, Japanese municipalities use local bonds, in which the municipality issues debt papers, committing to pay the amount with interest in the future. The action in question is possible due to the decentralization of power, in which local government is given greater responsibility. This is a global trend that is being accepted by the international community, according to Pokrovskaia and Belov (2020).

Most municipalities are struggling to increase their revenue levels, although there are cities, especially coastal ones, that run the risk of reducing their tax revenues for climatic reasons. Rising sea levels and land use can jeopardize municipalities' monetary collection. Shi and Varuzzo (2020) warn about the acceleration of climate risks over time, generating fiscal stress that increases regional differences and vulnerability to climate change. As a solution, constant argumentation between scientists and politicians is recommended to convert, or at least mitigate, the situation.

Meloche and Vaillancourt (2021) conclude that diversifying the way taxes are collected does not necessarily lead to tax increases. In order to improve their municipalities' revenues, Canadian provinces have sought to provide new sources of taxes, where, supposedly, the diversification of means would provide dynamism and an increase in revenues. However, the data shows that there is no uniform relationship between diversity and the ability to prospect for financial resources. The availability of prospective sources does not automatically result in more services being provided to the population.

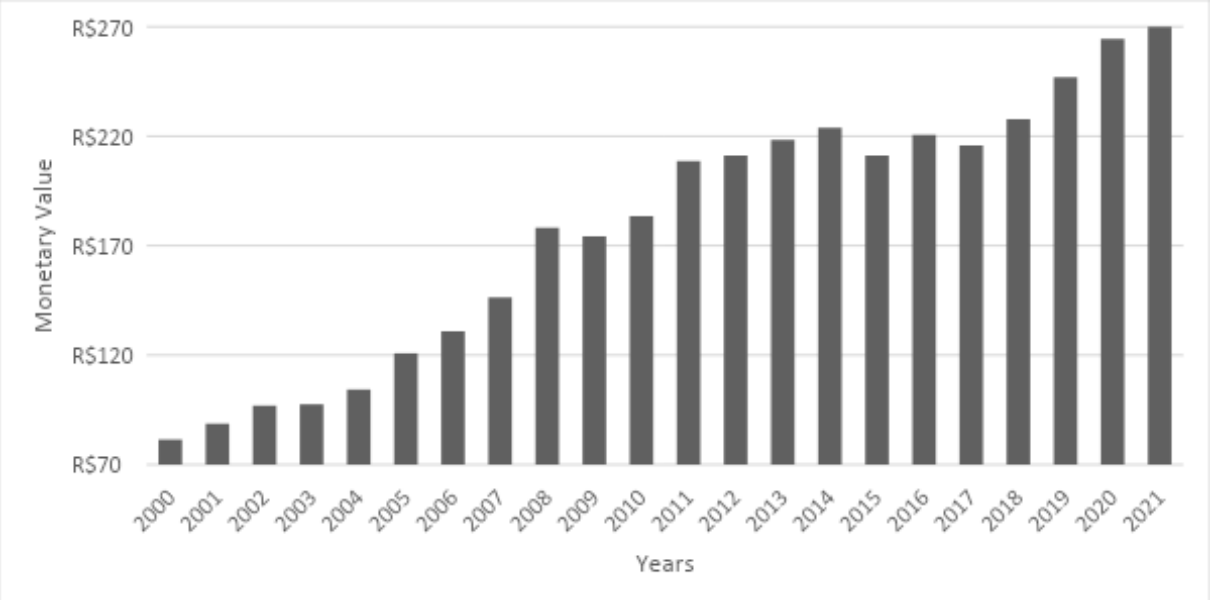
Statistical inferences about municipal revenue are applied in some cases. In order to verify the future level of ISS revenue in the region chosen by Caldart (2006), an appropriate ARI model (13, 1, 0) was presented, covering the period from 1996 to 2005. Using time series to project amounts to be collected, Pereira, Sampaio and Guilherme (2019) performed Spearman's coefficient test on stationary and non-stationary sequences, showing that there was a reduction

in the monetary value received from taxes in the chosen time interval and indicating the lack of investment in specialized personnel as the reason for the retraction. The mathematical-statistical methods trend lines and correlation coefficient assessed the revenue creation mechanisms of small regions in Slovakia and the Czech Republic in the period 2009-2018 by Papcunová et. al (2020), defining that self-collection is adequate to reduce the dependence of smaller areas on the national federative entity.

3. MATERIALS AND METHODS

The AEDE and the local Moran's Index were used. GEODA software helped generate the cartographic images that show the results. The data on transfers to federal entities was collected from the transparency portal of the national treasury and the state of Paraná, inflated to the base year 2021 using the Broad National Consumer Price Index (IPCA), which is provided by the Brazilian Institute of Geography and Statistics (IBGE). For spatial inference, the average temporal data from 2017 to 2021 was standardized and normalized.

Figure 1 - transfers in Reais from the Federal Government to Brazilian municipalities

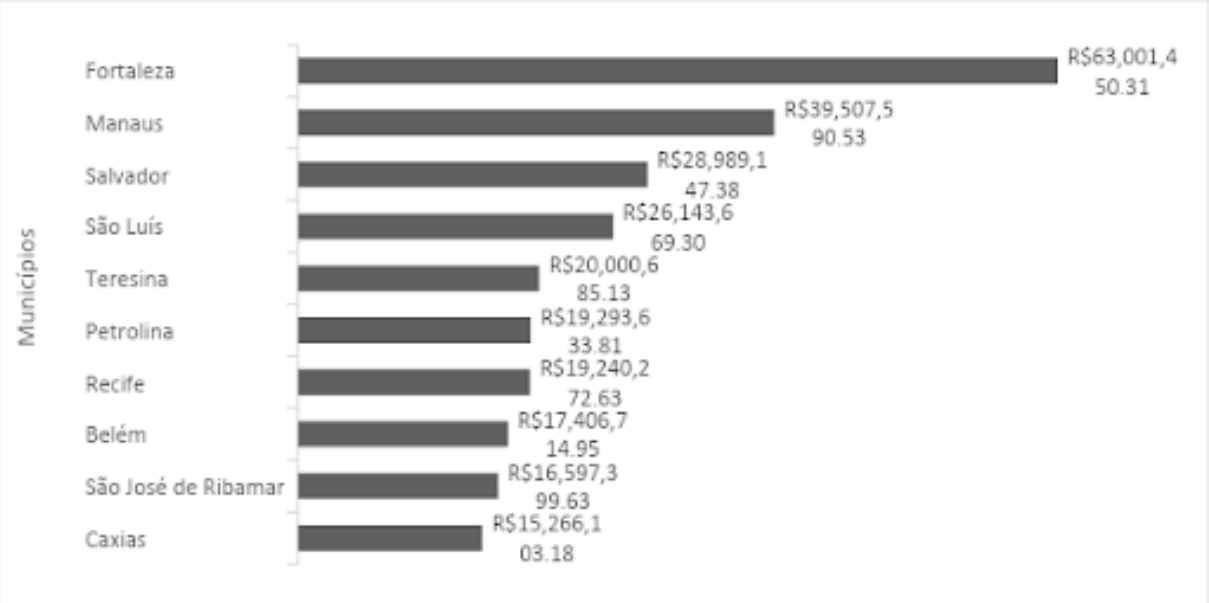


Source: own elaboration.

The distribution from the federal to the municipal level is shown in Figure 1. The division of taxes collected by the state is essential to reduce the social inequalities that exist in the regions, with the aim of balancing the socio-economic situation between the federal entities. It

is the National Treasury's job to share the resources collected with the states and municipalities within the legal period. As stated in the Constitution, the most relevant transfers are the Municipal Participation Fund (FPM); Industrialized Product Tax (IPI) - exports; State and Federal District Participation Fund (FPE); Economic Domain Intervention Constitution (CIDE) - fuels; Fund for the Maintenance and Development of Basic Education and Valorization of Education Professionals (FUNDEB); Royalties - oil; Rural Territorial Tax (ITR). A considerable monetary increase in transfers can be seen from 2000 onwards in Figure 1, since, by promoting social welfare, community-oriented policies influence the increase in the monetary value of transfers.

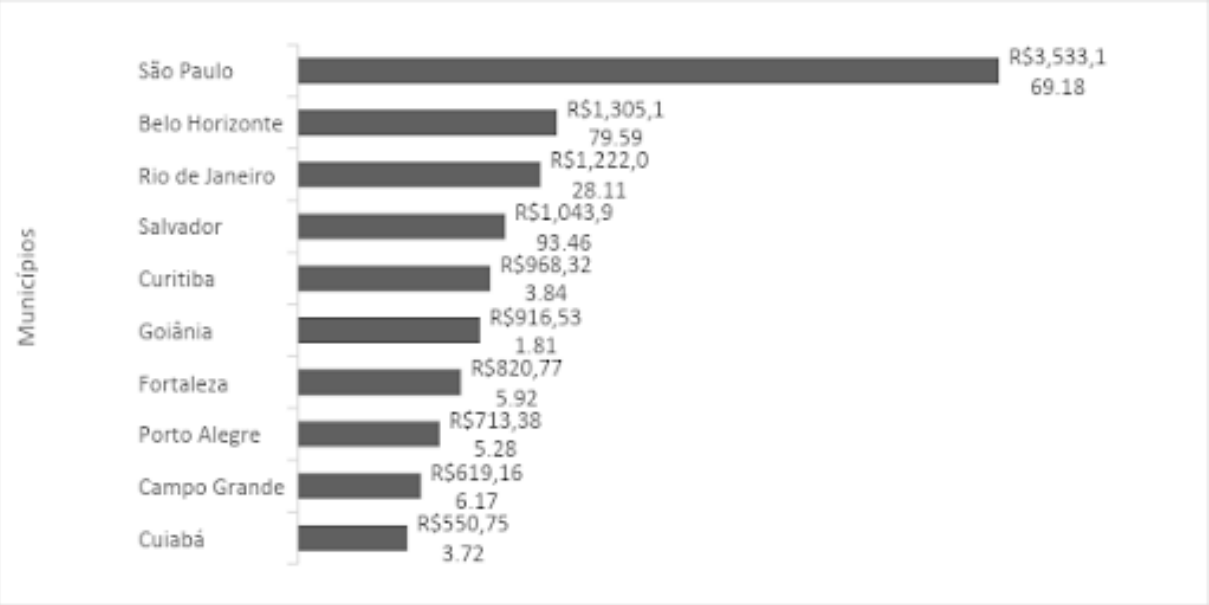
Figure 2 - transfers in reais from the Federal Government to the ten Brazilian municipalities with the highest transfers in 2021 (FUNDEB-adjustment).



Source: own elaboration.

Figure 2 shows the FUNDEB-adjustment transfer, which distributes FUNDEB amounts on a monthly basis according to estimated revenue. At the end of each financial year, the amount of money actually received is checked and, after analysis, the surplus is transferred to the federal entities. Locations with the highest social demand - mostly in the Northeast and North of Brazil - have acquired a larger amount in reals from the FUNDEB-adjustment than other regions, thus confirming the social nature of this tax.

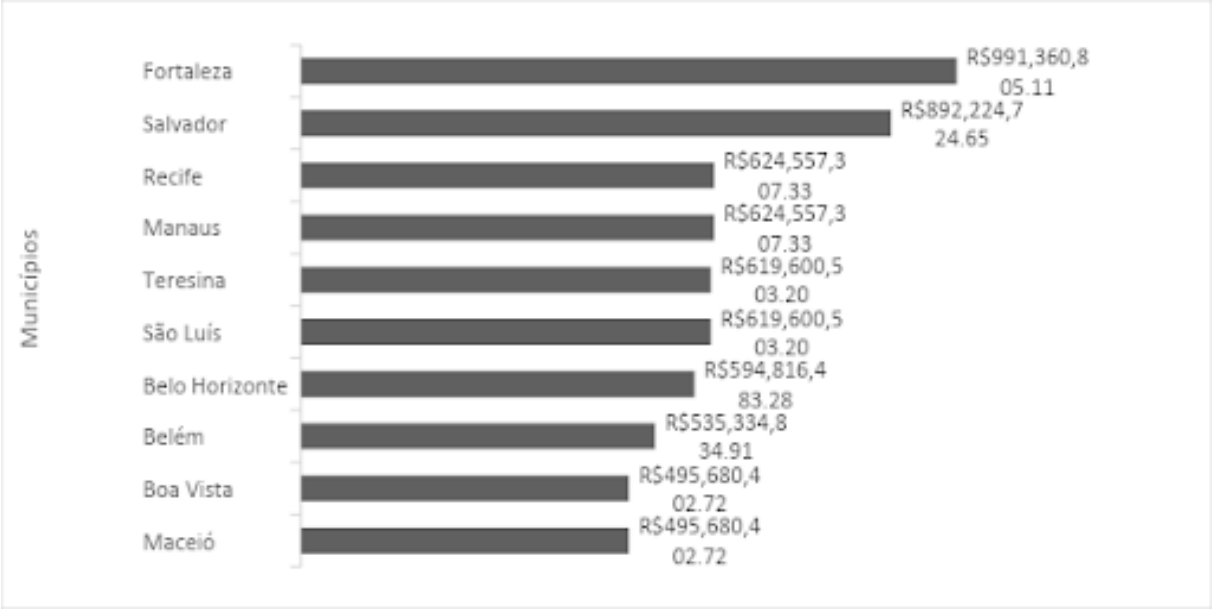
Figure 3 - transfers in reais from the Federal Government to the ten Brazilian municipalities with the highest transfers in 2021 (CIDE-fuels).



Source: own elaboration.

Considering more populous cities, Figure 3 shows the cities that received a higher degree of transfers. These are economically important regions with high transport flows, such as São Paulo, which received almost two thirds more than Belo Horizonte. This contribution, CIDE-combustíveis, was created by Law 10.336/2021 with the intention of ensuring a minimum amount of resources for transportation infrastructure and environmental projects related to the various categories of fuels and derivatives (Senado Federal, 2021).

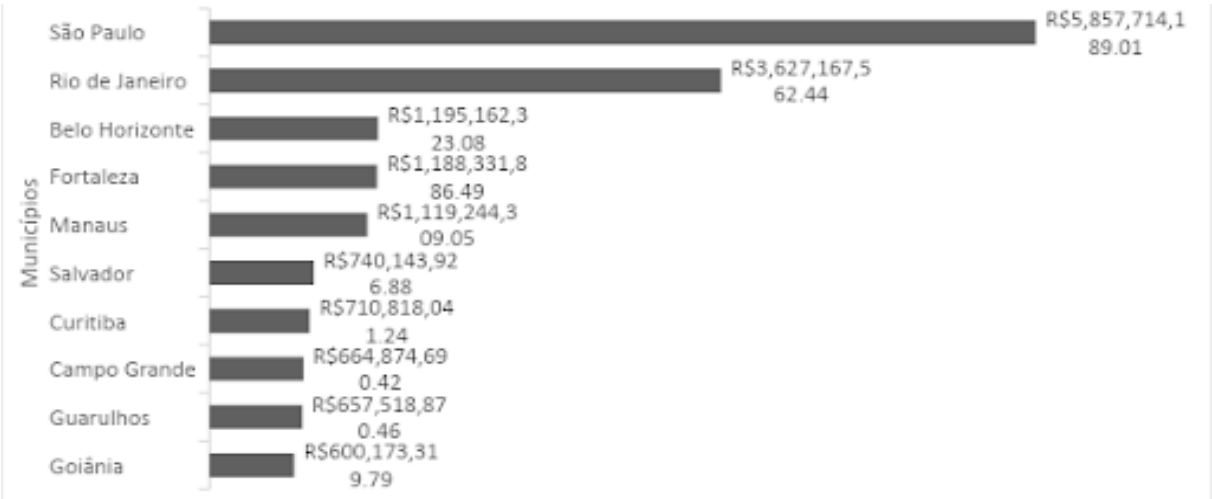
Figure 4 - transfers in reais from the Federal Government to the ten Brazilian municipalities with the highest transfers in 2021 (FPM).



Source: own elaboration.

According to Article 159, I, paragraphs b and d of the Federal Constitution, the purpose of the FPM is to redistribute income between federal entities (Brazil, 1988). It is made up of 22.5% net of Income Tax (IR) and IPI. As the purpose of the FPM is to share income, it can again be seen that the socially vulnerable areas received a greater distributive proportion. Fortaleza was allocated close to a billion reais, and eight of the ten cities in Figure 4 are in the northeast of Brazil.

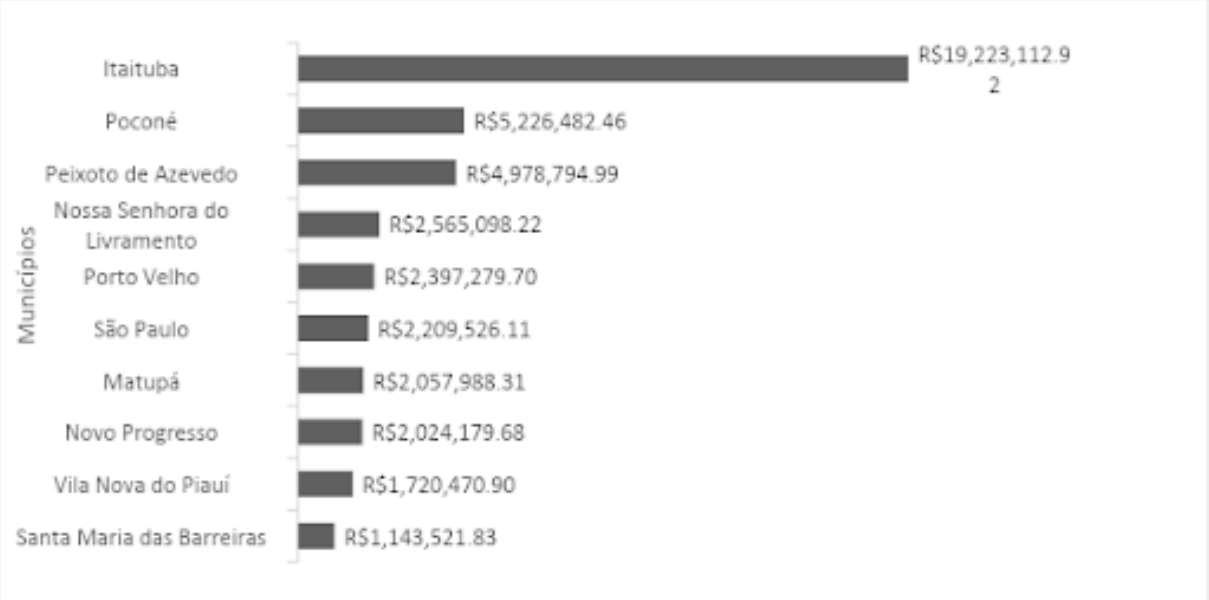
Figure 5 - transfers in Reais from the Federal Government to the ten Brazilian municipalities with the highest transfers in 2021 (FUNDEB).



Source: own elaboration.

The federal government allocates FUNDEB funds to the areas with the largest populations. São Paulo received around six billion reais, as can be seen in Figure 5. The city of Rio de Janeiro also received a significant amount, approximately 3.5 billion. Next up is a group made up of Belo Horizonte, Manaus and Fortaleza, all of which received slightly more than 1.1 billion each. Lastly, Salvador, Curitiba, Campo Grande, Guarulhos and Goiânia received between 600-700 million reais.

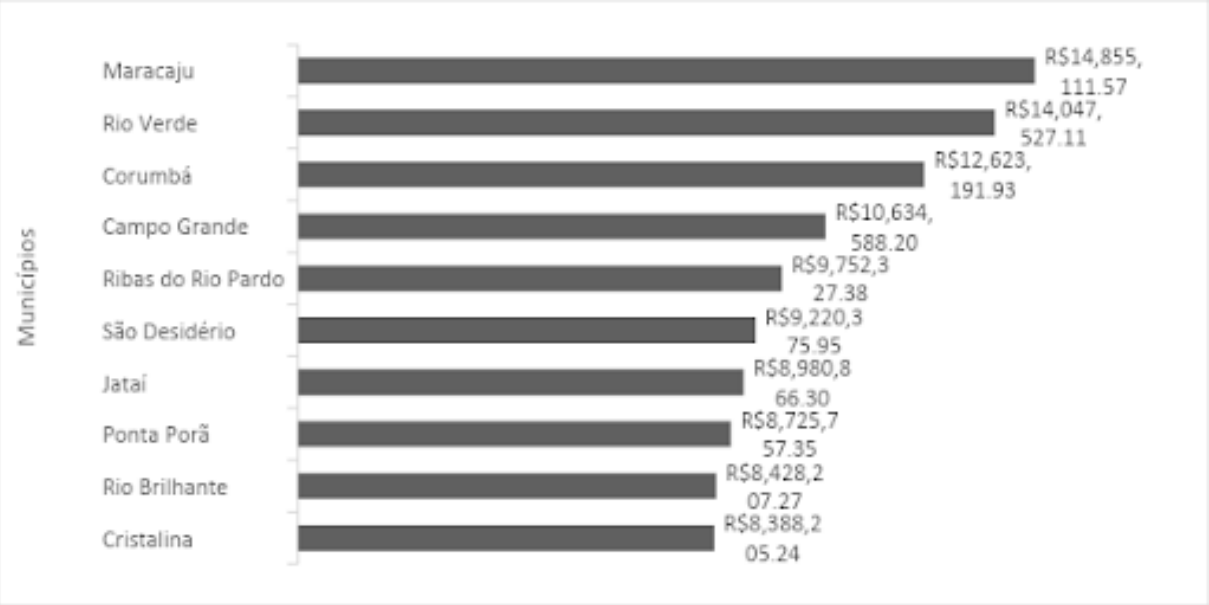
Figure 6 - transfers in Reais from the Federal Government to the top ten Brazilian municipalities in 2021 (IOF-Gold).



Source: own elaboration.

Financial transactions linked to gold, IOF-Gold, are the responsibility of the Union, as expressly provided for in the 1988 Constitution in Article 153, item V, paragraph 5, later regulated by Law 7.766 of May 11, 1989. The tax rate is 1% of transactions and revenue, with 30% going to the federal government and 70% to the municipalities. The funds are allocated to the state and municipality or Federal District of incidence/origin. The registration is identified by supporting documents. Therefore, according to the criteria of the law in force, the locality with the highest transaction value will receive the largest share of this tax. The municipalities highlighted in Figure 6 are those where gold is grown. With the exception of São Paulo, which is an economic center, it is natural for interactions between agents to take place in the city.

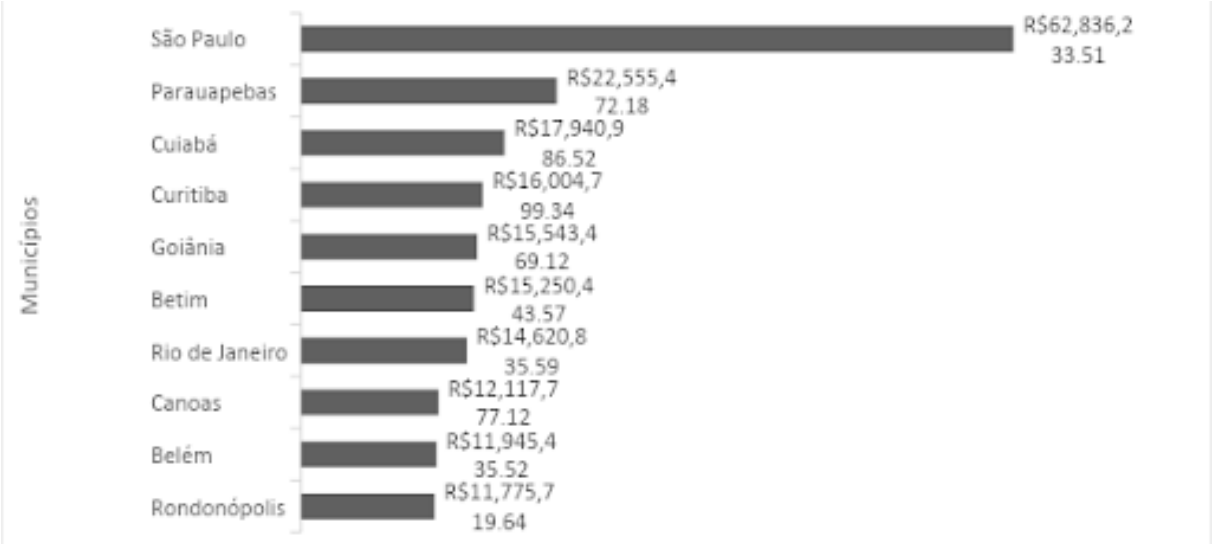
Figure 7 - transfers in Reais from the Federal Government to the ten Brazilian municipalities with the highest transfers in 2021 (ITR).



Source: own elaboration.

Figure 7 shows the largest allocation of ITR by region in 2021. The tax is provided for in item VI of article 153 of the Federal Constitution and regulated by Law No. 9.393/1996, and is levied annually on rural property outside the urban area. It is passed on by the National Treasury Secretariat (STN), but the body that determines the amounts collected is the Special Secretariat of the Federal Revenue of Brazil (RFB). The RFB checks whether the municipality has an agreement with the Federal Government in order to make the transfer, although those with more productive land generally receive a higher amount. Most of the cities highlighted in Figure 7 are located in grain-producing regions, mostly soybean, with a large territorial extension when compared to Paraná's grain-producing properties.

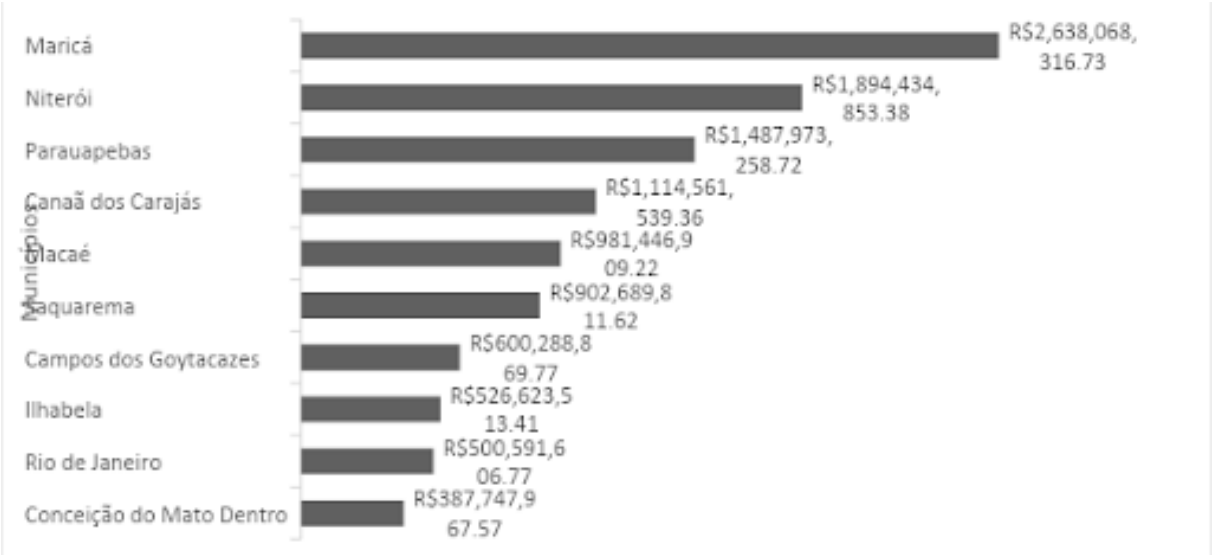
Figure 8 - Transfers in Reais from the Federal Government to the top ten Brazilian municipalities in 2021 (LC).



Source: own elaboration.

The pandemic caused by COVID-19 has led governments to take measures to alleviate the situation caused by the virus. Complementary Law No. 172 of April 2020 was published, which will apply until the end of the 2021 financial year, and which provides for the transposition and transfer of financial balances in state health funds from federal transfers. The cities in Figure 8 represent the critical centers, those that needed the most help to combat the health issue, thus justifying the financial amount for these points.

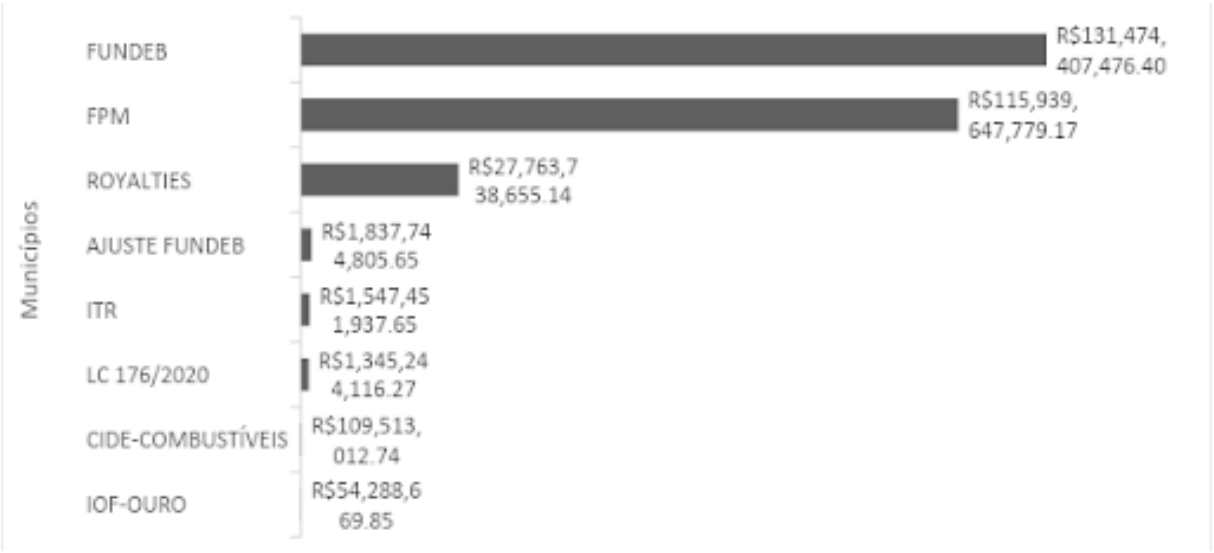
Figure 9 - Transfers in Reais from the Federal Government to the ten Brazilian municipalities with the highest transfers in 2021 (Oil Royalties).



Source: own elaboration.

One way of compensating states, municipalities and the federal government for the fact that oil and natural gas are not renewable is through royalties. These are levied on production and collected monthly, at a rate of between 5% and 15% of the price. It is legally based on Laws 9.478/1997 and 7.990/1989 and Decrees 2.705/1998 and 1/1991. In the same way as the gold IOF, oil royalties mostly benefit the regions that have oil extraction in their territories. We can see in Figure 9 that most of the municipalities highlighted are in the state of Rio de Janeiro, and after the start of exploration in the pre-salt area, a greater degree of extraction was identified in the Rio de Janeiro environment.

Figure 10 - Transfers in Reais from the Federal Government to the top ten Brazilian municipalities in 2021 (Transfers by source).



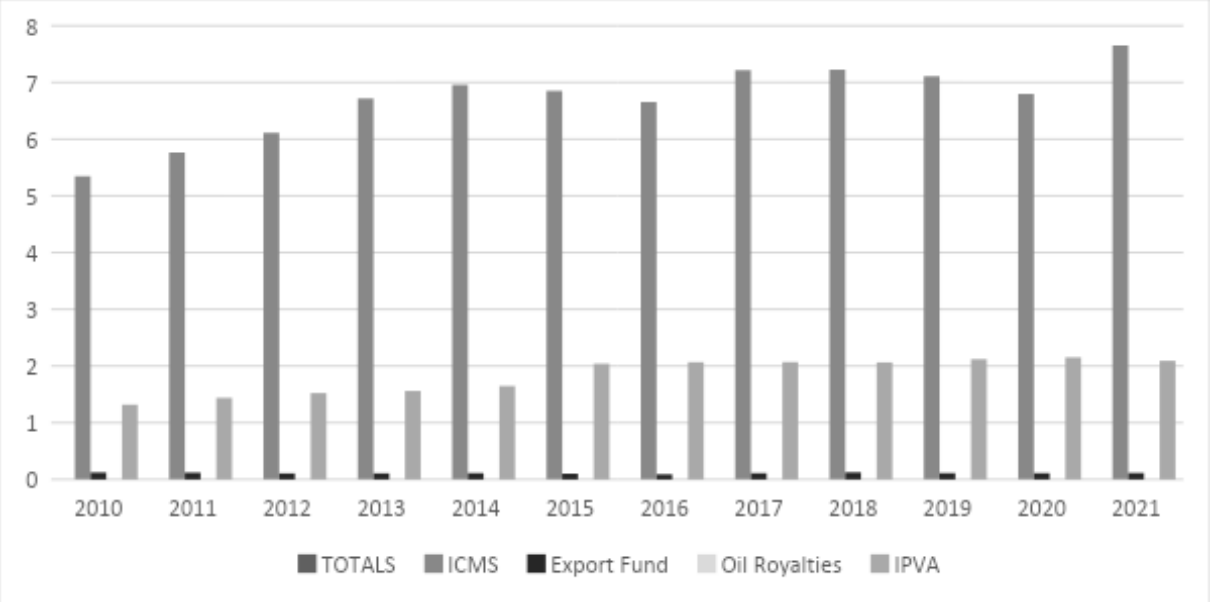
Source: own elaboration.

Figure 10 summarizes the total amount of money transferred in 2021 by source. Approximately 130 billion reais was transferred to municipalities through FUNDEB, showing that the purpose of the aid coming from the Union is to provide social balance in Brazilian localities. Another important source of income for the federative entities is the FPM, which has no social aspect, only passing on the percentages earmarked on a legal basis. Almost 116 billion reais were sent to the municipalities, although no specific destination was identified, it still makes up a large part of the revenue.

As it contains extractive material, it damages the local environment, so the addition of re-

venue to those affected via royalties has become a sufficient solution to avoid curbing economic expansion. This category reached around 27 billion reais for the beneficiaries. Considering the sources of transfers, the FUNDEB figure shows an intention to promote social development; however, other sources such as the FPM and royalties directly benefit federal entities with specific characteristics or positive economic results.

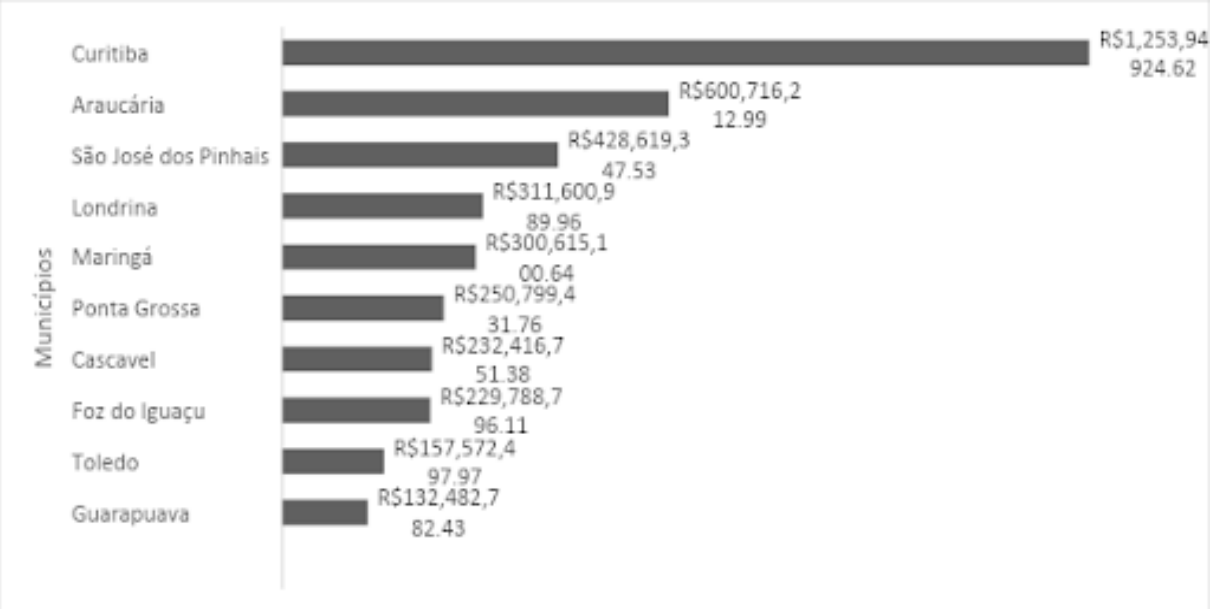
Figure 11 - transfers in reais from the state of Paraná to municipalities between 2010 and 2021. (Transfer by source).



Source: own elaboration.

As far as Paraná is concerned, it can be seen that the structure of transfers from Brazilian states to their municipalities is similar, with no major changes. Figure 11 shows the monetary result transferred from the state of Paraná to the municipalities from 2010-2021. Composed of net ICMS, export fund, oil royalties and IPVA, IPVA and ICMS stood out proportionally. Unlike transfers from the federal government, which, through FUNDEB, manages to cover social perspectives, the revenue sent to municipalities by the state is based predominantly on the amount collected in each region, with the locality that collected the most money acquiring a large monetary contingent.

Figure 12 - transfers in reais from the state of Paraná to the ten municipalities with the highest transfers in 2021.



Source: own elaboration.

The most populous cities with the highest economic performance received the most money in 2021, as shown in Figure 12. Curitiba, the state capital, has more than double the amount of Araucária, the second municipality in transfers. The commercial flow, together with the degree of population and income, corroborate the capital's positive situation. Then there are areas with similar characteristics and, following the same distributive dynamics as Curitiba, they achieved proportional amounts.

The autocorrelation of regional data was checked using local spatial association indicators (LISA), a framework theorized by Anselin (1995) and the foundation of the ESA. This local analysis allows for the decomposition of global indicators, such as the Moran's I statistic, in order to analyze the contribution of each individual observation. The author sets out two statistical requirements for LISA: (i) significant spatial clustering of similar values and (ii) the sum of all local observations resulting in a global indicator of spatial association.

In detail, the equation shows the decomposition of the LISA analysis. In this, a variable y, observed at location i, has a local statistic Lias shown in equation (1):

$$L_i = f(y_i, yj_i) \quad (1)$$

where f is the possibility function and yj_i are the observed values in the vicinity j of i. O y represents the original observations and may be standardized to avoid possible scalar dependence. The observations, as in the Moran's I statistic, are taken as deviations from the mean in

this case.

For each observation, the neighborhood *j* is defined as an average of the spatial weights, presented in a contiguity matrix (W). The columns with a non-zero term in this matrix indicate the relevant neighbors, elements of j. The criteria for determining neighbors are: first-order contiguity and critical distance. O L_i must finally be statistically significant in order to perform the local spatial inference of i, as shown in equation (2),

$$Prob\ [L_i > \partial_i]a_i, \tag{2}$$

in which ∂_i displays the critical value and a_i shows the chosen significance, or pseudosignificance if the result came from a random test.

Finally, the relationship between the LISA statistic and the global statistic is formalized as in equation (3),

$$\Sigma_i L_i = \gamma \wedge \tag{3}$$

where the term $\wedge$ is a global spatial indicator and represents the scale factor. In other words, the sum of the local indicators equals the global indicator.

Similarly to the LISA statistic, a significant spatial association can be said to exist over the entire data set when the relationship described in equation (4) is evident, very similar to that shown in equation (3):

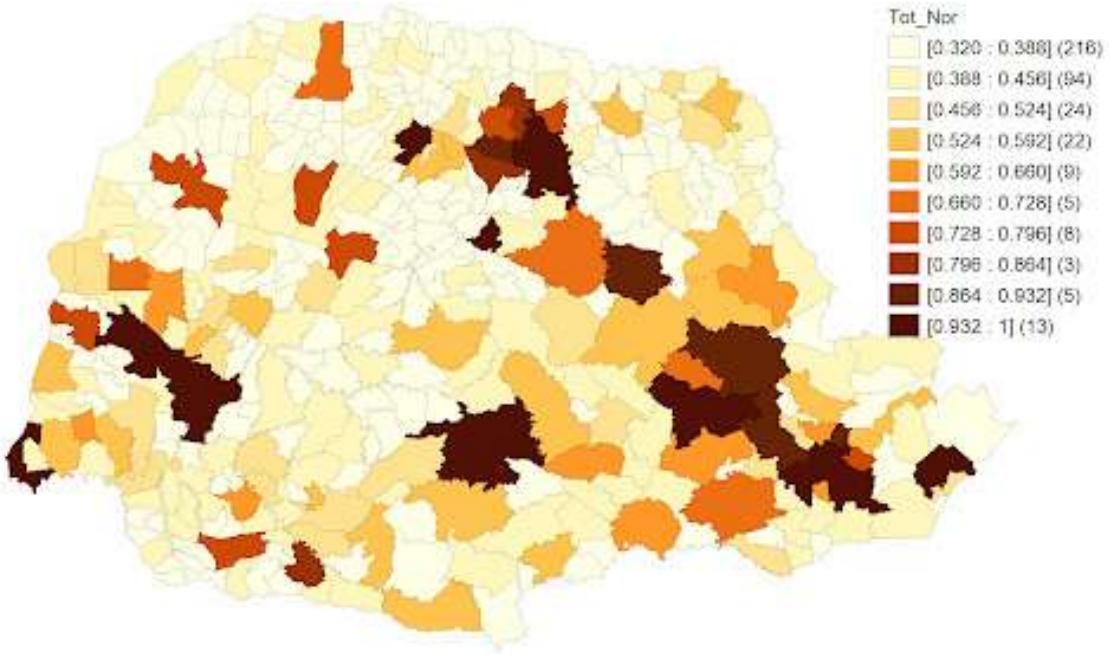
$$Prob\ [\wedge > \partial\ ] \leq a \tag{4}$$

Using the above statistical procedures, special interactions were analyzed, followed by the composition of correlated clusters. In this way, the local Moran index was defined.

4. RESULTS AND DISCUSSION

In order to investigate the existence of a pattern in the allocation of taxes passed on from the state government to the municipalities, they were separated into identical intervals. The darker colors indicate a higher level of receipt, as shown in Figure 13. The cities with the most efficient economies, where inhabitants have higher consumption, are reference points for the regions, indicating probable concentrations in the north, west and the capital. Guarapuava is isolated to the south because of its commercial prominence in the area.

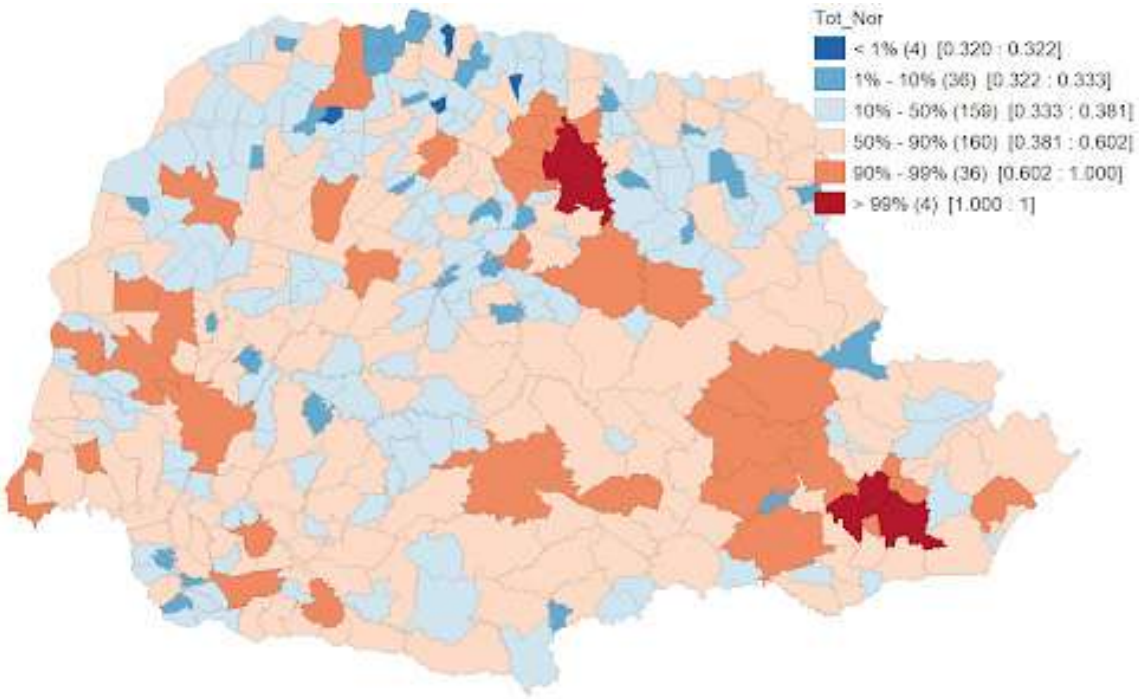
Figure 13 - distribution of transfers from the state of Paraná to municipalities, average 2017-2021.



Source: own elaboration.

The allocative discrepancy between the regions is greater in the percentile cartogram shown in Figure 14. Santa Inês, Miraselva, Nova Aliança do Ivaí and Florida are the four municipalities between 0.320 and 0.322 with low population and commercial activity. Londrina, São José dos Pinhais, Curitiba and Araucária represent the highest index category.

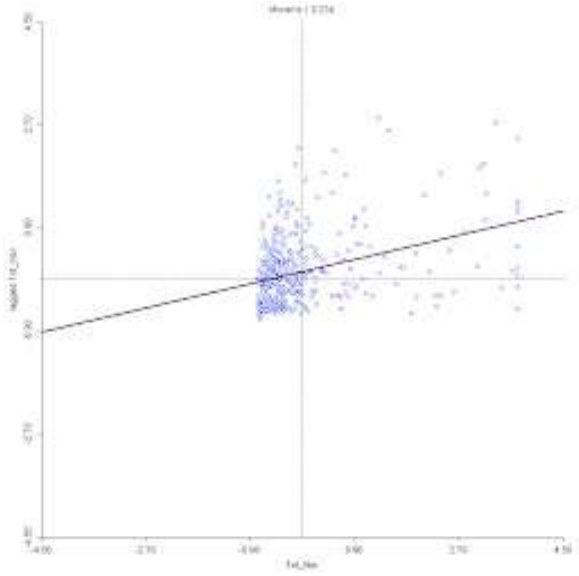
Figure 14 - Percentile distribution of transfers from the state of Paraná to municipalities, average 2017-2021.

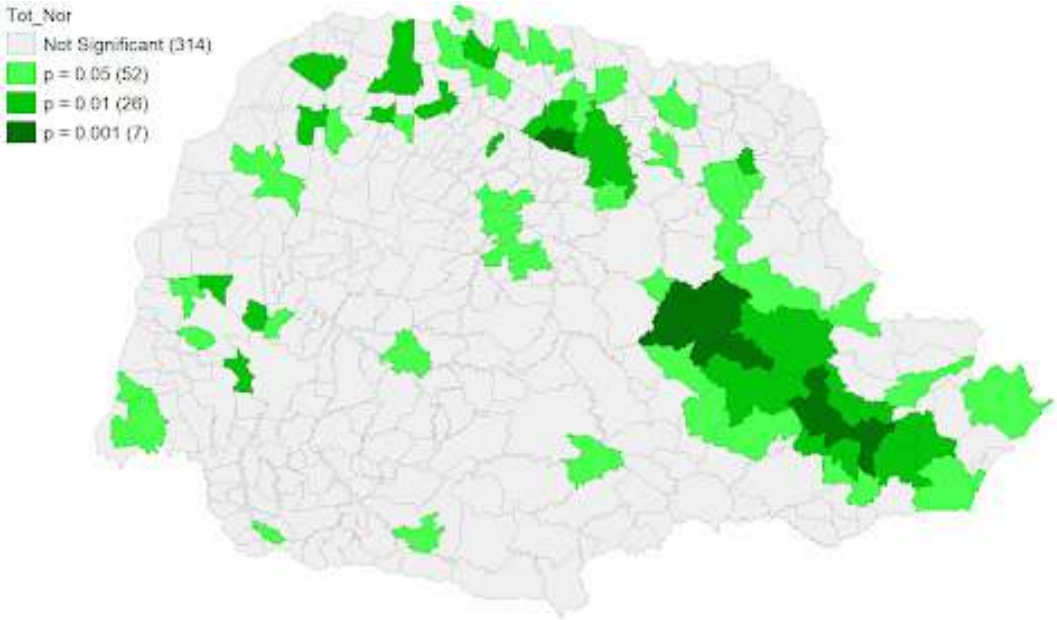


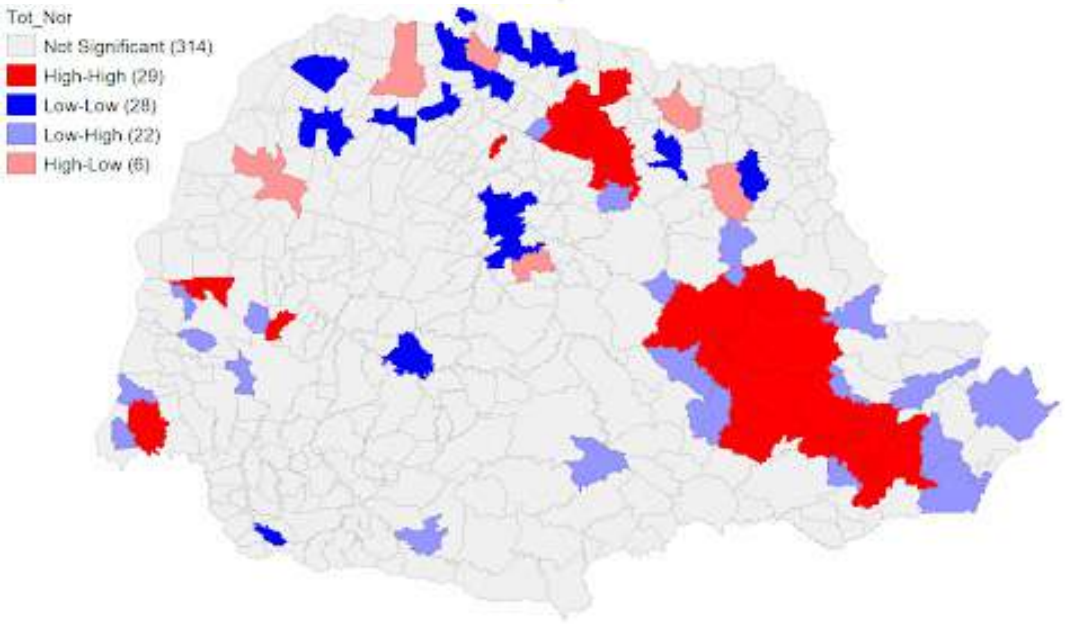
Source: own elaboration.

The spatial autocorrelation is shown in Figure 15 together with the significance of the data and the local Moran's I. Approximately 23% of the information is auto-correlated, indicating spatial interaction between municipalities and their neighbors, i.e. there is a border spillover effect, where particularities of an area influence its surroundings. Out of 399 municipalities, significance of at least 10% was obtained in only 85 of them, highlighting some locations in the north, in the Campos Gerais and the metropolitan area of Curitiba, which make it possible to form groupings, or clusters, of low or high levels of transfer.

Figura 15 - índice de Moran local dos repasses do estado do Paraná aos municípios, média de 2017-2021.




Tot_Nor
Not Significant (314)
p = 0.05 (52)
p = 0.01 (26)
p = 0.001 (7)


Tot_Nor
Not Significant (314)
High-High (29)
Low-Low (28)
Low-High (22)
High-Low (6)

Source: own elaboration.

Figure 15 also identifies two clusters, the largest of which starts in the Curitiba metropolitan area and continues to the Campos Gerais region. In addition to the economic interaction that takes place in the capital of Paraná, there is a notable agro-industrial activity in Campos Gerais, which has resulted in a high concentration of state transfers, while the surrounding area shows low revenue. Another smaller cluster, found in the north of the state, is made up of fewer municipalities than the first. Rolândia, Cambé, Sertanópolis, Londrina and Arapongas make up the region. Arapongas and Rolândia are industrial municipalities, with hubs that drive the area's economy. Londrina, like Cambé, stands out for its services and Sertanópolis for its agriculture.

5. FINAL CONSIDERATIONS

Deriving from the spatial inference, it can be seen that cities with a higher economic level contribute and consequently receive a percentage proportion based on participation, an argument that holds true for ICMS and IPVA. For ISS, the same concept applies: a greater flow of commerce will generate a greater degree of activity that will contribute to the total amount of money received by the municipality in question.

The clusters in the locations in Paraná are based on the spillover effect. In the clusters found in the north and south of the state of Paraná, interaction was identified between the three market sectors. Cities that specialize in providing services - Londrina and Curitiba - together with industrial areas - Arapongas, Rolândia and São José dos Pinhais - and agricultural producers - Sertanópolis and Castro - indicate joint prosperity due to the interaction of their areas.

Organizational measures such as registering and outlining the structure of companies help to ensure that the tax is paid by your city hall, making non-payment impossible. For this to happen, technological computerization is essential through the inclusion of systems, programs, projects and trained personnel.

The main limitation of this research was the lack of statistical significance of some municipalities in the interior of the state of Paraná, thus making spatial inference impossible for these regions. For future moments, we recommend extending the proposal to other Brazilian areas and using a broader time frame.

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