

Public Choice Theory In The Analysis Of Investments In Basic Sanitation In Brazil

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Abstract

The aim of this study was to analyze the factors that explain federal investment spending on basic sanitation in Brazil in the light of Public Choice Theory, since, despite the importance of investments in this area, there is a popular sense that this government action is neglected due to its low visibility and, consequently, low electoral appeal. To this end, a multiple linear regression was carried out in which the data on federal investments in sanitation was the response variable, and the independent variables were the percentage of existing sewage systems, the human development index (HDI) and the electorate of each state and the Federal District. The results showed that the electorate and HDI were significant, while the existing sewage network showed different results.

Keywords: *Investments; Basic Sanitation; Public Choice Theory.*

Date of Submission: 05-01-2024

Date of Acceptance: 15-01-2024

I. INTRODUCTION

Concerns about the efficiency of public spending have deserved attention, mainly because on the one hand there is the population that expects better use of resources and on the other there are the limits and restrictions of the public budget, further highlighting the need for efficiency in these expenditures (Cândido Júnior, 2001). Therefore, in an ideal environment, public managers should make their budgeting decisions in such a way as to efficiently allocate the available resources to the priority needs of the population.

However, the context of Brazilian public administration does not seem to follow this ideal environment, but rather the one described by the Theory of Public Choices (TEP), in which public managers follow the logic of Economic Theory, individually seeking to maximize their own interests (Dias, 2009). This means that the public manager is often faced with a choice of how to use public resources that, on the one hand, could generate greater efficiency in public spending and, on the other, could maximize their own interests, such as gaining more votes (Quaesneret et al., 2017).

In order to highlight the motivation for allocating public investment, this study used federal investments in basic sanitation as its object. This is because the problems related to basic sanitation in Brazil are recurrent and its importance is widely recognized due to its essential role in maintaining life, health and the environment, factors that have an impact on the quality of life of individuals (Mendonça and Motta, 2005). Despite this importance and priority need, according to the National Water Agency (ANA) (2017), 45% of the Brazilian population does not have sewage treatment, of which 18% have their sewage collected but not treated and 27% do not even have sewage collection.

It can be seen, therefore, that there is a social demand for investment in this area, but there is a popular sense that this government action is neglected due to its low visibility and, consequently, low electoral appeal. Thus, the following problem arises: in the light of Public Choice Theory, what factors explain federal investment spending on basic sanitation in Brazil? The aim of this study is to analyze the factors that explain federal investment spending on basic sanitation in Brazil in the light of Public Choice Theory. To this end, the methodology used was quantitative in nature, with the estimation of a multiple linear regression model in which the response variable was federal investment in basic sanitation and the independent variables were the HDI of the federal units, the sewage network in each federal unit and the electorate of each federal unit.

In this way, it is hoped that the results of the model can show whether the relationships between these variables confirm the assumption of PTE for public spending on sanitation, expanding empirical studies on the application of Public Choice Theory, especially with regard to spending on basic sanitation and the motivations that lead managers to choose between the existing choices, making it possible to build scientific knowledge about what is observed and commented on by society.

In practical terms, given the conditions of basic sanitation in Brazil, it is important to carry out this research, given that the amount of the budget allocated to this area and the efficiency of this public spending

have a direct impact on the quality of life of individuals and on human development indicators. Thus, it is hoped to indicate the reasons why basic sanitation rates in Brazil are still poor, despite the importance of this service, providing a reflection on improving planning and directing the budget allocation process for this state function in a more technical and efficient manner.

II. THEORETICAL FOUNDATION

Public Choice Theory

The actions of public managers, especially in budget investment decisions, need to follow a process of administrative, financial and budgetary planning, which in Brazil is known as program budgeting (Machado Júnior, 2012). Thus, Brazilian budget spending has two economic classification categories, current expenditure and capital expenditure, the latter including public investment, which is spending on planning and executing works, and on acquiring facilities, equipment and permanent material (Silva and Triches, 2014).

In the case of investments in basic sanitation, the federal government has its own budget for this area, since it was up to the federal government to establish the national guidelines for basic sanitation and to define the federal basic sanitation policy, through Law 11.445 of 2007 (Brasil, 2007). Furthermore, "federal investments are largely carried out in partnership with states and municipalities. Therefore, public infrastructure policies are major vectors of political alliances with segments of society and political leaders" (Abreu and Câmara, 2015:76).

Therefore, federal investments in basic sanitation must follow specific guidelines to meet the social demands of this area. However, despite this legislative framework, the execution of budgetary investments still reveals the realization of works or projects that are ineffective in terms of population needs (World Bank, 2017), a context that shows a perception of inadequate investments and poor public management, raising doubts about the reasons why this situation occurs.

One possible analysis is that derived from the School of Public Choice or Public Choice Theory (PCT), which adopts an economic perspective to analyze political phenomena, especially decisions in non-market or political market situations (Dias, 2009). PCT is relevant and widely used internationally, but still incipient in Brazilian research (Rovaris, Cavichioli and Dallasta, 2016).

The approach adopted by the Theory is due to the fact that the theory and practice of public finance seem to diverge from each other and therefore deserve a specific explanation in order to highlight the cost-benefit ratio for tax payers (Buchanan, 1949). Thus, if there are defined collective public objectives, but managers make decisions that differ from these objectives, the TEP presupposes that, as in economic theory, public administrators are utility-maximizing individuals, i.e. they act according to their personal objectives (Bernabel, 2009). This is because the political environment can be understood as a specific market so that "whether in the market or in politics, individuals behaved in the same way, that is, they were driven by the same motivations - they were self-interest maximizers" (Dias, 2009:204).

Along these lines, Santiago, Borges and Borges (2014) point out that, in the case of political decisions, these are based on non-technical criteria, thus seeking electoral gains to the detriment of collective demands. Similarly, Bernabel (2009:32) states that "bargaining for votes between different issues is a positive-sum game" in which individuals prefer more to less. For this reason, it is possible to identify the potential votes to be acquired as an element to measure the interest of public managers in their investment decisions, with a view to verifying whether there is a significant relationship between the public investment made and the possible votes or whether the investments are associated with real social problems.

In the case of this study, the area of analysis of public investments was basic sanitation, since this type of allocation is commonly associated with a lack of interest on the part of government managers, since these are achievements that do not result in visible public facilities, and consequently have little electoral appeal, despite their social essentiality.

With this, it is possible to analyze whether the public budget investment in basic sanitation passed on by the Federal Government to the states follows the TEP assumption that managers' choices are made to maximize their utility, measured here by the electorate of a Brazilian state (States and Federal District). The amount of investments to be used refers to the amounts transferred by the federal government to the federal units for sanitation. This leads to the assumption to be verified: H1 - The larger the electorate of a Brazilian state, the greater the potential for political gain, which is why it is expected that there will be greater public investments, regardless of the real social demands of that federal entity.

Basic sanitation

The importance of basic sanitation services for people's health and well-being is widely recognized, and is strongly associated with living conditions, people's health and the environment. Thus, the demand for basic sanitation can be understood as one of the inputs that improve the individual's quality of life (Mendonça and Motta, 2005). Thus, sanitation in Brazil is regulated, among other norms, by Law No. 9.433/1997, which deals with the National Water Resources Policy (PNRH), and by Law No. 11.445/2007, which establishes the national

guidelines for basic sanitation, the purpose of which is to define investment guidelines and strategies in the sanitation area, targeting two important points: the implementation and expansion of water supply and sewage networks (Leoneti, Prado and Oliveira, 2011).

According to a report by the National Confederation of Industry (CNI) (2018), in order to achieve universal sanitation in Brazil, the country needs to increase investment in water and sewage networks by 62% to meet the universalization target by 2033, as established in the National Sanitation Plan. Thus, if it continues to underinvest, Brazil will only reach the target of expanding the sanitation network by 2050.

Table 1 below shows the number of homes without access to the sewage system and the cost of universalization per unit of the Federation.

Table 1 - Households without access to the general sewage system and cost of universalization by unit of the Federation (2011)

Federation Units	Homes without access to water	Homes without access to sewage	Cost of universalization* R\$ - in billions**	% of GDP
North	2.704.207	4.379.744	31,434	14,1%
Rondônia	329.168	438.575	3,588	12,9%
Acre	116.357	185.892	1,340	15,2%
Amazonas	428.681	874.331	5,850	9,1%
Roraima	44.351	110.815	0,703	10,1%
Pará	1.568.755	2.136.607	16,289	18,4%
Amapá	128.651	182.156	1,369	15,3%
Tocantins	88.244	406.368	2,294	12,7%
North East	6.006.949	13.455.755	75,904	13,7%
Maranhão	1.177.931	1.731.974	11,109	21,3%
Piauí	369.801	889.003	4,925	20,0%
Ceará	875.644	1.980.116	11,142	12,7%
Rio Grande do Norte	260.653	812.808	4,247	11,8%
Paraíba	383.067	948.149	5,216	14,7%
Pernambuco	1.009.673	2.387.001	13,280	12,7%
Alagoas	441.359	833.071	4,929	17,3%
Sergipe	144.685	563.869	2,827	10,8%
Bahia	1.344.136	3.309.764	18,229	11,4%
South East	3.089.931	8.222.308	123,515	5,4%
Minas Gerais	986.657	2.379.881	36,598	9,5%
Holy Spirit	161.407	714.634	9,751	10,0%
Rio de Janeiro	1.153.953	2.686.784	41,686	9,0%
São Paulo	787.914	2.441.009	35,480	2,6%
South	1.547.586	6.464.436	51,502	7,7%
Paraná	485.160	1.720.481	14,097	5,9%
Santa Catarina	426.078	1.936.859	15,231	9,0%
Rio Grande do Sul	636.348	2.807.096	22,174	8,4%
Center West	998.552	2.962.400	30,808	7,8%
Mato Grosso do Sul	213.106	671.712	6,899	14,0%
Mato Grosso	450.214	881.366	10,164	14,2%
Goiás	392.352	1.342.260	13,568	12,2%
Federal District	(57.120)	67.062	0,178	0,1%
Brazil	14.347.225	35.484.643	313,162	7,6%

* Universal access to sanitation and treated water.

** At average 2013 prices.

Source: ExanteConsultoriaEconômica (2014).

Looking at Table 1 and as pointed out by Leoneti, Prado and Oliveira (2011), the regions most in need of investment in sanitation for universalization are the North and Northeast regions of Brazil and the region with the least need for investment in this area is the Southeast. The authors also point out that the North has the highest *per capita* income in relation to the total needed to be invested in sanitation, which would increase the need for state action with non-reimbursable investments, i.e. those that do not require payment by the borrower: H2 - The greater the need to extend and expand the region's sanitation network, it is expected that there will be greater investments in the area.

However, it is known that part of the Brazilian population is found in regions with still precarious sanitation conditions (Mendonça and Motta, 2005). The National Water Agency (ANA) (2017), in its report Atlas Esgoto- depollution of river basins, states that 18% of the Brazilian population have their sewage collected but not treated, and 27% have no treatment or collection. According to the same report, the Brazilian region with the lowest share of the population with adequate sewage treatment is the North, with 33%, followed by the Northeast, with 48%. The South, on the other hand, has the highest percentage, with 65%, followed by the Midwest, with 63% and the Southeast, with 58%.

The constancy of problems related to sanitation is associated with the socio-economic model practiced, in which the most vulnerable population is also the one that least perceives the effects of development. Thus, "the globalization process remains hegemonic worldwide, supported by a neoliberal vision of development", and it is "legitimate to assume that the situation of dependence of the peripheral economy will continue" (Heller, 1998:74), which leads to the permanence of conditions of poverty and problems related to sanitation and health.

In this context, the lack of adequate sanitation conditions clearly indicates that water and sewage disposal are one of the main causes of illness and, above all, infant mortality (Mendonça and Motta, 2005). Due to the association between sanitation conditions and health issues, at various times in history attention has been focused on sanitation as a source of environmental improvement, with a view to preventing problems related to human health (Heller, 1998). According to Prüss-Ustün and colleagues (2008), around 4% of deaths in the world are caused by waterborne diseases due to a lack of adequate sanitation.

Thus, the development indicators of countries, including Brazil, are constantly examined in the light of health indicators, and it is expected that the greater the coverage of sanitation services in Brazil, the better the performance of health indicators, demonstrating the greater the degree of economic and human development of the region (Heller, 1998).

According to the United Nations Development Program (UNDP) (2017), the concept of human development is a little broader than that observed only from the point of view of economic growth (which understands well-being as the generation of resources or income): it considers the capacity and opportunities available to individuals. In this concept of human development, in addition to the economic aspect, other social, cultural and political characteristics that influence the quality of human life are also considered (Silva et al., 2015).

In this context, the study by Libânio, Chernicharo and Nascimento (2005) aimed to assess the importance of the water quality dimension in the management of water resources, by comparing the relationship between water availability and sanitation indicators with social and health indicators. The data collected from the Brazilian Institute of Geography and Statistics (IBGE) (2000) and the study by Libânio, Chernicharo and Nascimento (2005) refers to the year 2000, the Brazilian federal units and 174 other countries. The joint analysis of the information contained in the different studies consulted showed that the well-being of populations, assessed by means of social and health indicators, in the various countries and in the national territory, is seen in places where water and sewage services are covered, and not necessarily where there is water potential or *per capita* water availability.

Sanitation indicators, such as the coverage of water and sewage services, are associated with indicators that express the population's living conditions, such as: social development indicators (HDI) and life expectancy; and public health indicators, such as mortality and morbidity rates from waterborne parasitic and infectious diseases. The correlation between sanitation and the HDI is mainly due to the fact that the HDI considers life expectancy at birth in its calculation (Libânio, Chernicharo and Nascimento, 2005).

The study by Souza, Ferreira and Formiga (2016) aimed to establish a relationship based on spatial cluster analysis of the 246 municipalities in the state of Goiás, Brazil, considering basic sanitation data, the human development index and vegetation cover. To this end, 140 springs in Goiás were observed and data was collected from 2005 to 2009. As a result, the study showed that there was a significant increase of 99.8% in the number of households served by adequate sanitation in the state of Goiás between 2000 and 2010. The southern region of the state of Goiás concentrates the municipalities most served by sanitation, which in turn are also those with the highest HDI, while the northern and central regions of the state concentrate the municipalities with the least availability of this type of service. In the regions with more deforested municipalities and which generally have better sanitation services, the average HDI was higher.

Teixeira and Guilhermino (2006) evaluated the association between sanitation conditions and epidemiological indicators in Brazilian states, using secondary data from the Ministry of Health's Indicators and Basic Data for Health 2003 - IDB 2003 database. As sanitation indicators, the authors considered population coverage by water supply networks, sewage systems and waste collection services. Epidemiological indicators were represented by the infant mortality rate, proportional mortality due to acute diarrheal disease in children under five and proportional mortality due to infectious and parasitic diseases for all ages. The results show that the expansion of sanitation infrastructure in states with poor sanitation conditions is an investment that provides better public health conditions, contributing to a reduction in public and private spending on curative medicine, which allows us to infer the following assumption to be tested: H3 - Regions with better HDI have more adequate basic sanitation and consequently need less investment in this area.

III. METHODOLOGICAL PROCEDURES

In order to verify the theoretical relationship between the characteristics of the managers and the public results observed, multiple linear regression analysis was used, with the following variables studied: investment in sanitation transferred by the federal government to the federative units (INVSAN); the human development

index of each federative unit (HDI); the percentage of sewage network coverage in each federative unit (RESG); and the electorate of each federative unit (ELEI).

Thus, this study has a quantitative approach, so the statistical method was chosen because it provides results that analyze the theoretical hypotheses used and, consequently, achieves the objective intended by the work.

Sample definition, data collection and processing

Since the scope of this research is the Federal Government's investments in basic sanitation, the monetary values used in the study were all the transfers made by the Federal Government to the States and the Federal District between 2013 and 2017, taken from the Federal Government's Transparency Portal (<http://www.portaltransparencia.gov.br/localidades>). All the transfers classified in the function or in any budget action that contained the term sanitation were added up, and this was the model's response variable.

Data on the HDI, the percentage of sewage network coverage in each federal unit and the electorate was collected on a secondary basis through the IBGE's 2011 Sanitation Atlas (IBGE, 2011) and the website of the Superior Electoral Court (<http://www.tse.jus.br/eleitor/estatisticas-de-eleitorado/consulta-quantitativo>).

The data collected was tabulated and processed using *Excel and SPSS® software*, meeting the assumptions of the estimated model.

Model specification

The following econometric model was therefore estimated:

$$INVSAN = \alpha_0 + \alpha_1 IDH + \alpha_2 RESG + \alpha_3 ELEI + \alpha_i$$

In which:

INVSAN - total amount of investments in sanitation (in reais) transferred by the Federal Government to the federal units in the period 2013 to 2017;

α_0 - intercept of the regression model;

IDH - human development index for each federal unit;

RESG - percentage of sewage network coverage in each federative unit;

ELEI - current electorate of each federal unit;

α_i - random error term in the model.

With this model, it was possible to verify the relationships between the variables, as well as to test the theoretical hypotheses indicated in this study.

IV. ANALYSIS OF RESULTS

Descriptive analysis

Initially, descriptive statistics are presented to outline general aspects of each of the independent variables (HDI, sanitation network and electorate) of the Brazilian federal units. In addition, this section presents the descriptive statistics for the response variable, amounts transferred for basic sanitation, used to represent public investment in sanitation. Table 2 shows the descriptive statistics for the HDI variable.

Table 2 - Descriptive HDI

	HDI	Federal Unit
Minimum	0,667	Alagoas
Maximum	0,839	Federal District
Medium	0,738	

Source: Research data (2018).

The lowest HDI in the country was in the state of Alagoas and the highest was in the Federal District, with the average Brazilian HDI being 0.738. When analyzing the behavior of the HDI by region, we see that the South has the highest average HDI (0.794), followed by the Southeast (0.784) and the Midwest, with an average HDI of 0.780, especially the Federal District, with an HDI of 0.839 (the highest in the Midwest and Brazil). The North and Northeast regions had the lowest HDI in the country, with 0.718 and 0.694, respectively.

In terms of the size of the sanitation network in the Brazilian states, Piauí is the state with the smallest sanitation network in the country, i.e. it is the most underserved in terms of basic sanitation. On the other hand, the Federal District has a 100% basic sanitation network, surpassing the Brazilian average, which is only 45%, as shown in Table 3.

Table 3 - Basic sanitation network

	Network	Federal Unit
Minimum	0,045	Piauí
Maximum	1,000	Federal District
Medium	0,459	

Source: Research data (2018).

Analyzing the sanitation network by region, it was found that the Southeast had the highest sanitation network coverage, with 0.953 (95% sanitation coverage), with the state of São Paulo standing out with 99% coverage. The Midwest had 0.480 network coverage, with the Federal District standing out with 100% coverage. Third place went to the Northeast, with 0.449 network coverage, followed by the South, with 0.393, and finally the North, with just 0.175 (17% sanitation network coverage).

Observing the coverage of basic sanitation networks throughout the country and considering that the lower the coverage of the existing basic sanitation network (sanitation structure), the greater the amounts spent on universalizing the sanitation system for more households, it is assumed that the amounts transferred for this item should follow the same logic, i.e. the smaller the sanitation network, the greater the investment for a given region, considering only public need and not the self-interest of government officials. In order to check whether the behavior of the amounts invested followed the need for investment in sanitation (sanitation network/coverage), the amounts transferred to the states were analyzed, as shown in Table 4.

Table 4 - Investment in basic sanitation

	Investment in sanitation	Federal Unit
Minimum	1.074.556,87	Amazonas
Maximum	99.785.049,00	Maranhão
Medium	24.875.801,00	

Source: Research data (2018).

Table 4 shows that of the amounts (in Reais) transferred from the Federal Government to the states and the Federal District, the lowest was to the state of Amazonas, which has a sanitation network of 0.177, and the highest transfer was to the state of Maranhão, which has one of the smallest networks in the country (0.065). As both states have low basic sanitation coverage, it cannot be said that the criterion for the federal government's transfer was the need to invest in sanitation. Regression is therefore justified in order to check whether or not this relationship exists. Table 5 shows the total transfers from the federal government to the states and the Federal District by region.

Table 5 - Amounts transferred

Regions	Amounts transferred
South East	144.609.542,24
South	52.897.742,59
Midwest	53.648.268,85
North East	343.777.656,11
North	76.713.414,39

Source: Research data (2018).

It can be seen that the largest transfer (in reais) went to the Northeast, followed by the Southeast. The North was in third place, followed by the Midwest and lastly, with the lowest amount, the South. From a purely descriptive analysis, it can be seen that it is not possible to associate the highest amounts transferred with those who have the greatest need for sanitation, as indicated by the sanitation coverage network.

Thus, it is known that public investment can be motivated by reasons other than the real driver, which would be the need to invest in basic sanitation. In this way, we also sought to analyze the electorate of the federal units, as shown in Table 6.

Table 6 - Brazilian electorate

	Electorate	Federal Unit
Minimum	233.596	Roraima
Maximum	28.037.734	São Paulo
Medium	1.781.316	

Source: Research data (2018).

It was found that the state with the smallest electorate is Roraima and the state with the largest electorate is São Paulo, with the average Brazilian electorate being close to 1,781,316 inhabitants. Table 7 shows the electorate by region of the country.

Table 7 - Electorate by region

Regions	Electorate
South East	54.944.898
South	19.040.335
Midwest	8.890.686
North East	34.133.740
North	8.817.460

Source: Research data (2018).

As shown in Table 7, the two regions with the largest number of voters were the Southeast and Northeast, which also received the largest amounts in transfers from the federal government for investment in basic sanitation. The third region in terms of number of voters is the South, followed by the Midwest and finally, with the lowest number of voters, the North, which also received the lowest amount of transfers for investment in basic sanitation. All this may suggest that the electorate may be a variable to be taken into account when making decisions about the allocation of resources and not just the need for investment in basic sanitation.

Analysis of correlations

Once the descriptive analysis had been carried out, we went on to analyze the correlations between the variables used in the research, in order to show the direction and intensity of the interactions, as shown in Table 8.

Table 8 - Correlation matrix of the variables analyzed

	HDI	SRSG	ELEI	INVSAN
HDI	1			
SRSG	0,524181663	1		
ELEI	0,410579671	0,53296001	1	
INVSAN	-0,176291605	0,105669504	0,500004352	1

Source: Research data (2018).

Table 8 shows that there is no high correlation between the explanatory variables, since the correlation coefficients between the regressors were no higher than 0.8, which means that multicollinearity between them is assumed (Gujarati, 2006).

On the other hand, the signs make it possible to identify the directions of the interactions between the response variable and the explanatory variables, so that the HDI showed a negative correlation with the response variation (INVSAN), while the sewage system (RESG) and the electorate (ELEI) were positive. Table 9 summarizes the directions found and compares them with those expected.

Table 9 - Comparison between expected and found correlations

Dependent variables	Direction of correlation with the dependent variable	
	Expected	Found
HDI	Negative	Negative
SRSG	Negative	Positive
ELEI	Positive	Positive

Source: Research data (2018).

Only the variable of the percentage of sewage network coverage in each federal unit (RESG) did not show the expected behavior, indicating that the tendency to transfer resources to sanitation does not go in the same direction as the size of the existing sewage network, which is an important finding of the research, as it reveals that resource allocation decisions are not aligned with the direction of social need. On the other hand, the highest correlation was with the electorate, precisely the variable used to analyze the particular interest of public managers, according to the TEP.

However, these results should be analyzed with caution, since only with the electorate did the indicator reach 0.5; with the others, it was below that, which would be a moderate correlation in terms of explaining the variation in response to repressive measures (Gujarati, 2006). Even so, this evidence is important to show that the results obtained for sanitation investments do not seem to safeguard the flow of public planning stipulated by law, but rather the assumption of the TEP, that the potential for votes interferes with the execution of budget investments in this area.

Analysis of regression results

After the correlation matrix, multiple linear regression and variance analyses of the model were carried out; the significance level of 5% ($\alpha = 0.05$) was adopted for interpreting the results. Thus, "when the *p-value* of a hypothesis test is less than the chosen value of α , the test procedure leads to the rejection of the null hypothesis" (Hill, Griffiths and Judge, 2006:119). Thus, the regression showed the values specified in Table 10.

Table 10 - Regression results

	Coefficients	Standard error	Stat t	P-value
Intersection	177059238,1	66374022,6	2,667598424	0,013751787
HDI	-222778279,2	94168183,24	-2,365748934	0,02679968*
SRSG	-2547716,378	15134069,79	-0,16834311	0,867784966
ELEI	2,857104901	0,773423495	3,694101511	0,001198565*

Source: Research data (2018).

The regression model had an R^2 coefficient of determination of 0.4258, i.e. 42.58% of the total amount of sanitation investments (in reais) transferred by the federal government to the federal units between 2013 and 2017 is explained by the regressors. Furthermore, the model proved to be an adequate fit, according to the variance test (ANAVA).

It can be seen from the results in Table 10 that there was statistical significance for two regressors, HDI and ELEI, with an α of 5%, accepting the theoretical hypothesis H1 that the electorate influences sanitation decisions, since the potential for votes interferes with public management, confirming the theoretical assumption of the TEP that, in sanitation investments, administrators are more concerned with their own interests than with real social need.

Theoretical hypothesis H3 was also confirmed: regions with better HDIs have more adequate basic sanitation and consequently need less investment in this area. The confirmation of this theoretical hypothesis reveals that investments were related, to some extent, to this indicator which is used to analyze the general quality of life of the population, which includes the existence of basic sanitation. However, the key variable in this social demand, the sewage system (RESG), was not strongly or negatively related to the response variable and was not even significant in explaining investments in sanitation, as would be expected from administrators concerned with resolving this constant demand from the population.

Thus, with the result of the R^2 and considering that investments in sanitation should follow the logic of the need to expand the supply of sewage, the results presented and the explanatory value of the model confirm the assumption of the TEP that if there is no electoral gain, the allocation is not carried out satisfactorily. In this scenario, both the correlation and the regression indicate interesting results that have not yet been explored in the public sector, specifically in the explanatory analysis of sanitation investments made by the Federal Government. Therefore, the disclosure of these analyses with the form of measurement used, in addition to the results obtained, provides a theoretical and methodological expansion that can be verified in Brazilian public administration which, despite its economic and social importance, is not tested as it should be.

V. FINAL CONSIDERATIONS

The aim of this study was to analyze the factors that explain federal investments in basic sanitation in Brazil in the light of Public Choice Theory. In this way, this research incorporates into the analysis of sanitation budget investments the verification of the PTE assumption that public managers act in favor of their personal returns and not for existing social needs.

Statistical verification of this applicability broadens the scope for testing the assumptions used and the measurement variables adopted in the model, providing empirical evidence of the relationship between choices in this area of government activity.

Using a descriptive analysis, correlation and the estimation of a multiple linear regression model in which the response variable was federal investment in sanitation and the independent variables were percentage of existing sewage network, HDI and electorate of each state and the Federal District, the results obtained showed that the theoretical hypothesis that the greater the need to extend and expand the region's sanitation

network, the greater the investments in the area should be, was not confirmed. The electorate and HDI variables were statistically significant for the goodness-of-fit model (R^2 of 0.4258), showing that sanitation investments, considered to have little electoral visibility, do not in fact follow the logic of the real needs of the population, as would be expected from a public administration focused on social demands.

As a result, the study identified that the electorate has a high explanatory power for federal investments in sanitation, confirming the assumption of Public Choice Theory. These results allow for new studies in various areas to be applied, as well as improved forms of measurement to broaden the conclusions reached in this study, which will contribute to the verifiability of PTE in public administration as a whole and in the way sanitation is defined and invested in.

Thus, it is hoped that public managers can pay attention to the effective allocation of resources in the area of sanitation, so that the scenario of neglect in this sector can be overcome, with the universal provision of this service, as recommended by its regulatory and legal framework.

Suggestions for further work include the inclusion of other characteristics or another group of public managers. With regard to performance, different indicators could be tested, as well as the analysis methodology. In this way, it is hoped that there will be a broadening of studies on public administrators and the results expected from their management, contributing to the improvement of government administration as a whole.

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