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**GASTOS PÚBLICOS E DESENVOLVIMENTO MUNICIPAL: UMA
ANÁLISE A PARTIR DO IFDM NOS MUNICÍPIOS CEARENSES**

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ABSTRACT

This study analyzes the relationship between municipal public spending and the level of development of municipalities in the state of Ceará, as measured by the FIRJAN Municipal Development Index (IFDM). Data from the IFDM provided by the Federation of Industries of the State of Rio de Janeiro (FIRJAN) and information on municipal public expenditures from the Finanças do Brasil* (FINBRA) database were used, covering 179 municipalities in Ceará from 2014 to 2016. Expenditures in the functional areas of Administration, Social Assistance, Education, Health, Labor, Housing, and Sanitation were considered and converted into per capita values. The analysis employed descriptive statistics, normality tests, tests for homogeneity of covariance matrices, and discriminant analysis. The results reveal heterogeneity among the municipalities and indicate that spending on Health and Sanitation has the greatest capacity to differentiate between development levels, although no strong relationship was identified between the aggregate of analyzed expenditures and the overall IFDM. The findings suggest that the volume of public resources invested, in isolation, is insufficient to explain the observed differences in municipal development. Thus, beyond resource availability, the study highlights the importance of public spending efficiency specifically regarding proper allocation and the capacity to transform budgetary resources into improved conditions for education, health, employment, and income for the population.

Keywords: Public spending. Municipal development. IFDM. Municipalities in Ceará. Discriminant analysis.

RESUMO

O estudo analisa a relação entre os gastos públicos municipais e o nível de desenvolvimento dos municípios do estado do Ceará, mensurado pelo Índice FIRJAN de Desenvolvimento Municipal (IFDM). Foram utilizados dados do IFDM, disponibilizados pela Federação das Indústrias do Estado do Rio de Janeiro (FIRJAN), e informações sobre as despesas públicas municipais provenientes das Finanças do Brasil (FINBRA), abrangendo 179 municípios cearenses no período de 2014 a 2016. Foram consideradas as despesas nas funções Administração, Assistência Social, Educação, Saúde, Trabalho, Habitação e Saneamento, convertidas em valores *per capita*. A análise foi realizada por meio de estatística descritiva, testes de normalidade, homogeneidade das matrizes de covariância e análise discriminante. Os resultados evidenciam heterogeneidade entre os municípios e indicam que as despesas com Saúde e Saneamento apresentam maior capacidade de diferenciação entre os níveis de desenvolvimento, embora não seja identificada relação forte entre o conjunto das despesas analisadas e o IFDM geral. Os achados sugerem que o volume de recursos públicos aplicado, isoladamente, não é suficiente para explicar as diferenças observadas no desenvolvimento municipal. Nesse sentido, além da disponibilidade de recursos, destaca-se a importância da eficiência dos gastos públicos, considerando sua adequada alocação e capacidade de transformar recursos orçamentários em melhores condições de educação, saúde, emprego e renda para a população.

Palavras-chave: Gastos públicos. Desenvolvimento municipal. IFDM. Municípios cearenses. Análise discriminante.

INTRODUCTION

Municipal public administration plays an important role in promoting economic and social development through the provision of services and the application of resources to areas such as education, health, social assistance, labor, housing, and sanitation. In this context, the discussion of public spending involves not only the volume of resources allocated but also their allocation and capacity to generate outcomes for the population.

The relationship between public spending and development has been examined in several studies. Bogoni et al. (2011) note that expenditures in areas such as education, health, and housing may contribute to local economic dynamics. However, greater resource availability does not necessarily imply better outcomes. Faria et al. (2008) emphasize that municipalities with higher expenditures may perform worse than those that use their resources more efficiently.

The economic, social, fiscal, and administrative differences among municipalities reinforce the importance of this discussion. To measure municipal development, this study uses the FIRJAN Municipal Development Index (IFDM), which comprises the Employment and Income, Education, and Health dimensions and is constructed from official public statistics.



Accordingly, the following research question is established: to what extent do municipal public expenditures on Administration, Social Assistance, Education, Health, Labor, Housing, and Sanitation contribute to differentiating municipalities in Ceará according to their development levels as measured by the IFDM?

The objective of this study is to analyze the relationship between municipal public spending and the development levels of municipalities in Ceará, as measured by the IFDM, by examining behavior of expenditure and identifying the expenditure functions with the greatest ability to differentiate among development levels. The analysis covers 179 municipalities in Ceará from 2014 to 2016, using information from Finanças do Brasil (FINBRA) and FIRJAN.

This study contributes to the discussion on the relationship between the composition of public spending and municipal development by considering the distribution of expenditures across different functions and providing evidence for the debate on efficiency, planning, and the allocation of public resources. In addition to this introduction, the article presents the theoretical framework, addressing public spending, efficiency, and municipal development; the methodological procedures; the analysis and discussion of the results; and, finally, the concluding remarks.

THEORETICAL FRAMEWORK

PUBLIC SPENDING, EFFICIENCY, AND MUNICIPAL DEVELOPMENT

Public spending is an important instrument of the State for providing goods and services and promoting economic and social development. At the municipal level, its relevance is associated with the implementation of policies directly related to the population's living conditions, such as education, health, social assistance, sanitation, housing, and economic development. However, the assessment of public spending should consider not only the volume of resources but also their allocation and efficiency, understood as the capacity to transform available resources into goods, services, and outcomes for society.

In this regard, municipalities with similar expenditure levels may achieve different outcomes. Lopes and Cunha (2024), when analyzing municipal spending on health and education in Paraná, found no positive relationship between higher expenditure levels and greater efficiency. Complementarily,



Portugal Júnior et al. (2022) emphasize the importance of relating budgetary effort to the outcomes achieved in different areas, reinforcing that the assessment of public spending should jointly consider the resources employed and the outcomes produced.

This relationship may also vary according to municipal characteristics. Sousa et al. (2022), using the IFDM and information on Brazilian municipalities between 2005 and 2016, found that changes in the composition of public spending did not, in general, result in significant improvements in well-being, highlighting that similar policies may produce different outcomes depending on local specificities. For Ceará, Queiroz et al. (2025) likewise show that increases in education spending, considered in isolation, do not ensure better socioeconomic indicators, underscoring the importance of efficiency and resource management.

Diniz (2009), in discussing Celso Furtado's contributions, highlights that regional inequalities are associated with the characteristics of economic and spatial structures, emphasizing the importance of planning and public policies in promoting development. This perspective reinforces the view that territorial development does not depend exclusively on economic growth but involves different structural and institutional determinants.

At the municipal level, however, development encompasses dimensions that go beyond economic growth and depends on both the availability and the composition and efficiency of resource allocation. Accordingly, this study considers expenditures on Administration, Social Assistance, Education, Health, Labor, Housing, and Sanitation, seeking to identify their relationship with the different levels of municipal development measured by the IFDM.

MUNICIPAL DEVELOPMENT INDICATORS

Municipal development is a multidimensional phenomenon and cannot be understood exclusively through economic indicators such as income or Gross Domestic Product (GDP). Its analysis also involves aspects related to the population's living conditions, including education, health, employment, income, and inequality. In this context, composite indicators are used to bring together different socioeconomic dimensions and enable comparisons across municipalities and over time.



Among the indicators used to measure aspects of development are the Human Development Index (HDI), the Municipal Human Development Index (MHDI), the Gini Index, and the FIRJAN Municipal Development Index (IFDM). Although these indicators differ in methodology and purpose, they make it possible to identify territorial inequalities and monitor different dimensions of the population's socioeconomic conditions.

At the municipal level, the use of development indicators also makes it possible to relate socioeconomic outcomes to public policies and the allocation of government resources. Sousa et al. (2022), for example, use the IFDM to investigate the relationship between the composition of public spending and human development in Brazilian municipalities, demonstrating the relevance of multidimensional indicators for analyses of this nature.

Among the available alternatives, this study uses the FIRJAN Municipal Development Index (IFDM) because it encompasses the Employment & Income, Education, and Health dimensions, allowing the performance of Brazilian municipalities to be monitored and compared on the basis of official data. Its characteristics, composition, classification criteria, and suitability for the purpose of this research are presented in the following section.

FIRJAN MUNICIPAL DEVELOPMENT INDEX (IFDM)

The FIRJAN Municipal Development Index (IFDM) was developed by the Federation of Industries of the State of Rio de Janeiro (FIRJAN) to monitor the socioeconomic development of Brazilian municipalities. The indicator has nationwide coverage, is published annually, and uses data from official sources, encompassing three dimensions of municipal development: Employment & Income, Education, and Health (FIRJAN, 2018).

The IFDM is a composite measure ranging from zero to one, with values closer to one representing higher levels of development. The use of this indicator in municipal studies allows different localities to be compared and its association with economic, social, fiscal, and budgetary aspects to be investigated. Avelino, Bressan, and Cunha (2013), for example, analyzed accounting factors associated with the IFDM of Brazilian state capitals and identified variables related to public accounts that were significantly associated with the level of municipal development.

The relationship between public expenditures and the IFDM was also investigated by Barroso et al. (2022), who analyzed municipal expenditures on Education, Health, and Labor in municipalities in the state of São Paulo. The authors used the IFDM as a measure of municipal development and sought to assess its relationship with different public expenditure functions. These applications reinforce the use of the index as an instrument for studies seeking to relate the allocation of public resources to different levels of municipal development.

METHODOLOGY

NATURE AND SOURCE OF THE DATA

This research is quantitative and descriptive and uses secondary data on municipalities in the state of Ceará. The study period covers 2014 to 2016, and 179 municipalities were analyzed based on the joint availability of the information required for the study.

Municipal development was measured using the FIRJAN Municipal Development Index (IFDM), developed by the Federation of Industries of the State of Rio de Janeiro (FIRJAN). Data on municipal public expenditures were obtained from Finanças do Brasil (FINBRA), made available by the Brazilian National Treasury Secretariat (STN). Expenditures on Administration, Social Assistance, Education, Health, Labor, Housing, and Sanitation were considered and subsequently expressed in per capita terms to improve comparability across municipalities of different population sizes.

Exhibit 1 presents the classification of public expenditures available in FINBRA.

Exhibit 1 | Classification of public expenditures by function in FINBRA

1) Legislative	2) Judiciary	3) Essential to Justice	4) Administration
5) National Defense	6) Public Security	7) Foreign Affairs	8) Social Assistance
9) Social Security	10) Health	11) Labor	12) Education
13) Culture	14) Citizenship Rights	15) Urban Development	16) Housing
17) Sanitation	18) Environmental Management	19) Science and Technology	20) Agriculture
21) Agrarian Organization	22) Industry	23) Commerce and Services	24) Communications
25) Energy	26) Transportation	27) Sports and Leisure	28) Special Charges

Source: Adapted from Brazil (n.d.).



The choice of the IFDM as a measure of municipal development is justified by its nationwide coverage, annual periodicity, and use of official public statistics, as well as by its inclusion of three relevant dimensions of development: Employment & Income, Education, and Health. Compared with indicators that are updated less frequently, its periodicity facilitates monitoring differences in development among municipalities throughout the period analyzed. These characteristics make the IFDM suitable for the objective of this research, which seeks to relate different public expenditure functions to the development levels of municipalities in Ceará (FIRJAN, 2018).

FIRJAN (2018) establishes four official ranges for interpreting the IFDM: low development (0.0 to 0.4), regular development (above 0.4 up to 0.6), moderate development (above 0.6 up to 0.8), and high development (above 0.8 up to 1.0). These ranges are used as a reference for the substantive interpretation of municipal development levels. For the purposes of discriminant analysis, however, group formation followed a statistical procedure adapted from Barroso et al. (2022), as described in the following section.

The choice of the state of Ceará is justified by its position as one of the leading economies in the Northeast region, ranking 11th among Brazilian federative units in 2016 (Cavalcante et al., 2021). The state also stands out nationally in education, particularly in the Basic Education Development Index (IDEB), although it continues to be marked by substantial social disparities.

METHOD OF ANALYSIS

To analyze the relationship between public spending and municipal development levels, discriminant analysis was employed, a multivariate technique used to identify the variables that best differentiate previously established groups and to classify observations into these groups. In this study, municipal public expenditures per capita constitute the discriminating variables, while the statistical groups formed from the distribution of the IFDM represent the grouping variable.

In the discriminant analysis, municipalities were distributed into four groups (Table 1) using a categorization procedure adapted from Barroso et al. (2022), a study that also employed the IFDM as a grouping variable in analyzing the relationship between public spending and municipal development.



Table 1 | Group intervals of the FIRJAN Index

IFDM 2014/2015/2016	Class	Absolute Frequency (municipalities)	Relative Frequency (%)
Group 1	$\leq 0,5914$	14	7,82
Group 2	0,5915-0,6676	102	56,98
Group 3	0,6677-0,7438	53	29,61
Group 4	$\geq 0,7439$	10	5,59

Source: Research results, 2023.

To operationalize the discriminant analysis, four groups were formed from the distribution of the IFDM among municipalities in Ceará, according to the intervals presented in Table 1. The categorization strategy was based on the approach of Barroso et al. (2022), who also used IFDM groups to apply discriminant analysis. It should be emphasized that these groups serve a statistical purpose and do not replace the official development ranges established by FIRJAN (2018), which are used as a reference for interpreting the indicator.

According to Field (2009), discriminant analysis seeks to identify linear combinations of discriminating variables capable of maximizing separation among previously defined groups. The technique therefore makes it possible to assess which variables contribute most to group differentiation. For this purpose, measures and tests such as Wilks' Lambda, canonical correlation, and eigenvalues are used (Fávero & Belfiore, 2017). The procedure involves the relationship between the dependent variables and group membership. Discriminant analysis is a statistical technique that identifies the variables with the greatest prominence in discriminating among groups; for this purpose, several statistics, including Wilks' Lambda, canonical correlation, and eigenvalues, are generated (Fávero & Belfiore, 2017).

The application of discriminant analysis requires an assessment of assumptions related to the distribution of the data and the behavior of variables across groups. Normality was examined using the Shapiro–Wilk test, whose null hypothesis states that the data follow a normal distribution. Thus, significance values below the adopted level provide evidence for rejecting the normality hypothesis. Assessing this assumption is relevant because substantial departures from normality may affect the estimates and significance tests associated with discriminant analysis.

The homogeneity of variance–covariance matrices across groups was assessed using Box’s M test. In this test, the null hypothesis assumes equality of the groups’ covariance matrices; therefore, failure to reject it provides evidence in favor of meeting this assumption of discriminant analysis. The assessment should be conducted cautiously because the test is sensitive to violations of normality and to sample characteristics.

After assessing the assumptions, the discriminant functions were estimated. The significance of the functions was examined using Wilks’ Lambda, a statistic that assesses the ability of discriminant functions to separate the groups. Lower Lambda values indicate greater differentiation among groups, and statistical significance is used to determine whether the functions effectively contribute to this discrimination.

The contribution of the variables to differentiating development levels was examined using the results of the discriminant functions and their respective coefficients. For municipal classification, Fisher’s classification functions were considered; these use combinations of discriminating variables to assign each observation to the group with which it has the strongest statistical association. This made it possible to assess the model’s classification ability and identify which public expenditure functions are most relevant for differentiating municipalities according to their development levels as measured by the IFDM.

The data used in this study are publicly accessible and come from FINBRA, made available by the Brazilian National Treasury Secretariat (STN), and from the FIRJAN Municipal Development Index (IFDM), made available by FIRJAN. Data processing and statistical analyses were conducted using IBM SPSS Statistics, version 21. The identification of the data sources, study period, variables used, and statistical procedures adopted allows the procedures employed in the study to be replicated.

RESULTS AND DISCUSSION

DESCRIPTIVE ANALYSIS AND NORMALITY TEST FOR MUNICIPALITIES IN CEARÁ

Table 2 presents the descriptive analysis of the variables for municipalities in Ceará from 2014 to 2016. The highest expenditures were on Education, Health, and Administration. Regarding education, under the 1988 Federal Constitution (BRAZIL, 1988), municipalities must allocate at least 25% of tax revenue, including revenue from transfers, to the maintenance and development of education. In the health sector, municipalities must allocate at least 15% of their revenues.

A high dispersion of per capita public expenditures is observed among municipalities in Ceará, as evidenced by the standard deviations and the range between minimum and maximum values, particularly for Education, Health, and Sanitation. This heterogeneity demonstrates that municipalities exhibit different patterns of public resource allocation. In the case of sanitation, although average per capita expenditure is relatively low, there is substantial variability across municipalities, an important aspect given the relationship of this function with health conditions and the population's quality of life. These results reinforce the importance of analyzing not only the volume of expenditures but also their distribution and their ability to differentiate municipalities according to development levels.

Table 2 | Descriptive statistics for the 179 municipalities in the State of Ceará, 2014–2016

Indicators	Mean	Standard deviation	Minimum	Maximum
IFDM	0,667925	0,052931	0,5153	0,8467
Administration (R\$ per capita)	251,14	152,37	0	1.077,65
Social Assistance (R\$ per capita)	82,83	37,81	0	293,07
Health (R\$ per capita)	497,9	169,06	19,47	1.620,45
Labor (R\$ per capita)	6,52	60,39	0	923,19
Education (R\$ per capita)	812,86	216,87	0	2.555,95
Housing (R\$ per capita)	1,34	6,35	0	90,8
Sanitation (R\$ per capita)	25,67	51,63	0	438,23

Note: Public expenditures are expressed in Brazilian reais per inhabitant (R\$ per capita). The IFDM is a dimensionless index ranging from 0 to 1.

Source: Research results, 2023.



The descriptive analysis reveals substantial differences in the distribution of per capita public spending among municipalities in Ceará from 2014 to 2016. The IFDM had a mean of 0.6679, indicating, on average, a moderate level of municipal development. Among the functions analyzed, Education had the highest average per capita expenditure (R\$ 812.86), followed by Health (R\$ 497.90) and Administration (R\$ 251.14). In contrast, Housing (R\$ 1.34) and Labor (R\$ 6.52) recorded the lowest averages.

The high maximum values and standard deviations, especially for Education, Health, and Administration, reveal heterogeneity in the distribution of expenditures among municipalities. Overall, the results demonstrate relevant differences in municipal public resource allocation patterns. Consistent with Aguiar et al. (2020), a higher volume of public investment does not necessarily translate into greater municipal effectiveness, since outcomes also depend on how resources are managed and allocated.

Table 3 presents the Shapiro–Wilk normality tests for the years under study.

Table 3 | Shapiro–Wilk Normality Test for Expenditures in 2014, 2015, and 2016

Indicators	Shapiro-Wilk		
	Statistic	df	Sig.
Administration 2014	,828	179	,000
Social Assistance 2014	,895	179	,000
Health 2014	,815	179	,000
Labor 2014	,089	179	,000
Education 2014	,767	179	,000
Housing 2014	,362	179	,000
Sanitation 2014	,576	179	,000
Administration 2015	,861	179	,000
Social Assistance 2015	,866	179	,000
Health 2015	,805	179	,000
Labor 2015	,097	179	,000
Education 2015	,907	179	,000
Housing 2015	,154	179	,000
Sanitation 2015	,562	179	,000
Administration 2016	,910	179	,000
Social Assistance 2016	,878	179	,000
Health 2016	,789	179	,000
Labor 2016	,083	179	,000
Education 2016	,907	179	,000
Housing 2016	,250	179	,000
Sanitation 2016	,542	179	,000

Source: Research results, 2023.



The normality of the variables was assessed using the Shapiro–Wilk test, which evaluates the extent to which the data conform to a normal distribution. The results showed significance levels below 5% ($p < 0.05$), leading to rejection of the null hypothesis of normality and indicating that the variables analyzed are not normally distributed. This result is relevant to discriminant analysis because normality of the variables is one of its assumptions, and its violation must be considered when interpreting the results.

A similar result was observed by Barroso et al. (2022), the methodological reference used in this study, who also applied the Shapiro–Wilk test to public expenditures and found statistical significance, rejecting the normality hypothesis for the Health, Labor, and Education variables.

TEST OF EQUALITY OF GROUP MEANS

The Wilks' Lambda test (Table 4) indicates how strongly an independent variable discriminates among groups; that is, it examines whether the variable means differ across groups. Values closer to 1 indicate greater similarity among the groups and a smaller contribution of the variables to group discrimination.

Table 4 | Tests of equality of group means, 2014–2016

Indicators	Wilks' Lambda	F	df1	df2	Sig.
Administration 2014	,977	1,353	3	175	,259
Social Assistance 2014	,984	,962	3	175	,412
Health	,961	2,383	3	175	,071
Labor 2014	,996	,245	3	175	,864
Education 2014	,978	1,340	3	175	,263
Housing 2014	,913	5,578	3	175	,001
Sanitation 2014	,940	3,719	3	175	,013
Administration 2015	,964	2,149	3	175	,096
Social Assistance 2015	,983	,989	3	175	,399
Health 2015	,847	10,567	3	175	,000
Labor 2015	,976	1,464	3	175	,226
Education 2015	,959	2,510	3	175	,060
Housing 2015	,996	,216	3	175	,886
Sanitation 2015	,876	8,227	3	175	,000
Administration 2016	,980	1,219	3	175	,304
Social Assistance 2016	,988	,701	3	175	,553
Health 2016	,845	10,719	3	175	,000
Labor 2016	,995	,316	3	175	,814
Education 2016	,972	1,657	3	175	,178
Housing 2016	,998	,121	3	175	,948
Sanitation 2016	,906	6,032	3	175	,001

Source: Research results, 2023.



Wilks' Lambda allows the discriminating ability of each variable to be assessed individually. Values closer to 1 indicate greater similarity among group means, whereas lower values suggest greater differentiation. The statistical significance of the test indicates whether the observed differences among group means are statistically significant.

In 2014, only expenditures on Housing ($\Lambda = 0.913$; $p = 0.001$) and Sanitation ($\Lambda = 0.940$; $p = 0.013$) showed statistically significant differences among groups. Although Health had a Lambda of 0.961, its significance level was 0.071, which does not allow rejection of the hypothesis of equal means at the 5% level.

In 2015, the results show greater discriminating ability for Health ($\Lambda = 0.847$; $p < 0.001$) and Sanitation ($\Lambda = 0.876$; $p < 0.001$) expenditures. The remaining functions did not show statistically significant differences among groups. In 2016, Health ($\Lambda = 0.845$; $p < 0.001$) and Sanitation ($\Lambda = 0.906$; $p = 0.001$) again stood out, with Health presenting the lowest Wilks' Lambda in that year.

Considering the three periods jointly, the results indicate that Sanitation had statistically significant differentiating ability in every year analyzed, while Health stood out mainly in 2015 and 2016. Housing was significant only in 2014. Thus, the results do not indicate a single predominant function throughout the period but show a greater relative prominence of Sanitation and Health expenditures in differentiating groups of municipalities according to the IFDM.

BOX'S M TEST OF EQUALITY

The results of Box's M test assess the assumption of equality of the groups' covariance matrices (Table 5).

Table 5 | Box's M Test

2014 test results			2015 test results			2016 test results		
Box's M		300,085	Box's M		1082,646	Box's M		759,308
F	Aprox.	4,319	F	Aprox.	10,327	F	Aprox.	7,243
	df1	56		df1	84		df1	84
	df2	1912,158		df2	3298,733		df2	3298,733
	Sig.	,000		Sig.	,000		Sig.	,000

Source: Research results, 2023.



As shown in Table 5, the results were statistically significant in all three periods analyzed: in 2014, Box's $M = 300.085$ ($p < 0.001$); in 2015, Box's $M = 1,082.646$ ($p < 0.001$); and in 2016, Box's $M = 759.308$ ($p < 0.001$). Therefore, the null hypothesis of equal covariance matrices is rejected, indicating that the homogeneity assumption was not met in any of the three years.

This result should be considered when interpreting the discriminant analysis, particularly because Box's M test is sensitive to departures from normality and differences in group sizes. Because the Shapiro–Wilk test previously indicated non-normality of the variables, the discriminant analysis results should be interpreted cautiously in light of these violations of statistical assumptions.

A similar result was found by Barroso et al. (2022), who also rejected the hypothesis of equal covariance matrices in their analysis of municipalities in São Paulo (Box's $M = 68.541$; $p < 0.001$). The authors emphasized that matrix heterogeneity should be considered when proceeding with discriminant analysis. Thus, both the reference study and the present analysis of municipalities in Ceará identified violations of the assumptions of normality and homogeneity of covariance matrices.

SIGNIFICANCE TEST OF THE DISCRIMINANT FUNCTIONS

Table 6 presents the significance test of the discriminant functions, also analyzed using Wilks' Lambda. Three discriminant functions are identified because the dependent variable has only four categories.

Table 6 | Significance test of the discriminant functions

Test of functions 2014	Wilks' Lambda	Chi-square	df	Sig.
1 through 3	,786	41,536	21	,005
2 through 3	,924	13,681	12	,322
3	,983	3,004	5	,699
Test of functions 2015	Wilks' Lambda	Chi-square	df	Sig.
1 through 3	,688	64,419	21	,000
2 through 3	,919	14,479	12	,271
3	,993	1,207	5	,944
Test of functions 2016	Wilks' Lambda	Chi-square	df	Sig.
1 through 3	,740	51,853	21	,000
2 through 3	,955	7,895	12	,793
3	,985	2,691	5	,748

Source: Research results, 2023.



In all three years analyzed, the set of Functions 1 through 3 was statistically significant: 2014 ($\Lambda = 0.786$; $p = 0.005$), 2015 ($\Lambda = 0.688$; $p < 0.001$), and 2016 ($\Lambda = 0.740$; $p < 0.001$). However, after the first function was removed, Functions 2 and 3 were no longer significant. Thus, the results indicate that the ability to differentiate among groups is concentrated mainly in the first discriminant function, a pattern observed throughout the period analyzed. The lower the Wilks' Lambda value, the greater the difference among group means and, therefore, the greater the estimated function's ability to discriminate among group members.

ANALYSIS OF STANDARDIZED COEFFICIENTS AND THE STRUCTURE MATRIX

Table 7 presents the standardized coefficients, which are discriminant weights and can be used to assess the relative importance of each explanatory variable to the discriminant function. Therefore, explanatory variables with greater discriminating power have larger weights.

Table 7 | Standardized canonical discriminant function coefficients

Indicators	Function 2014			Function 2015			Function 2016		
	1	2	3	1	2	3	1	2	3
Administration	,137	,083	-,695	,022	-,317	-,217	,019	,447	-,956
Social Assistance	,127	-,401	,713	-,268	,511	,547	-,209	-,738	,405
Health	,210	-,666	-,680	,772	,360	-,544	,895	-,352	-,244
Labor	,102	,022	,238	,242	,365	-,185	-,112	,565	,325
Education	,113	,971	,171	,430	-,500	-,347	-,039	,786	,501
Housing	,724	-,022	,125	,104	-,098	,342	,007	,103	,149
Sanitation	,510	,309	,170	,561	-,218	,696	,564	,171	,299

Source: Research results, 2023.

Considering the first discriminant function, Housing had the greatest weight in 2014, while Health stood out in 2015 and 2016. Sanitation also made a relevant contribution in all three periods. These results indicate a greater relative contribution of these expenditures to differentiating groups of municipalities according to the IFDM, without necessarily implying a causal relationship between increased spending and higher municipal development.

Passos et al. (2018) found that the range of factors determining municipal performance on the FIRJAN Fiscal Management Index (IFGF) is broader than those included in its calculation. This is also



evident in Table 7 for the IFDM, in which variables other than Education, Labor, and Health also contribute to differentiating municipalities according to their IFDM levels.

GROUP CLASSIFICATION RESULTS

Table 8 presents the results of classifying municipalities into groups, showing that 59.2%, 63.1%, and 62.0% of observations were correctly classified in 2014, 2015, and 2016, respectively.

Table 8 | Group Classification Results

2014 classification results							
Group		Predicted group membership				Total	
		1	2	3	4		
Original	Count	1	0	14	0	14	
		2	0	95	3	102	
		3	0	42	8	53	
		4	0	7	0	10	
	%	1	0,0	100,0	0,0	0,0	100,0
		2	0,0	93,1	2,9	3,9	100,0
		3	0,0	79,2	15,1	5,7	100,0
		4	0,0	70,0	0,0	30,0	100,0
a. 59.2% of original grouped cases correctly classified.							
2015 classification results							
Group		Predicted group membership				Total	
		1	2	3	4		
Original	Count	1,0	0	14	0	14	
		2,0	0	100	1	102	
		3,0	0	43	9	53	
		4,0	0	4	2	10	
	%	1,0	0,0	100,0	0,0	0,0	100,0
		2,0	0,0	98,0	1,0	1,0	100,0
		3,0	0,0	81,1	17,0	1,9	100,0
		4,0	0,0	40,0	20,0	40,0	100,0
a. 63.1% of original grouped cases correctly classified.							
2016 classification results							
Groups		Predicted group membership				Total	
		1	2	3	4		
Original	Count	1	0	13	1	14	
		2	1	98	3	102	
		3	0	38	10	53	
		4	0	4	3	10	
	%	1	0,0	92,9	7,1	0,0	100,0
		2	1,0	96,1	2,9	0,0	100,0
		3	0,0	71,7	18,9	9,4	100,0
		4	0,0	40,0	30,0	30,0	100,0
a. 62.0% of original grouped cases correctly classified.							

Source: Research results, 2023.



The results show correct classification rates above 59% in all three periods analyzed: 59.2% in 2014, 63.1% in 2015, and 62.0% in 2016. The best classification performance was observed in 2015. These results indicate that the model has classification ability, although they should be interpreted cautiously in light of the previously identified violations of the assumptions of normality and homogeneity of covariance matrices.

By comparison, the study by Barroso et al. (2022) reported an overall correct classification rate of 28.6% for the 607 municipalities in the state of São Paulo and a classification-model accuracy rate below 42%, indicating generally low predictive performance.

FINAL CONSIDERATIONS

This study analyzed the relationship between municipal public spending and the development levels of municipalities in Ceará, as measured by the IFDM, from 2014 to 2016. The results revealed substantial heterogeneity in the distribution of public expenditures, with the highest average per capita spending on Education and Health and the lowest values in functions such as Labor, Housing, and Sanitation.

The discriminant analysis showed that Sanitation had a significant ability to differentiate among groups in all three years, while Health stood out in 2015 and 2016 and Housing in 2014. Taken together, the results indicate that the volume of the public expenditures analyzed, considered in isolation, has limited ability to differentiate municipalities according to their development levels, suggesting that other socioeconomic and institutional factors, as well as factors related to the efficiency of the application of resources, should also be considered.

The study has several limitations, including the unavailability of information for some municipalities in FINBRA, the time lag inherent in the publication of the IFDM, substantial skewness in some expenditure functions, and the violations of the assumptions of normality and homogeneity of covariance matrices identified in the statistical tests. These characteristics call for caution when interpreting and generalizing the results. Future studies should extend the analysis period, incorporate additional socioeconomic and fiscal variables, and use complementary methods to assess the robustness of the associations between public spending and municipal development.



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