
EVALUATION OF THE SOCIAL ECONOMIC INDICATORS OF THE MUNICIPALITIES OF THE SÃO PAULO STATE GROUPS 1, 2 AND 3 WITH THE USE OF MULTIVARIATE ANALYSIS OF VARIANCE

ARTIGO – ADMINISTRAÇÃO PÚBLICA

Maria Aparecida Gouvêa

*Associate Professor, Department of Business Administration, University of São Paulo School of Economics, Business Administration and Accounting (FEA-USP)
Professor, Statistics and Research Methodology, Department of Business Administration, FEA-USP – São Paulo-SP, Brazil
E-mail: magouvea@usp.br*

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Patrícia Siqueira Varela

*Master of Controllershship and Accounting, University of São Paulo School of Economics, Business Administration and Accounting (FEA-USP)
Doctoral student, Controllershship and Accounting program, FEA-USP – São Paulo-SP, Brazil
E-mail: psvarela@usp.br*

Milton Carlos Farina

*Master of Business Administration, Escola de Administração de Empresas de São Paulo, Fundação Getulio Vargas (FGV)
Doctoral student, Administration program, University of São Paulo School of Economics, Business Administration and Accounting (FEA-USP)
Professor and coordinator, Information Systems, Statistics, and Actuarial Sciences programs, Centro Universitário Capital – Unicapital – São Paulo-SP, Brazil
E-mail: milton_farina@uol.com.br; estatística@unicapital.edu.br*

ABSTRACT

This article is part of an extensive study that deals with the statistical analysis of several groups of municipalities. The objective of this study is to ascertain whether the mean per capita values of transfers from the Municipalities Participation Fund (Fundo de Participação dos Municípios, FPM), the state Tax on the Circulation of Goods and Services (ICMS) quota, and tax revenue are statistically different among the municipalities of the state of São Paulo, classified by the State Social Responsibility Index into municipalities with high economic and social indicators (group 1), municipalities with high wealth and medium/low social indicators (group 2), and municipalities with low wealth and high/moderate social indicators (group 3), based on multivariate analysis of variance. We found that the Tax Revenue variable had the highest mean difference among the three groups. We may state that, for the three groups analyzed, the ICMS quota has provided benefits to group 1 in terms of resources available for social investments. The distribution of FPM resources, in turn, is contributing effectively to creating equitable conditions for municipalities in the state.

Key words: *Public Revenues, São Paulo State Social Responsibility Index, Multivariate Analysis of Variance.*

AValiação DE Indicadores Socioeconômicos Dos Grupos 1, 2 E 3 DE Municípios Paulistas Com O Uso Da Análise Multivariada De Variância

RESUMO

Este trabalho faz parte de um amplo estudo que combina diversos grupos de municípios paulistas, os quais são analisados mediante técnicas estatísticas. O trabalho objetivou indicar se as variáveis valores *per capita* de transferência do Fundo de Participação dos Municípios (FPM), quota-parte do Imposto sobre Circulação de Mercadorias e Serviços (ICMS) e Receita Tributária arrecadada têm médias estatisticamente diferentes entre os municípios paulistas caracterizados pelo Índice Paulista de Responsabilidade Social (IPRS) como municípios com altos índices econômicos e sociais (grupo 1), municípios com alto índice de riqueza e médios/baixos índices sociais (grupo 2) e municípios com baixo índice de riqueza e altos/médios índices sociais (grupo 3), com base na análise multivariada de variância. Foi observado que a variável Receita Tributária possui a maior diferença de média entre os três grupos. É possível dizer que, para estes grupos analisados, o grupo 1 tem sido beneficiado pela Quota-parte de ICMS com a disponibilização de recursos para investimentos na área social. A distribuição do FPM, por sua vez, está contribuindo de forma efetiva para tornar as condições dos municípios mais equitativas.

Palavras-chave: Receitas Públicas, Índice Paulista de Responsabilidade Social, Análise Multivariada de Variância.

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RESUMEN

Este trabajo es parte de un amplio estudio que combina varios grupos de municipios paulistas, que son analizados mediante técnicas estadísticas. El trabajo tuvo como objetivo indicar si las variables valores per capita de transferencia del Fondo de Participación de los Municipios (FPM), cuota-parte del Impuesto sobre Circulación de Mercaderías y Servicios (ICMS) y Ingreso Tributario recogido tienen promedios estadísticamente diferentes entre los municipios paulistas caracterizados por el Índice Paulista de Responsabilidad Social (IPRS) como municipios con altos índices económicos y sociales (grupo 1), municipios con alto índice de riqueza y medianos/bajos índices sociales (grupo 2) y municipios con bajo índice de riqueza y altos/medianos índices sociales (grupo 3), basado en el análisis multivariado de varianza. Fue observado que la variable Ingreso Tributario posee la mayor diferencia de media entre los tres grupos. Es posible decir que, para estos grupos analizados, el grupo 1 ha sido beneficiado por la Cuota-parte del ICMS con la disponibilidad de recursos para inversiones en el área social. La distribución del FPM, a su vez, está contribuyendo de forma efectiva para hacer las condiciones de las ciudades más equitativas.

Palabras-clave: Ingresos Públicos, Índice Paulista de Responsabilidad Social, Análisis Multivariada de Varianza.

1. INTRODUCTION

In the last decades, one of the core issues of State reform is the radical change in the rule concerning the social division of labor, that is, the responsibility taken by municipalities and by the private sector in the production of goods and services, which were considered a duty of the State (OSZLAK, 1998, p. 53).

In the specific case of the municipalities, decentralization has been the strategy of choice both for the State reform process and for the redemocratization of the country, making possible the transfer of power, resources and attributions to local governments.

Local governments were the major beneficiaries of the tax decentralization started in the second half of the 1970s and reinforced by the 1988 Constitution, especially due to the federal and state transfers they received. The federal Municipalities Participation Fund (FPM) and the state Tax on the Circulation of Goods and Services (ICMS) quota are the main transfers made to the municipalities.

To the majority of municipalities, constitutional transfers represent the most significant source of funding for their expenses. Bovo (2001, p. 114) states that, for more than 3.000 out of the 5.550 or so municipalities in the country, constitutional transfers, especially the FPM, make up 90% of their resources.

It must also be stressed that the main municipal taxes – the Tax on Services (ISS) and the Tax on Urban and Territorial Property (IPTU) – show greater power of collection in medium-sized and large municipalities. Moreover, in the criteria for the transfer of the ICMS tax quota belonging to the municipalities (25% of the total collected by the State), the intensity of economic production exerts great influence – that is, the transferred values are directly related to the potential for wealth generation at the municipal level. “[...] the predominant logic underlying this tax is to reward economically successful municipalities.” (ABRUCIO; COUTO, 1996, p. 44).

The criteria for distribution of the resources which make up the FPM has a significant impact on the finances of small municipalities. According to Subsection II, art. 161, of the 1988 Federal Constitution, is the duty of the complementary law

to establish rules on how FPM resources must be distributed, seeking a socio-economical balance between municipalities. Currently, the main criterion for FPM allotment is the size of the population. However, one may inquire whether this criterion alone would be enough to achieve the socio-economical balance intended, as the differences between the municipalities are not restricted to this factor exclusively, but are also dependent on economic terms, urbanization levels, physical conditions, capacity for tax collection, and other factors, besides proper resource management by the municipality.

Analysis of the reality of local governments in São Paulo state under the lens of the São Paulo State Social Responsibility Index (IPRS) shows groups of municipalities with different combinations of wealth levels, longevity indicators, and education indicators (FUNDAÇÃO SEADE, 2005a). The present study focuses on three groups of municipalities with discrepancies in wealth levels and social indicators. One hypothesis raised is that the criteria for FPM distribution influence the capacity for social investments of the groups by being a means of income redistribution.

Based on the premise that larger municipalities have higher economic output and, consequently, collect more taxes and are given larger ICMS transfers, FPM transfers should favor small municipalities. Thus, the following research question was established:

Are the mean values of the variables (i) per capita tax revenue, (ii) per capita ICMS quota, and (iii) per capita FPM different between groups of municipalities within the state of São Paulo as defined by the IPRS?

The aim of this study is to ascertain whether some of the groups of São Paulo state municipalities as defined by the IPRS have different mean per capita values of FPM transfers, ICMS quotas, and collected tax revenue. Furthermore, we will attempt to determine the relationship between these variables as a set and the classification of the municipalities given by the IPRS.

2. THEORETICAL BACKGROUND

This section presents the theoretical framework on which the study is based.

2.1. Municipalities Participation Fund - FPM

The main feature of the Brazilian experience concerning the decentralization process was the lack of coordination, which, in turn, brought consequences such as an increase in inter- and intra-regional socio-economical inequalities and inadequate distribution of fees to the three federal levels by the Federal Constitution of 1988, which implies the coexistence of gaps or an overlapping of functions (AFFONSO, 1996). This was due to the fact that the decentralization process, which began in the late 1970s in the context of redemocratization, was commanded by the states and, mainly, by the municipalities, not by the federal government (AFFONSO, 1996).

The Constitution's lack of definition on the division of competencies notwithstanding, states and municipalities ended up taking on new responsibilities due to an increase in the volume of available resources coming from fiscal decentralization, decreasing federal expenses and pressure from civil society (AFFONSO, 1996).

According to Abrucio and Couto (1996), municipalities began to face a double challenge: to ensure basic social welfare conditions for their populations (welfare function) and to promote the economical development based on actions at the local level, in partnership with civil society (development function).

To the authors, facing these challenges would depend on three parameters: the federal fiscal structure, the socio-economical differences between the municipalities, and the characteristic political dynamic of municipal government (ABRUCIO; COUTO, 1996).

The fiscal decentralization process, which began in the 1970s, was reinforced by the Federal Constitution of 1988, having as its main consequences an increase in the tax-levying power of subnational unities within their own jurisdictions and an increase in the availability of non-earmarked resources for municipalities, as a result of constitutional transfers, including the Municipalities Participation Fund (FPM) and participation in ICMS revenue (ABRUCIO; COUTO, 1996).

Although local governments had increased their fiscal potential, this process did not occur in a homogeneous fashion among Brazilian

municipalities. Bovo (2001) points out that the main source of tax for the municipalities are the Tax on Services Rendered (ISS), the Municipal Real Estate Tax (IPTU) and the Property Transfer Tax (ITBI), which are taxes with better collecting potential in medium-sized and large municipalities, as urban property and the service sectors in small municipalities, which are eminently rural, are of little significance.

“The insufficiency of available redistributive tools, especially at the municipal level, is an aggravating circumstance” (ABRUCIO; COUTO, 1996, p. 43). Resources transferred by the Union and by the states to municipalities should serve as a device for generating equitable conditions to allow Brazilian municipalities to face the new social responsibilities. However, this is not always the case, as with the ICMS quota, which rewards economically successful municipalities (ABRUCIO; COUTO, 1996, p. 44).

Thus, municipal performance in the social area is highly influenced by the redistributive efficiency or inefficiency of the Municipality Participation Fund. The FPM is a constitutional transfer made by the Union to the municipalities, which comprises 22.5% of the Tax Revenue (IR) collected and the Tax on the Industrialized Products (IPI).

The transfer of the resources that make up the FPM is divided into three parts:

- 10% are distributed to the state capitals according to coefficients that take into account the inverse of per capita income and the population of the State.
- 86.4% are distributed to municipalities in the countryside, according to coefficients defined by population brackets in Decree-Law 1881/81.
- 3.6% are destined to the Reserve Municipalities Participation Fund, which are distributed between the municipalities in the countryside with a coefficient of 4.0 until 1998 and 3.8 from fiscal year 1999 onwards. Reserve resources are a complement to the values received according to the prior item, and the distribution occurs according to the coefficients of the inverse per capita income and the population of the State.

In all three cases, the participation of each municipality is given by the division of its

coefficient by the sum of the coefficients of the Brazilian municipalities within each group.

According to Section 4, art. 91 of Decree-Law no. 1881/81, the upper and lower limits of the population brackets will be readjusted when, according to census data, the total population of the country is shown to have had a percentage increase based on the previous census.

According to Section 1, art. 1 of Complementary Law 91/97, municipality participation quotas will be readjusted yearly based on official population data obtained by the Brazilian Institute of Geography and Statistics (IBGE). However, Section 2 of the same article establishes that the 1997 FPM participation coefficients will remain unchanged for

the municipalities which had their coefficients reduced due to IBGE estimates. The added earnings resulting from this decision have been gradually eliminated since 1999, and are expected to be totally eliminated by 2008.

Abrucio and Couto (1996) view the criteria for the distribution of the FPM as inefficient, as they consider the income factor only for larger cities and state capitals.

In other municipalities, the main criterion for FPM resource distribution is the size of the population, with coefficients of participation being established by population brackets instead of a specific number, as can be seen in Table 1.

Table 1: Individual FPM Participation Coefficients

Population brackets (1980)	Coefficient	Population brackets (1980)	Coefficient
10,188 or less	0.6	61,129 to 71,316	2.4
10,189 to 13,584	0.8	71,317 to 81,504	2.6
13,585 to 16,980	1	81,505 to 91,692	2.8
16,981 to 23,772	1.2	91,623 to 101,880	3.0
23,773 to 30,564	1.4	101,881 to 115,464	3.2
30,565 to 37,356	1.6	115,465 to 129,048	3.4
37,357 to 44,148	1.8	129,049 to 142,632	3.6
44,149 to 50,940	2.0	142,632 to 156,216	3.8
50,941 to 61,128	2.2	over 156,216	4.0

Source: Adapted from Decree-Law no. 1881/81, Article 1.

The range of the brackets and the fact that coefficients do not increase in the same proportion as the population brackets do is the cause of a large difference between municipalities if the per capita FPM is considered, benefiting small municipalities.

Data from the National Treasury Department (STN, 2007) show that 86 out of 516 São Paulo state municipalities received the amount of R\$ 2,176,261.73 in FPM transfers in 2004. Of these 86 municipalities, the smallest one (Nova Castilho), with a population of 1020, received an annual per capita FPM of R\$ 2. The largest municipality, Valentim Gentil, with a population of 9,990, received an annual per capita FPM of R\$ 217.84. The same FPM amount is given to municipalities with very different population sizes, but within the same population bracket. These disparities occur for all values of FPM revenue within the various brackets.

Apart from the city of São Paulo, the municipality of Osasco was given the highest amount of total FPM, R\$ 28,212,304.42; concerning the per capita distribution, it was given one of the lowest amounts, R\$ 40.54, because the amount from the FPM does not increase in the same proportion of the population.

There is a tendency for larger municipalities to receive lower per capita FPM transfers. There are also differences in the fiscal capacity of the municipalities and in the management of the benefits coming from the distribution of the ICMS quota.

2.2. São Paulo State Social Responsibility Index

In the public sector, several initiatives and experiences in the use of social indicators can be observed. The best known is from the United Nations (UN), which, during the 1990s, created the Human Development Index (HDI), introducing in

its conception the variables of longevity and education, as well as income, to compare national development.

Other experiences have appeared since the creation of the HDI, as is the case of the São Paulo State Social Responsibility Index (IPRS). This index was constructed by the State Data Analysis System Foundation (SEADE), a São Paulo state government organization, in response to a request from the leaders and counselors of the Forum São Paulo – Século XXI for the construction of indices that would allow the continuous detection of progress – or not – of the development of the São Paulo state municipalities towards a much-desired society widely discussed in the Forum.

The objective of the IPRS is the classification of São Paulo state municipalities regarding the quality of life of their inhabitants. In order to achieve this, the three dimensions within the HDI (income, longevity and education) were taken into account,

although using other variables more appropriate to the municipal reality. The initial idea was to use indicators which could evaluate not only the results of the efforts made by the public power in favor of local-level development, but the level of participation and control of the civil society over those actions as well.

To obtain this index, São Paulo state municipalities were classified by cluster analysis into groups with similar features of wealth, longevity and education, and named as follows: (1) hub municipalities, (2) economically dynamic and low social development, (3) healthy and low economic development, (4) low economical development and undergoing social transition, and (5) low economic and social development.

The variables considered in each of the IPRS dimensions and the corresponding weighting structure are summarized in Table 2.

Table 2: Summary of selected variables and weighting structure

Dimension	Selected variables	Contribution towards indicator
Municipal wealth	Residential power consumption	44%
	Power consumption in the agriculture, commerce, and service sector	23%
	Mean compensation of registered and public sector employees	19%
	Per capita fiscal added value	14%
Longevity	Perinatal mortality	30%
	Child mortality	30%
	Mortality in the 15-to-39-year age bracket	20%
	Mortality among those 60 years or older	20%
Education	Percentage of youths 15 to 17 years old who graduated elementary school	36%
	Percentage of youths 15 to 17 years old with at least four years' formal education	8%
	Percentage of youths 18 to 19 years old who graduated secondary school	36%
	Percentage of children 5 to 6 years old who attend preschool	20%

Source: FUNDAÇÃO SEADE, 2005b.

The synthetic indicator of each dimension is the result of the combination of the variables, and the weight of each variable in combination was obtained through factor analysis. To make comparison between the municipalities easy, the indicator was turned into a scale from 0 to 100.

SEADE Foundation synthesized the indicators of municipal wealth, longevity and education into a categorical scale, which express the “general pattern” of the created groups. The synthesis of the criteria for the creation of the groups of municipalities by the IPRS is described in Table 3.

Table 3: IPRS group formation criteria

Groups	IPRS group formation criteria	Description
Group 1	High wealth, high longevity, medium education High wealth, high longevity, high education High wealth, medium longevity, medium education High wealth, medium longevity, high education	High wealth level and good social indicator levels
Group 2	High wealth, low longevity, low education High wealth, low longevity, medium education High wealth, low longevity, high education High wealth, medium longevity, low education High wealth, high longevity, low education	High wealth levels, but unable to reach good social indicator levels
Group 3	Low wealth, high longevity, medium education Low wealth, high longevity, high education Low wealth, medium longevity, medium education Low wealth, medium longevity, high education	Low wealth level, but good social indicator levels
Group 4	Low wealth, low longevity, medium education Low wealth, low longevity, high education Low wealth, low longevity, medium education Low wealth, high longevity, low education	Low wealth levels and medium longevity and/or education indicators
Group 5	Low wealth, low longevity, low education	Financially and socially disadvantaged

Source: FUNDAÇÃO SEADE, 2005b.

Table 3 shows different combinations of municipal levels of wealth and social indicators. Three groups stand out: group 1 for its high level of municipal wealth and good social indicators; group 2 for high levels of wealth and average or low levels of social indicators; and group 3, despite its low level of wealth, shows good performance in the social context.

Group 1 is made up of large São Paulo state municipalities and important regional hubs located along the main highway axes of the state, and in 2002 was home to 50% of the state population (nearly 19 million people). Group 2, with a population of more than 10 million, contains municipalities located mainly in the metropolitan areas and their surroundings, and are characterized by industrial activities, gated communities, and potential for tourism. Group 3 comprised 201 small and medium municipalities with an estimated population of 3 million in 2002. The small size of the population in group 3 is, theoretically, a factor which should make the tools of decentralization in health and education more transparent and efficient.

Therefore, the question arises of whether government transfers, especially the FPM, influence the capacity of the municipalities, in the three groups, of making social investments. However, it is

important to emphasize that social indicator patterns are not dependant exclusively on funding conditions. Quality of spending and environmental factors, such as the seasonality of the population of tourist destinations, are determinant factors of public policy performance as well.

3. METHODS

The following section describes the methods of this study.

3.1. Population

The target population concerns the capital and the São Paulo state countryside municipalities belonging to groups 1, 2, and 3. The particularities of groups 1, 2 and 3 suggest the possibility of a distinct distribution of the FPM, ICMS quota and tax revenue. This led to an interest in the analysis of these three groups.

3.2. Data collection

Data were collected on four variables: FPM, ICMS quota, Tax revenue, and IPRS municipality groups.

Data were obtained from two sources: 2002 SEADE Foundation website data (2005b) on all São

Paulo state municipalities, that is, all 645 municipalities of the state; and 2007 National Treasury Department data on 518 São Paulo state municipalities.

3.3. Prior treatment of data

To confirm the significance of the per capita tax revenue values of the three groups studied, the multivariate analysis of variance technique was employed.

The independent variable is named *iprs*, which identifies the municipalities from groups 1, 2, and 3 of the IPRS, and the dependant variables are the per capita values of FPM transfers, ICMS quota and tax revenue.

Some premises inherent to the multivariate analysis of variance must be checked. Such suppositions can be summarized into: (1) absence of outliers, (2) normality of the dependent variables, (3) absence of multicollinearity between the dependent variables, and (4) equality of variance and covariance matrices.

The following section presents an investigation of missing data and our verification of these suppositions.

3.3.1. Treatment of missing data

Regarding missing data, we must focus on the reasons which led to their being missing in the first place (HAIR JR. et al., 2006, p. 49). There were no National Treasury Department data on all 645 São Paulo State municipalities, only on 518. According to Hair Jr. et al. (2006), the simplest and more straightforward approach is to include only complete data observations in the study, which was our chosen approach.

3.3.2. Treatment of outliers

Of the 518 municipalities, two had wrong data, with excessively discrepant FPM values (Bento de Abreu and Ouroeste), suggesting errors in the data available on the National Treasury Department website (STN, 2007). Therefore, treatment of outliers was made on the 516 remaining municipalities. The advantage of analyzing the whole set is that in this way the variables from public revenues of each municipality are compared

to the observations on all São Paulo state municipalities, as the IPRS classification covers the whole state.

The disadvantage lies in the fact that if the analysis was made in respect of groups 1, 2, and 3, there would be fewer outliers. This restrictive treatment, however, could raise doubts concerning its legitimacy in the use of multivariate techniques.

The chosen detection method for outliers was the Mahalanobis distance, which is recommended in the multivariate context (HAIR JR. et al., 2006). For the simultaneous focus on the three variables of per capita public revenues in this study, a centroid was calculated and the Mahalanobis distance of each municipality in relation to this centroid. Each distance is then compared to a critical value obtained in the Student's *t* distribution. The municipalities of Paulínia, Águas de São Pedro and São Paulo were considered outliers, as their distances exceeded this critical value. After the treatment of missing data and outliers, the total sample was narrowed down to 513 municipalities. Group 1 has 61 municipalities, group 2 has 70 municipalities and group 3, 154 municipalities, for a total of 285 municipalities in the three groups.

The three variables for per capita public revenue were also standardized using the Z-scores method.

3.3.3. Normal Distribution

For the standardized per capita dependent variables subjected to the normal logarithm, a non-parametric Kolmogorov-Smirnov goodness-of-fit test was applied. A transformation to the natural logarithm was necessary to obtain better fit to the normal distribution. The per capita FPM, ICMS and tax revenue variables obtained the following significance levels: 0.156, 0.523, and 0.294 respectively, which reinforces the goodness of fit to the normal curve of the 3 variables. The notations *fpmt*, *icmst* and *rect* that were used from this section on correspond to the per capita variables standardized and subjected to the natural logarithm.

3.3.4. Multicollinearity

We will first check the correlation between the pairs of variables on Table 4:

Table 4: Group correlation matrix

	<i>fpmt</i>	<i>icmst</i>	<i>rect</i>
<i>fpmt</i>	1.000	0.386	-0.631
<i>icmst</i>	0.386	1.000	-0.167
<i>rect</i>	-0.631	-0.167	1.000

Source: Authors.

The correlations which can be considered significant in modulo are *fpmt* with *icmst* (0.386) and *rect* with *fpmt* (-0.631). The results show that federal resources (*fpmt*) and state resources (*icmst*) are positively correlated, that is, municipalities which receive more resources from the Union also receive more resources from the state and vice-versa. However, municipalities with more municipal resources (*rect*) receive fewer federal resources (*fpmt*).

The negative correlation between *icmst* and *rect* indicates that state resources (*icmst*) do not reward

economically successful municipalities, although this correlation is not very high in modulo (-0.167).

The use of multivariate analysis of variants (MANOVA) presumes that the dependent variables are correlated. Thus, a certain level of multicollinearity between them is desired. Bartlett's test and the Roy-Bargman stepdown F-test were used in the evaluation of intensity of multicollinearity. Table 5 presents the results of Bartlett's test.

Table 5: Bartlett's sphericity test

Chi-square	Degrees of freedom	Descriptive level
131.989	5	0.000

Source: Authors.

Table 5 shows rejection of hypothesis that the correlation matrix of the three variables presented in Table 4 is equal to the identity matrix. Thus, the use of MANOVA is justified.

Table 6 presents the results of the Roy-Bargman stepdown F - test.

Table 6: Roy-Bargman stepdown F-test

Variables	Mean square between groups	Mean square within groups	Stepdown F	G. L. Between	G. L. Within	Stepdown F significance
<i>fpmt</i>	64.108	0.688	93.232	2	282	0.000
<i>icmst</i>	18.203	0.734	24.802	2	281	0.000
<i>rect</i>	12.742	0.513	24.845	2	280	0.000

Source: Authors.

Table 6 shows that, for each variable, the hypothesis that its mean is the same in the three groups is rejected when the other variables are included. So, each of the three dependent variables has features that distinguish groups 1, 2 and 3. Therefore, the intercorrelation between the three variables does not characterize a high level of multicollinearity, supporting the use of MANOVA.

3.3.5. Variance and Covariance Matrix Equality

According to Table 7, Box's M test presented a significance of 0.040 – that is, the null hypothesis is rejected, considering the 0.05 level, but not strongly. The expectation in this test is the non-rejection of the null hypothesis, which states the equality of the three groups' covariance matrices. Authors such as Hair et al. (2006, p. 409) clarify that this test is extremely sensitive to sample

fluctuation and size. When the result practically straddles the border between hypothesis acceptance and rejection, the authors believe that the study did not stray far from the supposition established for

correct application of the technique. Thus, the result of this test does not negate the use of MANOVA.

Table 7: Results of Box's M test

Box's M	9.707
Approximate F	1.701
df1	12
df2	156466
Significance	0.040

Source: Authors.

To test the hypothesis that the variance of each variable was homogeneous across all three groups, we used Levene's test. Table 8 shows that variances

may be considered equal only with significance levels that are more restrictive (lower than 1.3%).

Table 8: Levene's test

	Levene test	
	F	Sig.
fpmt	3.834	0.023
icmst	3.192	0.043
rect	5.986	0.013

Source: Authors.

Therefore, generally speaking, all premises for application of MANOVA were met.

This section will show some univariate and multivariate statistics.

4. ANALYSIS OF RESULTS

4.1. Descriptive statistics

The core MANOVA question is as follows: do variables fpmt, icmst, and rect, considered simultaneously, have different means in groups 1, 2, and 3?

This section will show some univariate statistics.

Table 9 below shows the descriptive statistics relative to means and standard deviations in each group.

Table 9: Descriptive Statistics

	Variables	Mean	SD
Group 1	fpmt	-0.8290	0.9346
	icmst	0.4726	0.9788
	rect	0.8253	0.7878
Group 2	fpmt	-0.9818	0.7324
	icmst	-0.2891	1.1807
	rect	1.1015	0.9404
Group 3	fpmt	0.4312	0.8264
	icmst	0.1243	0.8568
	rect	-0.2913	0.6774

Source: Authors.

The negative means of the fpmt variable in groups 1 and 2 suggest that lower values of this revenue were transferred to wealthier

municipalities. Wealth is proved by the positive means of rect. The opposite is found with means in group 3, which comprises low-wealth

municipalities, that is, it showed a positive *fpmt* mean and a negative *rect* mean.

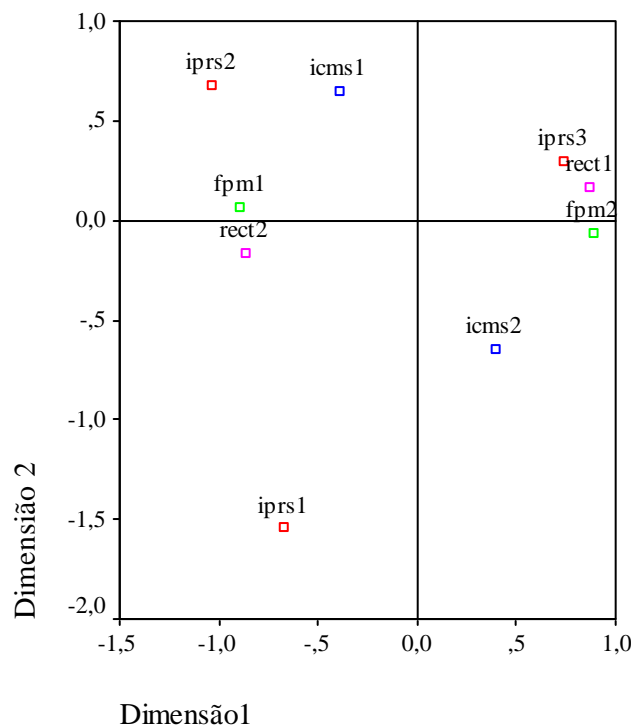
Notably, standard deviation values were very high, showing great heterogeneity within each group.

4.2. Multivariate analysis

4.2.1. Variable mapping

Seeking to visualize the relationship between the variables and the three groups, we created two ranges for each variable and conducted multiple correspondence analysis. Creation of these ranges made the variables non-metric, a requirement for the use of this technique. Chart 1 shows this relationship.

Chart 1: IPRS and public revenues



Source: Authors.

Suffixes 1 and 2 correspond to ranges 1 and 2, with code 2 corresponding to the highest values of each variable. For *iprs*, groups 1 and 2 had the highest *rect* and lowest *fpmt* values – the opposite of group 3. This chart suggests that the variables, when considered simultaneously, have the power to distinguish the three study groups.

4.2.2. Multivariate test for equality of means

The test's statistical hypothesis (H_0) corresponds to the equality of the vector of the means of the three dependent variables along the three groups (independent variable).

$$H_0: \begin{bmatrix} \mu_{fpmt_1} \\ \mu_{icmst_1} \\ \mu_{rect_1} \end{bmatrix} = \begin{bmatrix} \mu_{fpmt_2} \\ \mu_{icmst_2} \\ \mu_{rect_2} \end{bmatrix} = \begin{bmatrix} \mu_{fpmt_3} \\ \mu_{icmst_3} \\ \mu_{rect_3} \end{bmatrix} \text{ versus } H_1: \text{at least one } t \text{ group with mean} \neq$$

Table 10 shows the results of the multivariate test for equality of means.

Table 10: Multivariate test

Test	Value	F	G. L. Entre	G. L. Dentro	F significance	Effect size	Power
Pillai's criterion	0.608	40.942	6	562	0.000	0.304	1.00
Wilks' lambda	0.435	48.254	6	560	0.000	0.341	1.00
Hotelling trace	1.203	55.926	6	558	0.000	0.376	1.00
Roy's largest root	1.114	104.364	3	281	0.000	0.527	1.00

Source: Authors.

Table 10 contains the four multivariate tests most used in MANOVA. The results of each test point to rejection of the null hypothesis, that is, public revenues, when considered as a set, show a highly statistically significant difference among the three groups of municipalities studied.

The statistical power obtained for each test was 1.00, showing that group sizes and group effect sizes on dependent variables were sufficient to ensure that the statistical differences detected were effective.

After concluding that the three public revenue variables differed as a set in all three groups studied, we examined each variable separately to assess its distinguishing value for each group. To test the equality of means for each variable in the three groups, we used the F test, available in MANOVA, the statistic of which is the same as that obtained in univariate ANOVA. As shown in Table 11, we found that means could be considered different with a significance level of 0.05.

Table 11: F test

	F test	
	F	Sig.
fpmt	93.232	0.000
icmst	10.155	0.000
rect	96.771	0.000

Source: Authors.

The highest value for the F-test statistic was found for variable rect. Thus, rect is the variable most able to distinguish the three groups, followed closely by the fpmt variable.

Table 12 below shows the group that most differs from the others for each dependent variable, according to Scheffé's post-hoc test for multiple comparisons, performed due to rejection of the null hypothesis in all three study groups.

Table 12: Descriptive statistics

	Group 1	Group 2	Group 3
fpmt			X
icmst		X	
rect			X

Source: Authors.

"X" marks the group whose mean is statistically different from the means of the other two groups for each public revenue variable.

In group 3, the highest FPM transfers were consistent with what is expected for making funding conditions for this group more equitable as compared to those of the two other groups.

5. CONCLUSIONS

Our interest in comparing the revenues of specific groups of municipalities in the state of São Paulo arose from the existence of different economic and social levels, which led to the question of whether government transfers – particularly FPM transfers – are contributing to the generation of equitable conditions for spending on public services.

The volume of resources available at the local level for use in socioeconomic projects depends on the fiscal capacity of each municipality and on existing mechanisms for the redistribution of resources. Given the greater capacity of larger municipalities to collect revenue independently at the municipal level, due to the characteristics of municipal taxes, criteria for municipal participation towards federal and state revenues are expected to be effective in terms of revenue redistribution. However, as our theoretical review and analysis of empirical data showed, this is not always the case.

Mean per capita public revenues were different across groups 1, 2, and 3. The former had higher per capita tax revenues and lower per capita FPM values.

Analysis of the relationship between variables showed that the greater the fiscal capacity of a municipality, the lower its per capita FPM revenue and the higher its per capita tax revenue will be. Testing for equality of means showed that the per capita tax revenue variable was most capable of distinguishing among the three groups of municipalities.

We may also say that, in the three groups studied, FPM distribution criteria are contributing towards the effective use of available revenues.

FPM criteria contribute towards the treatment of horizontal inequalities, that is, the generation of equitable conditions for municipalities to promote social welfare within their communities. However, this will depend on their capacity to turn available public resources into public goods adapted to the needs of the population – which is considered one of the greatest advantages of decentralized systems – and on how each municipality carries out its distributive functions. It is important to stress that reducing inequality between municipalities does not

necessarily imply solving the issue of socioeconomic disparities among their citizens.

The poor performance of group 2 in terms of social indicators when compared to groups 1 and 3 cannot be justified merely by the findings of this study. Other variables must also be considered, such as whether the municipality is a tourist destination, whether the municipality is a bedroom community, its internal inequalities, and the quality of public spending. In fact, environmental factors and public spending should be considered in the assessment of public policy results, but this falls beyond the scope of this study.

We cannot state that these results are reproduced in other groups of municipalities in the state of São Paulo or even other municipalities in Brazil, and thus recommend that this analysis be repeated for other select groups of municipalities.

Another suggestion involves the classification of municipalities by the SEADE Foundation. It may be interesting to include not only wealth-generating capacity as a criterion for grouping municipalities, but also the availability of resources for public policies.

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