

Relation between the government transfers, own tax collection and education index of the municipalities of the state of Minas Gerais

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Considering the changes in Brazilian municipalities since the Federal Constitution of 1988, this study sought to verify the relationship between government transfers, own tax collection and the education index of municipalities of the state of Minas Gerais (2009 to 2013). The hypothesis adopted was that a greater financial resources availability would have a positive impact on the municipal education's quality. The study variables were tested using randomized block variance analysis, Spearman's correlation, k-rates clusters' analysis and multiple linear regression. Among the results obtained, the study highlights the lack of connection between the degree of financial autonomy and the investments in education, as well as it finds that the amount of revenues from taxes and the extra percentage of investment do not affect the education index.

Keywords: government transfers; own tax collection; investments in education; municipal education index; municipalities of the state of Minas Gerais.

A relação entre as transferências governamentais, a arrecadação tributária própria e o índice de educação dos municípios do estado de Minas Gerais

Considerando as mudanças proporcionadas aos municípios brasileiros, desde a promulgação da Constituição Federal de 1988, objetivou-se verificar a relação entre as transferências governamentais, a arrecadação tributária própria e o índice de educação dos municípios do estado de Minas Gerais (2009 a 2013), partindo da hipótese de que uma maior disponibilidade de recursos financeiros impactaria positivamente a qualidade da educação municipal. As variáveis do estudo foram testadas por meio da análise de variância em blocos casualizados, correlação de Spearman, análise de *clusters* de k-médias e regressão linear múltipla. Entre as inferências deste estudo, destaca-se a falta de associação entre o grau de autonomia financeira e os investimentos em educação, e o achado de que o quantitativo de receitas tributárias e o percentual adicional de investimento em educação não impactam o índice de educação.

Palavras-chave: transferências governamentais; arrecadação tributária própria; investimentos em educação; índice de educação municipal; municípios do estado de Minas Gerais.

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La relación entre las transferencias gubernamentales, la recaudación de impuestos y el índice de educación de los municipios del estado de Minas Gerais

Considerando que las modificaciones son proporcionadas a los municipios brasileños, desde la promulgación de la Constitución Federal de 1988, que alteró la asignación de recursos públicos a la educación, los municipios brasileños pasaron a recibir más recursos del gobierno, así como aumentar el porcentaje de la asignación municipal invertida en el área de educación. Así, en este estudio se objetivó verificar la relación entre las transferencias gubernamentales, la recaudación de impuestos propia y el índice de educación de los municipios del estado de Minas Gerais (2009 a 2013), partiendo de la hipótesis de que una mayor disponibilidad de recursos financieros impactaría positivamente la calidad de la educación municipal. Las variables del estudio se probaron por medio del análisis de varianza en bloques casualizados, correlación de Spearman, análisis de clusters de k-medias y regresión lineal múltiple. Entre las inferencias de este estudio, se destaca la falta de asociación entre el grado de autonomía financiera y las inversiones en educación, y el hallazgo de que el cuantitativo del aumento de impuestos y el porcentaje adicional de inversión en educación no impactan el índice de educación.

Palabras clave: transferencias gubernamentales; recaudación tributaria propia; inversiones en educación; índice de educación municipal; municipios del estado de Minas Gerais.

1. INTRODUCTION

The enactment of the 1988 Constitution was a landmark for great changes in Brazilian municipalities, which underwent a significant increase in the revenues originated from fiscal transfers from state and federal governments, along with resources earned through municipal tax collection. However, municipalities had to bear the burden of the responsibility to manage those resources and offer basic public services to local population. In the mid-1990's, legislative changes imposed on municipal governments the compulsory requirement to act mainly in elementary and children education, determining the minimum destination of 25% of tax revenues to the provision of educational services.

The political reforms stimulated the decentralization of policies and actions, igniting a strong discussion over their financing (Cruz, 2006). The insufficiency of municipal revenue to meet local problems is a drawback for most Brazilian municipalities, entailing a rise on regional gaps, usually worsened by the diversity of demographic and environmental issues (Galvarro et al., 2009).

The present study aimed at verifying the relationship between fiscal transfers, municipal tax collection and the education index of cities in the state of Minas Gerais, within the period ranging between 2009 and 2013, considering the hypothesis that a greater availability of financial resources would favorably impact the quality of municipal education. Specifically, the study meant to establish a comparison between the municipalities of the state of Minas Gerais, by studying the degree of municipal financial autonomy, investigating possible empirical relations between the main variables covered by this study, and grouping the cities of the state of Minas Gerais into clusters according to their percentage of municipal tax collection.

The sample of the study encompasses all the municipalities of the state of Minas Gerais, subdivided into mesoregions, between 2009 and 2013. The financial information was obtained through the Information System on Public Budget for Education. The website of the Brazilian Institute of Geography and Statistics (IBGE) was also crucial to compose the variables, analyzed through statistical tests of randomized block variance analysis, Spearman correlation, k-rates clusters analysis and multiple

linear regression. In order to compare the educational situation of the cities in the Southeastern area, the Firjan Index for Municipal Development was used — education as an indicator of the quality of public municipal schooling.

2. THEORETICAL REFERENCES

Brazilian federalism emerged as an attempt to decentralize the power, centered around a unitary State (Palotti, 2009), marked by a broad decentralization process and by the creation of a model for intergovernmental relationships (Abrucio, 2005), enabling subnational entities to execute national public policies through transfers of public funds, in order to attend to the basic needs of local population (Cruz, 2006). This distribution of competences throughout the subnational levels is a result of the adoption of fiscal federalism (Silva, 2005).

Brazilian cities were the entities that most benefited from the decentralization ideals introduced by the 1998 constitution, as they became more independent to allocate municipal resources, to fund and manage their revenues (Souza, 2002) and witnessed the broadening of municipal capacity, asserting them greater financial autonomy (Santos, 2003). However, not every city is capable of financially supporting local population, therefore demanding resources from upper entities (Souza and Blumm, 1999).

Those municipal units are provided with revenues arising from three sources: their own tax collection, legal and constitutional transfers, and voluntary or negotiated transfers (Mello, 1993; Postali and Rocha, 2003). Municipal own tax collection is basically derived from municipal taxation, stemming from triggering events such as the rendering of services, urban property ownership and *inter vivos* transfer of property (Santos, 2008), and the charging of special assessment taxes for urban improvement, fares and pension contributions (Mello, 1993). The intergovernmental constitutional or fiscal transfers are directly related to the Brazilian fiscal system, while the voluntary or negotiated transfers derive mostly from agreements settled between the Federal Government and the municipalities (Mello, 1993; Postali and Rocha, 2003).

The intergovernmental fiscal transfers in Brazil represent resources that are relevant to the balance of the municipal public finances (Gonçalves, 2013) and constitute an important political instrument within the scope of fiscal federalism, presenting three potential roles: internalization of indirect benefits into other jurisdictions, fiscal equalization between the jurisdictions, and improvement of the overall fiscal system (Oates, 1999). Massardi and Abrantes (2015) further state that in countries where subnational entities hold greater autonomy, it becomes necessary to harmonize the level of resources of those units in order to offer public services to the local population, thereby disassembling local inequalities. In this sense, smaller countries or regions should be more successful in meeting the social needs of their population (Breuss and Eller, 2004).

The 1988 Federal Constitution, through the regulation of municipal revenue, brought a potential increase of the tax revenue basis, with the consequential growth of the revenues and the expansion of municipal duties (Ozaki and Biderman, 2004). However, despite the growth of municipal tax collection (Santos, 2003), local budgets are strongly dependent on the transfers from central government (Arévalo and Mendoza, 2015). Thus, the share of own tax collection represents the degree of municipal autonomy, and its increase entails greater autonomy (Silva, 1992; Afonso and Araújo, 2000).

Brazilian public education has undergone a series of transformations since the 1998 Federal Constitution, especially regarding municipal and state capacities: the municipalities should preferably offer primary education and both municipal and state governments were obligated to invest 25% of tax revenues and fiscal transfers into Education (Arretche, 2002). In September 1996, the constitutional text was altered by enactment of constitutional amendment number 14, circumscribing municipal action mainly within early childhood and primary education (Brazil, 1996). Subsequently, Law number 9.394/1996 determined that municipal and state governments were fully responsible for early childhood, primary and secondary schooling, a landmark for the decentralization of the education system in Brazil (Durham, 2010).

Along with the debate over capacity, funding is another key aspect to assure the fulfillment of social rights. Regarding education, the debate becomes even more important, considering that both international and national scenarios report serious budgetary deficits, taking into account that the future of education, especially in developing countries, such as Brazil, needs a wise input of financial and human resources (Fortunati, 2007).

Menezes-Filho and Nuñez (2012) assert that Brazil presents a high level of investment in education, both public and private, despite not holding a favorable position in the worldwide ranking. In a work developed by Greenwald, Hedges and Laine (1996), educational expenditure was proven significantly related to the performance of the students, and the perceived relationship is extremely important to the educational process, not only the amount of investments, but also the management of those resources and the incentives created for both teachers and students are equally relevant.

Hanushek (1986) warns that an increase in education spending alone does not necessarily imply a direct improvement of the quality of education, because the resources destined to public schools are inefficiently managed. Davies (2006) mentions that, in Brazil, it is pointless to create funds or to increase the resources destined for education when there are no assurance that those resources will be properly applied.

Menezes-Filho and Amaral (2009) tested if Brazilian municipalities with greater educational expenditure would present better quality in education, measuring according to the average results of the student in Math and Portuguese language exams in the *Prova Brasil* (Brazil Test). The conclusion was that, despite the fact that the impact of the expenses with education was statistically significant on educational performance, it did not present significant practical relevance (Menezes-Filho and Amaral, 2009).

Meyer (2010) adds that a series of factors demands an increase in educational expenses, but previous research have shown that the volume of resources applied may not be the main issue, excelling the paradigm that more money would necessarily mean a better education. Gouveia and Souza (2012) support that investments in education do not automatically convert into quality education conditions. Menezes-Filho and Nuñez (2012) note that there is no clear tendency between the total amount spent on education and educational performance.

Monteiro (2015) attempted to investigate the relationship between public spending on education and educational performance in some Brazilian cities, through the results of *Prova Brasil*, and found that an increase in education spending is related to a better schooling level, regarding the years of study, and a reduction of illiteracy among the young population. Yet, it is not related with an increase in the quality of the educational system.

In Brazil, subnational governments rely on programs that fund public studies, allocated by the National Fund for the Development of Education (FNDE), an autarchy linked to the Education Ministry, in order to assure a minimum standard for the quality of education and the adjustment of educational opportunities (Cruz, 2012). The same author also considers funding policies for public education relevant in facing the existing socio-economical differences within the Brazilian territory, which result foremost from the gap in the taxation capabilities of different subnational entities.

Finally, considering the extensive theoretical construction presented and despite the series of studies that showed conflicting results, a possible positive relationship between education spending and the quality of the education offered may be envisioned because of the possibility of improvements in the educational infrastructure through investments (Greenwald, Hedges and Laine, 1996; Fortunati, 2007; Cruz, 2012). For that purpose, the hypothesis that guides the present work refers to the assumption that municipalities in the state of Minas Gerais with greater municipal tax collection tend to invest more resources in education and, consequently, have better municipal education indexes.

3. METHODOLOGY

3.1 DELIMITATION AND COLLECTION OF THE SAMPLE AND OPERATIONALIZATION OF THE VARIABLES

The state of Minas Gerais was adopted as the focus of analysis, considering its subdivision into municipal units and its 12 mesoregions. Minas Gerais represents the second most populous state in Brazil, the largest in the Southeastern region, the fourth in territorial extension and the third economy of the country (Silva et al., 2012).

The following data were extracted from the sample in order to perform empirical tests: 2011 (Barão do Monte Alto/MG; Nanuque/MG), 2012 (Coronel Murta/MG; Pedrinópolis/MG), 2013 (Esmeraldas/MG), because of the lack of financial data available, and the city of Naque-2012, for presenting negative municipal tax collection, due to superior deductions held in the period.

The financial information of each municipal unit was obtained through the Information System on Public Budget for Education (Siope), run by the National Fund for the Development of Education (FNDE), where can be found the Revenue and Expenses Information with the Maintenance and Development of Education — MDE — Municipal Units (DRDMDE). The financial values were extracted from the column “Bimonthly EXECUTED REVENUE” of each demonstrative (Siope, 2016).

A formalized education index was chosen for the development of this work: the Firjan Index for Municipal Development (IFDM), created by the Industry Federation of the State of Rio de Janeiro (Firjan, 2015). The IFDM is an index that results from the simple average of the results obtained by three important areas of human development: Employment and Income, Education and Health (Firjan, 2015). The study only used the IFDM — Education Index, which ranges from 0 to 1, with higher values meaning a greater development of the municipal unit (Firjan, 2015).

Through the website of the Brazilian Institute of Geography and Statistics (IBGE) it was possible to obtain the count on municipal population according to the 2012 census (IBGE, 2010), the population estimates sent to the Brazilian Federal Accountability Office (TCU) (IBGE, 2016a) and the value of the Gross Domestic Product (GDP) of the cities in the state of Minas Gerais (IBGE, 2016b).

The analysis period proposed for the research was between 2009 and 2013, taking into consideration the data available, limited to 2013, due to discrepancies in the publication of the Firjan Index. The indexes regarding the year of 2013 were only released by the end of the year 2015 (Firjan, 2015).

The variables used in the study are represented in chart 1.

CHART 1 VARIABLE BUILT FOR THE STUDY

Variable/Equation/Additional Information

Percentage of Municipal Tax Collection (Prect): expresses the degree of financial autonomy of each municipal unit (Silva, 1992).

$$PRECT = \frac{\text{Own tax collection}}{\text{Total tax revenue}} \times 100$$

Municipal Tax Revenue: value presented in the field 1 of the DRDMDE.

Total Tax Revenue: value presented in the field 3 of the DRDMDE (comprising the sum of Tax Revenue and the Revenue from Legal and Constitutional Transfer).

Number of Inhabitants of the Municipal Units (Habit)

Based on the demographic census of 2010 (IBGE, 2010), and on the municipal population estimates sent to the Federal Accountability Office (TCU) (IBGE, 2016a).

Municipal Tax Collection Per Capita (RECTp)

$$RECTp = \frac{\text{Own tax collection}}{INHABITANTS}$$

Fiscal Transfers Per Capita (TRFp)

$$TRFp = \frac{\text{Revenue from constitutional and legal transfers}}{INHABITANTS}$$

Percentage of Municipal GDP (RGDP)

$$RGDP = \frac{\text{Total municipal GDP}}{\text{Total state GDP}} \times 100$$

Percentage of Additional Investment in Municipal Education (Pade)

PADE = Percentage of municipal budget spent on education – 25

Percentage of the municipal budget spent on education: presented on field 39 of the DRDMDE.

25%: annual minimum to be met by the end of the fiscal year (Brazil, 1988).

Municipal Education Index (ledu)

Municipal index released by Firjan, ranging from 0 to 1, the closest to 1, the greater the education development level of the municipal unit (Firjan, 2015).

Source: Elaborated by the authors.

The values regarding municipal tax collection and legal and constitutional transfers, from 2009 to 2012, were updated to December/2013, using the General Index for Market Values (IGP-M/FGV), provided by the Brazilian Central Bank (BCB, 2016). The indexes applied, by the multiplicative method, were the following: data from 2009 (1,3276045); data from 2010 (1,2039394); data from 2011 (1,1363272); and data from 2012 (1,0624323).

The use of *per capita* variables aimed at minimizing the possible impact of the absolute amount in the empirical analyses and to eliminate the distance of the values raised by municipal units of various sizes, reducing the incidence of outliers.

3.2 SENSITIVITY ANALYSIS

In order to compare the level of autonomy of the different municipalities that form the mesoregions of the state of Minas Gerais, a randomized block variance analysis was performed (Banzato and Kronka, 1989) through the observation of the percentage of municipal tax collection, which demonstrates the level of autonomy of the municipal unit. The years of 2009, 2010, 2011, 2012 e 2013 were considered blocks. The statistical significance of the variance factors that result from the analysis of the representative percentages of the Prect variable of the mesoregions led to the use of the Scott-Knott test to compare the average estimates found (Scott and Knott, 1974). To perform those two empirical tests, the Sisvar® statistical software, version 5.6 was used (Build 86).

Furthering the empirical development, the study investigated the possible relation between the percentage of own tax collection, the percentage of the municipal GDP, the additional percentage of investment in education and the municipal index of education with data represented by ordered pairs (Prect and RGDP; Prect and Pade; Prect and Iedu; RGDP and Pade; RGDP and Iedu; Pade and Iedu). In order to determine the existence of a linear correlation between the variables, the coefficients of the Spearman correlation (γ_s) were calculated and their respective statistical significances, using IBM SPSS Statistics® 17 software.

Attempting to reduce the discrepancies of the features of Minas Gerais' municipalities, groupings based on the estimate average of own tax collection, between 2009 and 2013, were formed through the method of k-rates clusters analysis (Maroco, 2007), due to the large amounts of information in the sample. The clusters were formed using the IBM SPSS Statistics® 17 software and, afterwards, the cartographic representation was operationalized with the QGIS® 2.18.0 software.

Finally, in order to verify the relationship between own tax collection *per capita*, fiscal transfers *per capita*, the additional percentage of investment in education and the Firjan index for municipal education, multiple linear regression was chosen, because it enables the study of the relations between two or more variables (independent), that are presented in a linear form, and a metric dependent variable (Fávero et al., 2009), according to the following equation (1):

$$IEDU_{it} = \beta_0 + \beta_1 RECTp_{ij} + \beta_2 TRFp_{ij} + \beta_3 PADE_{ij} + \epsilon_{ij} \quad (1)$$

Where:

$IEDU_{it}$: Education index of the i municipal unit in the j year;

β_0 : Constant;

β_1 : Linear coefficient corresponding to the RECTp variable;

$RECTp_{ij}$: Per capita own tax collection of the i municipal unit in the j year;

β_2 : Linear coefficient corresponding to the TRFp variable;

$TRFp_{ij}$: Per capita do fiscal transfers of the i municipal unit in the j year;

β_3 : Linear coefficient corresponding to the Pade variable;

$PADE_{ij}$: Additional percentage of investment in municipal education in the i municipal unit in the j year;

ϵ_{ij} : Random error.

The multiple linear regression models were conducted for each cluster using the IBM SPSS Statistics® 17 software.

Some constraints should be taken into account in the analysis of the results and conclusions: the Revenue Data and the Expenses with Education Maintenance and Development are self declared by the municipal units and the sources of the revenue applied to each stage of the education process are not discriminated; the most recent informative released by the Firjan Index of Municipal Development (IFDM) dates from 2015 and is based on information collected in 2013.

4. ANALYSIS AND DISCUSSION OF THE RESULTS

The degree of financial autonomy of the governmental institutions may be verified by the ratio between their own tax revenue and the total revenue available (Silva, 1992); an increase in this ratio indicates an increase in the autonomy of the public entity. Inside this context, the degree of financial autonomy is directly related to the municipal government's capability of collecting taxes (Santos, 2004), represented in this survey by the own tax collection percentage variable. In order to compare the estimates of that variable, a randomized block variance analysis was performed, presented in table 1.

TABLE 1 VARIANCE ANALYSIS OF THE OWN TAX COLLECTION PERCENTAGES (PRECT) OF THE MUNICIPALITIES IN THE STATE OF MINAS GERAIS (2009 TO 2013)

Variance Factor	Degrees of Freedom	Sum of Squares	Quadratic Mean	F-test	P-value
YEAR	4	283,026893	70,756723	1,404	0,2300
MESOREGION	11	24156,342443	2196,031131	43,569	0,0000
Error	4243	213863,308507	50,403796		
Corrected Total	4258	238302,677843			

Source: Elaborated by the authors.

The tax collection percentage of the municipal units that compose the mesoregions of Minas Gerais present statistical differences at a significance level of 95%. The same analysis shows that in the period between 2009 and 2013 those percentages remained statistically similar.

The results of the *Scott-Knott* test performed to compare the average estimates of the own tax collection between the mesoregions of the state of Minas Gerais are shown in table 2.

TABLE 2 SCOTT-KNOTT TEST REGARDING THE AVERAGE ESTIMATE OF THE OWN TAX COLLECTION PERCENTAGE OF THE MUNICIPALITIES IN THE STATE OF MINAS GERAIS (2009 TO 2013)

Mesoregions	Average estimates*
Jequitinhonha	05,60 a
Vale do Mucuri	06,15 a
North of Minas	06,21 a
Zona da Mata	06,63 a
Vale do Rio Doce	06,73 a
Campo das Vertentes	06,76 a
Central Mineira	07,86 a
South/Southwest of Minas	08,69 b
West of Minas	09,35 b
Northwest of Minas	09,62 b
Triângulo Mineiro/Alto Paranaíba	10,39 b
Metropolitan Belo Horizonte	13,50 c

* Averages followed by the same letter are not statistically differentiable through the Scott-Knott test at a nominal significance level of 0,05.

Source: Elaborated by the authors.

The state was divided into three blocks of mesoregions, statistically different at a significance level of 95%. The first block is formed by the municipalities in the mesoregions of Jequitinhonha, Vale do Mucuri, Norte de Minas, Zona da Mata, Vale do Rio Doce, Campo das Vertentes and Central Mineira.

The South/Southeast, West and Northwest of Minas and Triângulo Mineiro/Alto Paranaíba mesoregions form the second block. Each group of municipal units has estimate averages that are statistically similar and they are at the same level of significance. The Metropolitan Belo Horizonte mesoregion presented the highest average estimate, statistically different from the others.

The mesoregions of the state of Minas Gerais exhibited behavior that leads to the possible relationship between the degree of municipal financial autonomy and the average estimate of the GDP (IBGE, 2016b) over the period analyzed.

Silva and colleagues (2012) highlight that the state of Minas Gerais is marked by strong economic and social inequalities; both inter and intraregional, including municipalities with outstanding development but also municipalities with low socio-economic and quality of life indexes. The municipalities of Minas Gerais present high variability of data regarding the percentage of their own tax collection.

The mesoregions with lower degree of financial autonomy, Jequitinhonha, Vale do Mucuri and North of Minas, presented lower average estimates of the GDP (IBGE, 2016b), showing that less economically developed mesoregions would likely be related to municipalities with less financial autonomy. Silva and colleagues (2012) underscore that the Jequitinhonha and North of Minas mesoregions present high socioeconomic vulnerability.

The municipal units in the mesoregions of South/Southwest, West, Northwest, Triângulo Mineiro/Alto Paranaíba and Metropolitan Belo Horizonte, besides presenting more autonomy, present higher GDP average estimates (IBGE, 2016b), also revealing that mesoregions formed by municipalities with more financial autonomy may be related to more economically developed mesoregions, with expressive collection of Municipal Service Tax (ISS). Santos (2004) highlights that the ISS is the main source of municipal own tax collection in Brazil.

The possible empirical relationships between the variables, Prect, RGDP, Pade and IEDU, were also investigated through a correlation analysis, in order to predict possible explanations for the ensuing diagnosis.

Table 3 presents the results from the Spearman correlation test between the variables mentioned above. There is a positive and considerable relation, statistically significant at a 1% level, between the percentages of own tax collection (Prect) and the percentage of representativeness of the municipalities regarding total GDP (RGDP).

TABLE 3 SPEARMAN CORRELATION COEFFICIENTS (r_s) AND THEIR RESPECTIVE SIGNIFICANCE (P-VALUE) FOR THE MUNICIPALITIES OF THE STATE OF MINAS GERAIS (2009 TO 2013)

Variables	r_s	p-Value	Variables	r_s	p-Value
Prect × RGDP	0,768	0,000	RGDP x Pade	-0,009	0,574
Prect × Pade	-0,092	0,000	RGDP x Iedu	0,274	0,000
Prect × Iedu	0,216	0,000	Pade x Iedu	0,037	0,016

Source: Elaborated by the authors.

A positive relation between the level of financial autonomy and local economic development is evidenced. Namely, municipalities with greater autonomy present higher economic development and municipalities with lesser autonomy present lower economic development, when considering their individual participation in the GDP of the state of Minas Gerais.

Analyzing the relationship between the Prect and Pade variables, it is to note that the municipalities of Minas Gerais hold significant *Spearman* coefficients, at a 1% level, but the association between the variables exhibits negative and low behavior, showing that those municipalities, despite manifesting greater autonomy, do not carry out higher investments in education when compared to the municipalities with less autonomy.

The analysis of the relation between the *Prect e Iedu* variables revealed that the municipalities show a coefficient that is statistically significant, but lower. In this case, the empirical findings show that there is little relation between the financial autonomy and the municipal education index. For that matter, the hypothesis that the municipal units with greater tax collection would tend to invest more resources into education and, consequently, present better municipal education indexes was not empirically verifiable, meaning that the *Spearman* correlation test proved there is no relation between financial autonomy, investments and municipal education indexes in the state of Minas Gerais.

Examining the correlation between the RGDP and Pade variables the correlation coefficient ascertained is not statistically significant, indicating that the municipal level of economic development may not have any relationship with additional investments in education. Similar behavior is observed between the RGDP and Iedu variables, where the correlation coefficient is statistically significant but shows a low expression, demonstrating that the levels of economic development in these municipalities has little influence over the evaluations obtained in the education index.

Finally, the assessment of the behavior between the Pade and Iedu variables refers to a statistically significant correlation coefficient, but with no significant representation, revealing that additional investments in education may not imply better indexes, strengthening the statement of Diniz and Corrar (2011), who claim there is no consensus regarding a positive effect in the quality of education due to increased investments in education.

In order to reduce the variation of the data, the municipalities of Minas Gerais were gathered into groups, considering the average estimate percentage of own tax collection of each municipal unit, through a k-rates clusters' analysis, with significance rate of 1%, according to the descriptive analysis presented in table 4.

TABLE 4 DESCRIPTIVE ANALYSIS OF THE ESTIMATED AVERAGE PERCENTAGE OF MUNICIPAL OWN TAX COLLECTION IN THE STATE OF MINAS GERAIS, GLOBAL AND BY CLUSTERS (2009 TO 2013)

State/Group	Average	Minimum	Maximum	Standard Deviation	Coefficient of Variation
Minas Gerais (853 municipal units)					
Prect	8,27	1,45	57,84	7,11	85,99
Cluster 1 (86 municipal units)					
Prect	22,56	17,01	33,80	4,16	18,42
Cluster 2 (221 municipal units)					
Prect	10,97	7,81	16,87	2,43	22,20

Continue

State/Group	Average	Minimum	Maximum	Standard Deviation	Coefficient of Variation
<i>Cluster 3 (8 municipal units)</i>					
Prect	45,13	35,35	57,84	8,79	19,47
<i>Cluster 4 (538 municipal units)</i>					
Prect	4,33	1,45	7,70	1,63	37,68

Source: Elaborated by the authors.

The subdivision of the municipalities of Minas Gerais into groups rendered a notable reduction in the variation of the data. *Cluster 1*, formed by approximately 10% of all the municipalities, presents an estimate average percentage of own tax collection higher than the estimated average of the state, but lower than the estimated average of the municipalities in *cluster 3*. *Cluster 2* is the second largest group of municipalities, with almost 26% of the municipal units, presenting an estimated average percentage of own tax collection lower than *cluster 1*, but higher than the state average and the average of *cluster 4*. The third group (*cluster 3*) comprises only eight municipal units which hold the highest estimated average percentage of own tax collection. Finally, *cluster 4* constitutes the largest agglomeration of municipalities and holds the smallest estimated average percentage of own tax collection, lower than the estimated average of the state. It configures the greatest data variability, what could be explained by the large amount of municipal units.

The representation of the groups of municipalities of the state of Minas Gerais is illustrated in figure 1.

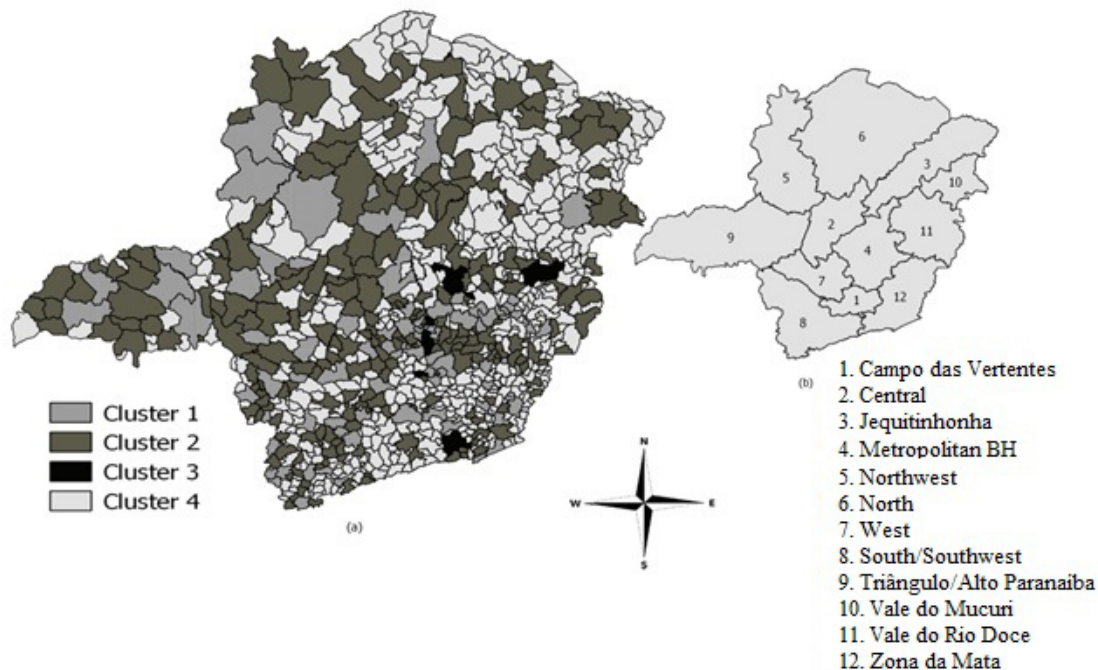
Cluster 1 holds the second largest estimated average percentage of own tax collection and the largest estimated average of representation in the state's GDP (45% of the total average of the state) (IBGE, 2016b). Those municipalities are well spread in terms of population size. Around 63% of the municipal units that form the afore-mentioned group are located in the mesoregions of Metropolitan Belo Horizonte, South/Southeast and Zona da Mata. This cluster includes municipalities with good utilization of their own tax base, supported by the high degree of financial autonomy and, due to the high representation on the total GDP, those municipalities hold the second best estimated average of the GDP by municipality. Those municipalities stand out on the estimated average of participation of the Urban Property Tax (IPTU) in the total own tax revenue (Siope, 2016).

Cluster 2 comprises the second largest group of municipalities. With estimated percentage average of own tax collection higher than the state's average, those municipalities are responsible for 23,88% of the state's GDP (IBGE, 2016b). The great majority of those municipal units are described as small-sized, with representation in all mesoregions of the state.

Cluster 3 presents the highest estimated average percentage of own tax collection in the state and the highest estimated average of the GDP by municipality (IBGE, 2016b). Most of the municipal units in this group are describe as medium and large sized, in addition to comprising the Belo Horizonte metropolis. The municipalities are located in the Metropolitan mesoregions, with one representative of the Vale do Rio Doce and another one of the Zona da Mata. Those municipalities show strong eco-

conomic development and a respective high degree of financial autonomy, standing out on the estimated average participation of the Municipal Service Tax (ISS) in their own tax collection (Siope, 2016).

FIGURE 1 MAP OF THE MUNICIPALITIES OF THE STATE OF MINAS GERAIS ORGANIZED INTO K-RATE CLUSTERS (A) AND INTO GEOGRAPHIC MESOREGIONS (B)



Source: Elaborated by the authors.

Completing the analysis, *cluster 4* presents the highest agglomeration of municipalities, but the smallest estimated average percentage of own tax collection, lower than the state's estimated average. Responsible for only 9,45% of the estimated average of the state's GDP over the period analyzed (IBGE, 2016b), those municipalities can be considered the less economically developed. They are all considered small-sized, with representatives in all mesoregions, and marked by the lowest estimated average of participation of the Municipal Service Tax (ISS) in the total composition of local taxes (Siope, 2016).

In this context it is possible to verify that population size is likely related to the economic development of the municipality and, consequently, with the degree of local financial autonomy.

After a thorough analysis of the degrees of municipal financial autonomy in the state of Minas Gerais, with a subsequent grouping of the municipalities into four *cluster*, the study examined the possible relations between own tax collection, fiscal transfers, additional percentage of investment in education and the municipal education indexes, through a test of multiple linear regression. In order to reduce possible influences of the total values of municipal revenue, an estimated average of own tax collection *per capita* and estimated average of fiscal transfers *per capita* of the municipalities during the investigation period were calculated. Besides those variables, the percentage of additional investment

in education was presented as an independent variable, in order to ascertain a possible association between the investments in education and the index published. Finally, a regression study was made for each of the clusters, in order to see the behavior of the variables within more homogeneous groups.

Table 5 presents a descriptive analysis of the explanatory and dependent variables, for the municipalities of Minas Gerais, considering the groups formed.

TABLE 5 DESCRIPTIVE ANALYSIS OF THE ESTIMATED AVERAGE TAX REVENUE PER CAPITA, FISCAL TRANSFERS PER CAPITA, PERCENTAGE OF ADDITIONAL INVESTMENTS IN EDUCATION AND MUNICIPAL EDUCATION INDEXES OF THE MUNICIPALITIES OF MINAS GERAIS GROUPED INTO CLUSTERS

State/Group	Average	Minimum	Maximum	Standard Deviation	Coefficient of Variation (%)
<i>Cluster 1 (86 municipalities)</i>					
RECTp	314,55	70,80	2197,80	257,43	81,84
TRFp	1043,90	250,50	4861,90	646,14	61,90
Pade	2,77	-1,20	14,00	2,36	85,22
ledu	0,79	0,59	0,92	0,06	7,79
<i>Cluster 2 (221 municipalities)</i>					
RECTp	166,66	34,30	1858,30	145,32	87,20
TRFp	1337,12	324,70	12549,00	893,06	66,79
Pade	3,05	-2,70	16,90	2,48	81,54
ledu	0,77	0,52	1,00	0,06	8,10
<i>Cluster 3 (8 municipalities)</i>					
RECTp	1241,57	101,60	6534,70	1350,46	108,77
TRFp	1217,74	481,80	2756,60	733,15	60,21
Pade	2,73	0,00	10,70	2,43	89,10
ledu	0,77	0,63	0,89	0,06	8,09
<i>Cluster 4 (538 municipalities)</i>					
RECTp	71,05	8,50	625,00	47,33	66,61
TRFp	1698,05	207,10	9847,70	945,37	55,67
Pade	3,27	-1,80	12,60	2,60	79,48
ledu	0,75	0,44	1,00	0,07	9,82

Source: Elaborated by the authors.

The municipalities of Minas Gerais enhance the differences regarding own tax collection *per capita* and fiscal transfers *per capita*, highlighting the current discrepancies, which may also be related to the high number of municipalities that form the state. The small sized municipalities (*cluster 4*) show a higher dependency on fiscal transfers and, consequently, a lower degree of financial autonomy, especially for the estimated average of own tax collection *per capita* with less variation. The municipalities grouped into cluster 3 exhibit a higher degree of financial autonomy, with an estimated average of own tax collection *per capita* higher than the estimated average of fiscal transfers *per capita*. Despite the group being formed by only three municipalities, the estimated average tax collection *per capita* shows the highest data variation.

The inverse relation between the degree of financial autonomy and the additional percentage of investment in education is also inferred. Specifically, municipalities with more autonomy (*cluster 3*) present the lowest estimated average of additional investment in education, while the municipalities with the smallest estimated average regarding financial autonomy are marked by the highest estimated average additional percentage of investment in education (*cluster 4*). Small municipalities, despite a low degree of municipal autonomy, tend to invest more resources into education. Dal Magro and Silva (2016) add that smaller sized municipalities tend to present better educational levels.

Within this segment, the eight municipalities distinguished as more autonomous, that is, those that show a good harnessing of their own tax collection, direct less additional resources to education. This finding might be explained by the high demand for enrollment in bigger municipalities and also by the complexity of other services demanded in more populous cities. Silva and colleagues (2012) and Souza and colleagues (2012) add that one of the greatest challenges for the public systems is the efficient allocation of resources in order to maximize social benefits.

The Firjan education index showed low variation within and between the groups, presenting very close values. The following step deals with the multiple linear regression tests using the variables pertaining to the municipalities of Minas Gerais, according to table 6.

TABLE 6 RESULTS OF THE VARIANCE ANALYSIS AND MULTIPLE LINEAR REGRESSIONS CONSIDERING THE MUNICIPALITIES IN THE STATE OF MINAS GERAIS GROUPED INTO CLUSTERS

Clusters	Models	Coefficients	T Test	p-Values	Anova*	R ² **
1	Constant	0,800	122,641	0,000	0,038	0,020
	RECTp	0,000	2,612	0,009		
	TRFp	0,000	-2,866	0,004		
	Pade	0,000	0,314	0,754		
2	Constant	0,769	197,075	0,000	0,028	0,008
	RECTp	0,000	2,731	0,006		
	TRFp	0,000	-1,568	0,117		
	Pade	0,000	-0,362	0,718		

Continue

Clusters	Models	Coefficients	T Test	p-Values	Anova*	R ² **
3	Constant	0,774	37,620	0,000	0,507	0,062
	RECTp	0,000	0,328	0,745		
	TRFp	0,000	-1,010	0,319		
	Pade	0,006	1,364	0,181		
4	Constant	0,708	210,144	0,000	0,000	0,064
	RECTp	0,000	3,594	0,000		
	TRFp	0,000	9,507	0,000		
	Pade	0,001	1,506	0,132		

Notes: *Significance of the Regression Model according to the Variance Analysis; **Coefficient of Determination.

Source: Elaborated by the authors.

In the study of the multiple linear regression models, only the results of cluster 3 did not show statistical significance. However, even in the other groups, which presented statistical significance regarding the structure of the regression model, the low coefficients of determination show the reduced predictive capability of the regression model and the coefficients presented for the independent variables are irrelevant.

The lack of significance of the linear regression models for the groups formed for the municipalities of Minas Gerais may be related to the great amount of municipal divisions that the state has, as well as for the high heterogeneity of the municipalities (Silva et al., 2012), with regard to the explanatory variables, granted the precarious data variability that represent the Firjan education index, taken as the dependent variable of the study.

Consequently, the multiple linear regression models showed poor predictive power, even after the organization of the municipal units into more homogeneous groups, according to their financial autonomy. Those findings support the work of Menezes-Filho and Amaral (2009), Meyer (2012), Gouveia and Souza (2012), Menezes-Filho and Nuñez (2012) and Monteiro (2015) in the sense of not showing a clear relation between education spending and the education index.

Menezes-Filho and Amaral (2009) warn that improvements in educational performance are not obtainable by increasing the resources spent, because issues regarding the ineffective management of those resources might hinder their conversion into quality of education. Monteiro (2015) reinforces that the schools that receive greater financial resources do not necessarily show an academic performance superior to those with limited resources. The same author lists the following factors as possible explanations for the lack of relation between spending and quality in education: financial resources might be inefficiently applied, failing to promote improvements in the educational process, or those resources might be poorly managed due to lack of managerial knowledge or inability.

5. FINAL CONSIDERATIONS

Initially, observing the agglomerates of municipal units, the heterogeneity of the municipalities of Minas Gerais regarding financial autonomy was noticed, reinforced by the recognition of greater discrepancies when compared to the estimated averages of the mesoregions. In search for possible relations between the variables, it was possible to ascertain that the local economic development might be linked to the financial autonomy of the municipalities of the state of Minas Gerais.

Another relevant issue regards the statistical evidence that there is no relation between the degree of financial autonomy and the investments in education. The grouping that gathered small-sized municipalities, considered less autonomous, on average, performed more investments in education. This finding could be explained by the lower demands of students and by the fact that smaller cities are not affected by some of the current problems of large-sized municipalities, such as security, transportation, basic sanitation, housing, etc. In addition, municipalities with greater financial autonomy show the importance of the Urban Property Tax (IPTU) and the Municipal Service Tax (ISS) in the composition of their own tax collection, showing that municipal government should improve verification, collection and control over those taxes.

Finally, in search for an answer to the main hypothesis of this study, the multiple linear regression models for the clusters were presented, marked by the lack of statistical significance of one model (*cluster 3*) or by very low coefficients of determination, which granted very little predictive capability to the analysis. Therefore, it demonstrated that the quantitative of own tax collection *per capita* and the fiscal transfers *per capita*, as well as the additional percentage of investment in education, did not impact the education index used on the research. The proximity of the values of the municipal education indexes may be pointed as one of the causes for the impossibility of building empirical models with substantial predictive capability.

The fact that no empirical relation between the investments in education and the quality of education was found does not dismiss the importance of financing municipal educational services. The resources might be poorly managed due to a possible inefficiency of the public sector. Should that be the case, public management should be more attentive to the management of the available funds and concerned with the return and the efficiency of the services offered.

We recommend that future research could build a quality index for municipal education based on the variables used in similar studies, expanding the sample to other regions of the country. A qualitative research of municipal educational expenditure is also suggested, seeking to identify the sources of the public resources.

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