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# Determining characteristics in the environmental performance of municipalities in the state of São Paulo

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Decentralization of monitoring and licensing of the use of natural resources, from the federal and state spheres to the municipalities, has generated pressure to adopt a governance model that is able to establish a relationship between the demands of quality public services, job creation and income generation activities, and a lower environmental impact. This research evaluates whether the municipalities fiscal effort and revenues dependency as well as the expenses by function are relevant variables to explain the best and worst environmental performance obtained. The data of 645 municipalities of the state of São Paulo, from 2008 to 2017, were analyzed. The quantile regression method was used to analyze the relationship between the indicators since it provides more accurate results. The results showed that the municipalities expenditures are better than the revenues to explain the environmental performance. However, it was identified that greater fiscal effort and investments in environmental management policies, basic sanitation, and sport and leisure have a positive impact on the environmental assessment index of the municipality. Finally, it was found that municipalities governed by the center and right parties have achieved better environmental indices compared to governments adopting a more progressive political spectrum.

**Keywords:** environmental performance; GreenBlue Program; municipalities of the state of São Paulo.

## Características determinantes no desempenho ambiental dos municípios paulistas

A descentralização da competência para o monitoramento e licenciamento do uso dos recursos naturais, das esferas federais e estaduais para os municípios, tem gerado uma pressão para a adoção de um modelo de governança que consiga congregar as demandas de serviços públicos de qualidade, geração de trabalho e renda, com menor impacto ambiental. Esta pesquisa avaliou se o esforço e a dependência fiscal (receitas) dos municípios e as despesas por função são variáveis relevantes para explicar os melhores e piores desempenhos ambientais obtidos. Foram analisados os dados de 645 municípios do estado de São Paulo, de 2008 a 2017. Utilizou-se o método de regressão quantílica para analisar a relação entre os indicadores; ele propicia a obtenção de resultados mais precisos, ao considerar os municípios em quantis. Os resultados demonstraram que os gastos realizados são mais relevantes para explicar os melhores desempenhos ambientais do que as receitas, contudo, identificaram que maior esforço fiscal e maiores investimentos em políticas de gestão ambiental, saneamento básico e desporto e lazer têm impacto positivo sobre o Índice de Avaliação Ambiental (IAA) do município. Por fim, constatou-se que municípios governados pelos partidos de centro e direita têm alcançado melhores índices ambientais, comparativamente aos governos que adotam estratégias mais progressistas.

**Palavras-chave:** desempenho ambiental; Programa Município VerdeAzul; municípios do Estado de São Paulo.

## Características determinantes en el desempeño ambiental de los municipios paulistas

La descentralización de la competencia para el monitoreo y licenciamiento del uso de los recursos naturales, de las esferas federales y estatales a los municipios, ha generado una presión para la adopción de un modelo de gobernanza, que consiga congregar las demandas de servicios públicos de calidad, generación de trabajo y renta, con menor impacto ambiental. Esta investigación evaluó si el esfuerzo y la dependencia fiscal (ingresos) de los municipios y los gastos por función son variables relevantes para explicar los mejores y peores desempeños ambientales obtenidos. Se analizaron los datos de 645 municipios del estado de São Paulo, de 2008 a 2017. Se utilizó el método de regresión cuantílica para analizar la relación entre los indicadores; este propicia la obtención de resultados más precisos, al considerar los municipios en cuantiles. Los resultados demuestran que los gastos realizados son más relevantes para explicar los mejores desempeños ambientales que los ingresos, no obstante, identificaron que el mayor esfuerzo fiscal y las inversiones en políticas de gestión ambiental, saneamiento básico y deporte y esparcimiento tienen un impacto positivo sobre el índice de evaluación ambiental del municipio. Por último, se constató que municipios gobernados por los partidos de centro y derecha han alcanzado mejores índices ambientales, en comparación con los gobiernos que adoptan estrategias más progresistas.

**Palabras clave:** desempeño ambiental; Programa Municipio VerdeAzul; municipios del estado de São Paulo.

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## 1. INTRODUCTION

Society has demanded from public managers the adoption of a governance model that can deliver quality public services, increase employment and income, and has a minimum environmental impact.

Most modern environmental governance solutions eventually create a complex system of laws and institutions (Paavola, 2007), and several solutions may be considered when trying to align the concept of environmental governance with the notion of economies of scale or scope in delivering public services at municipal, state or federal levels.

Concerns about environmental issues have required special attention from municipalities, especially since Resolution 237/1997 of the National Environment Council (Conama), which provided that the management of local environmental impacts is the competence of municipalities. Thus, the local authorities were required to balance the economic development with the proposal of public policies that minimize the environmental impact, through systematic and continuous monitoring.

Tassi and Kühn (2014) analyzed the effects of Resolution 237/1997 observing the environmental licensing process carried out by municipalities in this role of environmental management. The authors found that although there are criticisms of municipal environmental licensing, it is more effective than the management centered in the state or federal governments.

Given the current expectation toward the performance of public management, municipalities are required to promote coherent environmental thinking, engaging the community while implementing and coordinating actions to establish standards that will allow controlling environmental deterioration and rehabilitation of the most affected areas (Schneider, 2001).

The environmental problem is directly related to public policies for controlling environmental resources, as they affect the rights related to common goods such as water, air, soil, and ecosystem services.<sup>1</sup> In the meantime, public managers have the task of accommodating private interests in the use of natural resources, to ensure their preservation for future generations, and to encourage economic development to meet the social demands of its citizens. At the same time, public managers have to deal with inefficiencies, lack of agility to keep up with new technologies, a thoroughly institutionalized bureaucratic management model and, finally, a growing demand for quality public services.

The improvement of living conditions is measured by the evolution of the social structure and the acquisition of durable material goods and consumer goods. These conditions may represent the framework for economic and social development. However, these conditions alone do not guarantee stability if they do not take into account the existence and the characteristics of the environment where they are inserted (Almeida, Marques, Moraes, & Bernardo, 1999).

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<sup>1</sup> Ecosystem services are the direct and indirect benefits that human beings obtain from ecosystems, such as provision/supply services (food, wood, biochemistry, genetic resources); regulation services (climate, disease, biological, natural damage); cultural services (ecotourism and recreation, educational, cultural heritage); and support services (such as soil, oxygen production, nutrient cycling) (Daily, 1997; Costanza et al., 1997; De Groot, Wilson, & Boumans, 2002; Andrade & Romeiro, 2009).

For Kinlaw (1997), sustainable development is humankind's greatest challenge in the new millennium, in which the reality presents, among other characteristics, the intense economic growth and the concentration of productive processes due to economies of scale; population concentration and disorderly urbanization; the scarcity of natural resources and their irrational use; industrialization and modernization, as well as many other actions. This reality unbalances the tripod of sustainable development, which takes into account social, economic and ecological aspects.

In this context, this study aims to evaluate, in an exploratory way, whether the fiscal effort and dependency of municipalities and the policies adopted for the application of resources are relevant variables to explain the best and worst environmental performance obtained by municipalities, in the period from 2008 to 2017.

This work is structured in five parts, including this introduction. The next presents the theoretical framework and a review on the concepts around the subject, followed by a third part discussing the methodology. The forth section shows the results and the analysis conducted, leading to the final part with the final considerations.

## 2. THEORETICAL FRAMEWORK

### 2.1 Environmental governance and performance of municipalities

Environmental governance comprises a set of arrangements and actions designed to propose policies related to sustainable development. The governance of natural resources is still a complex subject because it depends on private and public interest. In this sense, Paavola (2007) emphasizes that environmental governance must include social justice in decision-making. Also, private environmental policies, although not aimed at the common property (Paavola, 2007), can help in the process of institutionalization and somehow reaffirm new habits regarding the use of natural resources.

In this regard, Ostrom (2000) adds that common property rights are usually related to the natural resource system, which is hypothetically relevant to understanding the wide diversity of laws on property rights laws that are present in today's societies. However, common property rights are considered inefficient by most economists because no one has sufficient incentives to make improvements that bring about an increase in productivity without degrading the environment.

Municipalities have an indispensable role formulating social, economic and environmental development policies, giving permission for the exploration of natural resources, monitoring the functioning of organizations, maintaining order and morals, and inhibiting the disruptive behavior of institutionalized norms for the protection of natural resources and collective living.

Pragmatically, it is up to municipalities to regulate and monitor private and common property rights, when it comes to natural resources. In order to achieve efficiency in environmental management, municipalities have institutionalized structures and standards (laws and regulations) in order to obtain

a desired set of behaviors, for example<sup>2</sup> *Lei do Parcelamento do Solo* (law on land division); *Código de Obras* (building law); *Código Ambiental*<sup>3</sup> (environmental regulation), and the Municipal Master Plan, which defines the policy of urban expansion and development.

The institutionalization of environmental governance practices by municipalities should be used to resolve environmental conflicts, and its central role is to achieve social justice in decisions involving the environment, for example: the exclusion of unauthorized users, the regulation of use of authorized sources and distribution of benefits, provision of environmental recovery costs, monitoring of agents, guaranteeing the application of current norms, resolution of conflicts in related areas, and help in the definition of collective choices, counterbalancing social gain with loss due to environmental impact (Paavola, 2007).

## 2.2 Environmental policies and indicators

The conduction of a model of municipal environmental management requires from public managers the development of indicators and periodic analyzes that reflect the interaction between private and common interests regarding the use of natural resources.

The indicators have the function of assisting in the decision-making process, clearly synthesizing, the results obtained from a policy or program (Magalhães, 2004). Nahas, Gonçalves, Souza, and Vieira (2006) add that the indicators are essential to evaluate both the current conditions and the trends of an event; (in terms of goals, objectives, and actions) and warn managers about facts and phenomena that influence future conditions.

In the movement to institutionalize guidelines, indicators and reports on environmental protection issues, launched after the 1972 United Nations Conference on the Human Environment in Stockholm, several international organizations have devoted their efforts to developing concepts, definitions and classification for the variables to be considered in environmental and urban statistics (Nahas, 2003, p. 12)

R. F. Santos (2004) emphasizes that the indicators must have a systematized, grouped and ordered system of obtaining information, so they can finally lead to the synthesis necessary for the decision-making process. For the author, in the area of environmental management, indicators or indexes must be able to reliably measure and express the characteristics of events and demonstrate their

<sup>2</sup> *Lei do Parcelamento do Solo* (law on land division) provides for: the division of urban land; protection of the soil during construction, revegetation or paving works; defines the minimum percentage of green areas in development projects, protection of permanent environmental preservation areas and flood areas. *Código de Obras* (building law) provides for: the buildings, in terms of engineering and architecture, aiming at the safety and the quality of the works in the municipality. Regulations regarding channeling and treatment of industrial waste, design of the collection and treatment systems for domestic sewage, sanitation, ventilation, lighting, installation of fire-fighting equipment, lightning arresters, standards for the execution of works that protect urban afforestation and public equipment, collection and final disposal of urban solid waste. *Código Ambiental* (environmental regulation) establishes rules of environmental law and social interest: it aims at protecting, conservation, preservation, recovery and improvement of environmental quality; establishes the Environment Council; establishes the Environment Fund; provides on environmental education; pollution control; emission of noise; and monitoring. Municipal Master Plan defines the policy of urban expansion and development: road system and terminals; transport system (road, rail, waterway and airway); rainwater drainage system, avoiding soil sealing; environment: preservation of springs, soil, fauna and flora; preferential location of economic activities: commerce, industry and services; acceptable standards and levels of environmental pollution in relation to natural resources; areas for occupation and urban expansion; preservation of historical and artistic heritage.

<sup>3</sup> The law 1,388/1997, of December 31, 1997, which establishes the *Código Ambiental* (environmental code) of the municipality of Viana in Art. 65, III, seeks to promote the teaching of environmental education as a compulsory subject in all levels of education of the municipality education system.

completeness, stability, solidity, relationship with the priorities of the environmental management process, communicability, efficiency, effectiveness, relevance, and measurability.

### 2.3 Município VerdeAzul Program

Amongst the many guidelines, policies, and programs focused on social and environmental issues, the program “*Município VerdeAzul*” (PMVA), launched by the São Paulo state government in 2007, stands out. The program aims to decentralize the environmental policy to the municipalities, obtaining greater efficiency in the protection of natural resources and improving the valorization of environmental issues by the local community. This program aims to institutionalize the effective participation of municipal agents, by democratizing the environmental public management (which was later decentralized in the environmental agenda of the Secretariat for the Environment of the State of São Paulo in 2012).

Decentralization of the environmental agenda provides the democratization of social processes and increases popular participation. It allows to elaborate diagnosis and propose solutions for the population to reduce negative impacts of interventions on the environment. However, the actions must be coordinated, to prevent the reduction of the quality of the services provided.

Shared environmental management creates a mutual responsibility, stimulating the development of management skills in municipalities. The role of the state is to provide technical collaboration and training to local teams.

For the Secretariat for the Environment of the State of São Paulo (SMA, 2012), this decentralized environmental policy aims to promote the participation of society in environmental management and, therefore, to make the population aware, including people as social actors committed to the environmental issues in their cities. The private sector, the government, and grassroots organizations, in this sense, should work together to find solutions to local challenges. Shared environmental management presupposes cooperation and co-responsibility between government and civil society, especially because the municipal government is the closest to the citizen. Therefore, the opinion of all those involved in environmental management should be considered, as in the case of rural, riverine and indigenous populations, which, for decades, have not had a voice.

After signing a “Letter of Intent” in 2010, all 645 municipalities in the state of São Paulo made their participation in the PMVA official. Every year the Secretariat for the Environment of the State of São Paulo provides orientation, according to criteria annually evaluated, what measures are necessary to ensure that the municipality is certified by the program as a “*Município VerdeAzul*”.

The municipalities participating in the program are committed to conducting the local environmental management, based on the ten goals defined by the State Secretariat. The goals are established in the following areas: i) sewage treatment; ii) solid waste; iii) riparian forest; iv) urban vegetation; v) environmental education; vi) sustainable city; vii) water use; viii) air quality; ix) environmental structure; and x) environmental committee.

The PMVA's evaluation is conducted using the Environmental Assessment Index (IAA), developed with the aim of measuring the effective results to be achieved by the environmental policy proposed by the municipalities. The IAA is established by the following formula:<sup>4</sup>

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<sup>4</sup> Provided by the Resolution of SMA-36 of July 18, 2011.



$$IAA = \sum ID_i + \sum PRO_i - PP \quad (1)$$

Where,

- $\sum ID_i$  — is the sum of the indicators of compliance with environmental goals. The maximum value of the sum is 80.  $ID_i$  is the indicator of compliance to each of the environmental goal (indicated by  $i$ ).  $ID_i$  corresponds to a score ranging from 0 to 10, attributed by the criteria set out in Annex III, adjusted subsequently by the weight of each goal  $i$ .
- $\sum PRO_i$  — is the sum of the indicators of the actions related to the environmental goal that are taken proactively by the municipality. The maximum value of the sum is 20.  $PRO_i$  is the proactivity indicator, for each environmental goal, indicated by  $i$ ). This indicator will correspond to a score, varying from 0 to 2, according to criteria established for every year.
- $PP$  — includes any environmental issues and/or liabilities under the municipality's responsibility, regardless of the environmental goals. This value varies from 0 to 30, according to the liabilities established by the State System of Administration of Environmental Quality, Protection, Control and Development of the Environment and Proper Use of Natural Resources (Seaqu).<sup>5</sup>

#### BOX 1 THE TEN GOALS OF THE ENVIRONMENT ASSESSMENT INDEX, THEIR WEIGHTS AND DESCRIPTIONS

Goal	Weight	Description
Sewage Treatment	12	To establish and maintain, through a city-owned system or concession, the collection, removal, treatment and adequate disposal of domestic sewage, seeking the efficiency of the system, to protect the water resources of the launching of these organic loads, aiming at the improvement of water quality in the state of São Paulo.
Solid waste	12	To establish solid waste management, by national and state policies, prohibit any form of open garbage disposal, promoting, where appropriate, the recovery, remediation or revitalization of degraded areas or contaminated areas.
Riparian forest	8	To promote actions to recover riparian forests, identifying, delimiting and demarcating the priority areas of action, with emphasis on protecting the main sources of water to contribute, with the support of local farmers, to the goals established by the Secretariat for the environment of the state of São a Paulo.
Urban Vegetation	5	To implement a program of urban afforestation and maintenance of municipal green areas, selecting the species to be used, preferably those native of the region, including the maintenance of the municipal nursery to supply seedlings.

*Continue*

<sup>5</sup> Liabilities are calculated based on the following items: existence of contaminated areas and penalties applied by the Environmental Company of São Paulo State (Cetesb); issues related to environmental licensing; evidence of waste disposed in areas of permanent protection (APP); non-compliance with the Environmental Recovery Commitment Term (TCRA) (Licensing or Assessment) and the existence of Acts of Environmental Violation (AIA) (filled against the local authority). The score obtained as Index of Collection and Treatment of Sewage in the Municipality (Ictem) and the Index of Landfill Quality (IQR) are also at the bases of the liabilities.

Goal	Weight	Description
Environmental education	12	To establish an environmental education program for the municipal public education system, promoting information and awareness of the population regarding the impacts environmental issues have on the quality of life.
Sustainable city	5	To promote the reduction of the use of native wood by means of actions of the local government and promote the incorporation of concepts of environmental sustainability, such as the use of clean technology, water reuse, rainwater harvesting, alternative energy systems, and ecological sidewalks.
Water use	5	To stimulate the fight against water waste, to guarantee the protection of the public sources of supply, coordinating the water management policies.
Air quality	5	To implement activities and participate in initiatives that contribute to the defense of air quality and control of air pollution and greenhouse gases.
Environmental structure	8	To establish and strengthen the environmental structure, so that the municipal environmental system is implemented, evidencing the relevance of the environmental protection, enabling efficiency in the administration of these issues, resulting in the strengthening of the State System of Administration of Environmental Quality, Protection, Control and Development of the Environment and Proper Use of Natural Resources (Seaqua)
Environmental committee	8	To establish and strengthen the Municipal Environmental Committee, encouraging the participation of civil society – in equal number and condition with public agents – in the discussion of local environmental issues and decision-making, ensuring its regular operation and its deliberative nature.

**Source:** Secretaria do Meio Ambiente do Estado de São Paulo (2012).

The calculation of the IAA is conducted through analysis and evaluation of the local administration's action plan, as well as the analysis of the information on the environmental system and the data obtained by the team of the PMVA. Thus, the score attributed to the municipality in the program may vary from -30 to 100, which is the score used to rank the cities. The municipalities with the highest scores are then recognized with the title "*Município VerdeAzul*".

Girão (2012) concludes that the Environmental Assessment Index of the program is an excellent environmental index because it includes appropriate indicators to evaluate the environmental management presented by all 645 municipalities in the state of São Paulo. According to the Secretariat for the Environment of the State of São Paulo, the results obtained with this project are visible and demonstrate that the decentralization of environmental management and the transfer of information to municipalities are a great way to achieve sustainable development.

Several research works have studied the PMVA, observing its guidelines and the fact that the environmental issue is a transversal subject. Mancini (2016) considered that the program's statistics are still not conclusive regarding the municipalities' appropriation of the program in the various regions of the state. According to the author, there is a lack of alignment of some of the goals of the program with the local reality, observing that municipalities had preexisting environmental policies. In the future, some aspects should be improved to expand the dialogue between the State Secretariat and the municipalities, regarding the definition of goals, so they are more appropriate to the local realities and problems.

Lodi (2017) analyzed the voluntary environmental action in the municipalities and the factors that influence the voluntary participation of the municipalities of the state of São Paulo in the program.



The study shows the need to improve the transparency on the process of selecting the municipalities that receive transfers; the participation of municipal governments in the design of the program; and the definition of evaluation criteria. Also, it is important to improve the rules regarding monitoring, oversight, and motivation of senior management, and to adapt the criteria according to the local realities.

Machado (2014) analyzed the contributions of the effectiveness of the program in the municipalities, noting that there were advances in the structure of the local environmental management system.

Barbosa (2016) evaluated the effectiveness factors in the PMVA implementation phase. The author observed that the implementation of the program is complex and subject to the interference of different problems that jeopardize the effectiveness of the program in achieving the goal of encouraging the planning and the environmental agenda in the municipalities.

Dantas (2016) studied the relationship between the PMVA, the public spending, and the health indicators. She found that environmental expenditures were slightly and positively correlated with the IAA, corroborating the association between the number of financial resources and the environmental management capacity. Regarding health and environment integration, the author highlights the lack of correlation for infant mortality, and higher environmental expenditures were associated with lower rates of hospitalization for diarrheal diseases in children. The study emphasizes the need to carry out further research discussing municipal environmental management and actions for the balance between the human being and the limits of the planet. These can be valuable studies to improve public decision making and, consequently, the environmental quality offered to society.

Eziquiel (2016) analyzed the municipal public policies, the goals of the PMVA and the questions around the various dimensions of the environmental issue (social, economic, natural), which make this an effective public policy, considering the characteristics of the global society.

Costa (2015) analyzed the municipalities' management of the urban afforestation, finding that the scores attributed to this goal were not sensitive to some important items such as the existence of law and nurseries and, often, items related to management. The author adds that, with some points to be improved, the PMVA was fundamental to stimulate the engagement of municipalities in the implementation of public policies and actions of urban afforestation management.

Souza (2015) researched the profile of two public policies in implementation in the state of São Paulo: the "*ICMS Ecológico*" and the PMVA. The thematic maps and the anamorphoses used by the program "*ICMS Ecológico*" are strictly territorial and pose difficulties to the implementation of the program in many municipalities of the northwest of São Paulo. As for the PMVA, although more democratic and with more qualified criteria, the program does not have the same amount of resources as the "*ICMS Ecológico*" and can, as more municipalities reach the goals proposed, fail to offer attractive incentives to keep municipalities engaged.

It is essential to keep in mind that the municipality is where people live, where things happen. It is where people are born, grow up, become adults, get old, learn, take care of their health, work, have fun and live surrounded by factors that make them feel safe or not. It is in the municipality where people use the so-called environmental assets, aiming at full social integration, based on the concept of citizenship (Fiorillo, 2000).

In the literature review, no research was found that correlated the municipal environmental performance, measured by the IAA, with the economic-financial variables (revenues and expenditures),

in particular, the availability of resources to meet the demands of public services and the realization of investments in infrastructure. Thus, this study seeks to evaluate whether there is a correlation between the expenditures by function and the municipalities' revenues (their own revenues and other revenues from intergovernmental transfers) and the indices of environmental performance of the municipalities.

### 3. METHODOLOGY

#### 3.1 Sample and data collection

The sample is composed of the municipalities of the state of São Paulo, from 2008 to 2017 (in a universe of 645 municipalities). The study used data from all the municipalities that made them available in Finbra<sup>6</sup> (Sistema de Informações Contábeis e Fiscais do Setor Público Brasileiro [Siconfi], n.d.) and the Program “*Município VerdeAzul*” (PMVA, n.d.)<sup>7</sup>. Also, it gathered data on municipalities' tax revenues and government transfers and expenditures by function.

#### 3.2 Variables used in the models

##### 3.2.1 Economic, financial and fiscal data of the municipalities in the state of São Paulo

To analyze the correlations, the independent variables presented in Box 2 were selected, which have a conceptual relationship with the ten program goals. Only six variables related to revenues were considered. The central hypothesis was that the greater availability of resources has a negative or positive correlation with the municipality's IAA, depending on the nature and origin of the resources.

#### BOX 2 VARIABLES — MUNICIPALITIES' REVENUES (FISCAL EFFORT AND DEPENDENCY)

Variables	Measurement	Hypotheses and possible relations
Fiscal effort/ own revenues	Taxes: IPTU, ITBI e ISSQN; Fees: Exercise of police power; Services; Judicial fees and costs; Use of the integrated system of foreign trade; Fees and costs of administrative processes; Registration services; Fee for services related to fisheries and aquaculture; Cemetery; Extra-judicial fees and costs; Public cleaning; other fees.	Municipalities that are less fiscal dependent on federal resources tend to better manage the collection and control of their taxes; therefore, they should have less litigation in the management of economic activities and property rights and should have better performance in the preservation of natural resources; thus, positive relationship with the IAA is expected.

*Continue*

<sup>6</sup> Retrieved from [https://siconfi.tesouro.gov.br/siconfi/pages/public/consulta\\_finbra/finbra\\_list.jsf](https://siconfi.tesouro.gov.br/siconfi/pages/public/consulta_finbra/finbra_list.jsf)

<sup>7</sup> Retrieved from <http://verdeazuldigital.sp.gov.br/site/>

Variables	Measurement	Hypotheses and possible relations
Contribution of improvement	Contribution of improvement: Expansion of water supply and sewage systems; Expansion of public street lighting system; Road and supplementary infrastructure works and other contributions of improvement	Municipalities that are more fiscal dependent on local taxpayers to carry out investments in public services infrastructure and improvements should have worse environmental performance; thus, a negative relationship with the IAA is expected.
Economic activity index (ICMS per capita)	Resources obtained from ICMS taxpayers' economic activities (production and consumption)	The level of tax collection on production and consumption (ICMS) represents an index of economic activity of the municipalities; thus, the higher the index, the more significant the environmental impact of economic agents and litigation related to property rights about the preservation of natural resources. Therefore, a negative relationship between the economic activity index and the IAA is expected.
Federal fiscal transfers	Tax revenues from federal transfer	Municipalities that are more fiscal dependent on federal transfers tend to present a poorer management of the local tax collection and control; therefore, they probably have greater litigation in the management of economic activities and property rights, as well as in the preservation of natural resources; thus, a negative relationship with the IAA is expected.
State fiscal transfers	Tax revenues from state transfers of the municipality's share of the state tax ICMS, IPVA, and others.	Municipalities that are more dependent on state transfers tend to present poorer management of the local tax collection and control; therefore, they probably have greater litigation in the management of economic activities and property rights, as well as in the preservation of natural resources; thus, a negative relationship with the IAA is expected.
Financial compensation for the exploration of natural resources	Municipality's share of the royalties paid as compensation for use of water; Financial compensation for use of mineral resources (CFEM); Royalties – Financial compensation for oil production – Law 7990/1989; Royalties for exceeding oil production – Law 9478/1997, article 49, I and II; Royalties for special participation – Law 9478/1997, article 50; Oil Special Fund (FEP); and other transfers resulting from financial compensation for exploration of natural resources.	Municipalities that receive larger shares of the financial compensation for the exploration of natural resources should have greater litigation in the management of economic activities, property rights and the preservation of natural resources; thus, a negative relationship with the IAA is expected.

**Source:** Elaborated by the authors.

Among the principles for the formulation of sustainability policies, it is essential to have a consistent system of information to measure the economic performance of a country or region. The values of expenditure by function represent important controls to evaluate the efforts employed by

public management, both to meet social demands and to manage issues related to the protection and use of natural resources.

In a sustainable society, progress must be apprehended by the quality of life (health, longevity, psychological maturity, education, a clean environment, community spirit, smartly enjoyed leisure and so on) and not just by pure consumerism (Cavalcanti, 1999). Considering this aspect, 16 spending variables were selected that can be correlated with the PMVA goals, which include quality of life, public services, environmental management services and level of economic activity of the municipality, as shown in Box 3.

### BOX 3 VARIABLES — EXPENDITURES BY FUNCTION (COST OF PUBLIC SERVICES AND INVESTMENTS)

Variables	Measurement	Hypothesis and possible relations
Legislative branch	Legislative expenditures involve the following specific actions: the general administration of the processes and human resources involved, legislative action and external control actions.	The better the laws and regulation tools, elaborated in tune with the property rights and the social demands, the better the balance between the development of IAA.
Public safety	Expenditures on police administration, civil defense, and generation of information and intelligence.	Actions toward maintaining the order and building a proactive civil defense should be associated with better law-abiding citizens and less disorderly growth and unserved people in the municipality; thus, it should correlate positively with the IAA.
Social service	Expenditures on the administration of demands regarding assisting the elderly, the disabled, children and adolescents, and the community.	It is expected that municipalities that invest in minorities are more likely to have arrangements and mechanisms for the management of property rights and should have a better IAA.
Social security	Expenditures on the pension of municipal civil servants.	It is expected that municipalities that invest in the protection and future guarantee of their citizens will have better arrangements and mechanisms for the management of property rights and should present a better IAA.
Health	Expenditures on the general administration of primary care, hospital and outpatient services, prophylactic and therapeutic support, sanitary surveillance (and epidemiological surveillance) and food and nutrition.	It is expected that there will be an inverse relationship between expenditures on basic care services, hospital and outpatient care, and the IAA. This happens because problems that lead to the need for health care such as disorderly occupation, lack of basic sanitation, and poor essential public services such as waste collection and policies on waste treatment are usually related to less attention to natural resources of common and private interest.

*Continue*

Variables	Measurement	Hypothesis and possible relations
Work	Expenditures on monitoring standards of workers' benefits and protection, compliance with employment relation (level of employability) and job creation.	These practices should indicate that municipalities that more frequently monitor the conditions offered to private agents must adhere to social and environmental norms; thus, a positive relation of these expenditures with the IAA is expected.
Education	Expenditures on the provision of elementary school, secondary/high school, professional training, and higher education, including special education and education for adults.	It is believed that the more the municipality invests in education, the greater the level of citizens' environmental awareness, over time, promoting better balance when it comes to property rights, greater direct and indirect monitoring of the use of natural resources (recycling, water, protection of rivers and springs); thus, education spending is expected to correlate positively with the IAA.
Culture	Expenditures on the administration of historical, artistic and archaeological heritage, and with cultural diffusion.	The attention in the administration of the historical, artistic and archaeological heritage by the municipalities should reflect a greater degree of institutionalized awareness and better cultural diffusion of the local values and traditions; thus, it is expected that greater investments in cultural areas will lead public agents to demand that private agents comply with environmental standards; thus, a positive correlation with the IAA is expected.
Housing	Expenditures on the general administration of rural and urban housing.	Municipalities that offer better urban housing conditions, through popular housing programs, should produce less environmental impact; thus, a positive correlation of these expenditures with the IAA is expected.
Sanitation	Expenditures on the administration of basic rural and urban sanitation infrastructure.	Municipalities with high levels of spending on municipal health activities (rural and urban) should produce less environmental impact; thus, a positive correlation of these expenditures with the IAA is expected. However, it should be noted that many municipalities outsource these services via concession.
Environmental management	Expenditures on the administration of norms and practices for the preservation and conservation of the environment, including environmental control, recovery of degraded areas, and management of water resources.	Municipalities that have environmental management policies should show, in the medium term, a lower environmental impact and a positive correlation with the IAA, due to policies for the protection, control, and management of natural resources. However, it should be emphasized that there may be municipalities that apply resources, only in a decoupling way, in order to obtain access to more governmental resources and not producing environmental results (for example Law 12305/2010 – National Policy on Solid Waste; the Ecological ICMS).

*Continue*

Variables	Measurement	Hypothesis and possible relations
Agriculture	Expenditures on the management of supply, monitoring of rural extension (involving basins and areas of permanent preservation) and the promotion of agricultural production and defense.	Municipalities that seek to pay attention to agrarian policies can develop, together with farmers, in the medium term, greater awareness about the scarcity of natural resources.
Industry	Expenditures on the administration of the policies of industrial promotion and production and with the rules and regulations related to quality.	Municipalities that have devoted more effort in recent decades to attract companies tend to relax the assumptions of health surveillance and waste generation. Thus, a negative correlation of these expenditures with the IAA is expected.
Tourism	Expenditures on the administration of the diffusion of the economic opportunities regarding the exploration of the local historical, cultural and environmental vocation (that can be explored by touristic services), and expenditures on the activities of monitoring and control of the companies that work in this segment.	Municipalities that devote more effort to actions aimed at tourism services to strengthen trade and services activities tend to be more concerned with the conditions of job creation for local citizens, and these activities are less aggressive toward the environment; thus, a positive correlation of these expenditures with the IAA is expected.
Transportation	Expenditures with the administration of urban and interstate mobility flow (air, road, waterway and special transport).	Municipalities that offer better urban mobility to their citizens, through public transportation, should produce less environmental impact; thus, a positive correlation of these expenditures with the IAA is expected.
Sports and leisure	Expenses with the administration of activities related to high-performance sports, community sports, leisure, and special expenses.	Municipalities that offer better structures and activities of sport and leisure are generally more concerned with the management of public spaces of urban mobility to their citizens (public transport) and should produce less environmental impact; thus, a positive correlation of these expenditures with the IAA is expected.

**Source:** Elaborated by the authors.

### 3.3 Method and models

The research applied quantile regression, using the Stata® statistical software. The quantile regression, as well as the other regression techniques, is used to verify the relationship between variables, to show whether and how a variable influences the other variable. However, conventional regression analysis considers the method of minimization of least squares for estimation of parameters, while the quantile regression uses the minimization of weighted absolute errors. This method minimizes the effects of the outliers, and when the data do not have a normal distribution (assumption for applying regression), it presents a better result when estimating the central position of the distribution (B. R. Santos, 2012).



In order to identify if there is a significant relationship between the dependent and independent variables, the Environmental Assessment Index (IAA) was used as the dependent variable, whose objective is to measure the effectiveness of the environmental policy adopted by the municipalities. The IAA was used as proxy for environmental performance, calculated by the following equation:

$$IAA = \Sigma IDi + \Sigma PROi - PP \quad (2)$$

Where:

- $\Sigma IDi$ : is the sum of the indicators of compliance with environmental goals, whose maximum value of the sum is 80.
- $\Sigma PROi$ : is the sum of the indicators of the proactive actions of the municipality, related to the environmental goals.
- $PP$ : are any pending and/or environmental liabilities of the municipality, regardless of environmental goals.

The fiscal effort and dependence model (revenues) is expressed by the equation:

$$IAA_{i,t} = \alpha_0 + \alpha_1 Ef_{i,t} + \alpha_2 Cm_{i,t} + \alpha_3 Dfe_{i,t} + \alpha_4 Dff_{i,t} + \alpha_5 Cfrn_{i,t} + \alpha_6 Iae_{i,t} + \alpha_7 Dd_{i,t} + \alpha_8 Pp_{i,t} + \varepsilon_{i,t} \quad (3)$$

The independent variables<sup>8</sup> include:

- $Ef_{i,t}$  = Fiscal effort in the collection of local taxes ISSQN, ITBI, IPTU and fees, by the municipality i, in period t;
- $Cm_{i,t}$  = Contribution of improvement, collected by the municipality i, in period t;
- $Dfe_{i,t}$  = Fiscal transfers (from the state) received by the municipality i, in period t;
- $Dff_{i,t}$  = Fiscal transfers (federal) received by the municipality i, in period t;
- $Cfrn_{i,t}$  = Financial compensation (royalties) for the exploration of natural resources, received by the municipality i, in period t.

The resource allocation model (costs and capital expenditure) is expressed by the equation:

$$IAA_{i,t} = \alpha_0 + \alpha_1 Leg_{i,t} + \alpha_2 Sp_{i,t} + \alpha_3 As_{i,t} + \alpha_4 Ps_{i,t} + \alpha_5 Sau_{i,t} + \alpha_6 Edu_{i,t} + \alpha_7 Cul_{i,t} + \alpha_8 San_{i,t} + \alpha_9 Ga_{i,t} + \alpha_{10} Agr_{i,t} + \alpha_{11} Ind_{i,t} + \alpha_{12} Tur_{i,t} + \alpha_{13} Tran_{i,t} + \alpha_{14} Deslaz_{i,t} + \alpha_{15} Dd_{i,t} + \alpha_{16} Ppe_{i,t} + \alpha_{17} Ppc_{i,t} + \alpha_{18} Ppd_{i,t} + \varepsilon_{i,t} \quad (4)$$

The independent variables<sup>9</sup> include:

- $Leg_{i,t}$  = expenditure per capita with the legislative branch activities, by the municipality i, in period t;
- $Sp_{i,t}$  = expenditure per capita with public safety activities, by the municipality i, in period t;
- $As_{i,t}$  = expenditure per capita with social assistance activities, by the municipality i, in period t;
- $Ps_{i,t}$  = expenditure per capita with social security activities, by the municipality i, in period t;

<sup>8</sup> The economic and financial variables were scaled by the population, municipality/year.

<sup>9</sup> The economic and financial variables were scaled by the population, municipality/year.

- $Sal_{i,t}$  = expenditure per capita with health activities, by the municipality  $i$ , in period  $t$ ;
- $Edu_{i,t}$  = expenditure per capita with education activities, by the municipality  $i$ , in period  $t$ ;
- $Cul_{i,t}$  = expenditure per capita with culture activities, by municipality  $i$ , in period  $t$ ;
- $San_{i,t}$  = expenditure per capita with sanitation activities, by the municipality  $i$ , in period  $t$ ;
- $Ga_{i,t}$  = per capita expenditure with environmental management activities, by the municipality  $i$ , in period  $t$ ;
- $Agr_{i,t}$  = expenditure per capita with agriculture activities, by the municipality  $i$ , in period  $t$ ;
- $Ind_{i,t}$  = expenditure per capita with industry activities, by the municipality  $i$ , in period  $t$ ;
- $Tur_{i,t}$  = expenditure per capita with tourism activities by the municipality  $i$ , in period  $t$ ;
- $Tans_{i,t}$  = expenditure per capita with transportation activities, by the municipality  $i$ , in period  $t$ ;
- $Dlazz_{i,t}$  = expenditure per capita with the activities of sports and leisure management, by the municipality  $i$ , in period  $t$ .

The control variables used in the models were:

- $Iae_{i,t}$  = economic activity index, measured by total ICMS tax per capita, by the municipality  $i$ , in period  $t$ ;
- $Dd_{i,t}$  = population density, per municipality  $i$ , in period  $t$ ; and
- $PP_{i,t}$  = political party elected to the government, in municipality  $i$ , in period  $t$ .

It was necessary to separate political parties in groups, because if the division was made by the number of parties (25), it would not be possible to establish a link between some of the parties and environmental management, because of the small number of observations and hence the lack of statistical relevance. Thus, the parties were divided into three groups, according to their ideologies, according to box 4.

#### BOX 4 DISTRIBUTION OF POLITICAL PARTIES IN THREE GROUPS

Variable	Description	Parties
Left-wing parties	Left-wing parties	PCdoB, PDT, PMN, Pros, PSB, PT e Rede
Center and center-left parties	Center and center left parties	PEN, PHS, PPS, PRB, PRP, PSC, PSD, PSDC, PSL, PTB, PTC, PTN, PV e SD
Right-wing and center-right parties	Right-wing and center-right parties	DEM, PMDB, PP, PR e PSDB

Source: Elaborated by the authors.

Results obtained from the application of the linear equations are presented in the next section.

## 4. RESULTS ANALYSIS

Table 1 shows the descriptive statistics of the variables used in the survey in the period studied, related to the fiscal effort and dependence of the municipalities.

**TABLE 1** DESCRIPTIVE STATISTICS

Variables	Obs.	Average	Std. Dev.	Min.	Max.
IAA	5.995	40.84	30.64	-6.73	98.69
Fiscal effort/own revenues	5.995	281.16	299.24	0.00	4,017.19
Contribution of improvement	5.995	1.25	12.50	0.00	805.41
Federal fiscal transfers	5.995	887.05	624.41	0.00	9,403.30
Compensation for exploration of natural resources	5.995	1,170.51	925.53	0.00	14,404.56
State fiscal transfers	5.995	47.88	318.54	0.00	13,411.98
Economic activity index	5.995	126.43	178.49	0.00	3,375.46
Demographic density	5.995	310.26	1,224.42	3.70	13,509.70
Left wing parties	5.995	0.14	0.35	0	1
Center parties	5.995	0.30	0.46	0	1
Right wing parties	5.995	0.42	0.49	0	1

**Source:** Elaborated by the authors.

Regarding the variables related to the use of resources (expenditures by function – costs and capital).

**TABLE 2** DESCRIPTIVE STATISTICS

Variables	Obs.	Average	Std. Dev.	Min.	Max.
IAA	6.301	40.39	30.52	-6.73	98.69
Legislative branch	6.301	88.26	91.42	0.0	3274.6
Public safety	6.301	16.85	37.15	0.0	384.2
Welfare	6.301	127.00	102.42	0.0	1514.3
Social security	6.301	72.49	120.46	0.0	1478.4
Health	6.301	659.59	325.38	0.0	3245.0

*Continue*

Variables	Obs.	Average	Std. Dev.	Min.	Max.
Education	6.301	793.83	353.71	0.0	3418.2
Culture	6.301	27.89	40.27	0.0	785.2
Sanitation	6.301	57.82	90.22	0.0	952.4
Environmental management	6.301	14.63	40.63	0.0	1107.9
Agriculture	6.301	37.90	57.49	0.0	703.0
Industry	6.301	2.08	9.41	0.0	201.0
Tourism	6.301	13.02	53.61	0.0	1399.7
Transportation	6.301	82.81	119.16	0.0	1661.3
Sports and leisure	6.301	48.33	52.41	0.0	540.4
Demographic density	6.301	313.46	1,234.60	3.70	13,534.82
Left wing parties	6.301	0.14	0.35	0	1
Center parties	6.301	0.31	0.46	0	1
Right wing parties	6.301	0.42	0.49	0	1

Source: Elaborated by the authors.

#### 4.1 Analysis between the fiscal effort and dependency of the municipalities and the environmental performance

Analyses were performed between the environmental performance of the municipalities, measured by the program “*Município VerdeAzul*” (PMVA) in each municipality, and their financial resources, individually (revenues from tax and assets), which comprise the resources generated in the economic activities of the municipalities and the government transfers received.

In this group of variables, the aim was to observe whether a greater availability of resources per capita of the municipalities has a positive correlation with the IAA, for the period between 2008 and 2017. Table 3 shows the results obtained by the quantile regression method, considering four quantiles (0.1, 0.25, 0.5 and 0.75).

**TABLE 3** QUANTILE REGRESSION BETWEEN THE ENVIRONMENTAL ASSESSMENT INDEX, REVENUES (FISCAL EFFORT AND DEPENDENCY) AND CONTROL VARIABLES

Variables	Quantile 0.10		Quantile 0.25		Quantile 0.5		Quantile 0.75	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Constant	-1.6650	0.0000*	8.0025	0.0000*	35.7935	0.0000*	63.0158	0.0000*
Ef <sub>i,t</sub>	0.0049	0.0150**	0.0095	0.1050	0.0269	0.0000*	0.0212	0.0000*
Cm <sub>i,t</sub>	0.0244	0.3830	0.0156	0.8370	0.0033	0.9860	-0.0395	0.8610

Continue

Variables	Quantile 0.10		Quantile 0.25		Quantile 0.5		Quantile 0.75	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
$Dfe_{i,t}$	0.0013	0.0620	0.0014	0.1590	0.0028	<b>0.0040**</b>	0.0017	0.2100
$Dff_{i,t}$	0.0011	0.0050*	-0.0002	0.6800	-0.0057	<b>0.0000*</b>	-0.0030	<b>0.0000*</b>
$Cfrn_{i,t}$	-0.0017	0.0590**	-0.0022	0.3850	-0.0014	0.7130	-0.0016	0.5540
$Iae_{i,t}$	-0.0054	0.1660	-0.0027	0.7320	-0.0250	<b>0.0000*</b>	-0.0238	<b>0.0000*</b>
$Dd_{i,t}$	-0.0002	0.2030	-0.0012	<b>0.0000*</b>	-0.0015	<b>0.0000*</b>	-0.0019	<b>0.0000*</b>
$Ppe_{i,t}$	1.3703	0.1580	1.9413	0.1140	-1.3346	0.5370	-0.4373	0.8440
$Ppc_{i,t}$	0.0047	0.9710	0.4514	0.6710	0.8847	0.6580	6.5934	<b>0.0050*</b>
$Ppd_{i,t}$	0.2082	0.1990	2.6837	<b>0.0130**</b>	6.3598	<b>0.0040*</b>	7.8014	<b>0.0000*</b>
Pseudo R2	<b>0.0071</b>		<b>0.007</b>		<b>0.0216</b>		<b>0.0157</b>	

Source: Elaborated by the authors.

Level of statistical significance: \* 1%; \*\* 5% and \*\*\* 10%

Equation:  $IAA_{i,t} = \alpha_0 + \alpha_1 Ef_{i,t} + \alpha_2 Cm_{i,t} + \alpha_3 Dfe_{i,t} + \alpha_4 Dff_{i,t} + \alpha_5 Cfrn_{i,t} + \alpha_6 Iae_{i,t} + \alpha_7 Dd_{i,t} + \alpha_8 Pp_{i,t} + \varepsilon_{i,t}$

Note: sample formed of 5,995 observations, in the period between 2008 and 2017, using unbalanced panels.

According to the results, considering the period from 2008 to 2017 for the 645 municipalities of the state of São Paulo, it is possible to see that:

- The fiscal effort, measured by the municipalities' taxes (ISSQN, IPTU, ITBI and fees), was statistically significant in all quantiles, which leads to conclude that the more attention the municipality gives to economic activities and real estate transactions (and monitors such activities, as well as the order, customs and hygiene), the more it obtains, over time, a better result of environmental efficiency (IAA);
- The variable contribution of improvement, which represents the per capita volume of resources collected and used for the construction of infrastructure assets and public service offerings, was not statistically significant. This result is an indication that the municipalities with the worst environmental indices were negligent in the implementation of the master plan<sup>10</sup>, since they are passing on the costs of constructing infrastructure assets<sup>11</sup> for their residents;
- The fiscal dependence of the municipality, measured by the transfers received from the federal and state governments, shows a statistically negative relation in the case of federal resources, i.e., the more resources the municipalities receive, the lower the index over time. It can be assumed that more financially dependent municipalities have less monitoring of activities that produce environmental externalities. As for the transfers received from the state, the result is significant and positive for those with the lowest IAA, but does not have a significant influence on the municipalities that have the best environmental performance indexes;
- The financial compensation for the exploration of natural resources, received by the municipalities, is statistically significant only for the municipalities that present a lower IAA, with negative

<sup>10</sup> Includes the mechanisms such as the environmental regulation, the building law and the secretary of environmental management.

<sup>11</sup> Costs of paving roads, building storm sewer and water and sanitation system.

coefficients, which may indicate that, the more financial compensation is received, the lower the concern or attention given by the municipality to the protection of natural resources;

- The economic activity index indicates a statistically significant relation for almost all quantiles, that is, the greater the economic activity of the municipality, the lower the environmental performance. Therefore, municipalities that seek to attract companies, with the promotion of economic and social development, through policies of granting fiscal incentives, tend to adopt greater relaxation for the environmental rules;
- The political party in municipal government, measured in three groups (left-wing, center, and right-wing), indicates that only the center and right wing parties have a positive and statistically significant correlation with the environmental performance of the municipality.

#### 4.2 Analysis between the municipalities' expenditures with costs of public services and investments, and environmental performance

In this model, we analyzed the relationship between the environmental performance of municipalities (IAA) and the expenditures incurred with the cost of public services and investments, for the period between 2008 and 2017.

**TABLE 4** QUANTILE REGRESSION BETWEEN THE ENVIRONMENTAL ASSESSMENT INDEX, EXPENDITURES BY FUNCTION (COSTS OF PUBLIC SERVICES AND INVESTMENTS) AND CONTROL VARIABLES

Variables	Quantile 0.10		Quantile 0.25		Quantile 0.5		Quantile 0.75	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Constant	-2.6366	<b>0.0000*</b>	9.0977	<b>0.0000*</b>	44.7849	<b>0.0000*</b>	69.0474	<b>0.0000*</b>
Leg <sub>i,t</sub>	0.0075	0.1170	0.0036	0.6020	-0.0094	0.2260	-0.0185	0.1950
Sp <sub>i,t</sub>	0.0155	0.1190	0.0898	<b>0.0000*</b>	0.1614	<b>0.0000*</b>	0.0683	<b>0.0000*</b>
As <sub>i,t</sub>	-0.0071	<b>0.0010*</b>	-0.0019	0.7620	0.0124	0.4110	0.0051	0.3530
Ps <sub>i,t</sub>	0.0010	0.5850	0.0039	0.1170	0.0310	<b>0.0000*</b>	0.0264	<b>0.0000*</b>
Sau <sub>i,t</sub>	0.0074	<b>0.0000*</b>	0.0041	<b>0.0280**</b>	0.0038	0.3000	0.0033	0.4590
Edu <sub>i,t</sub>	0.0018	<b>0.0220**</b>	-0.0049	<b>0.0030*</b>	-0.0292	<b>0.0000*</b>	-0.0221	<b>0.0000*</b>
Cul <sub>i,t</sub>	-0.0137	0.0080*	0.0001	0.9930	0.0181	0.2140	0.0355	<b>0.0110**</b>
San <sub>i,t</sub>	-0.0010	0.6320	0.0064	0.2070	0.0220	<b>0.0090*</b>	0.0280	<b>0.0010*</b>
Ga <sub>i,t</sub>	0.0108	0.2250	0.0437	<b>0.0210**</b>	0.0935	<b>0.0000*</b>	0.0865	<b>0.0000*</b>
Agr <sub>i,t</sub>	0.0039	<b>0.0720***</b>	0.0175	<b>0.0470**</b>	0.0602	<b>0.0020*</b>	0.0530	<b>0.0000*</b>
Ind <sub>i,t</sub>	0.0555	0.2440	0.1788	<b>0.0320**</b>	0.2501	<b>0.0000*</b>	0.1126	<b>0.0220**</b>
Tur <sub>i,t</sub>	-0.0075	<b>0.0010*</b>	-0.0087	0.1580	-0.0181	<b>0.0270**</b>	-0.0525	<b>0.0000*</b>
Tran <sub>i,t</sub>	-0.0080	<b>0.0000*</b>	-0.0063	0.1290	-0.0108	0.2490	-0.0160	<b>0.0900***</b>



Variables	Quantile 0.10		Quantile 0.25		Quantile 0.5		Quantile 0.75	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
<b>Deslaz<sub>i,t</sub></b>	-0.0091	<b>0.0580***</b>	0.0184	<b>0.0770***</b>	0.0624	<b>0.0000*</b>	0.0570	<b>0.0000*</b>
<b>Dd<sub>i,t</sub></b>	-0.0003	<b>0.0180**</b>	-0.0013	<b>0.0000*</b>	-0.0016	<b>0.0010*</b>	-0.0017	<b>0.0000*</b>
<b>Ppe<sub>i,t</sub></b>	1.0262	0.0960	2.0324	<b>0.0140**</b>	-1.7405	0.3840	-1.7279	0.3790
<b>Ppc<sub>i,t</sub></b>	0.2605	0.4020	-0.2725	0.7850	-1.3656	0.5450	4.4903	<b>0.0510***</b>
<b>Ppd<sub>i,t</sub></b>	0.5468	0.1250	2.7774	<b>0.0110**</b>	4.7753	<b>0.0390**</b>	6.4056	<b>0.0010*</b>
<b>Pseudo R2</b>	<b>0.0245</b>		<b>0.0245</b>		<b>0.0529</b>		<b>0.051</b>	

Source: Elaborated by the authors.

\* 5% level of statistical significance: \* 1%; \*\* 5% and \*\*\* 10%

Equation:  $IAA_{i,t} = \alpha_0 + \alpha_1 Leg_{i,t} + \alpha_2 Sp_{i,t} + \alpha_3 As_{i,t} + \alpha_4 Ps_{i,t} + \alpha_5 Sau_{i,t} + \alpha_6 Edu_{i,t} + \alpha_7 Cul_{i,t} + \alpha_8 San_{i,t} + \alpha_9 Ga_{i,t} + \alpha_{10} Agr_{i,t} + \alpha_{11} Ind_{i,t} + \alpha_{12} Tur_{i,t} + \alpha_{13} Tran_{i,t} + \alpha_{14} Deslaz_{i,t} + \alpha_{15} Dd_{i,t} + \alpha_{16} Ppe_{i,t} + \alpha_{17} Ppc_{i,t} + \alpha_{18} Ppd_{i,t} + \varepsilon_{i,t}$

Note: sample formed of 6,301 observations, in the period between 2008 and 2017, using unbalanced panels.

Table 4 shows the results obtained by quantile regression, considering four quantiles (0.1, 0.25, 0.5, 0.75). The results indicate that:

- Social security expenditures have a positive and statistically significant correlation with the IAA;
- There was no significant correlation between the municipalities' IAA and health expenditures; this may be due to the population density and the quality of public services provided by the municipality (eg, lack of sewage services), which generate greater demand for health;
- Education expenditures showed negative correlation with the municipalities' IAA, in almost all quantiles. Unfortunately, there are no results that prove that the greater the expenditure on education, the greater the citizens' environmental awareness;
- Basic sanitation expenditures proved to be significant for almost all quantiles, except for 0.2; 0.3, and 0.4. These results demonstrate that investments in sanitation promote better quality of local life and greater protection of natural resources;
- The expenditures with agriculture were used as a measure of the economic vocation of the municipality; the results obtained showed a positive correlation with the IAA. These results may indicate that the greater the territory and the more distant the municipality is from the industrial centers and the metropolitan regions, the higher the IAA;
- Expenditures on transport activities have a negative and statistically significant correlation with the IAA; this may indicate that the greater the expense with transportation, the more externality is produced;
- Expenditures on sports and leisure activities were statistically significant in nine quantiles, which shows that the higher the IAA, the more municipalities have invested in activities for the citizens' well-being;
- Demographic density was used as a control variable; in all quantiles, a negative and statistically significant relation was observed, where the higher the population density, the lower the municipalities' IAA;

- The results of the political party variable presented results similar to those obtained in the first model. Center and right-wing parties have a positive and statistically significant correlation with the groups of municipalities that present better IAA.

## 5. FINAL CONSIDERATIONS

The study analyzed the influence of socioeconomic variables on the environmental performance of municipalities in the last ten years, using the environmental assessment index (IAA) applied to the municipalities of the state of São Paulo. According to Girão (2012), the IAA has limitations, but it is an adequate environmental indicator.

The research did not advance in explaining how the socioeconomic variables affect the IAA and was limited to observe if there are correlations and whether these correlations are significant. The statistical analysis identified if there were relations between the ten goals of the program “*Município VerdeAzul*” (PMVA) with the variables of the proposed models. In the first model, the variables related to the fiscal effort and dependence of the municipality (revenues) were observed; in the second model, the variables related to realized expenditures and expenditures by function were analyzed.

The results show:

- Fiscal effort in the collection of municipal taxes, indicates more attention to local economic activities and attention to externalities produced;
- The dependence of collected taxes, through the contribution of improvement, is a sign of insufficient infrastructure to environmental and sanitation demands. It is correlated with the lower IAA;
- Fiscal dependence of federal transfers entails less attention to environmental and fiscal demands;
- Receiving financial compensation for the exploration of environmental resources is related to lower IAA;
- Economic activity and population density have a negative impact on environmental indices;
- Municipalities with better IAA are more aware of keeping the social order, and alert to sanitation and monitoring the economic activities;
- Social services expenditures show correlation only with the group of municipalities with the worst environmental indices;
- Municipalities governed by the center and right wing political parties have obtained better IAA, comparatively, to the governments that adopt more progressive strategies and with focus on the demands related to the direct combat of the social inequalities; and
- Municipalities that present the best IAA are those that invest the most in the municipality’s environmental management, sanitation, culture, public safety, social security, and sports and leisure. However, the research identified a negative relation of the IAA with the expenditures on tourism, transportation, education and demographic density of the municipalities.

Finally, the findings are robust to affirm that the public policies adopted correlate with the environmental assessment index (IAA) of the municipalities, during the analyzed period (2008 to 2017). The statistical results allow concluding that the expenditures by function showed in the proposed model have greater explanatory power compared to the model based on revenues (fiscal effort and dependence), in the evaluation of the environmental performance of the municipalities in the state of São Paulo.

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