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Determinants of public transparency in Brazilian capitals using multiple linear regression

Determinantes da transparência pública nas capitais brasileiras a partir do uso de regressão linear múltipla

Determinantes de la transparencia pública en las capitales brasileñas mediante regresión lineal múltiple

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ABSTRACT

Objective: To identify determinants capable of influencing the level of transparency in Brazilian capital cities using multiple linear regression. **Methodology:** Multiple linear regression was used, with the dependent variable being the transparency index calculated by the Center for Studies on Administrative Transparency and Public Interest Communication (NETACIP) at USP, and the independent variables being GDP per capita, industrial GDP, IDEB (Brazilian Development Index), HDI (Individual Development Index), infant mortality, sewage disposal rates, population, and schooling rates. **Origin:** This broadened the scope of research aimed at identifying variables capable of increasing the level of public transparency. **Results:** The findings reinforce the importance of choosing independent variables and their association due to their multifaceted relationships. Among the eight variables proposed in the study, three were statistically significant: HDI, IDEB, and GDP per capita after testing a second regression model, emphasizing the impact of the first variable on the others. **Theoretical contributions:** The impacts of statistically significant variables were accurately identified, enabling future users of the proposed model to better select the suggested variables in the decision-making process. **Social contributions:** The study aims to contribute to the dissemination of transparency as a tool for improving citizen participation.

Keywords: Public transparency. Accountability. Multiple linear regression.

RESUMO

Objetivo: identificar determinantes capazes de influenciar o nível de transparência das capitais brasileiras, mediante o uso de regressão linear múltipla. **Metodologia:** uso de regressão linear múltipla, tendo como variável dependente o índice de transparência calculado pelo Núcleo de Estudos da Transparência Administrativa e da Comunicação de Interesse Público (NETACIP), da USP, e como variáveis independentes, o PIB *per capita*, PIB indústria, IDEB, IDH, mortalidade infantil, taxa de esgoto, população e taxa de escolaridade. **Originalidade:** ampliação do escopo das pesquisas voltadas para identificação de variáveis capazes de elevar o nível de transparência pública. **Resultados:** os achados reforçam a importância da escolha das variáveis independentes e associação entre elas devido à relação multifacetada existente entre elas. Dentre as oito variáveis propostas no estudo, três resultaram significantes estatisticamente: IDH, IDEB e PIB *per capita* após teste de um segundo modelo de regressão analisado, com ênfase para o impacto da 1ª. variável em relação às demais. **Contribuições teóricas:** foram identificados com precisão os impactos das variáveis com significância estatística, possibilitando aos futuros usuários do modelo proposto uma melhor escolha das variáveis sugeridas junto ao processo de tomada de decisão. **Contribuições sociais:** busca contribuir para a difusão da transparência como instrumento de aperfeiçoamento da participação cidadã.

Palavras-chave: Transparência pública. *Accountability*. Regressão linear múltipla.

RESUMEN

Objetivo: Identificar los determinantes que influyen en el nivel de transparencia en las capitales brasileñas mediante regresión lineal múltiple. **Metodología:** Se utilizó la regresión lineal múltiple, siendo la variable dependiente el índice de transparencia calculado por el Centro de Estudios de Transparencia Administrativa y Comunicación de Interés Público (NETACIP) de la USP, y las variables independientes el PIB per cápita, el PIB industrial, el IDEB (Índice de Desarrollo Brasileño), el IDH (Índice de Desarrollo Individual), la mortalidad infantil, las tasas de alcantarillado, la población y la escolarización. **Origen**: Esto amplió el alcance de la investigación destinada a identificar variables capaces de aumentar el nivel de transparencia pública. **Resultados**: Los hallazgos refuerzan la importancia de elegir variables independientes y su asociación debido a sus múltiples relaciones. De las ocho variables propuestas en el estudio, tres resultaron estadísticamente significativas: el IDH, el IDEB y el PIB per cápita, tras probar un segundo modelo de regresión, destacando el impacto de la primera variable sobre las demás. **Contribuciones teóricas:** Se identificaron con precisión los impactos de las variables estadísticamente significativas, lo que permitió a los futuros usuarios del modelo propuesto seleccionar mejor las variables sugeridas en el proceso de toma de decisiones. **Contribuciones sociales:** El estudio busca contribuir a la difusión de la transparencia como herramienta para mejorar la participación ciudadana.

Palabras clave: Transparencia pública. Rendición de cuentas. Regresión lineal múltiple.

INTRODUCTION

In Brazil, transparency plays a key role in combating fraud and corruption, as it contributes to social control and optimizes the management of public resources (Zuccoloto & Teixeira, 2019). Additionally, at the international level, transparency is observed as an important factor for society's trust in the public sector (Bozhenko et al., 2023; Vasylieva et al., 2023; Zakharkin et al., 2022).

To ensure access to public information and promote social control, managers have adopted transparency practices mediated by information and communication technologies (Zimaitis et al., 2022; Midor et al., 2021; Maile & Vyas-Doorgapersad, 2023; Lyeonov et al., 2020; Lyeonov et al., 2021b). These initiatives expand citizens' access to fundamental rights and help mitigate corrupt practices. However, the adoption of transparency is not uniform across different spheres of government.

Studies by Gomes (2020), Lima and Portela (2019), and Costa and Souza (2020) have examined the importance of transparency in strengthening democracy and social control. Arruda (2016) analyzed the implementation of the Access to Information Law (LAI) (Law No. 12.527, 2011) in Brazilian municipalities, identifying compliance and influential variables in the transparency index. Together, these studies highlight the importance of effective transparency in the public sector, shaped by legal frameworks and institutional, administrative, and social conditions.

The association between transparency and public information has generated significant interest, leading the Center for the Study of Administrative Transparency and Communication of Public Interest (NETACIP) at the USP Law School to conduct a transparency ranking of Brazilian federated entities. the study aimed to help citizens access the rights guaranteed by Article 5 of the Federal Constitution (Federal Constitution, 1988-2025).

From the perspective of subnational public entities, transparency is even more varied, leading to the belief that in contexts with better institutional, fiscal, and administrative conditions, their performance is higher (Baldissera et al., 2021; Leite & Lira, 2023). This explains why identifying factors associated with public transparency has attracted significant academic interest (Brito, Bezerra Filho, and Santos, 2024; Carrara et al., 2025; Gramacho, Oliveira, and Silva, 2025; Palmeira, Oliveira, and Sena, 2026). These studies generally analyze the impact of factors exogenous to transparency, such as inequality, digital infrastructure, and fiscal autonomy, to identify relationships that can explain the behavior of managers, especially municipal managers.

In this context, socioeconomic variables have been repeatedly highlighted in the literature as key factors in explaining levels of transparency, which justifies their central role in recent empirical studies (Amaral et al., 2022; Leite & Lira, 2023; Fernandes & Teixeira, 2023). The focus on these variables stems from the understanding that conditions such as income level, education, economic development, and access to information influence both the institutional capacity of the State and the level of social demand for public information. Researchers have therefore prioritized these factors, recognizing

their foundational role in creating environments that foster accountability, social oversight, and the strengthening of public transparency practices.

Given the current context, this study aims to answer the following research question: What factors can influence transparency in Brazilian capitals?

The general objective is to investigate factors that influence transparency in Brazilian capitals. The specific objectives are: (i) to review the literature regarding the use of socioeconomic indicators as determinants of transparency levels in public management; and (ii) to explore significant relationships between the level of transparency in Brazilian capitals and their socioeconomic conditions.

As an academic justification, the importance of expanding studies focused on identifying and thoroughly analyzing variables that can positively and significantly impact transparency levels in public administration is highlighted. Such research advances theoretical and empirical knowledge about the determinants of transparency and supports the process of defining and selecting more robust and consistent indicators for its measurement.

On the social side, it seeks to promote transparency as a tool for improving citizen participation, since the people's involvement with public information can foster good governance and strengthen the rule of law. The identification of determinants, therefore, is able to offer analytical support to public administrators in formulating strategies to strengthen governance, accountability, and social control.

To this end, the work is divided into the following sections, in addition to this introduction: a theoretical framework addressing the main aspects of public transparency, the methodological procedures adopted, analysis and discussion of the results obtained, and the final considerations.

THEORETICAL REVIEW

Contextualizing public transparency

In a public context, theories aim to understand the structure under which an organization is formed and how its relationships are described, such as agency theory (Jensen & Meckling, 1976) and public choice theory, which originates from the writings of Marie Jean Antoine de Caritat, the Marquis de Condorcet (Buchanan & Tullock, 1962).

Agency theory suggests that social relations are based on formal or informal contracts between two or more individuals and are defined by two fundamental actors: agent versus principal (Sartori & Frederico, 2019). According to her, the relationships between these actors result in conflicts of interest, arising from the opposing desires of the parties involved, with additional impact when the political sphere acts as an agent in relation to the principal, the citizen.

A second theory related to AT is public choice theory (TEP). According to Rocha (2022), TEP focuses on analyzing individuals in the context of decision-making in public administration and promotes a deeper understanding of the incentives and motivations behind political decisions. It shows that public managers seek to achieve their personal goals through these choic-

es, demonstrating that their true intention is to remain in power and pursue private interests that often override the public purpose.

When applied to the public sector, both theories have relevant connections. While they explain the behavior of agents and decision-makers guided by private interests, they also provide foundations for creating mechanisms to mitigate these behaviors, such as governance, accountability, and public transparency.

Specifically regarding transparency in the public sector, these theories are useful for understanding it. Agency Theory demonstrates that transparency is not merely an accessory duty but the central mechanism to mitigate informational asymmetry between the manager (agent) and the citizen (principal). Public Choice Theory holds that the decision to promote open data is influenced by a rational calculation of political incentives and costs.

From this perspective, reducing government opacity serves as a tool to mitigate moral hazards, enabling society to monitor whether the agent acts in the public interest or pursues personal objectives. Therefore, data transparency imposes an exposure cost that managers tend to accept only under sufficient external pressure, factoring into the aforementioned calculation of incentives and political costs.

Therefore, it is understood that transparency is not a random phenomenon; on the contrary, it is intrinsically linked to the interaction between suppliers and demanders of information. From this dynamic arise the form, quantity, timeliness, and responsibility for the publication of data. Recognizing these aspects implies assuming that transparency goes beyond mere formal publicity, consolidating itself as a requirement for substantive accountability. From this perspective, it is no longer just the fulfillment of bureaucratic procedures but becomes an instrument of intelligibility, enabling citizens – in the agency relationship – not only to access data but also to understand the logic behind the allocation of public resources.

Based on the described relationships, it is assumed that the external environment exerts a decisive influence on the content disseminated, which is especially relevant in Brazil due to existing geographical, economic, and social disparities. In this context, socioeconomic and demographic variables – such as income, inequality, and education – can serve as drivers of public managers' behavior, explaining to what extent observed transparency levels are conditioned by these factors.

Determinants of public transparency

Transparency in public administration plays a fundamental role as a tool for control and verification. It allows citizens to know and assess whether the agreements made by public managers are being fulfilled. In addition, transparency promotes trust between citizens and public managers, supporting the growth of citizenship, the improvement of democracy, and confidence in decision-making by public agents (Mendonça et al., 2016).

Macadar et al. (2015) highlight that transparency allows the State to transmit its information to citizens in an agile and accurate manner, making the State open and visible to them. Since public transparency involves disclosing information of collective or general interest in an easily accessible

and understandable way, it enables social claims and helps society request changes related to the application of public resources (Cruz et al., 2012).

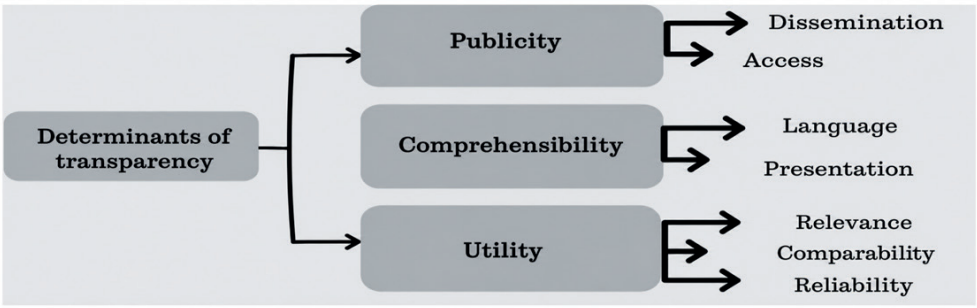
From a legal standpoint, transparency in public administration is a mandated rule within the country's legal framework, whether established by the Constitutional Charter or by statutory legislation. Transparency is implicitly linked to article 37, caput, together with article 5, item XXXIII, of the Federal Constitution of 1988 (Constitution of the Federative Republic of Brazil, 1988/2025), which enshrine both the principles of public administration and the right of access to information held by the State. This obligation is explicitly reinforced by the Fiscal Responsibility Law (Complementary Law No. 101 of 2000), which requires public managers to adopt practices that promote transparency, particularly regarding public participation, access to information on budget and financial execution, and the use of integrated financial management systems.

In addition, over the years, the transparency and publicity of Public Administration acts have clearly gained relevance, driven by the demands of a society with a new mentality regarding public services. This society began to demand greater participation and oversight in the implementation, execution, and control of public policies.

In a didactic manner, Oliveira and Ckagnazaroff (2022) present an adaptation (Figure 1) listing determinants of transparency to illustrate these concepts. Dissemination and public access, clarity and accessibility of language, relevance, comparability, and reliability of information are essential factors to ensure the quality of transparency. Other authors also address this topic (Baldissera et al., 2021; Hong & Kim, 2024).

Figure 1

Determinants of transparency



Note: Adapted from Oliveira and Ckagnazaroff (2022)

Between the coercive force of transparency norms and the realities within public organizations, there is a significant gap to be bridged. Transparency should not be understood as merely making data available; it depends on institutional arrangements that ensure access to and social appropriation of information, enabling its transformation into accountability (Brelàz et al., 2025; Teles et al., 2025). In other words, transparency extends far beyond a simple legal requirement; it is part of a broader system and should not be separated from accountability mechanisms, effective participation, and the integration of information with public action. Otherwise, it will become merely formal and have little impact (OECD, 2023).

Indeed, recent empirical evidence indicates that more demanding legislation on access to information can increase formal compliance, without necessarily achieving full transparency. According to Trautendorfer et al. (2025), the realization of this principle depends on additional factors, particularly institutional engagement and broader organizational commitments. Similarly, studies by Gjerazi (2025) and Romero (2025) indicate that the effects of transparency are more robust when combined with accountability instruments, institutional mediation mechanisms, and active forms of participation, demonstrating its intrinsic connection to existing governance arrangements.

In the country, although the normative framework for transparency is considered comprehensive and consistent, its implementation remains uneven among subnational entities. The national literature has tracked this issue over time, documenting the evolution and maturation of the debate. Zuccolotto and Teixeira (2014) highlighted the influence of fiscal and socioeconomic constraints on the transparency levels of Brazilian states. Later, Raupp (2022) demonstrated that, even after a decade of the LAI, significant limitations persist in the effectiveness of passive transparency. More recently, Leite and Lira (2023) expanded this research agenda by emphasizing the combined importance of economic, social, and political factors in explaining the observed variations.

Therefore, despite considerable progress in the country on this topic, significant gaps persist, highlighting the difference between the concepts and their effective implementation. Given this, it is necessary to broaden the debate surrounding transparency by incorporating other relevant aspects to deepen understanding of the subject. The following section addresses some of the variables involved in this discussion.

Previous studies

Previous studies were identified through a structured literature review aimed at mapping empirical evidence on factors associated with levels of public transparency, particularly in the context of subnational governments. Systematic searches were conducted in the SPELL (Scientific Periodicals Electronic Library), CAPES Journal Portal, and Google Scholar databases, using combinations of the keywords “public transparency,” “determinants of transparency,” “local governments,” and “public sector.” The inclusion criteria considered empirical studies focused on subnational entities, published in scientific journals or conference proceedings, that used quantitative or mixed methods and included socioeconomic, institutional, or political variables as explanatory factors of transparency. The results are as follows:

Table 1

Studies on determinants of government transparency

Author/year	Objective	Methodology	Result
Santos et al. (2021)	To analyze the determinants of passive public transparency in municipalities in Minas Gerais.	Tobit Model	GDP per capita, IFDM, education, manager's age, and per capita revenue influenced passive transparency.
Amaral et al. (2022)	Investigate the effect of municipal development on public transparency.	Quantitative study with descriptive statistics and Tobit model.	Average per capita income, per capita income, age of the population, and GDP per capita showed a significant relationship with public transparency, and GDP per capita had the opposite sign from what was expected.
Herman, Marques and Miola (2022)	To analyze factors associated with the digital transparency of local governments in Brazil.	Multiple regressions with 5,563 municipalities.	Population, GDP per capita, schooling and electoral participation were relevant.
Leite e Lira (2023)	Analyze the economic, social, political, and fiscal determinants of state transparency.	Multiple linear regression with panel data.	Population, education, illiteracy, electoral participation, financial autonomy and indebtedness explained the state's transparency.
Fernandes, Fernandes and Teixeira (2023)	To analyze the impact of inequality on subnational transparency.	Empirical study with panel data.	Greater economic equality was associated with greater transparency; Inequality had a negative relationship with transparency.
Brito, Bezerra Filho and Santos (2024)	To examine exogenous factors associated with the transparency of the municipalities of Pernambuco.	Regression with panel data.	MHDI, GDP per capita, IDEB, IFGF and revenue collected per capita showed a positive relationship with transparency.
Palmeira, Oliveira and Sena (2026)	Investigate the relationship between fiscal autonomy and municipal transparency.	Panel data with multiple linear and quantile regression.	Fiscal autonomy showed a positive relationship with municipal transparency.

Source. Prepared by the authors based on the studies analyzed.

The studies revealed considerable advances in research on public transparency in Brazil, highlighting that economic and demographic factors, such as GDP *per capita* and population size, are central determinants for the disclosure of government data. Research by Herman, Marques, and Miola (2022) and Leite and Lira (2023) shows that municipalities with larger populations and greater economic dynamism tend to have higher levels of digital and state transparency. However, the relationship with GDP is not linear. Amaral et al. (2022) observed an opposite effect to what was expected in certain analyses, suggesting that municipal wealth alone does not guarantee effective transparency if management is not focused on accountability.

In addition to financial factors, human and social development indicators such as the HDI (MHDI), IDEB, and schooling have become established as positive predictors of transparency. According to Brito, Bezerra Filho, and Santos (2024), stronger educational and social welfare indicators are directly linked to more transparent management, reflecting the influence of active citizenship and bureaucratic capacity. Although specific indicators like mortality and sewage (sanitation) rates often appear in aggregate form within development indices such as the IFDM (Santos et al., 2021) and the MHDI, they represent the social dimension of transparency: municipalities with better basic infrastructure and lower mortality rates tend to have more robust and transparent administrative structures.

These aspects indicate relative convergence regarding the relevance of socioeconomic variables, although the results are not homogeneous and vary according to context and methodological approach. This heterogeneity supports the formulation of the following hypotheses, which aim to test the joint effect of the identified factors on the level of transparency in Brazilian capitals, recognizing the multifaceted nature of these relationships:

> *H0: the variables GDP per capita, schooling rate, population, infant mortality, sewage rate, HDI, IDEB and industry GDP do not jointly influence the transparency index.*
>
> *H1: at least one of the variables GDP per capita, schooling rate, population, infant mortality, sewage rate, HDI, IDEB and industry GDP jointly exert influence on the transparency index.*

Methodology

The research used a quantitative approach to the problem, with exploratory and explanatory objectives, and employed documentary procedures.

The survey included the populations of the 26 Brazilian capitals, excluding the Federal District. The selection of capitals is based on the fact that these cities typically have more robust socioeconomic and demographic indicators than smaller municipalities. Additionally, their roles as political, economic, and administrative centers increase the analytical relevance of the study.

The study focused on the year 2023 to ensure complete information at the time of data collection, which is essential given the potential evolution of government practices over time. This approach provided a current and comprehensive view of transparency practices in Brazilian capitals, increasing the accuracy and relevance of the survey.

Data collection was based on secondary data. For the determinant factors of the study, the variables were selected based on previous empirical studies indicated in Table 2 below.

The data used to form the dependent variable (capitals) (*Transparency Ranking* 2021-2022) were extracted from the study prepared by the Center for Studies on Administrative Transparency and Communication of Legal Interest (NETACIP, 2022):

Table 2

Transparency Ranking of Brazilian Capitals 2021-2022

State	Municipality	Transparency Index	Note
Ceará	Fortaleza	342	91,44%
Rio de Janeiro	Rio de Janeiro	336	89,84%
Pernambuco	Recife	326	87,17%
Acre	Rio Branco	323	86,36%
Tocantins	Palmas	320	85,56%
Mato Grosso do Sul	Campo Grande	316	84,49%
Amazon	Manaus	311	83,16%
Paraíba	João Pessoa	309	82,62%
Roraima	Boa Vista	307	82,09%
São Paulo	São Paulo	307	82,09%
Victory	Vitória	304	81,28%
Goiás	Goiânia	301	80,48%
Rondônia	Porto Velho	301	80,48%
Pará	Belém	294	78,61%
Mato Grosso	Cuiabá	294	78,61%
Paraná	Curitiba	284	75,94%
Minas Gerais	Belo Horizonte	283	75,67%
Rio Grande do Norte	Natal	282	75,40%
Piauí	Teresina	281	75,13%
Amapá	Macapá	274	73,26%
Santa Catarina	Florianópolis	251	67,11%
Alagoas	Maceió	240	64,17%
Maranhão	São Luís	240	64,17%
Rio Grande do Sul	Porto Alegre	228	60,96%
Bahia	Salvador	219	58,56%
Sergipe	Aracaju	201	53,74%

Note: NETACIP, 2021-2022

The list of independent variables was based on socioeconomic and demographic indicators discussed in the national and international literature:

Figure 2

Dependent and independent variables used in the research

Type	Description	Source	Relationship	
			Positive	Negative
Dependent	Transparency Ranking	FDUSP	Not applicable	Not applicable
Independent	Human Development Index – HDI	UNDP	Akbari et al., 2022; Faria et al. (2022) Khosrowjerdi, M. (2022). Vasylieva, T. et al. (2023)	
Independent	Schooling rate from 0 to 10 years	IBGE	Baldissera (2020);	
Independent	Basic Education Development Index - IDEB	INEP	Baldissera (2020); Bartoluzzio and Anjos (2020); Brito, Bezerra Filho and Santos (2024)	
Independent	GDP per capita	IBGE	Baldissera (2020); Khosrowjerdi, M. (2022).	Leite e Lira (2023); Costa et al. (2020);
Independent	Industrialization of the municipality	IBGE		
Independent	Infant mortality (deaths per 1000 live births)	DATASUS		
Independent	Adequate sanitary sewage rate	ISNIS		
Explanatory	Population	IBGE	Leite e Lira (2023); Baldisserra (2020); Khosrowjerdi, M. (2022).	Bartoluzzio and Angels (2020)

To determine whether the variables contribute in any way to explaining transparency, an Analysis of Variance (ANOVA) was performed. As indicated by Costa et al. (2020), ANOVA uses means to assess the existence of statistically significant differences in the data and to analyze the relevance of these differences between the information. It was observed that analysis of variance tables are common in various types of statistical studies and are often integrated into programs for regression analysis, as well as into spreadsheets that support this type of analysis.

For data analysis, the statistical programming and graphics language R was used. This language is notable for its specialized capabilities in data manipulation, analysis, and visualization, offering a wide range of functionalities. R supports data in various formats, enabling the generation of detailed reports, calculation of comprehensive descriptive statistics, execution of complex statistical analyses, and creation of graphical representations.

It is believed that the ability to create high-quality graphs in R also plays a key role in data analysis, as effective visual representation can facilitate the understanding and communication of results. Therefore, the choice of this programming language is supported by its features and power in data manipulation, making it an essential tool for this research study.

The model used for the analysis included the independent variable (FDUSP transparency ranking) and the following explanatory variables: GDP *per capita* (in reais), schooling rate for ages 6 to 14, population, infant mortality rate (deaths per 1,000 live births), adequate sanitary sewage rate, human development index (HDI), basic education index (IDEB) for the initial

years, and industry participation rate in GDP. These variables were used to explain the points/transparency scores.

The points are calculated as the sum of the indicators in the transparency index, while the score is the standardized version of the points variable, expressed as a percentage (%) to facilitate comparison. Given the sample size, n, of the Brazilian capitals, where n = 26, the sample is limited. Descriptive analysis plays a significant role in statistics, as it aids in describing and understanding the behavior of variables and provides evidence for modeling.

After describing the variables, two concurrent multiple linear regression models were fitted to explain the transparency scores of the 26 capitals of Brazil, based on variables such as GDP *per capita* (R$), schooling rate, population, infant mortality, sewage rate, HDI, IDEB, and industry GDP.

The first model, model 1, has the following relational form:

$$\begin{aligned}\text{Transparency points} = {} & \beta_0 + \beta_1 \cdot \text{GDP per capita (R\$)} \\ & + \beta_2 \cdot \text{Schooling rate} + \beta_3 \cdot \text{Population} + \beta_4 \cdot \text{Infant mortality} \\ & + \beta_5 \cdot \text{Sewer rate} + \beta_6 \cdot \text{HDI} + \beta_7 \cdot \text{IDEB} + \beta_8 \cdot \text{GDP Industry} + \varepsilon\end{aligned}$$

Where:

- β_0 represents the intercept, which indicates the expected level of transparency when all explanatory variables are zero.
- β_1 indicates the relationship between GDP *per capita* and transparency points;
- β_2 shows how the schooling rate influences the points of transparency;
- β_3 represents the relationship between the population and the points of transparency;
- β_4 indicates how the infant mortality rate influences the points of transparency;
- β_5 shows the relationship between the sewage rate and the transparency points;
- β_6 represents the influence of the Human Development Index (HDI) on transparency points;
- β_7 indicates the relationship between the Basic Education Development Index (IDEB) and the transparency points;
- β_8 shows how the industry's GDP influences transparency points;
- ε the error that quantifies the failure of the model to fit the data exactly.

The second model to be fitted, model 2, has the following relational form:

$$\log \text{Transparency points} = \beta_1 \cdot \text{GDP per capita (R\$)} + \beta_2 \cdot (\text{GDP per capita (R\$)})^2 + \beta_3 \cdot \text{HDI} + \beta_4 \cdot (\text{HDI})^2 + \beta_5 \cdot \text{IDEB} + \varepsilon$$

Where:

- β_1 represents the linear relationship between GDP *per capita* and the logarithm of the transparency points;
- β_2 represents the quadratic relationship between GDP *per capita* and the logarithm of the transparency points;
- β_3 represents the linear relationship between the HDI and the logarithm of the transparency points;
- β_4 represents the quadratic relationship between the HDI and the logarithm of the transparency points,
- β_5 represents the linear relationship between the IDEB and the logarithm of the transparency points;
- ε the error that quantifies the failure of the model to fit the data exactly.

Comparing model 1 and model 2, it was observed that model 1 is more complex than model 2. Complexity was defined as the number of parameters involved in the modeling. Model 1 contains 9 parameters, while model 2 has only 5 parameters.

In addition to this difference in parameters, it was observed that model 2 did not include the intercept, β_0. The intercept indicates the expected level of transparency when all explanatory variables are zero, indicating the average transparency points of Brazilian capitals when GDP *per capita* (R$), schooling rate, population, infant mortality, sewage rate, HDI, IDEB, and industry GDP are all zero, which does not occur in practice.

Another difference between models 1 and 2 is the form of the dependent variable. In model 1, no transformation was applied to the transparency points of the Brazilian capitals, while in model 2, the logarithm of the transparency points of the Brazilian capitals is used.

The transformation used in model 2 is monotonic, meaning it does not alter the ranking of the transparency of the capitals. This lack of change in order is desirable, as it does not affect the model's ability to capture the relationship between variables.

RESULTS AND DISCUSSIONS

Analysis of Results

The examination of the results began with the presentation of measures of position and dispersion, which are very useful for initially understanding the proposed variables.

Table 3

Data from the described analysis of dependent and independent variables

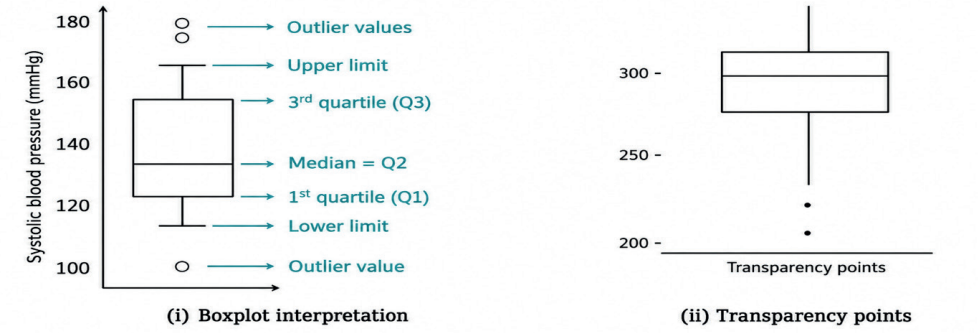
	Minimum	1st Wednesday.	Median	Average	3rd Quar.	Maximum	Desv. Pad.	Coef. Var.
Transparency Index	201,00	268,25	297,50	287,46	312,25	342,00	37,03	12,88%
GDP *per capita*	20,417	24,615	32,848	34,743	42,144	69,628	12,727	36,63%
Schooling rate	0,9420	0,9588	0,9670	0,9653	0,9760	0,9840	0,0115	1,19%
Population	302,692	518,017	928,008	1.679,556	1.846,21	11.451,99	2.327.642	138,59%
Infant mortality	7,100	9,460	12,060	12,088	13,845	19,620	3,140	25,97%
Sewage rate	0,0010	0,2460	0,6360	0,7747	0,7388	0,9680	0,2987	54,80%
HDI	0,7210	0,7498	0,7690	0,7747	0,8005	0,8470	0,0346	4,46%
IDEB	4,300	5,075	5,450	5,438	5,800	6,300	0,459	8,44%
Industry GDP	0,0740	0,1083	0,1240	0,1417	0,1575	0,36306	0,0632	44,57%

Based on this data set, the variable showing the greatest change is the population, which highlights the population disparity among Brazilian capitals. The variable with the least variability is the schooling rate, indicating well the homogeneity of this indicator across the capitals. Three other notable variables are the sanitary sewage rate (54.8%), industrial GDP (44.8%), and GDP *per capita* (36.6%). Individually, the data suggest regional disparities in the country, particularly the need for a greater State presence, differences in the level of industrialization among capitals, and why the distribution of wealth is so unequal.

Figure 3 shows a boxplot of the transparency index variable, which is ideal for observing the distribution of this variable in the analyzed sample set.

Figure 3

Capital Transparency Index boxplot chart



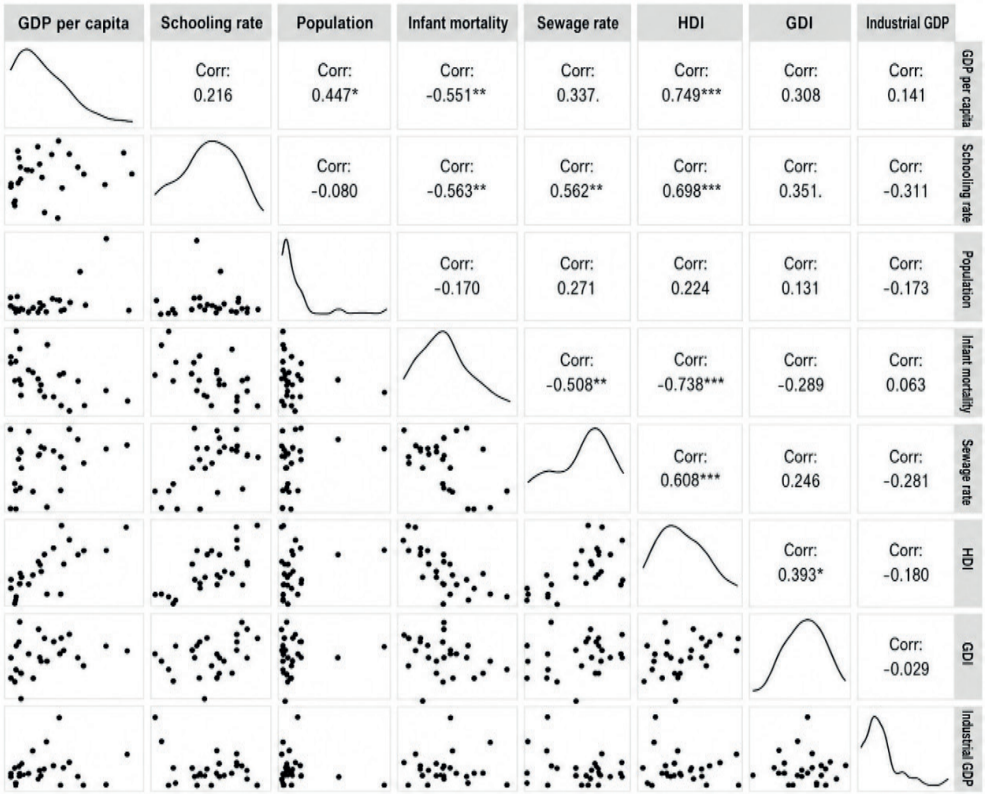
Note: adapted from Tukey (1997)

Based on the interpretation of the figure, there are outliers at the bottom of the graph, and the median is close to 300 points, with most results below this value.

Figure 4 shows the dispersion matrix of the variables studied, which is useful for visualizing relationships between pairs of variables and interpreting correlations, hypothesis tests, and pairwise dispersions. The principal diagonal displays the kernel density estimate of each variable.

Figure 4

Dispersion matrix of variables



In the analysis of the correlations in the upper part of the dispersion matrix, it was noted that industrial GDP does not show a significant correlation with any variable. This indicates that, although there are correlations among the variables, these relationships are not strong enough to influence the other variables.

The HDI variable showed statistical significance with all other variables except population. There was a positive correlation between HDI and GDP *per capita*, indicating that as HDI increases, GDP *per capita* also increases. Regarding infant mortality, the correlation was negative, meaning that as HDI increases, infant mortality decreases. The other correlations followed a similar interpretation.

At the bottom of the matrix are scatter plots for each pair of variables, with quantified correlations at the top. Both approaches offer a similar interpretation: the lower part graphically displays the relationships, while the upper part provides the numerical correlations.

It was also observed that, on the main diagonal, the variables GDP *per capita*, population, and industrial GDP show left skewness, indicating that few capitals have high values. The sewage rate, on the other hand, presents asymmetry to the right.

Table 4 summarizes the results of the Shapiro-Wilk test for each variable, which is used to determine whether the data follow a Gaussian (normal) or non-Gaussian (non-normal) distribution.

Table 4

Shapiro-Wilk normality test

Variable	Statistics	p-value
Transparency weights	0,9278	0,0687(*)
GDP per capita	0,8961	0,0129
Schooling rate	0,9631	0,4557(*)
Population	0,5500	0,0000
Infant mortality	0,9677	0,5649(*)
Sewage rate	0,9182	0,0409
HDI	0,9615	0,4217(*)
IDEB	0,9845	0,9522(*)
Industry GDP	0,8184	0,0004

Legend: p-value < 0.05, the null hypothesis of normality is rejected; p-value>0.05, the null hypothesis of normality is accepted (*)

Based on these results, the variables GDP *per capita*, population, sewage rate, and Industry GDP do not follow a normal distribution, with statistical significance below 0.05. This outcome was expected due to the shape of these variables on the main diagonal of Figure 4.

Table 5 shows the correlations between the variables, adding the associated p-values , complementing the correlation matrix and hypothesis tests in Figure 4.

Table 5

Correlation matrix of variables

	GDP per capita	Schooling Rate	Population	Infant mortality	Sewage Rate	HDI	IDEB	GDP Industry
GDP per capita	1,000	0,216	0,447	−0,551	0,337	0,749	0,308	0,141
Schooling rate	0,6980	1,000	−0,080	−0,563	0,562	0,698	0,351	−0,311
Population	0,0028	0,4052	1,000	−0,170	0,271	0,224	0,131	−0,173
Infant mortality	0,0028	0,1803	0,0081	1,000	−0,508	−0,738	−0,289	0,063
Sewage rate	0,0001	0,2711	0,0000	0,0010	1,000	0,608	0,246	−0,281
HDI	0,0786	0,5223	0,1515	0,2251	0,0469	1,000	0,393	−0,180
IDEB	0,1217	0,3973	0,7581	0,1645	0,3793	0,8865	1,000	−0,029
GDP Industry	0,8109	0,3186	0,6735	0,9857	0,8999	0,0987	0,6106	1,000

After the multicollinearity test was conducted, the following values were obtained:

Table 6

Analysis of the factor of variance (VIF)

Variables	VIF
GDP per capita	5,5849
Schooling rate	3,6369
Population	1,7059
Infant mortality	2,3012
Sewage rate	1,9210
HDI	9,5334
IDEB	1,2312
Industry GDP	1,5261

Based on the results presented, there was no significant multicollinearity among the model variables (VIF > 10). Even adopting a more conservative criterion of VIF > 5, only GDP *per capita* and HDI showed high correlation, with the latter being stronger. Therefore, excluding these variables does not improve the model, suggesting the absence of significant multicollinearity.

As a result, two models were estimated for analysis: model 1 and model 2.

Regarding model 1, initially proposed, we have the following values:

Figure 5

Summary of the proposed model

Model Summary:

```
Call:
lm(formula = Base$ `Transparency points` ~ `GDP per capita (USD)` +
    `Schooling rate` + Population + `Infant mortality` +
    `Sewage rate` + HDI + GDI + `Industrial GDP`)
```

Residuals:

Min	1Q	Median	3Q	Max
-60.759	-15.107	7.208	25.331	41.341

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	184.384375503	1005.599882658	0.183	0.857
`GDP per capita (USD)`	0.001681655	0.001423527	1.181	0.254
`Schooling rate`	734.175833367	1273.412822198	0.577	0.572
Population	0.000001283	0.000004302	0.298	0.769
`Infant mortality`	-2.503448821	3.703633889	-0.676	0.508
`Sewage rate`	3.549781925	35.567704406	0.100	0.922
HDI	-1030.225023882	684.704756689	-1.505	0.151
GDI	29.958790701	18.541325559	1.616	0.125
`Industrial GDP`	-18.881033877	149.902900047	-0.126	0.901

```
Residual standard error: 38.33 on 17 degrees of freedom
Multiple R-squared:  0.2713,  Adjusted R-squared:  -0.07157
F-statistic: 0.7913 on 8 and 17 DF,  p-value: 0.6175
```

In model 1, the intercept was estimated at 184.38, indicating the expected level of transparency when all other variables are zero. However, the p-value for the intercept is 0.857, suggesting there is insufficient evidence to conclude that the intercept is significantly different from zero.

Each coefficient (βi) indicates the expected change in the transparency index for a one-unit increase in the corresponding explanatory variable, keeping the others constant. For example, the coefficient for GDP *per capita* (*1)* is 0.00168, meaning that a one-unit increase in GDP *per capita* is associated with a 0.00168-unit increase in the transparency index. However, the p-value for this variable is 0.254, indicating it is not statistically significant. The other coefficients are interpreted similarly.

In summary, none of the variables analyzed in the model showed statistical significance, suggesting the need to reformulate the model by including or excluding variables.

Table 7 complements the analysis of model 1 by detailing the results of the Analysis of Variance (ANOVA), which explored the relationship between socioeconomic variables and the transparency index of Brazilian capitals.

Table 7

ANOVA of the proposed model 1

Parameters	Legend	Df	Sum Sq	Mean Sq	F value	Pr (>F)
β_1	GDP per capita	1	1097.3	1097.3	0.7469	0.3995
β_2	Schooling rate	1	277.8	277.8	0.1891	0.6691
β_3	Population x transparency index	1	514.5	514.5	0.3502	0.5618
β_4	Infant mortality	1	55.5	55.5	0.0378	0.8482
β_5	Sewage rate	1	176.4	176.4	0.1201	0.7332
β_6	HDI	1	3342.9	3342.9	2.2753	0.1498
β_7	IDEB	1	3812.6	3812.6	2.5951	0.1256
β_8	Industry GDP	1	23.3	23.3	0.0159	0.9012
Waste	—	17	24976.1	1469.2		

Legend: p-value<0.05 rejection of hypothesis H0; p-value>0.05 acceptance of hypothesis H0

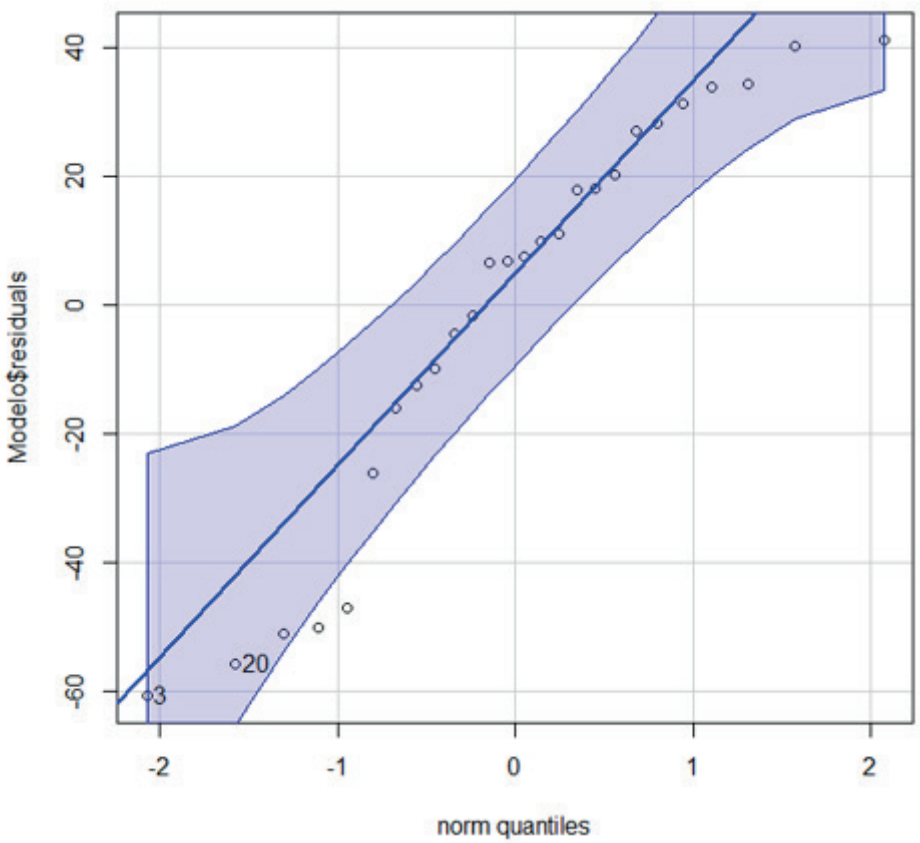
In the previous table, more details of model 1 were presented to thoroughly investigate the factors that influenced the transparency index, clarifying model 1 and its results. Based on model 1 and ANOVA, the initially proposed hypotheses were tested.

At a 5% significance level, it was not possible to reject H0, indicating a lack of statistical evidence that GDP *per capita*, schooling rate, population, infant mortality, sewage rate, HDI, IDEB, and Industry GDP jointly influence the transparency index (Figure 5 – quantile F: 0.7913, with 8 and 17 degrees of freedom, p-value: 0.6175).

Figure 6 shows the quantile-quantile graph, which supports the analysis of the non-normality of the residuals presented above.

Figure 6

Graph of the non-normality of the residuals of model 1



In summary, the transparency index of the capitals was not explained by the proposed independent variables. Due to the unsatisfactory results of model 1, as indicated by the research of Araújo et al. (2020), it was necessary to explore a new model (model 2) that could better fit the data and provide more satisfactory explanations.

In model 2, it was proposed to reduce the number of variables by excluding schooling rate, population, infant mortality, sewage rate, and industry GDP because the Shapiro-Wilk test showed that the residuals did not follow a normal distribution, suggesting that the conclusions about the non-significance of model 1 might not be appropriate.

Model 2:

$$\log(\text{Transparency Index}) = \beta_1 \cdot \text{GDP } \textit{per capita} + \beta_2 \cdot [\text{GDP } \textit{per capita}]^2 + \beta_3 \cdot \text{HDI} + \beta_4 \cdot (\text{HDI})^2 + \beta_5 \cdot \text{IDEB} + \varepsilon$$

Comparing model 1 with model 2, model 1 is more complex because it involves a greater number of parameters, totaling nine, while model 2 has only five parameters, excluding the β_0 intercept. The intercept represents the expected level of transparency when all explanatory variables are zero; however, this scenario is unrealistic in practice.

In addition, in model 2, the transparency index was transformed using the logarithm, a monotonic change that preserves the original ranking of the capitals by transparency. This transformation aims to improve the model's fit to the data. The inclusion of quadratic effects in the parameters was also investigated to determine the most appropriate model to explain the transparency index of Brazilian capitals.

Figure 7

Summary of the proposed model 2

```
Call:
lm(formula = log(Base$`Pontos de transparencia`) ~ -1 + `PIB per capita (R$)` +
    I(`PIB per capita (R$)`^2) + IDH + I((IDH)^2) + IDEB)

Residuals:
      Min        1Q    Median        3Q       Max
-0.262327 -0.038064 -0.007259  0.107430  0.150914

Coefficients:
                                  Estimate         Std. Error t value        Pr(>|t|)
`PIB per capita (R$)`       0.00000916402600   0.00001239061018   0.740          0.4677
I(`PIB per capita (R$)`^2)  -0.00000000004615   0.00000000014030  -0.329          0.7455
IDH                        14.35814606505238   1.12637709449307  12.747 0.0000000000237 ***
I((IDH)^2)                -10.57875802853169   1.33817317416570  -7.905 0.0000000996081 ***
IDEB                        0.11671259347572   0.06278661687638   1.859          0.0771 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.13 on 21 degrees of freedom
Multiple R-squared:  0.9996,    Adjusted R-squared:  0.9995
F-statistic:  9829 on 5 and 21 DF,  p-value: < 0.00000000000000022
```

Model 2, unlike model 1, does not have an intercept, which eliminates the transparency prediction when all explanatory variables are zero. Each coefficient (βi) in model 2 shows the expected change in the level of transparency for a one-unit increase in the corresponding explanatory variable, keeping the others constant, similar to model 1. For example, the coefficient for GDP *per capita* (β_1) is 0.000009164026, indicating that a one-unit increase in GDP *per capita* increases the transparency index by 0.000009164026 units; however, the p-value of 0.4677 suggests this result is not statistically significant. The other coefficients (β_2, β_3, β_4, and β_5) follow the same logic, with β_2 also being insignificant (p-value = 0.7455). In summary, the β_1 and β_2 coefficients are not statistically significant and require further analysis before any exclusion.

Table 8 complements the analysis of model 2 by detailing the ANOVA results and providing additional information about the model.

Table 8

Model 2 ANOVA

Parameters	Legend	Good luck	SQ	Who	Quartile F	Pr(>F)
β_1	GDP per capita	1	737,13	738,13	43661,71	<0.0001
β_2	Quadratic ratio of GDP per capita	1	82,03	82,03	4852,01	<0.0001
β_3	HDI	1	9,48	9,48	560,61	<0.0001
β_4	HDI linear ratio	1	1,12	1,12	66,06	<0.0001
β_5	Quadratic relationship of the HDI	1	0,06	0,6	3,46	0,0771
Waste	—	21	0,36	0,02		

In the previous table, the results show high statistical significance, indicating that the variables GDP *per capita*, HDI, and IDEB have a significant impact on the transparency index. Although the t-tests for the β_1 and β_2 coefficients (GDP *per capita*) were not significant in the model summary (Table 2), ANOVA demonstrated broad significance, reinforcing the importance of these variables. This suggests that even if the individual coefficients of GDP *per capita* are not significant, their inclusion is important for explaining the transparency index.

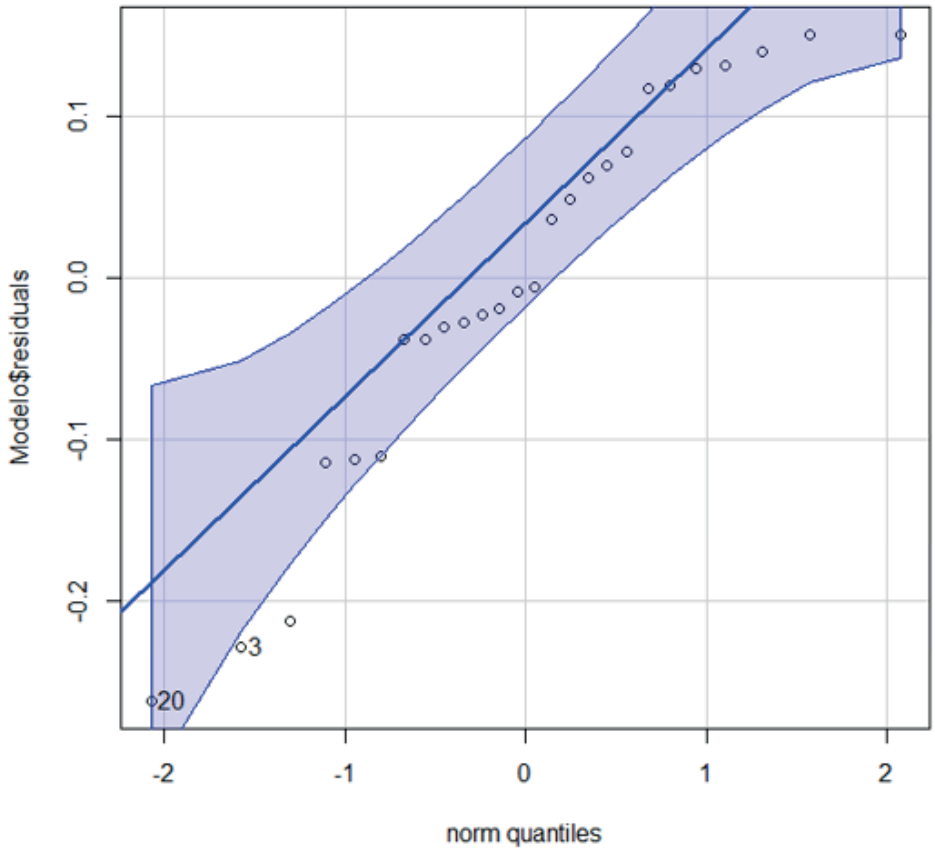
After testing the hypotheses, it was found that at a significance level of 1%, H0 could be rejected, indicating that the variables [GDP *per capita*]^2, HDI, (HDI)^2, and IDEB significantly influenced the transparency index (quartile F: 9829, with 5 and 21 degrees of freedom, p-value < 0.0001), as shown in Figure 7 of the ANOVA for model 2.

With good results and statistical significance in the new model, the transparency index can be explained by it. Pearson's correlation coefficient for model 2 indicated an extremely strong positive correlation of *r = 0.9998* between the transparency index and the independent variables. The coefficient of determination ($r^2 = 0.9996$) showed that 99.96% of the transparency score can be explained by GDP *per capita*, HDI, and IDEB. The Shapiro-Wilk test for model 2 residuals indicated compliance with the normal distribution (W = 0.92564, p-value = 0.0611), validating the results.

Figure 8 shows the graph that confirms the normality analysis of the residuals conducted previously.

Figure 8

Model 2 waste normality chart



Discussion of Results

Public transparency has gained relevance in the country in recent years, both due to legislative progress and improvements in public sector tools, especially advances in public accounting. Socioeconomic and demographic variables are commonly used to analyze their impact on the level of public transparency (Baldissera, 2020; Leite & Lira, 2023). Therefore, a set of independent variables (schooling rate, population, infant mortality, sewage rate, HDI, IDEB, GDP *per capita*, and industry GDP) was proposed as possible determinants associated with the transparency index of Brazilian capitals.

The results indicated that the transparency index of the capital municipalities reached a maximum of 374 points, and on average, the capitals obtained 287.46 points, revealing that 78.86% of them are transparent (Center for the Study of Administrative Transparency and Communication of Public Interest [NETACIP], 2023). However, it was observed that these federated entities were concentrated below the median, and there are outliers at the bottom of the boxplot, revealing the need to improve the transparency of the capitals in this range, especially those positioned significantly farther from the others.

Although the 21.14% rate of non-transparency can be considered relatively low, especially given the relevance of public transparency, some aspects of the result deserve analytical attention. Among the five worst performances, four were concentrated in capitals of the Northeast Region—44% of this group (Aracaju, São Luís, Salvador, and Maceió)—highlighting significant regional asymmetries that require attention from stakeholders.

In addition, the difference between the capital with the best performance and the one with the worst position reached 201 points, corresponding to a relative variation of 58.77%. This range indicates that the results are not evenly distributed among the entities evaluated, but show high heterogeneity. This scenario is possibly explained by the unequal adoption of practices, instruments, and strategies for access to public information by Brazilian capitals, prompting the public entities involved to reassess the mechanisms used.

This finding is consistent with the literature on transparency in the Brazilian context. Previous studies indicate that public transparency is influenced by a broad and multifaceted set of factors (Gjerazi, 2025; Romero, 2025), which extend beyond the mere existence of normative frameworks such as the Access to Information Law or the fiscal transparency mechanisms established by the Fiscal Responsibility Law (OECD, 2023; Trautendorfer et al., 2025), both widely emphasized in national legislation. Institutional, administrative, technological, organizational, and political aspects have been identified as relevant determinants of transparency performance (Brelàz et al., 2025; Teles et al., 2025).

In this sense, such factors should not be conceived or analyzed in isolation, as this risks disregarding the complexity of the phenomenon and contributing to the persistence of significant inequalities in public transparency among subnational governments.

Regarding the selection of possible independent variables, the correlation among the proposed variables (HDI, schooling rate, IDEB, GDP *per capita*, infant mortality, industrialization of the municipality, sanitary sewage, and population) was initially analyzed. A considerable number of associations were observed among them; however, most showed little sig-

nificance. This result suggested that other factors may be influencing the behavior detected in the study. Nevertheless, the associations between HDI and GDP *per capita*, schooling rate, sewage rate, and infant mortality was highlighted, with strong significance, the latter being negative.

After the regression test was performed, and given the absence of significant multicollinearity among the proposed variables, the results did not reveal any significant variables ($p < 0.05$). This finding suggests that the independent variables, individually or collectively, did not have a statistically significant relationship with the transparency index, which implies non-acceptance of the initially suggested model (model 1).

The result drew attention, as the coefficient of determination ($r^2 = 0.2713$) suggested that the transparency index was explained by 27.13% of the independent variables. This level of r^2, along with the rejection of the model, is justified by the residual analysis, which showed that the residuals did not follow a normal distribution ($W = 0.91256$, p-value = 0.0302), thereby compromising the resulting conclusions and inferences.

Given this context, it is suggested that the results should be interpreted with caution. The combination of low explanatory power and failure to meet statistical assumptions compromised the model's analytical robustness, justifying its rejection for inferential purposes. These findings reinforce the need to reassess the adopted specification, either by including new explanatory variables or by adopting alternative methodological approaches that better align with the data distribution.

Thus, due to the limited robustness of the first model, we chose to estimate an alternative model characterized by a reduced number of independent variables and the introduction of quadratic terms for those that showed theoretical and empirical signs of nonlinearity, notably GDP *per capita* and the Human Development Index (HDI). This methodological redefinition aimed to capture more complex relationships between socioeconomic conditions and performance in public transparency, aligning with recurrent strategies in the empirical literature on the subject.

The results of the alternative model showed high explanatory power, accounting for 99.96% of the variability in the transparency index. However, this level of adjustment should be interpreted with caution, especially given the risk of statistical overadjustment in small samples. Nevertheless, the following findings can be inferred.

Regarding income, the results suggest that higher economic levels tend to be associated with better transparency practices (Baldissera, 2020; Huseyin & Suleyman, 2021; Khosrowjerdi, 2022), although this effect does not manifest itself in a linear fashion. In other words, economic growth contributes to the advancement of transparency up to a certain point, after which its additional effects become progressively less significant. This evidence aligns with literature that points to the limitations of purely economic development as a sufficient factor for strengthening public transparency (Baldissera et al., 2020; Huseyin & Suleyman, 2021). From the perspective of public management, income is a relevant factor, but its ability to promote transparency depends on the articulation with other structural elements, so that together they can produce more consistent impacts on this performance.

The HDI emerged as the variable with the greatest explanatory weight, consolidating itself as a key factor for understanding the inequalities in transparency among the municipalities analyzed. This result supports

previous studies (Akbari et al., 2022; Faria et al., 2022; Khosrowjerdi, 2022; Vasylieva et al., 2023) that identify human development as an important determinant of government transparency practices. Similar to what was observed regarding income, the results indicate that the impact of human development also has limits, signaling that in more advanced contexts, other institutional and political factors begin to play a more significant role in explaining transparency levels.

The IDEB also proved to be statistically significant, confirming the research of Baldissera (2020), Bartoluzzio and Anjos (2020), and Brito, Bezerra Filho, and Santos (2024). These findings align with the literature, indicating that more educated citizens tend to have a greater capacity to exercise their rights and demand accountability from public managers. In this sense, education acts as a mediating element between the formal availability of information and its effective appropriation by society.

The finding reinforces the window of opportunity available to municipal and state public administrations – responsible for providing basic and secondary education in the country – to act decisively on this factor to strengthen public transparency. Furthermore, the result aligns with the understanding that education not only expands citizens' capacity to understand public information but also strengthens social demand for transparency and accountability. However, the fact that the effect associated with education was more significant than that of income considered in isolation is noteworthy. A possible explanation for this result lies both in the model specification and in the complexity of the interactions among the socioeconomic variables analyzed.

In general, the results confirmed that public transparency is a multifaceted phenomenon conditioned by complex relationships between human development, education, income, and other institutional elements, which are better explained collectively than in isolation. Although these variables do not fully explain the differences observed between the municipalities analyzed, they play a central role in creating favorable conditions for promoting transparency and can be mobilized by public managers for this purpose. From this perspective, understanding these relationships is essential for formulating more effective public policies aimed not only at expanding the supply of information, but also at strengthening citizens' capacity to access, understand, and use this information critically.

FINAL CONSIDERATIONS

This research aimed to identify factors influencing transparency in Brazilian capitals using multiple linear regression. The level of transparency calculated for Brazilian capitals for 2021-2022 by the Center for the Study of Administrative Transparency and Communication of Public Interest (NETACIP) was used as the dependent variable. and the following independent variables: schooling rate, population, infant mortality, sewage rate, HDI, IDEB, GDP *per capita*, and GDP in industry.

To test the explanatory factors, two multiple linear regression models were used. In the first model, none of the independent variables showed statistical significance, so hypothesis H0 was accepted. In the second model,

some of the initially suggested variables were included (GDP *per capita*, HDI, IDEB, and the quadratic ratio of GDP *per capita* and HDI), and the results showed that GDP *per capita*, HDI, and IDEB explained the identified levels of transparency.

The findings are consistent with previous literature, highlighting evidence that human development has a greater influence on public transparency levels than economic growth considered alone. From this perspective, the HDI serves as a proxy for both state capacity and the degree of active citizenship, reflecting contexts where the supply of public information is accompanied by greater social capacity for demand, understanding, and inspection.

Regarding GDP *per capita* and IDEB, although both are relevant to advancing public transparency, their effects must be interpreted in light of their specific characteristics. GDP *per capita* was presented as a necessary condition for strengthening transparency but is insufficient for consolidating substantive practices when not accompanied by other structural factors. The IDEB, on the other hand, was established as a mediating variable of the social demand for transparency by acting as a conditioning factor that can create environments more or less favorable to the appropriation of public information and the exercise of accountability.

In view of this, the findings revealed two conclusions. The first is related to the confirmation of the influence of socioeconomic indicators on the level of transparency of information about municipal public management, although this is associated with certain configurations among the variables studied. The result in question only ratifies the multifaceted relationship between the variables and the influence they exert on each other.

The second, shows that their participation in terms of impact was presented differently, highlighting the importance of choosing the attribute to maximize transparency levels. In this case, the results suggest that an increase of one HDI unit can raise the logarithm of the transparency index by about 14.96 units, while the IDEB effect is 0.1167 and the GDP *per capita* effect is 0.000009164. The study concluded by ratifying the relationship between HDI and GDP *per capita* in increasing transparency levels, corroborating previous studies.

The main limitation in the research is that the transparency index was developed based only on the reality of the capital municipalities, in addition to the lack of historical data on the level of transparency to evaluate results over the years.

For further studies, it is suggested that the transparency index be extended to other Brazilian municipalities to further examine the impact of the independent variables identified in the research.

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