RCC
Revista Contemporânea de Contabilidade

Efficiency, fiscal austerity and budget availability in federal institutions of higher education in the light of public choice theory

Eficiência, austeridade fiscal e disponibilidade orçamentária em instituições federais de ensino superior à luz da teoria da escolha pública

Eficiencia, austeridad fiscal y disponibilidad presupuestaria en las instituciones de educación superior federales a la luz de la teoría de la elección pública

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Abstract
This study analyzes to what extent the efficiency of an institution and the fiscal austerity allow to explain the budget availability, of the Federal Higher Education Institutions. To this end, concepts linked to Managerialism are used, especially in the search for the implementation of efficiency in different perspectives, which allows achieving, or maintaining, its performance even in adverse situations. Furthermore, the research is supported by discussions based on the Public Choice Theory, regarding the dilemma faced by managers during unpopular decision-making for budget control and equating. This is a predominantly quantitative research, whose sample is composed of 104 institutions, from 2008 to 2019 and which uses different statistical techniques, aiming to measure efficiency scores, cluster groups of variables into factors and establish relationships between the concepts addressed. Its results evinces the existence of a relationship between the institution's efficiency and the availability of resources, especially regarding social efficiency, which indicates proximity to the public choices faced by the manager, represented by the dilemma between aiming at efficiency in the allocation of resources or in the maintenance of service to the society. In addition, the research points out that public obligations, a set formed predominantly by budgetary and extra-budgetary expenditures, represent the most expressive factor in explaining resources availability. It is expected that the research outcomes will stimulate the search for more efficient procedures that allow for better management of institutions in their different forms and, with this, positive effects can be seen in the balance of budget availabilities.
Keywords: Budget Availability; Institution's Efficiency; Fiscal austerity; Public Choice Theory

Resumo
O estudo analisa em que medida a eficiência da instituição e a austeridade fiscal permitem explicar a disponibilidade orçamentária das Instituições Federais de Ensino Superior. Para tanto, são utilizados conceitos ligados ao gerencialismo, sobretudo na busca pelo implemento de eficiência em diferentes perspectivas, o que permite alcançar, ou manter, seu desempenho mesmo em situações adversas. Ademais, a pesquisa é amparada em discussões oriundas da Teoria da Escolha Pública, no que se refere ao dilema enfrentado pelos gestores durante a tomada de decisão impopular para controle e equacionamento orçamentário. Trata-se de pesquisa predominantemente quantitativa, cuja amostra é composta por 104 instituições, durante o interstício de 2008 a 2019 e que utiliza diferentes técnicas estatísticas, visando mensurar escores de eficiência, agrupar grupos de variáveis em fatores e estabelecer relações entre os conceitos abordados. Seus resultados demonstram que há relação entre a eficiência da instituição e as disponibilidades de recursos, especialmente quanto à eficiência social, o que indica

proximidade às escolhas públicas enfrentadas pelo gestor, representadas pelo dilema entre visar eficiência na alocação de recursos ou na manutenção do atendimento à sociedade. Além disso, a pesquisa aponta que as obrigações públicas, conjunto formado predominantemente por despesas orçamentárias e extraorçamentárias, representa o fator mais expressivo na explicação das disponibilidades de recursos. Espera-se que os achados da pesquisa estimulem a procura por procedimentos mais eficientes que permitam melhor gestão das instituições sob suas diferentes formas e, com isso, perceba-se reflexos positivos no saldo de disponibilidades orçamentárias.
Palavras-Chave: Disponibilidade Orçamentária; Eficiência da Instituição; Austeridade Fiscal; Teoria da Escolha Pública

Resumen
El estudio analiza en qué medida la eficiencia de la institución y la austeridad fiscal permiten explicar la disponibilidad presupuestaria de las Instituciones Federales de Educación Superior. Para ello se utilizan conceptos ligados al gerencialismo, especialmente en la búsqueda de la implementación de la eficiencia en diferentes perspectivas, que permita alcanzar, o mantener, su desempeño aún en situaciones adversas. Además, la investigación es apoyada por discusiones de la Teoría de la Elección Pública, en cuanto al dilema que enfrentan los gerentes durante la toma de decisiones impopulares para el control y la equiparación del presupuesto. Se trata de una investigación predominantemente cuantitativa, cuya muestra está compuesta por 104 instituciones, durante el intersticio de 2008 a 2019 y que utiliza diferentes técnicas estadísticas, con el objetivo de medir puntajes de eficiencia, agrupar grupos de variables en factores y establecer relaciones entre los conceptos abordados. Sus resultados demuestran que existe una relación entre la eficiencia de la institución y la disponibilidad de recursos, especialmente en lo que se refiere a la eficiencia social, lo que indica proximidad a las elecciones públicas que enfrenta el gestor, representadas por el dilema entre apuntar a la eficiencia en la asignación de recursos o en el mantenimiento del servicio a la sociedad. Además, la investigación señala que las obligaciones públicas, conjunto formado predominantemente por gastos presupuestarios y extrapresupuestarios, representan el factor más expresivo para explicar la disponibilidad de recursos. Se espera que los hallazgos de la investigación estimulen la búsqueda de procedimientos más eficientes que permitan una mejor gestión de las instituciones en sus diferentes formas y, con ello, se vean efectos positivos en el equilibrio de las disponibilidades presupuestarias.
Palabras chave: Disponibilidad de presupuesto; Eficiencia Institucional; Austeridad fiscal; Teoría de la elección pública

1 Introduction

Over the last few decades, a striking change has occurred in public administration regarding how it views its responsibility to meet social demands (Denhardt & Catlaw, 2017). This triggered management reform, which introduces new aspects in public administration, including the search for efficiency as a tool to achieve better performance (Denhardt & Catlaw, 2017; Matias-Pereira, 2018).

From a parallel perspective, even though budget execution can be optimized through more efficient management, there are budget balance measures that are inherent to the responsibilities of public managers (Giacomoni, 2019; Matos, 2021). These are measures that aim to increase the fiscal austerity of the government agency, especially via the systematic review of revenue and expenditure, thus avoiding indebtedness (Schakel, Wu & Jeurissen, 2018).

Given the above, the eagerness to carry out the actions and objectives provided in budget law sometimes has a negative effect on fiscal austerity (Giacomoni, 2019). This mismatch between budget availability and fiscal austerity may cause institutions to become indebted and prevent projects and programs from being executed.

However, the implementation of a restrictive budget policy is directly related to an institution's provision of goods and services to society, hindering its acceptance by the population and posing a challenge for managers (Rezende, 2015). In other words, managers commonly reflect on the burden of making unpopular decisions required to maintain fiscal austerity conditions. This impasse is debated within the scope of Public Choice Theory and helps understand the dilemma that managers face when making decisions that conflict with their personal expectations (Bociu, 2017; Mccarthy, 2021).

Therefore, considering the capacity of institutional efficiency to promote better resource management and fiscal austerity as a tool to explain budget availability balance, the following research question arises: to what extent do institutional efficiency and fiscal austerity explain the budget availability of federal higher education institutions (FHEI) in the light of Public Choice Theory?

This study objective is justified by the theoretical framework deriving from Managerialism, which makes it possible to assume that striving for efficiency improves conditions for better performance. Therefore, there is an empirical benefit in the development of a tool to analyze efficiency and the relationship between this systemic efficiency and the budget availability of federal higher education institutions. The

institutions can thus review their management criteria and seek the best relationship between invested resources and outcomes.

The expected contributions of the study also involve a theoretical discussion, in the light of Public Choice, of the dilemma faced by managers when implementing unpopular restrictive measures. More precisely, the study broadens the field by discussing the human factor inherent in the relationship between fiscal austerity and the result of availability. From this perspective, based on the theory, it is accepted that the proposed relationship between fiscal austerity and available budget is imperfect, despite the legal provisions that bring these concepts closer together (Alesina, Favero & Giavazzi, 2019; Matos, 2021).

Furthermore, it is necessary to highlight the expected benefits from a social point of view, especially when considering the institution's insertion in society as a relevant perspective of institutional action. That is, the efficiency with which society is served is evaluated as a direct perspective of the institution's efficiency as a whole.

2 Theoretical Framework

Considering the study guiding question, the theoretical framework seeks to clarify the relationship between the concepts. In this sense, efficiency is explained within the scope of Managerialism that aims to improve procedures in public institutions, enabling an appropriate use of resources to obtain better indicators (Bresser-Pereira, 2017).

In turn, the reasoning used addresses the directly proportional relationship between fiscal austerity and budget availability (Socol, Marinas, Socol & Armeanu, 2018; Alesina, Favero & Giavazzi, 2019). However, it is also assumed that the relationship between fiscal austerity and resource availability cannot be perfectly explained, as it may be mitigated based on the personal expectations of the public manager (Zamir & Sulitzeanu-Kenan, 2017; Sallaberry, Quaesner, Costa & Clemente, 2019). Hence the need to clarify any components arising from Public Choice theory that limit the ability to explain this relationship.

2.1 Efficiency of Public Sector Institutions

Given the dissatisfaction with the government's role during the bureaucratic period [1930–1995], Management reform, which drew on concepts from the private sector, was viewed as a mechanism to legitimize State action (Costa, 2012; Bresser-Pereira, 2017; Denhardt & Catlaw, 2017). These demands triggered the movement to redefine the role of the State. From this perspective, the term "Managerialism" addresses the challenge of executing government programs and objectives, reducing costs and improving procedures (Denhardt & Catlaw, 2017).

However, the transition from a bureaucratic to a managerial model did not occur through the promulgation of these formal documents (Costa, 2012). Based on the strict concept of efficiency, defended by Managerialism, it is assumed that it is possible to expand the service capacity of public institutions without necessarily reducing their investment capacity (Moura & Miller, 2019). Being more efficient also means making better use of resources to increase teaching indicators rather than solely reducing expenses (Matias-Pereira, 2018).

The acceptance of more efficient procedures and practices in institutions involves innovations and aspirations based on improving the provision of services by controlling public expenditure. For Brazil, the budget structure resulting from the implementation of budgeting program shows clear signs of alignment between budget availability and the goals to be achieved (Abrucio, 2006; Giacomoni, 2019).

It is a process that allows institutions to improve their performance by increasing the quality and quantity of services to society; to review procedures and protocols to carry out their core activities; and to adopt measures to review expenses and collect revenue in order to rationalize budget execution (Matias-Pereira, 2018).

From this perspective, it is important to introduce the concepts of efficiency presented by Mattos and Terra (2015), especially when considering that an institution may be efficient in a given aspect but not present good outputs in other areas. Therefore, it is opportune to evaluate institutional efficiency from different points of view.

The first aspect refers to technical efficiency, which analyzes the product or service offered (Lima Filho & Severo Peixe, 2020). To this end, this concept evaluates the ideal relationship between the necessary inputs and the outcomes obtained. In the scope of educational institutions, teaching quality indicators obtained can be used.

Allocative efficiency is also noteworthy, aimed at optimizing the financial and budget resources spent and the economic results obtained. Social efficiency, in turn, measures the usefulness of the institution to society, i.e., how the institution serves a certain segment of the population (Mattos & Terra, 2015). This may include the number of incoming and outgoing students.

2.2 Fiscal Austerity and Budget Availability

The relationship between aspects involving budget and fiscal situation of public institutions begins with the process of planning the Annual Budget Law (LOA). More precisely, determining expenses to meet the demands of society must consider the government's revenue capacity. Without the balance between expected revenue and fixed expenses, the fiscal year would already start irregularly (Giacomoni, 2019)

For this to occur, fiscal austerity deals with the process of planning budget execution at levels that are commensurate with revenue (Alesina, Favero & Giavazzi, 2019). In Brazil, a relevant milestone that directs the attention of public managers to the topic is the enactment of the Fiscal Accountability Law (LRF), whose focus on balancing the budget enables greater control over the relationship between revenue and expenditure during the fiscal year (Rezende, 2015; Matos, 2021).

More precisely, the LRF, among other goals, aims to balance the budget in order to maintain budgetary balance, avoiding risks and curbing distortions that might affect the public accounts. Among its provisions, the LRF requires controls that improve the pursuit of fiscal austerity, including a timely review of the relationship between resources obtained and paid expenses during the fiscal year (Matos, 2021).

Therefore, during the debate about the need for measures aimed at fiscal austerity, the government agency may resort to devices that restrict the ability to generate expenses (Giacomoni, 2019). This emphasizes the need for regular assessment of the fiscal condition of institutions so that, at the first signs of imbalance, minor adjustments can be made.

Despite the political discomfort stemming from the suppression of rights imposed by these adjustments, the studies by Brady (2015) and Schakel, Wu and Jeurissen (2018) stress that reducing expenses is an efficient tool for restoring public accounts balance. In other words, it is assumed that limiting budget commitments should not respect the conditions of each institution, considering the effects on society and management capacity, avoiding cuts in agencies that already work at an ideal level of managerial efficiency (Socol, Marinas, Socol & Armeanu, 2018; Matos, 2021).

Therefore, limiting budget commitments is a technical tool for balancing the budget. However, if the volume of blocked funds were only determined by the fiscal condition, the legitimacy of this mechanism would not be questioned (Hu & Zarazaga, 2018).

2.3 Public Choice Theory and Budget Management

Public Choice Theory, studied since the 1950s, with attention to political science, focuses on economics studies applied to certain groups, especially eligible politicians and public managers. This theory reveals the motivations and consequences of decisions made by politicians, authorities and public managers, which have repercussions on the way public goods and services are delivered to society (Sallaberry, Quaesner, Costa & Clemente, 2019). Therefore, by understanding that decisions made in the public sector are imperfect and may conflict with social understanding, Buchanan and Tullock (1962) suggest that there is a distance between managerial decisions and the promotion of the common good.

Considering the possibilities of applying Public Choice Theory, one may mention the paradox of the public manager's decision regarding budget allocation and availability. More precisely, it is observed that the decision to freeze budgets, which aims to ensure austere fiscal conditions, leads to reduced budget capacity and, consequently, reduced operational capacity of the public agency (Rezende, 2015; Sallaberry et al., 2019).

In this dilemma, maximization of self-interest may occur due to the shortsightedness effect, as explained by Silva and Silva (2017). This is a phenomenon in which action is taken seeking immediate results, affording the manager personal recognition. However, it implies a reduction in long-term benefits resulting from public policy, besides showing no concern about administrative effectiveness. Indeed, one notes that the decision to limit the budget is not simple due to the government's obligation to serve a segment of society that depends on the direct intervention of the public institution (Bociu, 2017).

In this sense, public spending without medium- and long-term concerns about public debt pleases society in the short term, but may debilitate the government agency or increase its need for greater revenue (Giacomoni, 2019; McCarthy, 2021). In other words, although the decision to restrict expenditure is a technical one, based on the institution's fiscal conditions, the political cost of the decision is sometimes taken into account. This situation complexifies the relationship between the quest for fiscal austerity and budgetary availability (Giacomoni, 2019; Döring & Oehmke, 2020).

Given the above, Gatauwa (2020) states that the entire field of analysis of the relationship between fiscal policy and public spending has not been exhaustively debated in the literature on Public Finance, considering that the decision to balance public accounts has a direct impact on social conditions.

The effect of these measures is perceived on employment rates, family income, prices and economic growth. This entire context makes the decision on budget restrictions more difficult (Družeta & Škare, 2017). Therefore, by restricting expenses, the government's ability to offer services to society is reduced (Döring & Oehmke, 2020).

2.4 Study Hypothesis Development

Considering the literature survey, it is assumed that there is a relationship between fiscal austerity and budget availability (Schakel, Wu & Jeurissen, 2018; Sallaberry et al., 2019). When a budget imbalance is observed, with the consequent worsening of the fiscal situation, mechanisms are devised to reduce the capacity to generate expenditure of public institutions (Gatauwa, 2020).

On the other hand, there is an increase in the concept of institutional efficiency, resulting from Managerialism in the public sector (Abrucio, 2006; Bresser-Pereira, 2017). This component understands efficiency as a potential agent in obtaining better indicators, given that it corresponds to the condition of maintaining or improving outcomes without causing greater expenditure (Mattos & Terra, 2015).

Therefore, it is possible to assume that more efficient institutions also have more devices to keep their finances healthy. This suggests that, in line with fiscal austerity, an institution's efficiency improves the outcomes observed in budget availability. This gives rise to the following research hypothesis:

Alternative Hypothesis (H¹): Institutional efficiency and fiscal austerity are significant components to explain the budget availability of federal higher education institutions.

Note that conceptually, fiscal austerity and institutional efficiency are not conditioned, which shows the capacity to increase these concepts on budgetary availability. According to Randma-Liiv and Kickert (2017), even though fiscal imbalance may encourage management reform to adopt more efficient procedures, there are intermediate aspects linked to the political, organizational, and human environment that create obstacles between those concepts.

3 Methodology

This is an exploratory study in which data is collected from documents and analyzed by using a quantitative approach with **R** environment version 4.1.3. The population comprises federal higher education institutions, given their homogeneous characteristics that enable an impartial analysis of efficiency. Moreover, there is a high number of institutions, which makes the number of observations robust to different procedures (Osborne, 2006).

Comparability among different institutions undermines the impartiality required for efficiency analysis to make sense (Ehrler, 2012; Alonso, Clifton & Días-Fuentes, 2015). Then, using data from federal higher education institutions reduces the possibility of the sample comprising institutions that follow different rules or are subject to dissimilar assessment indicators.

Data collection spanned from 2008 to 2019 and was done with the help of two platforms. Data on budget and equity were obtained from the Tesouro Gerencial platform (STN, 2021), which compiles financial statements into "Information Items." In turn, data related to quality and structure indicators are available on the portal of the Anísio Teixeira National Institute of Educational Studies and Research (INEP, 2021).

Thus, the population analyzed comprises 195 FHEI. Of those, data were extracted for 104 institutions, which presented data in the 12 fiscal years and required minimal intervention to fill in scarce missing data by using the linear interpolation method (Moritz & Bartz-Beielstein, 2017). Furthermore, any outliers were handled by using the modeling proposed by the Komsta (2011) tool. The final sample has a 6.65% margin of error within a 95% confidence interval, considered satisfactory for the continuity of the study.

Following the procedures for surveying and compiling the database, the analyses focused on the concepts of "*Institutional Efficiency*," "*Fiscal Austerity*," and "*Budget Availability*." Thus, in order to meet the research objective, data analysis occurred as described in Table 1.

Table 1
Analysis Protocol

Objective	Technique	Procedure	Reference
Measuring Institutional Efficiency scores	Data Envelopment Analysis (DEA)	--	Charnes and Cooper (1984), Boueri (2015) Bogetoft and Otto (2020), Lima Filho and Severo Peixe (2020)
Grouping information items related to "Fiscal Authority" and "Budget Availability"	Factor Analysis	KMO and Bartlett test	Hair (et al., 2009); Fávero and Belfiore (2017); Revelle (2021); Ossani and Cirillo (2021)
		Eigenvalue Analysis	
		Determination of Factors	
Quantifying the relationship between sets of variables	Descriptive Analysis	Central value, dispersion and interquartile tests	Bruni (2011); Fávero and Belfiore (2017).
		Pearson Correlation	
	Canonical Correlation Analysis	Significance of Correlation	Hair (et al., 2009); Bruni (2011); Fávero and Belfiore (2017); Jari Oksanen (et al., 2020); Ossani and Cirillo (2021)
		Canonical Correlations	
		Canonical Loads	
		Multiple Regression	

Note: In case of replication, tests used R version 4.1.0.

It is noted that achieving the proposed objective requires surveying the efficiency scores that make up "*Institutional Efficiency*." Then, to reduce the number of variables included in the analysis and make it easier to interpret the results, the variables linked to "*Fiscal Austerity*" and "*Budget Availability*" are transformed into factors. Those procedures are followed by the analysis of the relationship between the concepts.

From this perspective, efficiency scores were measured by data envelopment analysis (DEA). Created by Farrel (1957) and perfected by Banker (1993) and Banker, Charnes & Cooper (1984), DEA creates an efficient boundary between a certain number of decision making units (DMU). That is, based on a certain number of institutions, a criterion is created that assigns scores according to the best relationship between certain inputs and outputs (Boueri, 2015).

In this study, DEA modeling considers possible scale variations, called the BCC method, in reference to its creators, Banker, Charnes and Cooper (1984). Table 2 describes the variables that will be used as inputs and outputs for each efficiency perspective.

Table 2
Variables Related to the Efficiency Perspective

Perspective	Variables	Collection tool	References
Technical Efficiency	*Desp_Emp* (*input*)	STN (2021)	Boueri (2015); Dumitrescu and Dogaru (2016); Matos (2021)
	IDD; ENADE; IGC; CPC (outputs)	INEP (2021)	Boueri (2015); Førsund (2017)
Allocative Efficiency	*OrcAtu (inputs)*	STN (2021)	Boueri (2015); Lima (2018); Giacomoni (2019)
	Sit_Fin; Var_Pat; Equil_Orc; Result_Orc; Ger_Cx (outputs)		
Social Efficiency	*Incoming students, faculty, Infra_Inst, Org_Didat (inputs) Outgoing students, CPC (outputs)*	INEP (2021)	Marques and Almeida (2004); Boueri (2015)

Note: Adapted from Lima Filho and Severo Peixe (2020); *Desp_Emp* - Total volume of committed expenses, regardless of settlement or payment; *Orç_Atu* - Updated value in the budget that provides funds for FHEI activities.

It is worth noting that the variables that make up the Technical Efficiency outputs correspond to quality indicators of higher education (INEP, 2021). The four indicators are instruments for evaluating Brazilian higher education. In turn, the variables that make up the Allocative Efficiency outputs relate to indicators of financial statement analysis. Lima (2018) points out that the use of different indicators offers better conditions for analyzing the performance of institutions.

Table 3
Variables Used as Allocative Efficiency Outputs

Analysis Indicator	Financial Statement	Quotient Between Financial Statement	References
Budget Balance (*Equil_Orc)*	Budgeted balance sheet	Updated allocation / Updated forecast	Borges et al. (2010); Lima (2018); Giacomoni (2019)
Budget Result (*Result_Orc)*	Budgeted balance sheet	Paid Expenses / Committed Expenses	
Result of Balance Sheet Variance (*Var_Pat)*	Balance Sheet Variance Variation	Positive Variance. / Variações Negative Variance	Lima (2018); MCASP (2019)
Financial Status (*Sit_Fin*)	Balance Sheet	Current Assets / Current Liabilities	Lima (2018); MCASP (2019)
Cash Flow (*Ger_Cx*)	Cash Flows	Final Availability / Initial Availability	Lima (2018); MCASP (2019)

Note: Adapted from Lima Filho and Severo Peixe (2020);

In a parallel analysis to efficiency measurement, the budget and fiscal variables were obtained by considering only sources unlinked to the National Treasury, sources linked to internal revenue or those related to discretionary spending. Thus, the manager's ability to intervene in the institution's budget management is expanded (Matos, 2021), reflecting the efficiency of managerial performance under austerity conditions and its effects on budget availability.

It should be noted that regarding the functioning of these concepts within this study proposal, the variables related to "*Budget Availability*" correspond to the ability to generate new expenses while "*Fiscal Austerity*" indicates variables of paid expenditure and collected revenue, whether budgetary or extra-budgetary.

Among the variables that make up the concept of "*Budget Availability*," blocked funds are emphasized. Restricting budget commitments is not only the result of worsening fiscal imbalance, but also affects budget execution capacity (Giacomoni, 2019). Table 4 shows the concepts and corresponding variables.

Table 4
Variables Used in the Analysis

Concept	Category	Variable	Functioning	Reference
Institutional Efficiency	Efficiency	Allocative Efficiency	Resource management within the institution	Bresser-Pereira (2017); Matias-Pereira (2018); Moura and Miller (2019); Matos (2021)
		Social Efficiency	Institution's ability to serve society or to be part of society	
		Technical Efficiency	Management of the institution's core activities or general goals	
Fiscal Austerity	Expenditure	Committed Expenditure	Balance of committed expenses, regardless of settlement or payment	Jalles (2017); Socol et al (2018); Alesina, Favero e Giavazzi (2019); Giacomoni (2019)
		Settled Expenses	Balance of commitments which have already created payment obligations or have been paid	
		Paid Expenses	Budget expenses already paid	
	Other	Availability by Resource Allocation	Balance of resources maintained within withdrawal limits, deducting committed credits	
	Revenue	Budget Revenue	Collected Revenue, with no deductions	
	Payable Liabilities	Payable RPNP	Consolidated balance of expenses registered in RPNP, settled or not during the fiscal year, including those blocked by decree.	
		Settled RPNP	Expenses registered in RPNP that were settled during the fiscal year, paid or not.	
		Paid RPNP	Expenses registered in RPNP that were settled and paid during the fiscal year.	
		Cancelled RPNP	Expenses recorded in RPNP to be settled that were canceled due to cash shortage or other reasons	
		Paid RPP	Expenses registered in RPP that were paid throughout the financial year	
		Payable RPP	Expenses registered in RPP and not paid	
		Canceled RPP	Expenses recorded in RPP which were canceled with the write-off of financial liabilities	
	Flow of funds	Granted Provision	Portion of budget funds sent by decentralization that occurred within the actual ministry or agency.	
		Received Provision	Portion of budget funds received by decentralization that occurred within the actual ministry or agency..	
	Financial Programming	Transfer Receipt	Balance of received transfers already released by the responsible agency.	
		Sub-Transfer Release	Balance of granted sub-transfers already granted by the responsible agency.	
		Sub-Transfer Receipt	Balance of granted sub-transfers already released by the responsible agency.	
Budget Availability	Expenditure	Updated Allocation	Initial budget balance, plus supplementary, special and extraordinary funds	Rezende (2015); Bociu (2017); Randma-Liiv e Lickert (2017); Hu e Zarazaga (2018)
		Canceled or Rearranged Allocation	Flow by increase or reduction in the Expenditure Detail Table	
	Availability of Funds	Available Funds	Budget availability derived from the initial and additional allocation deducting committed or unavailable resources	
		Unavailable Funds	Set of blocked funds, including balances for relocation, internal control and budget programming.	
	Flow of Funds	Granted decentralization	Flow of funds from budget unit to another agency	
	Financial Programming	Budget Limit to Be Used	Budget limit, decentralized or not, for the movement of available funds and commitment of expenses	
		DDR Control	Availability of committed and settled funds, or already paid	

Note: RPNP – Settled amount to be paid; RPP – Not settled amount to be paid; Variables corresponding to Information Items categorized by the STN (2021)

After grouping the variables into factors, canonical correlation analysis was used to meet the study objective. Notably, canonical correlation is a technique for multivariate analysis of interrelationships between different sets of multiple dependent and independent variables (Hair et al., 2009). This technique makes it possible to increase the number of dependent variables analyzed, unlike linear regression, which comprises only one explained variable.

It is noteworthy that canonical correlation presents fewer restrictions on the sample and may even be used with a set of metric or non-metric variables (Hair et al., 2009). Furthermore, according to Fávero and Belfiore (2017), it is suitable when the researcher is not concerned with knowing the best candidate for the dependent variable, but rather the relationship between constructs, as in this study.

4 Data Analysis

According to the adopted theoretical framework, an institution should be evaluated from different perspectives (Mattos & Terra, 2015; Matias-Pereira, 2018; Matos, 2021). Therefore, the efficiency scores obtained through data envelopment analysis consider the scale variation between the variables and the graph orientation, DEA-BCC-Graph (Bogetoft & Otto, 2020), aiming for ideal adaptation to the differences in efficiency obtained between institutions.

Given the above, initially, based on the results obtained, it is noted that the average efficiency is higher in the indicators related to Social Efficiency (0.4859), while the Allocative and Technical Efficiency indicators were close, 0.2227 and 0.1190, respectively. This shows that budget and financial aspects, as well as management issues, need to be reviewed, especially if better resource management is expected to enable FHEI to maintain their activities even in situations of budget shortage (Rezende, 2015).

Next, when analyzing the evolution of efficiency averages over time, an oscillation in scores is noted, especially between 2009 and 2010. This result makes it possible to analyze aspects that may affect the efficiency of these institutions over the period. However, when restricting the analysis to the proposed objective, once again Social Efficiency stands out as the aspect with best results over the years.

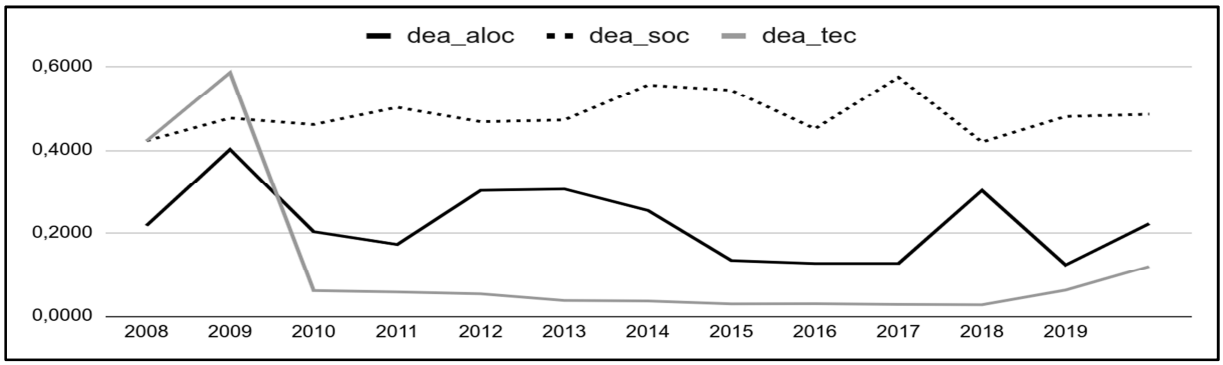

Figure 1: Evolution of Efficiency Scores Over Time

It should be noted that a preliminary analysis of the efficiency results showed that the technical efficiency and allocative efficiency indicators came up short, especially considering that they represent areas related to institution and budget management, which have an impact on the management of budget availability. In other words, the greater the dedication to efficient management, the greater the chance of reducing the unpredictability of aspects that may lead to budget restriction (Rezende, 2015).

Furthermore, considering the dilemma presented by Public Choice, it is assumed that concern with the institution's efficiency, especially technical and allocative efficiency, would help reduce managers' political discomfort in applying measures to block budget commitments (Matias-Pereira, 2018; Moura & Miller, 2019) as more conditions for balancing revenue and expenditure are created.

4.1 Factor Analysis

Continuing with the analyses proposed by the study design, factor analysis aims to group two distinct groups into factors. To this end, the set of endogenous variables is represented by two factors while the explanatory variables were reduced to five factors. Both matrices were rotated by using the varimax method, aiming to increase the capacity of the variance explained in the eigenvalues.

These factors were represented with 69.88% of accumulated variance in the budget availability group and 74.65% in fiscal austerity. Both values were defined based on eigenvalues greater than 1.000 (Hair et al., 2009). The factor loadings used to compose the factors are shown in Table 5.

Taking into account the study objective, the factors were not named, as the grouping of variables aimed merely to simplify the interpretation of the relationships between the concepts. It should be noted that, in general, the formation of factors related to fiscal austerity creates groupings that, conceptually, do not rule

out the movement of variables involved with the availability of budget resources (Brady, 2015; Socol et al., 2018, Schakel, Wu & Jeurissen, 2018).

Table 5
Factor Loadings

Categories	Variables	Fact._1	Fact._2	Fact._3	Fact._4	Fact._5	Commo
Budget Availability	Updated Allocation	0.9501	0.0467				0.9049
	Canceled or Rear.Allocation	0.9093	0.0008				0.8269
	Available Funds	0.5752	0.2800				0.4092
	Unavailable Funds	0.6396	0.1386				0.4283
	DDR Control	0.8354	0.0619				0.9216
	Granted Decentralization	0.0394	0.9592				0.7018
Fiscal Auterity	Committed Expenses	0.8738	0.1184	0.4100	0.1438	0.0175	0.9667
	Settled Expenses	0.8987	0.1057	0.3535	0.1612	0.0122	0.9699
	Paid Expenses	0.8994	0.1075	0.3517	0.1528	0.0084	0.9676
	Paid RPP	0.5941	0.0774	0.2128	0.2163	0.1169	0.4647
	Payable RPP	0.6085	0.3081	0.0076	0.0328	0.1649	0.4934
	Transfer Receipt	0.9059	0.0442	0.2474	0.1867	0.0339	0.9198
	Granted Provision	0.1940	0.9208	0.1880	0.1160	0.0440	0.9362
	Received Provision	0.1171	0.9350	0.0870	0.0975	0.0147	0.9052
	Gross Budget Revenue	0.3717	0.3106	0.5717	0.0895	0.0328	0.5704
	Payable RPNP	0.1888	0.0363	0.7605	0.0865	0.0780	0.6289
	Settled RPNP	0.4180	0.1582	0.8120	0.0242	0.0149	0.8599
	Paid RPNP	0.4151	0.1693	0.8106	0.0122	0.0167	0.8583
	Cancelled RPNP	0.0373	0.0507	0.5198	0.1334	0.2436	0.3513
	Sub-Transfer Release	0.1538	0.0523	0.0437	0.8438	0.0620	0.7440
	Sub-Transfer Receipt	0.4105	0.2136	0.1611	0.7024	0.0776	0.7394
	DDR	0.0308	0.0179	0.0362	0.2635	0.8228	0.7489
	Cancelled RPP	0.3586	0.0645	0.1176	0.2843	0.5805	0.5644

Note: RPP – Settled amount to be paid; RPNP – Not settled amount to be paid; DDR - Availability by Resource Allocation; Both sets presented satisfactory results regarding Bartlet sphericity (Budget availability = $X^2(6) = 32398$, p-value < 0.0000; Fiscal Austerity = $X^2(16) = 56839$, p-value < 0.0000). As well as with regarding the Kaiser–Meyer–Olkin Criterion (Budget availability = 0.74; Fiscal Austerity = 0.81).

Moreover, it should be noted that the chosen variables, resulting from the criteria established by the STN (2021), are similar in some aspects, which justifies the use of factor analysis, as it determines new variables arising from the correlation existing in the behavior of these variables (Hair et al., 2009; Fávero & Belfiore, 2017).

4.2 Relationship Analysis

At this point in the analysis, the aim is to quantify the relationship between the concepts of institutional efficiency and budget availability, considering the fiscal austerity of the analyzed institutions, as proposed in the research hypothesis. Therefore, descriptive analyses are carried out to understand the behavior of the scores obtained and then use the canonical correlation technique to determine the relationship coefficients.

Table 6
Descriptive Statistics of Scores Obtained

	Min	1Quart	Mean	Median	Sta.Dev.	Cof.Var.	3Quart	Max
Fator_Orç1	–6.6489	–0.2260	0.0000	0.3689	1.0153	–	0.6253	0.9175
Fator_Orç2	–0.7590	–0.2849	0.0000	–0.2508	1.0298	–	–0.1771	10.8710
dea_aloc	0.0640	0.1000	0.2227	0.1000	0.1897	0.8514	0.2791	1.0000
dea_soc	0.0746	0.2948	0.4859	0.4373	0.2333	0.4800	0.6626	1.0000
dea_tec	0.0065	0.0228	0.1190	0.0339	0.2328	1.9564	0.0588	1.0000
Fator_Fisc1	–2.3153	–0.5093	0.0000	–0.3330	1.0340	–	0.1673	9.1994
Fator_Fisc2	–8.9075	–0.3025	0.0000	0.2833	1.0081	–	0.5091	1.4821
Fator_Fisc3	–7.7570	–0.3319	0.0000	0.2541	1.0538	–	0.6486	2.8311
Fator_Fisc4	–11.9069	–0.1002	0.0000	0.3284	1.0110	–	0.4189	5.1930
Fator_Fisc5	–9.6738	–0.1558	0.0000	0.1335	1.0234	–	0.2660	7.4548

Note: Fator_Orç = Scores resulting from budget availability variables; Fator_Fisc = Scores resulting from fiscal austerity variables; DEA = Scores resulting from data envelopment analysis for the perspectives of allocative, social and technical efficiency, respectively; No concrete results were found for the coefficients of variation relating to the factors of budget availability and fiscal austerity, due to the mean results with a zero value, $CV = \frac{\sigma}{\mu}$ where σ corresponds to the dispersion calculated by Standard Deviation and μ isa equivalent to the estimate of the population average (Bruni, 2011).
Source: Prepared by the authors (2021)

That said, the data description focuses on interquartile analysis, central tendency and dispersion values. From this perspective, it is noted that the gap between minimum values and the first quartile are high in "*Fator_Orç1*," "*Fator_Fisc2*," "*Fator_Fisc3*," "*Fator_Fisc4*," "*Fator_Fisc5*." This result indicates a large concentration of data in the first 25% values.

Continuing with the interquartile analyses, the values between the 3rd quartile and the maximum values are distant, especially in *"Fator_Orç2."* In turn, the central tendency values are fairly close, which indicates that the average may indeed portray the centrality of the sample. Finally, dispersion restricted to the standard deviation analysis shows that there is low volatility in the sample, which limits the outliers to possible scarce data. This is especially due to the technique used for outlier conversion developed by Komsta (2011). Considering that no conspicuous distinctions are observed between the behavior of the variables, correlation analysis is required to quantify the relationship between the concepts (Fávero & Belfiore, 2017). The results are shown in Table 7.

Table 7
Pearson's Correlation

	Orç1	Orç2	Fisc1	Fisc2	Fisc3	Fisc4	Fisc5	dea_aloc	dea_soc	dea_tec
Orç1	1.000									
Orç2	0.000	1.000								
Fisc1	−0.917***	−0.028	1.000							
Fisc2	−0.115***	−0.053**	0.000	1.000						
Fisc3	0.006	0.158***	0.000	0.000	1.000					
Fisc4	−0.021	0.048*	0.000	0.000	0.000	1.000				
Fisc5	−0.091***	0.020	0.000	0.000	0.000	0.000	1.000			
dea_aloc	0.313***	−0.000	−0.335***	−0.093***	−0.089***	−0.003	0.004	1.000		
dea_soc	−0.459***	−0.055**	0.475***	0.161***	0.106***	0.019	0.015	−0.278***	1.000	
dea_tec	0.161***	0.034	−0.102***	−0.077***	0.120***	0.142***	−0.029	0.146***	−0.023	1.000

Note: Significance at the level of *0.1 **0.5 ***0.01

The correlation analysis shows that the *dea_aloc* and *dea_tec* signals denote that the greater the efficiency in these perspectives, the greater the availability of resources (Mattos & Terra, 2015; Boueri, 2015; Førsund, 2017; Bresser-Pereira, 2017; Matos, 2021), especially in *Orç1*, which is composed of the majority of endogenous variables. In this sense, the relationship between *dea_soc* and *Orç1* is significant and inversely proportional in the order of -0.459, the highest correlation among efficiency perspectives. This shows that the social perspective, besides being the one that has the highest scores and, therefore, attracts the most attention in general, is also the one that opposes budget availability. This correlation can be explained by the need for greater expenditure when the institutions start trying to expand or maintain services to society, even in situations of budget reduction (Marques & Almeida, 2004; Socol et al., 2018; Giacomoni, 2019).

Such results can also be associated with the provisions of the theoretical component resulting from Public Choice. More precisely, based on studies by Silva and Silva (2017), Bociu (2017) and Sallaberry et al. (2019), while allocative and technical efficiencies address the institution's management from the perspective of finance and its activities, social efficiency addresses managers' personal concerns. It should be noted that this is not about neglecting the other efficiencies, but it is assumed that there is greater concern with social needs in the face of difficulties in balancing the budget (Jalles, 2017; Socol et al., 2018).

The preliminary considerations about the sample data are followed by an analysis of the relationship according to the canonical correlation test. Attention is initially drawn to its usefulness as a tool for describing multiple relationships, especially to introduce the relationship between concepts (Fávero & Belfiore, 2017). Although canonical correlation supposes that the sample is linear, Hair et al. (2009) point out that it is a robust technique for non-linear samples, especially when they include standardized variables.

The analysis of the first dimension between the canonical variables μ_1 and υ_1 indicates a correlation of the order of 0.9319, while the second dimension μ_2 and υ_2 is correlated at 0.1839. The results for the second dimension, albeit lower, are still significant, according to Wilk's lambda test. That said, the analyses between canonical loads involve both dimensions, as shown in Table 8.

It is noteworthy that the *Fiscal1* factor is the one that most contributes to the formation of μ_1 (0.9178), i.e., the analysis of group Y indicates that the first factor is the one with the highest correlation. This result corroborates the relevance of public obligations in relation to resource availability (Schakel, Wu & Jeurissen, 2018; Giacomoni, 2019). Additionally, it was noted that using revenue to achieve fiscal balance did not make a relevant contribution, as predicted by Brady (2015) when arguing that this type of approach, in addition to being less effective, produces adverse effects from the social point of view.

From the point of view of institutional efficiency, according to the study hypothesis, it is observed that *dea_soc* is also relevant in the formation of μ_1 (0.4609), especially when compared to other efficiency perspectives. Likewise, as seen in previous analyses, *dea_aloc* and *dea_tec* presented relevant results, particularly when they involve variables that are linked to the financial, accounting and management results

of the institution (Boueri, 2015; Dumitrescu & Dogaru, 2016; Giacomoni, 2019; Matos, 2021).

Table 8
Canonical Loads and Regression Results

Correlation matrix between the canonical variables and the original variables of group Y				
Model	$Fisc1_1+Fisc1_2+Fisc1_3+Fisc1_4+Fisc1_5+dea\_aloc_6+dea\_soc_7+dea\_tec_8 = f(Orç1_1+Orç2_2)$		$Fisc1_1+Fisc1_2+Fisc1_3+Fisc1_4+Fisc1_5 = f(Orç1_1+Orç2_2)$	
	μ_1	μ_2	μ_1	μ_2
Fisc1	0.9178	–0.0047	–0.8205	–0.0313
Fisc2	0.1164	0.0494	01776	–0.0148
Fisc3	–0.0064	–0.1577	0.4154	–0.0652
Fisc4	0.0196	–0.0484	0.1212	0.0511
Fisc5	0.0897	–0.0230	–0.0123	0.0141
dea_aloc	–0.3123	0.0116		
dea_soc	0.4609	0.0389		
dea_tec	–0.1626	–0.0284		
Correlation matrix between the canonical variables and the original variables of group X				
	υ_1	ν_2	υ_1	ν_2
Orç1	*–0.9313*	0.0066	0.9688	0.0046
Orç2	*–0.0333*	–0.1838	0.0507	–0.0909
Regression model results				
R^2	$Y \rightarrow X = 0.4511$			
R^2 *Ajust*	$Y \rightarrow X = 0.4475$			
Wilk's lambda	$\mu 1 \upsilon 1$ (F(df=16) = 0.1272. p-value = 0.0000) $\mu 2\ \upsilon 2$ (F(df=7) = 0.9662. p-value = 0.0000)		$\mu 1 \upsilon 1$ (F(df=16) = 0.0568, p-value = 0.0000) $\mu 2\ \upsilon 2$ (F(df=7) = 0.9898, p-value = 0.0823)	
Pillai's trace	F = 0.9022. p-value = 0.0000			

Note: Canonical loads calculated from Ossani and Cirillo (2021) and the explanatory capacity is derived from Jari Oksanen (et al., 2020).

Therefore, although the results related to institutional efficiency did not behave as expected, one cannot exclude it as a relevant component in the relationship between fiscal austerity and resource availability, preserving H_1. This result is highlighted by the explanatory capacity of the model, whose composition does not include efficiency variables. With this modeling, the set of fiscal factors explains only 18.24% of budget availability, so that, when adding institutional efficiency, this percentage rises to 44.75%.

Moreover, it is worth highlighting that the modest result of *dea_aloc* and *dea_tec* can be explained by the condition of management unpredictability suggested by Rezende (2015). Such conditions pose some difficulty in mapping the adequate execution of activities in the institution, underestimating budget control measures and focusing on measures to support society.

As previously mentioned, managerial decisions involve several aspects, which rules out the idea that only fiscal aspects are enough to explain the behavior of budget availability (Randma-Liiv & Kickert, 2017; Socol et al., 2018). It is understood that this is supported by Public Choice theory as it determines the perspective used by managers when dedicating greater attention to improving social service mechanisms to the detriment of mechanisms for improving the institution's allocative and technical indicators (Jalles, 2017; Sallaberry et al., 2019).

Although the explanatory capacity of group x is not here under analysis, in accordance with the purpose of the study, it is noted that *Orç1* is the variable that most contributes to the explanation of υ_1. In addition, the second dimensions show clearly that *Fisc3*, arising mainly from the payment of Payable Liabilities (PL), is the preponderant variable in explaining μ_1 (0.1577). This is due to the pressure of PL on financial resources, reducing the ability to maintain available funds for commitments (Rezende, 2015; Giacomoni, 2019).

It should also be explained that the correlation herein presented showed statistical significance at the level of 0.01, as shown by Pillai's trace (F = 0.9022, p-value = 0.0000), and it is worth stressing that the explanatory capacity of budget availability, through the set formed by fiscal austerity and institutional efficiency, is R^2 45.11%, or adjusted R^2 of 44.75%. This result makes it possible to understand the behavior of almost half of resource availability.

However, it should be noted that the goal of canonical correlation is to survey the relationship between the sets of explained and explanatory variables (Hair et al., 2009; Fávero & Belfiore, 2017), as previously discussed. Therefore, it is not part of this goal to determine the explanatory capacity between the variables, however significant they may be.

5 Conclusion

This study draws on concepts arising from managerialism applied to public institutions and assumes that the search for more efficient practices in institutions can contribute to improving resource availability

indicators, without disregarding the institution's fiscal austerity conditions. However, when observing the literature, it is accepted that efficiency needs to be evaluated jointly within the institution in order to gauge different perspectives and assimilate what can be improved.

In view of this, it was observed that it is not possible to refute the study's alternative hypothesis, which argues that institutional efficiency is a significant component in the relationship between fiscal austerity and budget availability of FHEI. This was only possible by verifying that all efficiency perspectives are significant components of budget availability, especially when considering an institution's fiscal austerity. However, it was noted that such perspectives do not behave equally, so that efficiency focused on the social aspect is surpassed.

At this point, one of the contributions of the study is observed, especially considering that, according to Public Choice theory, hesitation in making unpopular decisions is part of human behavior. From this perspective, it is natural for public managers to turn their attention to practices that enjoy greater acceptance among society and enable the institution to serve its community more efficiently.

The fact that public obligations are related to the availability of funds shows that limiting expenses is a component that directly affects an institution's budget capacity. On the other hand, the absence of a clear relationship with public revenue shows that increasing revenue is not a notable instrument in seeking to increase the availability of funds.

That said, this study focuses on increased efficiency resulting from managerialism not only to evaluate the performance of institutions, but to do so impartially in different aspects, enabling institutions to review procedures against their peers. Additionally, budget availability management should be highlighted, since the hesitation of managers to use tools that aim to achieve greater fiscal austerity is supported by existing discussions in the light of Public Choice theory, but which are empirically tested in this study.

Although the desired results were achieved, this study has limitations. In particular, in analyzing the evolution of efficiency averages over time, oscillation in scores is noted, especially between 2009 and 2010. This time aspect combined with the choice of variables that determine efficiency scores may be reevaluated using different approaches, making way for new empirical tests that verify the primacy of social scores over others.

Also suggested in future studies is a more in-depth investigation of the theoretical component arising from Public Choice theory, verifying new concepts that may help explain the behavior of resource availability subject to managerial decision.

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NOTES

ACKNOWLEDGMENT
We would like to thank the Master's and Doctoral Graduate Program in Accounting at UFPR for the opportunity to participate in the research projects and the academic doctoral program. To CNPq for funding with resources for review and publication of the article in question, according to the project approved in a public notice by the study advisor.

AUTHORSHIP CONTRIBUTION
Conception and preparation of the manuscript: S.S.Lima Filho, B.C. Severo Peixe
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DATASET
The entire dataset supporting the results of this study was published in the paper itself.

FINANCING
From CNPq through the provision of resources to support the research carried out with the publication of articles in national and international journals.

CONSENT TO USE IMAGE
Does not apply.

APPROVAL OF THE RESEARCH ETHICS COMMITTEE
Does not apply.

CONFLICT OF INTERESTS
Does not apply.

PUBLISHER
Federal University of Santa Catarina. Accounting Sciences Course and Postgraduate Program in Accounting. Publication on the UFSC Journal Portal. The ideas expressed in this article are the responsibility

of their authors, and do not necessarily represent the opinion of the editors or the university.

EDITORS
José Alonso Borba, Denize Demarche Minatti Ferreira, Carlos Eduardo Facin Lavarda.

HISTORIC
Received on: 01/03/2022 - Peer reviewed on: 15/02/2023 - Reformulated on: 08/09/2023 - Recommended for publication on: 17/10/2023 - Published on: 24/11/2023