BAR Brazilian Administration Review

ANPAD

Research Article

The Effects of Expansionary Fiscal Policy on Macroeconomic Development: A Study on Tax Competition in an Emerging Market

Amery Moisés Nadir Junior[1], Anete Alberton[2], José Alonso Borba[1], Kleverton Clóvis de Oliveira Saath[3]

[1] Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Contabilidade, Florianópolis, SC, Brazil
[2] Universidade do Vale do Itajaí, Programa de Pós-Graduação em Administração, Itajaí, SC, Brazil
[3] Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Economia, Florianópolis, SC, Brazil

How to cite: Nadir, A. M. Junior, Alberton, A., Borba, J. A., & Saath, K. C. O. (2026). The effects of expansionary fiscal policy on macroeconomic development: A study on tax competition in an emerging market. *BAR-Brazilian Administration Review, 23*(1), e250057.

DOI: https://doi.org/10.1590/1807-7692bar2026250057

Keywords:
tax benefits; tax competition; macroeconomic development; tax on circulation of goods and services (ICMS); expansionary fiscal policy.

JEL Code:
H71, H77, E62

ABSTRACT

Objective: this article examines expansionary fiscal policy in the context of intergovernmental tax competition from a macroeconomic perspective, analyzing the effects of granting tax benefits under the state value-added tax on the circulation of goods and services (ICMS) on the economic development of Santa Catarina, a state in southern Brazil. **Methods:** monthly data spanning 1997–2020 were analyzed using a vector autoregression (VAR) model with Granger causality tests and impulse-response functions. **Results:** ICMS shocks temporarily increased the exchange rate and imports but had little or no effect on GDP (proxied by electricity consumption), interest rates, exports, inflation, state revenue, and, most notably, employment. Over the period, industry and import-related activities together received 74% of projected tax incentives, while accounting for only 32% and 11% of formal jobs, respectively. **Conclusions:** the findings challenge Keynesian expectations of broad-based stimulus and align with neoclassical and public-choice critiques, highlighting the inefficiency, limited employment impact, and rent-seeking nature of such tax policies.

Received:
March 19, 2025.
This paper was with the authors for four revisions.

Accepted:
December 22, 2025.

Publication date:
February 04, 2026.

Corresponding author:
Amery Moisés Nadir Junior
Universidade Federal de Santa Catarina
Rua Eng. Agronômico Andrei Cristian Ferreira, s/n,
CEP 88040-900 Florianópolis, SC, Brazil

Funding:
The author stated that there is no funding for the research.

Conflict of Interests:
The authors stated that there was no conflict of interest.

Editor-in-Chief:
Ricardo Limongi
(Universidade Federal de Goiás, Brazil)

Associate Editor:
Marcos Sousa
(Instituto Federal de Educação Ciência e Tecnologia Goiano, Brazil)

Reviewers:
Marcello Beckert Zappellini
(Universidade do Estado de Santa Catarina, Brazil)
Miguel Torres
(University of Kent, Kent Business School, United Kingdom)

Peer Review Report:
The Peer Review Report is available at this external URL.

Editorial assistants:
Eduarda Anastacio and Simone Rafael (ANPAD, Maringá, Brazil).

Data Availability: Moisés Nadir Junior, Amery; Alberton, Anete; Borba, José Alonso; Clóvis de Oliveira Saath, Kleverton (2026), "The effects of expansionary fiscal policy on macroeconomic development: A study on tax competition in an emerging market.", Mendeley Data, V2, doi: https://doi.org/10.17632/3fcrbfdrp5.2
BAR – Brazilian Administration Review encourages data sharing but, in compliance with ethical principles, it does not demand the disclosure of any means of identifying research subjects.

Plagiarism Check: BAR maintains the practice of submitting all documents received to the plagiarism check, using specific tools, e.g.: iThenticate.

Peer review: is responsible for acknowledging an article's potential contribution to the frontiers of scholarly knowledge on business or public administration. The authors are the ultimate responsible for the consistency of the theoretical references, the accurate report of empirical data, the personal perspectives, and the use of copyrighted material. This content was evaluated using the double-blind peer review process. The disclosure of the reviewers' information on the first page is made only after concluding the evaluation process, and with the voluntary consent of the respective reviewers.

INTRODUCTION

The 2008–2009 global financial crisis prompted Brazil and other countries to adopt fiscal stimulus measures, reigniting academic debates on the effectiveness of activist fiscal policies (Alves et al., 2019). Expansionary fiscal policy involves government actions — mainly increased public spending and tax cuts — to stimulate economic activity during times of crisis, recession, or economic slowdown. In Brazilian states, this strategy is frequently pursued through tax incentives under the state value-added tax on the circulation of goods and services (ICMS), aiming to attract investment and preserve employment. However, such measures also carry risks of fiscal imbalance and may contribute to distortions within the federal system.

In this context, a central question emerges: Is granting tax benefits worthwhile? This article examines expansionary fiscal policy within a scenario of intergovernmental tax competition from a macroeconomic perspective. The objective is to analyze the effects of expansionary fiscal policy, particularly ICMS tax benefits, on the macroeconomic development of the state of Santa Catarina, located in the southern region of Brazil. This state is the sixth-largest economy in the country and is characterized by a diversified economy and robust port infrastructure featuring five seaports.

Despite being primarily designed as a revenue-generating mechanism, Brazilian states have also used ICMS for extra-fiscal purposes, providing tax benefits to attract enterprises and investments, as well as to improve the competitiveness of vital economic sectors. Santa Catarina emerges as a leading proponent of ICMS tax benefits. The state's proactive stance results in a substantial projected revenue waiver of USD 2.67 billion in the 2022 fiscal year, equivalent to 66.75% of the anticipated ICMS revenue. However, the effectiveness of this waiver varies, as expansionary fiscal policies influence economic activity and market competitiveness, subsequently impacting tax collection.

Public policy on tax benefits should mainly aim to neutralize or offset the externalities caused by economic activities. However, recent decades have seen intergovernmental tax competition among states, commonly referred to as a 'fiscal war.' Regarded by many as predatory, this competition can potentially erode the ICMS tax base, which is the primary revenue source for states and municipalities.

Thus, the Chamber of Deputies passed a tax reform (Emenda Constitucional n. 132, 2023) on December 15, 2023, in an attempt to streamline the Brazilian tax system and combat fiscal competition. This reform introduces a dual value-added tax (VAT) system to replace (1) ICMS and the municipal services tax (ISS) — with existing tax benefits retained until 2032 — and (2) federal indirect taxes. Under this reform, states and municipalities will collect and oversee a subnational VAT known as the tax on goods and services (IBS). Importantly, the IBS will be governed by unified national legislation. The definitive implementation of the IBS is slated for 2033, with ICMS gradually phased out in the interim.

Given the multitude of theoretical hypotheses surrounding the relationship between taxation and economic development across countries, there is a pressing need for more empirical research to comprehensively analyze the impacts of expansionary fiscal policy facilitated by tax exemptions. Much of the available evidence is informal, anecdotal, or characterized by ambiguity and lacks robustness (Cavalcanti & Silva, 2010; Mattos et al., 2017). Several factors contribute to the complexity of conducting empirical research on ICMS. These include the intricate and fragmented nature of tax legislation arising from the overlapping jurisdictions of states (Mello, 2008), as well as the absence of quantitative and temporal constraints on the granting and utilization of tax benefits (Surrey, 1970).

According to Surrey (1970), conducting a realistic cost-benefit analysis of expansionary fiscal policies is imperative to ascertain which type of public expenditure (direct or indirect) best aligns with the state's objectives. Many researchers opt for the vector autoregressive (VAR) model, which enables the examination of the dynamic effects of fiscal policy on macroeconomic variables while imposing minimal theoretical constraints (Cavalcanti & Silva, 2010). Prominent fiscal studies adopting this approach include Ramey and Shapiro (1998), Blanchard and Perotti (2002), Perotti (2004), Romer and Romer (2010), and Auerbach and Gorodnichenko (2012).

Expansionary fiscal policy, particularly according to traditional Keynesian theory, is characterized as a tool of countercyclical economic policy, focusing on tax reductions and increased public spending (Dornbush et al., 2011). The Keynesian multiplier effect is a macroeconomic concept that expresses how an increase in government spending can induce a greater increase in gross domestic product (GDP) (Busato & Martins, 2022). This study hypothesizes that the adoption of an expansionary fiscal policy, specifically centered on the provision of tax benefits, has facilitated macroeconomic development in the state of Santa Catarina over time.

This article is divided into five additional sections. The next one delves into the theoretical framework, the institutional context of fiscal policy in Santa Catarina, and the existing empirical literature on the subject. The following section addresses data collection and meth-

ods, outlining the variables and elucidating the stages of VAR estimation. The subsequent section presents the results of the tests and model functions, followed by a discussion of the findings. The final section summarizes the main conclusions and suggests directions for future research, with reflections on the 2023 Brazilian tax reform.

THEORETICAL AND EMPIRICAL FOUNDATION

Theoretical background

The debate over the effectiveness of fiscal policy in stimulating economic activity has intensified since the rise of Keynesian theory, which emphasized the role of state intervention in influencing consumption through taxation and interest rates (Keynes, 1935), laying the foundation for modern expansionary fiscal strategies. While there is broad consensus that tax increases tend to be contractionary, substantial disagreement remains regarding the magnitude of their impact on economic activity (Mertens & Ravh, 2014). Some scholars, such as Ramey and Shapiro (1998), advocate for passive fiscal approaches, whereas others, like Blanchard and Perotti (2002), support active intervention — though employing distinct econometric methodologies. This lack of consensus partly stems from the challenge of simultaneity: identifying exogenous (i.e., unexpected and uncorrelated) fiscal shocks that are not influenced by other macroeconomic fluctuations (Alves et al., 2019; Cloyne, 2013).

Despite the well-intentioned goals of public managers, such as promoting growth and employment, expansionary fiscal policies based on tax exemptions can lead to unintended consequences, including windfall gains, revenue loss, inefficient capital allocation, and reduced economic freedom, ultimately compromising public welfare (Hayek, 1990; Parys & James, 2010; Surrey, 1970). These practices may also reflect an inefficient equilibrium within federative systems, particularly where tax competition among subnational governments is prevalent (Zodrow & Mieszkowski, 1986).

From a neoclassical perspective, the long-term neutrality of fiscal policy suggests that tax incentives distort resource allocation, leading to inefficiencies and lower potential output (Mertens & Ravh, 2014). This view holds that government interventions, including tax expenditures, often crowd out private investment and generate deadweight losses. In parallel, public choice theory — especially Buchanan's (1975) contributions — argues that fiscal decisions are frequently driven by political incentives and rent-seeking pressures, resulting in enduring tax privileges that may not serve the public interest.

Complementarily, the literature on tax competition offers divergent interpretations. Tiebout (1956) presents an optimistic view in which interjurisdictional competition enhances efficiency by aligning tax rates with local service demands. In contrast, Wilson (1999) cautions that the effectiveness of tax competition depends on the nature of the taxes involved and broader factors, including the quality of public service provision and strategic interactions among governments.

Empirical background: Institutional context

The excessive reliance on indirect taxes on consumption, such as the state value-added tax on the circulation of goods and services (ICMS), within the Brazilian tax system exacerbates social inequality due to their inherently regressive nature. This dynamic creates a vicious cycle in which tax benefits are granted both to offset the regressive effects of such taxes and to attract investment and stimulate economic activity.

The current ICMS is characterized as an indirect, multiphase tax collected by the state of origin. The amount due in each transaction is offset against amounts paid in previous transactions within the same or different states. However, the non-cumulative nature of ICMS encourages states to offer benefits in the form of presumed (or fictitious) credits to their taxpayers. In interstate transactions, this practice significantly undermines the tax revenue of the states receiving the goods and services (Mattos et al., 2017).

Furthermore, tax exemptions adversely affect the value of taxpayers' assets, as those not benefiting from the incentives experience reduced profit expectations due to unfair competition from taxpayers operating under privileged tax conditions (Castilho & Silveira, 2009). In addition, governments often grant repeated incentives through special amnesty and remission programs to reduce tax debts and fines, which further undermine the system's fairness and distort the expectations of compliant taxpayers (Carvalho et al., 2023).

Within the realm of intergovernmental tax competition, Federal Complementary Law 24 of 1975 (Lei Complementar n. 24, 1975) mandates states to prearrange national agreements at the National Council for Financial Policy (Confaz) for the authorization and revocation of ICMS benefits. However, despite this requirement, a significant portion of ICMS benefits has been unilaterally granted without the council's approval. This unilateral action has fueled tax competition commonly referred to as the 'fiscal war' among states or, in some cases, the 'port fiscal war,' particularly involving states with port facilities, such as Santa Catarina. Federal Complementary Law 160 of 2017

and Constitutional Amendment 132 of 2023 (Emenda Constitucional n. 132, 2023; Lei Complementar, n. 160, 2017) (tax reform) extended the validity of these benefits until 2032.

Appendix A presents Santa Catarina's projected annual revenue waiver values, categorized by the type of ICMS benefit, spanning from 2003 to 2020. Notably, among the tax benefits responsible for the largest amounts of revenue forgone are, in ascending order of value, presumed credit, reduction in the calculation base, and exemption. Furthermore, institutional tax programs with substantial tax exemption values include the now-defunct Santa Catarina Economic, Technological, and Social Modernization and Development Program (Compex), which incentivized imports of goods and merchandise through tax benefits and credit transfers; the Pro-Employment Program, introduced as a successor to Compex, which offers various types of tax benefits primarily aimed at promoting employment and income generation; the Companies' Development Program (Prodec), which facilitates the deferral of ICMS payments and offers subsidized interest rates to encourage industrial implementation or expansion within the state, particularly targeting municipalities with lower Human Development Index (HDI); and the Social Development Fund and the State Incentive System for Culture, Tourism, and Sports (Seitec), both now defunct, which provided financial support for inclusion and social promotion, as well as for the promotion of culture, tourism, and sports, respectively. These programs granted credit incentives, reducing taxpayers' tax liabilities in exchange for their contributions to these public funds.

Exemption totals increased by roughly 85% between 2003 and 2007, following the creation of Compex (2003) and Pró-Emprego (2007), amid intensified interstate fiscal competition. A decrease of about 30% occurred during 2008–2011, coinciding with the global financial crisis and the initial Prodec reform (2011), which consolidated programs and eliminated inefficient benefits. Between 2012 and 2017, exemptions expanded again by approximately 60%, particularly after Complementary Law 160/2017 (Lei Complementar, n. 160, 2017) formally validated previously irregular incentives. From 2018 to 2020, the series shows a 25% decline, associated with fiscal-adjustment measures and the anticipation of nationwide tax reform. Overall, exemptions grew at an average annual rate of about 3.5%, with the main inflection years — 2003, 2007, 2011, and 2017 — corresponding to structural policy changes as shown in Appendix A.1.

Despite an apparent contradiction, the state of Santa Catarina pursues an expansionary fiscal policy centered on extensive tax exemptions, aiming to bolster tax collection while concurrently stimulating economic activity and enhancing the competitiveness of businesses (Castilho & Silveira, 2009; Mello, 2008). However, it is noteworthy that the primary objective remains the increase in tax revenue, with economic development and the generation of employment and income considered secondary concerns (Afonso et al., 2002; Castilho & Silveira, 2009). This emphasis on revenue enhancement exacerbates the adverse effects of the state's disregard, minimization, or underestimation of tax competition.

When calculating the annual revenue waiver projection associated with the granting of tax benefits, the state of Santa Catarina adheres to the principle of prudence. This entails computing the waiver by comparing hypothetical revenue (without the tax benefit) to actual revenue (with the tax benefit), as stipulated in the Budgetary Guidelines Law (LDO) 18,170 of 2021 (Lei n. 18.170, 2021). Consequently, factors such as the attraction of enterprises due to tax exemptions, the stimulation of economic activity leading to job and income generation, and investments in infrastructure such as roads, ports, sanitation, electricity, and telecommunications are no longer factored into the waiver calculation. Therefore, a significant portion of the waiver does not necessarily imply an actual loss in revenue. From this perspective, the tax waiver projected by the state of Santa Catarina can be regarded as a potential waiver.

Starting in 2021, the state of Santa Catarina implemented a new method for calculating tax exemption waivers. This involved the development of electronic tools capable of accurately determining the entirety of presumed credits granted. Consequently, this adjustment in the calculation method led to a significant rise in the projected revenue waiver for 2022 compared to preceding years. Based on information from the LDO, for the 2022 fiscal year, the projected revenue waiver arising from ICMS tax benefits in Santa Catarina amounted to USD 2.67 billion, compared with USD 1.18 billion in 2021. During the 2022 fiscal year, this waiver accounted for 66.75% of net ICMS revenue (USD 4 billion), 47.04% of gross ICMS revenue (USD 5.7 billion), and 32.48% of the state's total net revenue — includ-

ing taxes, fees, contributions, and intergovernmental transfers from the federal government — which totaled USD 8.22 billion.

Table 1 summarizes the revenue waiver projection values for the 2022 fiscal year by type of ICMS benefit, calculated using the new waiver calculation method.

Table 1. Projected ICMS revenue waiver values for the 2022 fiscal year by type of tax benefit.

Tax benefit	Amount of tax waiver (USD)[a]	Participation (%)
Presumed credit	2,072,778,615.23	77.47
Reduction in the calculation base or rate	357,836,873.27	13.37
Exemption	203,021,097.70	7.59
Prodec subsidy	3,026,786.95	0.11
Other tax benefits	39,030,424.69	1.46
Total	2,675,693,797.84	100

Note. [a]When converting the waiver values from BRL to USD, the average exchange selling price in 2022 was applied (BRL/USD = 5.1648), as reported by the Central Bank of Brazil.
Source: Elaborated by the authors based on the Budget Guidelines Law (LDO) for the 2022 fiscal year (Lei n. 18.170, de 27 de julho de 2021. (2021). Lei Nº 18.170, de 27 de julho de 2021. Dispõe sobre as diretrizes orçamentárias para o exercício financeiro de 2022 e estabelece outras providências. https://leis.alesc.sc.gov.br/ato-normativo/21006).

Table 1 illustrates that presumed credit constitutes 77% of the total ICMS waiver, emerging as the most significant benefit within Santa Catarina's expansionary fiscal strategy. Amid the tax competition landscape, the state has lured numerous key industrial enterprises by signing intent protocols involving the state, municipalities, and companies. These intent protocols encompass ICMS benefits and municipal and logistical incentives. They entail commitments from participating industries, such as job creation and financial contributions to bolster business expansion, as detailed in information from the online news portal of the State Secretariat of Finance of Santa Catarina.

Table 2 illustrates the anticipated values of tax waivers for 2022 categorized by economic sector, encompassing total waiver values of state taxes rather than solely ICMS.

Table 2. Projected values of tax waivers for the 2022 fiscal year by economic sector.

Economic sector	Amount of tax waiver (USD)[a]	Participation (%)
Import	1,016,021,547.80	37.43
Industry	1,005,155,290.53	37.03
Agriculture and fishing	224,417,958.89	8.27
Medication and health equipment	114,950,162.13	4.23
Infrastructure	107,418,186.44	3.96
Social policy and basic food provision	83,606,872.42	3.08
Commerce	67,150,466.71	2.48
Miscellaneous	50,053,069.07	1.85
Transport	28,641,275.91	1.05
Communication	16,670,125.49	0.62
Total	2,714,084,955.39	100

Note. [a]When converting the waiver amounts from BRL to USD, the average commercial exchange rate for sales in 2022 was applied (BRL/USD = 5.1648), as reported by the Central Bank of Brazil.
Source: Elaborated by the authors based on the Budget Guidelines Law (LDO) for the 2022 fiscal year. (Lei n. 18.170, de 27 de julho de 2021. (2021). Lei Nº 18.170, de 27 de julho de 2021. Dispõe sobre as diretrizes orçamentárias para o exercício financeiro de 2022 e estabelece outras providências. https://leis.alesc.sc.gov.br/ato-normativo/21006).

As depicted in Table 2, the import and industry sectors are the primary beneficiaries of tax waivers, closely followed by the agriculture and fishing sectors. These sectors epitomize the diverse economy of Santa Catarina. However, investments attracted through tax incentives are often opportunistic, involving assets of

minimal significance and yielding little to no positive impact on the local economy, thus perpetuating underdevelopment in Brazil (Castilho & Silveira, 2009).

Since the ICMS is a state-level tax with nationwide effects, Brazilian states tend to replicate legislative changes adopted by neighboring states, particularly within the same geoeconomic region, such that spatial proximity amplifies parallel adjustments in tax burdens (Campos et al., 2015; Mello, 2008). Accordingly, Table 3 presents a descriptive comparison of ICMS revenue and projected tax waivers for 2022, focusing on Santa Catarina, Paraná, Rio Grande do Sul, and São Paulo.

Table 3. Gross ICMS collections and projected ICMS tax waiver amounts for fiscal year 2022[a].

State	ICMS revenue (USD)[b]	Tax waiver (USD)	Waiver share (%)
Santa Catarina	5,688,595,028.87	2,675,693,797.84	47.04
Paraná	6,933,474,598.62	3,388,320,941.76	48.87
Rio Grande do Sul	7,139,060,059.14	2,661,650,382.16	37.28
São Paulo	33,556,613,615.21	12,581,246,528.47	37.49

Note. [a] Waiver values were converted from BRL to USD using the 2022 average selling exchange rate (BRL/USD = 5.1648), as reported by the Central Bank of Brazil. [b]Gross ICMS revenue refers to amounts before legal deductions.
Sources: Elaborated by the authors based on data from the National Treasury Transparency Portal and the Budget Guidelines Laws (LDOs) of the respective states. (Lei n. 18.170, de 27 de julho de 2021. (2021). Lei Nº 18.170, de 27 de julho de 2021. Dispõe sobre as diretrizes orçamentárias para o exercício financeiro de 2022 e estabelece outras providências. https://leis.alesc.sc.gov.br/ato-normativo/21006).

Table 3 shows that in 2022 ICMS tax expenditures absorbed a large share of gross collections: Santa Catarina forewent 47.0%, Paraná 48.9% (after a flat 12% rate cut), and Rio Grande do Sul and São Paulo about 37% each. While São Paulo contested Santa Catarina's Pró-Emprego presumed credits, it simultaneously granted its own incentives outside Confaz approval. Santa Catarina's high share is particularly striking given its smaller economy, though it is one of the few states to publish detailed, transparent estimates, whereas many others still underreport waived amounts.

These figures reflect the intensity of the 'fiscal war' in southern Brazil and reinforce concerns about the inefficiencies of uncoordinated tax incentives, which create local distortions and broader federal imbalances (Castilho & Silveira, 2009; Campos et al., 2015; Mello, 2008).

While Table 3 presents a static cross-sectional comparison of ICMS revenue and tax-benefit magnitudes across southern states and São Paulo, Appendix B extends this perspective by introducing employment composition data from the RAIS database for 2003–2020. The appendix highlights the structural profile of formal employment in Santa Catarina, Paraná, and Rio Grande do Sul, allowing a qualitative connection between fiscal incentives and labor outcomes. São Paulo was intentionally excluded to maintain regional comparability and avoid distortions arising from its disproportionate economic scale and distinct incentive framework. This complementary evidence reinforces the interpretation that employment expansion in Santa Catarina was concurrent with periods of increased ICMS tax waivers, particularly following major incentive programs, as the state exhibits the highest share of industrial employment in small and medium firms and the strongest job growth (+2.8% per year), consistent with its intensive use of ICMS incentive policies favoring export-oriented and labor-intensive manufacturing. Evidence from the Organisation for Economic Co-operation and Development (OECD) (2018, 2023) likewise indicates that subnational governments often rely on targeted tax incentives concentrated in tradable and manufacturing sectors, producing short-term employment gains at the cost of long-term fiscal pressures and coordination challenges.

Empirical literature

Studies employing vector autoregressive (VAR) models to analyze the effects of fiscal policies on macroeconomic indicators have been conducted in various countries. For instance, in Brazil, Peres and Ellery (2009) observed that a positive shock to public spending leads to a positive change in GDP, while a positive shock to taxes results in a negative change in output. Cavalcanti and Silva (2010) claim that adopting an active fiscal policy has the potential to increase market uncertainty, leading to inefficient cyclical fluctuations detrimental to economic development. Pontes (2011) found that a random negative fiscal shock to taxes did not contribute to the growth of industrial employment in the Brazilian state of Ceará. Matheson and Pereira (2016) estimated fiscal multipliers spanning from 1999 to 2014, covering public spending, tax revenue, and public credit. Barros and Correia (2019) revealed that GDP rises following shocks in public spending and falls in response to tax shocks. Abreu and Lima (2022) highlighted that

a positive shock to public revenue led to an increase in public spending and a reduction in GDP. Similar to Peres and Ellery (2009) and Barros and Correia (2019), Attílio (2022) and Busato and Martins (2022) observed that a shock stemming from an increase in government consumption stimulated GDP.

In the USA, Blanchard and Perotti (2002) revealed that positive shocks in government spending had positive effects on output and private consumption, whereas positive shocks to taxes negatively impacted the same indicators. Romer and Romer (2010) concluded that increases in the tax burden were highly contractionary, especially when compared to more exogenous changes, such as raising tax rates to compensate for budget deficits. Ilzetzki (2011) found that shocks to tax policy appeared more effective in stimulating production than those to public spending. Auerbach and Gorodnichenko (2012) showed that fiscal multipliers were significantly larger during recessions than in periods of expansion, suggesting that government spending policies were more effective when the economy is operating below full capacity. Ramey (2019) observed that tax multipliers were generally negative, as a positive shock to taxes tended to decrease GDP. Apparently, Blanchard and Perotti (2002), Romer and Romer (2010), and Ramey (2019) reached similar conclusions regarding positive shocks to taxes.

In Europe, Cloyne (2013) found persistent and positive impacts of reducing the tax burden on GDP, consumption, investment, wages, and imports. However, Bank (2011) found that reductions in the tax burden did not tend to stabilize the economic cycle, while increases in public spending had an ambiguous effect on GDP. Hebous (2011) conducted a review of theoretical forecasting studies and empirical evidence using VAR models on the effects of expansionary fiscal policy on aggregates. Simionescu and Albu (2016) revealed that VAT rates generally have a positive influence on economic growth, but they found a reduction in GDP growth following a positive shock to VAT rates.

In OECD countries, Perotti (2004) found that (1) the impact of shocks on public spending and taxes, as well as on product and private investment and consumption, diminished significantly over time; and (2) there is no evidence indicating that reductions in the tax burden lead to faster or more effective outcomes for the same macroeconomic indicators when compared to increases in public spending.

DATA AND METHODS

Santa Catarina was selected as the empirical setting because it consistently uses ICMS tax incentives, maintains relatively transparent tax-expenditure reports, and wields considerable economic influence in southern Brazil. Its long-standing, aggressive fiscal-competition strategy, often leading to disputes with neighboring states, makes it a representative case for evaluating subnational tax exemptions and their macroeconomic effects.

To trace those effects, a vector autoregressive (VAR) model was estimated. The VAR framework is well suited to capturing the timing, strength, and persistence of fiscal shocks without imposing restrictive theoretical priors, an advantage in the complex arena of intergovernmental tax policy (Busato & Martins, 2022; Stock & Watson, 2001).

A series of diagnostic tests preceded estimation: the augmented Dickey–Fuller (ADF) test verified stationarity; information-criterion lag tests determined the optimal lag length; stability diagnostics checked for parameter constancy; and the Jarque–Bera test, along with skewness and kurtosis measures, assessed residual normality. Autocorrelation was ruled out using the Lagrange multiplier test, confirming the model's adequacy.

Once these preliminaries were satisfied, two standard VAR tools were used. Granger causality tests, based on Wald statistics, evaluated whether lagged values of one variable significantly improve forecasts of another, thereby indicating directionality (Granger, 1969). Impulse-response functions (IRFs) traced the dynamic path of each variable after an ICMS shock (Sims, 1993). Together, Granger tests and IRFs follow established time-series practice and provide a robust basis for assessing the macroeconomic consequences of Santa Catarina's ICMS incentives.

Research variables and data processing

In this study, the time series analysis is restricted to the state of Santa Catarina, Brazil, spanning from January 1997 to December 2020. This timeframe was selected based on the availability of monthly data from the sources. Therefore, a monthly frequency was deemed appropriate for several reasons: (1) ICMS is typically collected monthly; (2) it allows for the capture of seasonal patterns in the response of macroeconomic variables to changes in tax collection; and (3) it ensures the acquisition of a substantial set of variables and a sufficient sample size for the reliable estimation of the VAR model.

Table 4 presents the research variables: macroeconomic indicators impacting the Santa Catarina economy and ICMS collection.

Table 4. Research variables.

Description of variables	Sources
Exchange rate — V_1 (logarithmic variation, decimal)	IPEA[a] (http://ipeadata.gov.br/)
Interest — V_2 (percentage variation, decimal)	BCB[b] (https://www.bcb.gov.br/)
Electricity — V_3 (logarithmic variation, decimal)	Celesc[c] (https://www.celesc.com.br/)
Exports — V_4 (percentage variation, decimal)	MDIC[d] (https://www.gov.br/mdic/pt-br)
Imports — V_5 (percentage variation, decimal)	MDIC (https://www.gov.br/mdic/pt-br)
Employment — V_6 (percentage variation, decimal)	MTE[e] (https://www.gov.br/trabalho-e-emprego/pt-br)
ICMS — V_7 (percentage variation, decimal)	SEF[f] (http://www.sef.sc.gov.br/)
Inflation — V_8 (percentage variation, decimal)	IBGE[g] (https://www.ibge.gov.br/)

Note. Abbreviations: [a]Institute of Applied Economic Research. [b]Central Bank of Brazil. [c]Electricity Company of the State of Santa Catarina. [d]Ministry of Industry, Foreign Trade and Services. [e]Ministry of Labor and Employment. [f]State Secretariat of Finance of Santa Catarina. [g]Brazilian Institute of Geography and Statistics. Elaborated by the authors.

This study incorporates eight variables to meet the essential criteria to achieve stability and accurately predict what comes in the future (see Table 4). The selection of a sufficiently large number of variables is crucial in VAR modeling to ensure reliable predictions, as significant temporal variation — typically involving more than three variables — is needed to capture the most pertinent deviations in the equations (Sims, 1993). Additionally, the choice of variables considered their economic significance (Enders, 1995) and the specific characteristics of tax policy in Santa Catarina. It is important to note that other relevant macroeconomic indicators, such as GDP, tax exemptions, debt, and public expenditure, were not included due to limitations in data availability. Most of these variables are reported annually or quarterly, whereas this research relies on monthly data.

Exchange rate — V_1 represents the real bilateral exchange rate (IPA-DI Brazil/United States), expressed as an index with a base year of 2010. This rate reflects the national currency's purchasing power in international transactions, influencing the negotiation of goods and services in trade with other countries.

Interest — V_2 denotes the real interest rate, adjusted for inflation, calculated using the Accumulated Consumer Price Index (IPCA). It is determined by considering the rate of the Special Settlement and Custody System (Selic), which serves as the fundamental nominal interest rate for the Brazilian economy and is the main tool employed to implement monetary policy and regulate inflation.

Electricity — V_3 records monthly consumption in megawatt-hours (MWh) for Santa Catarina and serves as a proxy for state economic activity. The substitution is justified because (1) the Ministry of Economy does not provide a long, consistent series of subnational activity indicators suitable for a VAR spanning 1997–2020, and (2) monthly GDP estimates for Santa Catarina are unavailable for that period. A well-established literature supports electricity as a high-frequency gauge of economic activity: Kraft and Kraft (1978) first reported a significant GDP-to-electricity causal link, a finding later reinforced by Ameyaw et al. (2017). Bay (2018) identified a long-run, one-way causal flow from electricity to GDP, while Narayan et al. (2008) and Zang et al. (2017) confirmed positive and significant electricity–GDP relationships in several advanced economies. As a study-specific validation of the activity proxy, electricity consumption shows strong positive correlations with variables directly linked to economic activity in Santa Catarina: exports (r = 0.90), imports (r = 0.95), employment (r = 0.99), and ICMS (r = 0.99) when aggregated to quarterly means (see Appendix C). These results confirm, within the dataset, the adequacy of electricity as a high-frequency proxy for economic activity, consistent with prior empirical literature.

Exports — V_4 and imports — V_5, reported under the free on board (FOB) modality, represent transactions in USD involving the sale and purchase of goods between companies in Santa Catarina and those abroad.

Employment — V_6 represents the monthly stock of formal employment positions in Santa Catarina, sourced from the General Registry of Employed and Unemployed Persons (Caged). Within the tax incentive policy framework, one of the most prevalent rationales for ICMS exemptions is the purported encouragement of job creation within the state. To enrich interpretation, supplementary figures from RAIS-Vínculos (1997–2020) were aggregated by the National Classification of Economic Activities (CNAE) to compute average sectoral employment shares — industry (sections C and F) versus import-oriented trade (46, 461, 462) and logistics (49, 52). Although these descriptive data are not included in the VAR specification, they serve as a proxy for labor-absorption capacity and are explicitly referenced in the V_6 discussion to highlight the disproportion between projected tax incentives and effective job creation.

ICMS — V_7 records Santa Catarina's monthly ICMS collections and captures the combined influence of

economic activity and fiscal policy, including tax incentives. Because detailed tax-expenditure data are available only from 2003 onward (see Appendix A), the VAR (1997–2020) cannot include a separate waiver variable. Consequently, fluctuations in ICMS revenue are interpreted as the net outcome of changes in the tax base and the introduction or withdrawal of incentives. It is therefore crucial to distinguish ICMS revenue shocks, estimated within the VAR, from the embedded effects of tax benefits, which cannot be isolated. Although this limitation precludes a direct measure of waivers, the approach allows an indirect appraisal of expansionary fiscal policy through observed ICMS dynamics.

To contextualize fiscal dynamics over time, the analysis incorporated a qualitative dummy-based framework marking institutional episodes of tax benefit expansion or reform between 2003 and 2020 (see Appendix A.1). The dummy variable assumed the value one in years when major incentive programs were introduced or revised (e.g., Compex in 2003, Pró-Emprego in 2007, the Prodec reform in 2011, and the national convalidation under Complementary Law 160/2017 [Lei Complementar, n. 160, 2017]), and zero in years of policy stability. Although not included in the VAR estimation, this qualitative indicator was used to interpret turning points in the ICMS revenue and employment series. The dummy peaks coincide with documented increases in projected ICMS tax exemptions (see Appendix A), confirming internal consistency between institutional changes and fiscal outcomes.

Inflation — V_8 depicts the Brazilian inflation rate, derived from the IPCA (% p.m.).

Regarding the research data processing, the following procedures were implemented: (1) nominal price series underwent deflation using the IPCA and were then converted into present values as of December 2020; (2) import and export price series were deflated using their respective deflators: imports — exports — prices — index (2006) from the Fundação Centro de Estudos do Comércio Exterior (Funcex); (3) interest rates were computed in their real form, utilizing the IPCA and the Selic rate, according to the formula: $(1 + i) = (1 + pi) * (1 + r)$, where r represents the real interest, pi denotes inflation, and i is the nominal interest; (4) seasonal adjustments for series related to real interest rates and inflation indices were performed using X12-ARIMA, owing to the presence of negative data; however, other series in this research underwent seasonal adjustment using the multiplicative seasonal method; and (5) logarithmic returns for the series were calculated to facilitate statistical analysis, expressed as $(\ln t - \ln t - 1)$ or $\ln (t/t - 1)$.

Procedures adopted in estimating the VAR model

The VAR equations were estimated in first differences using ordinary least squares (OLS) to ensure stationarity. Although this is a standard approach, it has well-known drawbacks: differencing removes long-term level information and may distort inference when variables are highly persistent, nonlinear, or conditionally heteroskedastic, potentially leading to unstable parameters and spurious results (Stock & Watson, 2001). These caveats are acknowledged when interpreting the model's Granger causality and impulse-response results.

Based on Enders (1995), considering n stochastic processes x_{1t}, x_{2t}, ... x_{nt}, the compact matrix representation of the VAR model specification of this study, in standard form, is:

$$x_t = A_0 + A_1 x_{t-1} + A_2 x_{t-2} + \ldots + A_p x_{t-p} + \varepsilon_t \quad (1)$$

where x is the vector of endogenous variables, A is the matrix of coefficients, and ε is the uncorrelated residual error. To address contemporaneous correlations among VAR residuals, shocks were orthogonalized via Cholesky decomposition (Maindonald, 2007). Although the variable order is based on macroeconomic reasoning, it remains partially arbitrary — a limitation noted by Bueno (2022). The sequence adopted is exchange rate (V_1) → interest (V_2) → electricity (V_3) → exports (V_4) → imports (V_5) → employment (V_6) → ICMS revenue (V_7) → inflation (V_8), reflecting standard transmission channels and the specific features of Santa Catarina's tax policy.

The exchange rate (V_1), considered the most exogenous variable, influences monetary policy and affects inflation (V_8) through the pass-through effect (Tomazzia & Meurer, 2009). Interest (V_2), a key monetary policy tool, impacts GDP (proxied by V_3), employment (V_6), and inflation (V_8) (Taylor, 1995). In the Keynesian view, aggregate demand influences short-term GDP and employment (Abreu & Lima, 2022). Tax revenue (V_7) depends on GDP performance (Cavalcanti & Silva, 2010), as well as employment and income levels. Exports (V_4) and imports (V_5) are sensitive to exchange rate and interest rate fluctuations, which can stimulate or hinder trade (Tomazzia & Meurer, 2009).

To enhance methodological transparency, several robustness checks were performed (see Appendix D). Alternative Cholesky orderings were tested (e.g., switching employment and ICMS or reversing the fiscal–real variable order). The impulse-response functions maintained their qualitative patterns, confirming robustness to causal ordering. A subsample analysis (1997–2007 vs. 2008–2020) revealed similar dynamic responses to ICMS shocks, with only minor differences in amplitude after 2008, reflecting higher fiscal volatility. Additionally,

outlier months associated with major macroeconomic shocks — January 1999 (exchange-rate crisis), September 2008 (global financial crisis), and April 2020 (COVID-19 lockdown) — were temporarily excluded to assess sensitivity. Their removal did not alter the sign or timing of key responses. Together, these checks confirm that the model's results are not sensitive to alternative identification schemes or period-specific anomalies.

Although this study adopts a reduced-form VAR, the impulse-response patterns obtained are consistent with the sign restrictions commonly used in structural VARs (SVARs) analyzing fiscal shocks. ICMS tax shocks produce positive responses in employment, electricity consumption, and imports, and neutral-to-negative reactions in interest rates, suggesting that the estimated dynamics align with standard structural expectations reported in the SVAR literature (Blanchard & Perotti, 2002; Caldara & Kamps, 2017; Mertens & Ravh, 2014; Mountford & Uhlig, 2009) (see Appendix E). This coherence reinforces the structural consistency and empirical robustness of the model without requiring additional identification assumptions.

As a robustness check, the VAR specification was re-estimated excluding the employment series (V6), given its potential temporal inconsistency. Structural responses to ICMS shocks maintained their sign, direction, and timing across the reduced and baseline models, indicating that the results are not driven by this variable (see Appendix F).

Additionally, Appendix G reports a Bayesian VAR with a Minnesota prior (monthly data, 1997–2020) following the paper's identification order (exchange rate — V_1 → interest — V_2 → electricity — V_3 → exports — V_4 → imports — V_5 → employment — V_6 → ICMS — V_7 → inflation — V_8). Orthogonalized IRFs to an ICMS shock qualitatively reproduce the reduced-form patterns, providing a prior-based cross-check of the main findings.

A complementary vector error-correction model (VECM) was also estimated after confirming cointegration among the variables via Johansen's trace test. Although not used for structural identification, the VECM provides a long-run consistency check for the system's dynamics. Short-run impulse-response functions (Appendix H), computed with 90% bootstrap confidence intervals, closely mirror the qualitative patterns of the reduced-form VAR and the BVAR.

RESULTS

This section presents the results of the tests and the estimation of the reduced-form VAR model. Table 5 displays the outcomes of the ADF test, which assesses the stationarity of the variables used in the analysis.

Table 5. Stationarity test.

Variable	Addition	Prob.	Hypothesis test	AIC	SBIC	HQIC
V_1	*Constant	0	Rejects H_0	-3.868	-3.843	-3.858
	Constant and trend	0	Rejects H_0	-3.861	-3.823	-3.846
V_2	Constant	0.0003	Rejects H_0	0.515	0.540	0.525
	* Constant and trend	0	Rejects H_0	0.450	0.488	0.466
V_3	*Constant	0	Rejects H_0	-4.486	-4.448	-4.471
	Constant and trend	0	Rejects H_0	-4.481	-4.429	-4.460
V_4	*Constant	0	Rejects H_0	-2.475	-2.436	-2.459
	Constant and trend	0	Rejects H_0	-2.470	-2.419	-2.450
V_5	*Constant	0	Rejects H_0	-1.626	-1.588	-1.611
	Constant and trend	0	Rejects H_0	-1.622	-1.571	-1.602
V_6	*Constant	0	Rejects H_0	-8.910	-8.872	-8.895
	Constant and trend	0	Rejects H_0	-8.904	-8.852	-8.883
V_7	*Constant	0	Rejects H_0	-2.870	-2.831	-2.854
	Constant and trend	0	Rejects H_0	-2.863	-2.812	-2.843
V_8	*Constant	0	Rejects H_0	0.228	0.254	0.238
	Constant and trend	0	Rejects H_0	0.234	0.272	0.249

Note. H_0: The variables are non-stationary. * = Better specifications. Elaborated by the authors.

As depicted in Table 5, measurements were conducted using the Akaike (AIC), Schwarz–Bayesian (SBIC), and Hannan–Quinn (HQIC) information criteria. Based on the results, lag selection was performed using the SBIC, which yielded superior outcomes, considering a significance level of 5% ($\alpha \leq 0.05$) (Enders, 1995; Lütkepohl, 1993). Therefore, the null hypothesis (H_0) is rejected, with all variables stationary at level I (0) in the difference of the logarithm.

Table 6 presents the results of the number of lags test, enabling the identification of the optimal number of lags with stationary series in the same order.

Table 6. Lag quantity test.

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	5436.99				6.4e-28	-39.919	-39.8765	-39.813
1	6109.5	1345	64	0.000	7.3e-30	-44.3934	-44.0102*	-43.4389*
2	6217.61	216.2	64	0.000	5.2e-30	-44.7177	-43.9939	-42.9148
3	6283.26	131.32	64	0.000	5.2e-30	-44.7299	-43.6655	-42.0786
4	6369.78	173.03	64	0.000	4.4e-30*	-44.8954*	-43.4904	-41.3957
5	6429.09	118.62	64	0.000	4.6e-30	-44.8609	-43.1153	-40.5128
6	6487.16	116.14	64	0.000	4.9e-30	-44.8174	-42.7311	-39.6208
7	6532.98	91.631	64	0.013	5.7e-30	-44.6836	-42.2568	-38.6386
8	6586.5	107.06	64	0.001	6.3e-30	-44.6066	-41.8392	-37.7132
9	6655.71	138.42	64	0.000	6.3e-30	-44.6449	-41.5368	-36.9031
10	6704.76	98.09	64	0.004	7.3e-30	-44.535	-41.0863	-35.9447
11	6757.14	104.76	64	0.001	8.4e-30	-44.4495	-40.6602	-35.0108
12	6810.07	105.86	64	0.001	9.7e-30	-44.3681	-40.2382	-34.081
13	6860.21	100.29	64	0.003	1.2e-29	-44.2663	-39.7957	-33.1307
14	6916.74	113.06	64	0.000	1.3e-29	-44.2113	-39.4002	-32.2274
15	6989.19	144.9*	64	0.000	1.4e-29	-44.2735	-39.1217	-31.4411

Note. * = Good selection. Elaborated by the authors.

Initially, in the lag quantity test (Table 6), estimation using HQIC and SBIC suggested an optimal model of order one, whereas AIC indicated a model of order four. However, given that AIC tends to overestimate lag length and HQIC and SBIC tend to underestimate it, a second step was undertaken: starting with an initial significant value of lags, which was then reduced if found insignificant (Bozdogan, 1987; Lütkepohl, 1993). Consequently, VAR models of orders one through eight were estimated, with model specification tests conducted at each stage. Autocorrelation problems were detected in models of orders one and four, leading to the selection of a VAR model of order six. Note that, applying the LM test, no residual autocorrelation problems were detected for order six.

Table 7 summarizes the Granger causality test results between ICMS revenue and key macroeconomic variables.

Table 7. Granger causality (Wald test) — summary of main results.

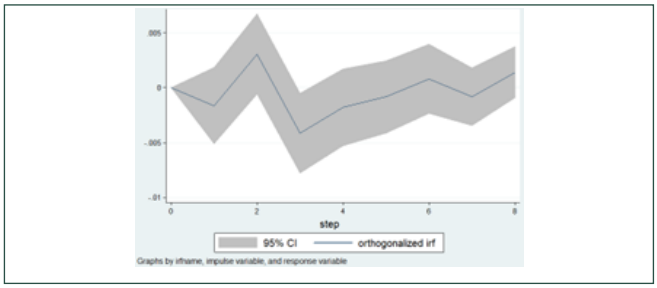
Dependent (Y)	Causal direction	Independent (X)	p-value
Exchange rate	←	Interest	0.002*
Exchange rate	←	ICMS	0.001*
Interest	←	Exchange rate	0.000*
Interest	←	ICMS	0.074**
Interest	←	Inflation	0.000*
Electricity	←	ICMS	0.017*
Exports	←	ICMS	0.304
Imports	←	ICMS	0.003*
Employment	←	ICMS	0.967
ICMS	←	Exchange rate	0.459
ICMS	←	Interest	0.000*
ICMS	←	Electricity	0.258
ICMS	←	Exports	0.162
ICMS	←	Imports	0.229
ICMS	←	Employment	0.000*
ICMS	←	Inflation	0.001*
Inflation	←	ICMS	0.046*

Note. H_0: X does not Granger-cause Y. Statistical significance: * = 5%; ** = 10%. Elaborated by the authors.

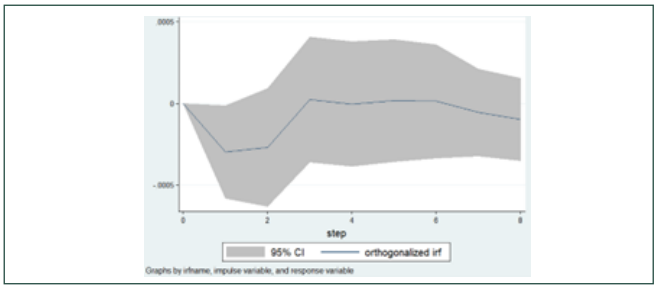
Wald statistics were used to test whether the variable in the second column (X) Granger-causes the one in the first column (Y), indicating a short-term relationship (see Table 7). The null hypothesis (H_0) is rejected when the p-value is less than or equal to the significance level ($p \leq \alpha$), typically set at 5% ($\alpha = 0.05$) or 10% ($\alpha = 0.10$) (Lütkepohl, 1993).

Figure 1 depicts the impulse-response function (IRFs), showcasing the shocks (impulses) of the ICMS variable (V7) and the corresponding responses (effects) of each variable in the model to these V7 shocks.

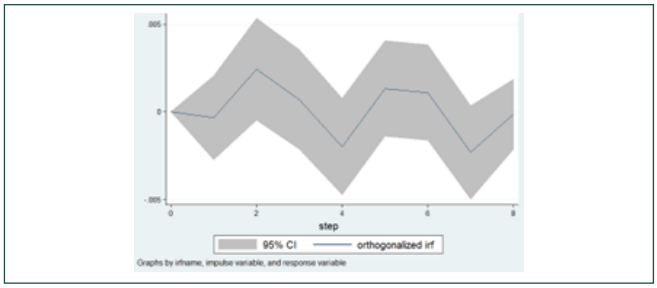
(a) Impulse (V_7) and response (exchange rate — V_1).



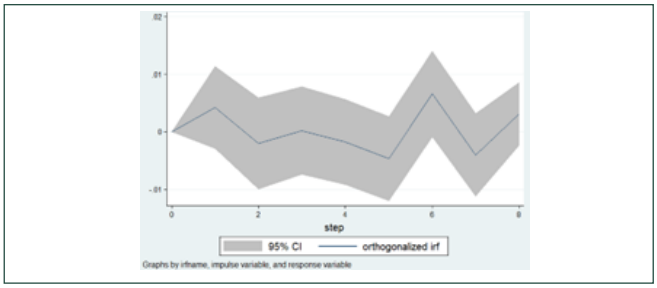
(b) Impulse (V_7) and response (interest — V_2).



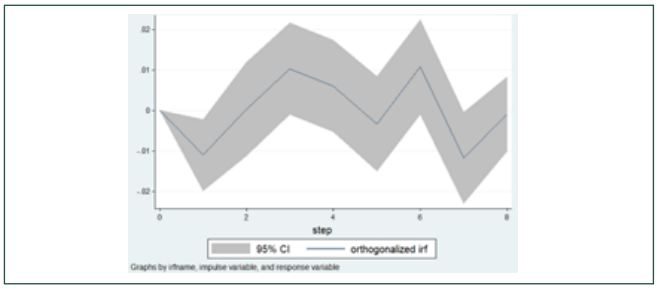
(c) Impulse (V_7) and response (electricity — V_3).



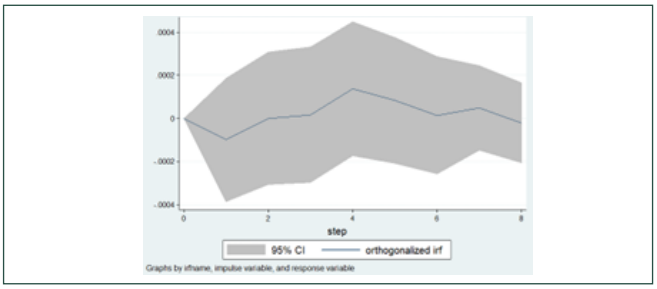
(d) Impulse (V_7) and response (exports — V_4).



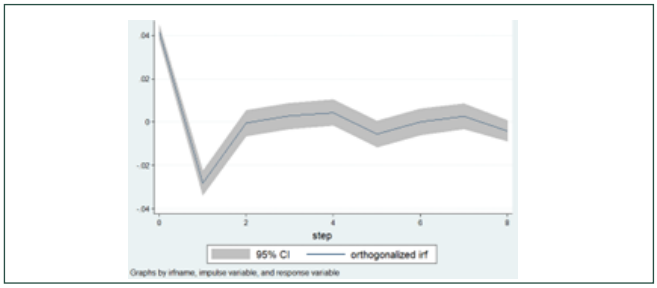
(e) Impulse (V_7) and response (imports — V_5)



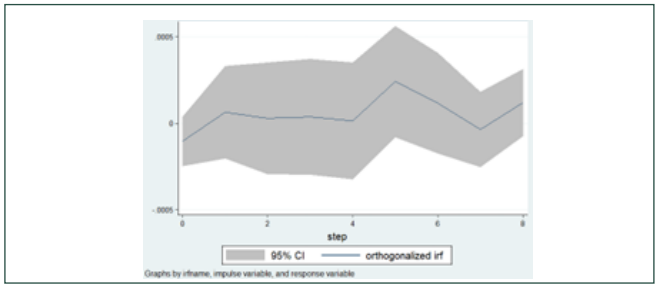
(f) Impulse (V_7) and response (employment — V_6)



(g) Impulse (V_7) and response (ICMS — V_7)



(h) Impulse (V_7) and response (inflation — V_8)



Source: Developed by the authors.

Figure 1. Impulse response function (IRF).

The lines depicted in the graphs (Figure 1) illustrate the trajectory of the orthogonal function, showcasing the responses of the model variables to the ICMS tax collection impulses. Therefore, on the x-axis (abscissa), the temporal space is represented in eight lag periods, while on the y-axis (ordinate), the effects (of the shocks) are measured in standard deviations. The shaded areas accompanying the lines represent the 95% confidence intervals (CI).

DISCUSSION

This section discusses the main results obtained from the estimation of the reduced-form VAR model, interpreting their economic and institutional implications.

Exchange rate — V_1

In the IRF results (Figure 1a), there is no contemporaneous effect on the exchange rate variable (V_1) in response to the shock on the ICMS variable (V_7), as indicated by the zero standard deviation on the y-axis. Subsequently, it can be observed that V_1 initially shows a negative response to V_7 until the first period, reaching an inflection point before the second period. This is succeeded by peaks of positive and negative responses in the second and third periods, respectively, with a gradually increasing positive trend leading to stabilization around zero by the eighth period. Therefore, in the third period, imports benefit the most due to the decrease in the real exchange rate following the shock to ICMS collection. Furthermore, it is noteworthy that

only in the third period do the two shaded lines extend beyond zero on the y-axis, indicating statistical significance during this timeframe.

Considering the expansionary fiscal policy in Santa Catarina, the IRF result (Figure 1a) during the second period, which shows a positive peak in the exchange rate variable (V_1), aligns with the findings of Cloyne (2013). Cloyne noted the short-term appreciation of real and nominal exchange rates following a 1% reduction in the tax burden relative to GDP, reflecting Keynesian models' assumptions regarding exchange rate appreciation after fiscal expansion (Hebous, 2011). However, Abreu and Lima (2022) found that a positive shock to public revenue in Brazil led to a positive effect on the exchange rate in the first three periods, albeit less enduring than its impact on the interest rate.

According to Attílio (2022), although Brazilian expansionary fiscal policy stimulates GDP, it contributes to the deterioration of the macroeconomic environment by favoring exchange rate appreciation, as well as driving up prices and interest rates. Consequently, exchange rate appreciation, particularly notable in the third period (Figure 1a), adversely affects export operations and local tradable goods producers while bolstering import operations. This, in turn, negatively impacts national production and, consequently, tax revenue (Dornbush et al., 2011).

The Granger causality test results (Table 7) show that ICMS (V_7) Granger-causes the exchange rate (V_1), with a p-value of 0.001 ($\alpha \leq 0.05$). However, this link is unidirectional, as V_1 does not Granger-cause V_7 (p = 0.459). As Enders (1995) metaphorically states, exchange rate appreciation is the 'Siamese twin' of high interest rates. This idea is supported by the test results, which indicate a bidirectional causal relationship between the exchange rate (V_1) and the interest rate (V_2), also at the 5% significance level. In the context of Santa Catarina, it is imperative to exercise caution when interpreting the results. Importing goods and merchandise from abroad is vital for bolstering the state's port infrastructure and augmenting ICMS collection. This is because export operations fall outside the purview of the tax. Furthermore, without ICMS benefits, trading companies and their operations would likely migrate to other Brazilian states that offer more favorable tax policies. From this perspective, while exchange rate appreciation may yield potential economic benefits for Santa Catarina, it simultaneously challenges the state's trade balance and industries, both locally and nationally.

Interest — V_2

The IRF results (Figure 1b) show that there is no immediate effect on the interest variable (V_2) following the shock to the ICMS variable (V_7), as indicated by the zero standard deviation on the y-axis. Subsequently, there is a negative peak in the first period, followed by a rebound in the second period, and stabilization around zero from the third period onward. This stabilization is accompanied by a negative trend from the sixth period onward. Notably, over the eight periods, there is an absence of an inflection point; there is no positive response of V_2 to the shock from V_7. Additionally, the two shaded lines, aside from being relatively wide, do not extend beyond zero on the y-axis in any of the periods, indicating diminished statistical precision and a lack of significance, respectively.

According to the Granger causality results (Table 7), ICMS revenue (V_7) does not Granger-cause the interest rate (V_2) at the 5% level (p = 0.074), although the effect becomes significant at the 10% threshold. By contrast, V_2 clearly Granger-causes V_7 (p = 0.000). This unidirectional pattern aligns with the IRF results (Figure 1b), which show low statistical precision and no meaningful response of V_2 to shocks in V_7. Monetary authorities often increase interest rates to counter potential inflationary pressures stemming from expansionary fiscal policy, setting off a cycle that typically results in a crowding-out effect (Alves et al., 2019). According to Matheson and Pereira (2016), shocks to public revenue affect interest rates in the short term, given that the monetary authority can react promptly. This understanding is further supported by the IRF results (Figure 1b), which show that tax collection had a negative impact on the real interest rate in the initial periods. However, as Perotti (2004) observes, since fiscal policy is announced in advance, its effects manifest almost immediately on interest rates and later on other macroeconomic variables.

Among the countries analyzed by Perotti (2004), nominal interest rates were adversely affected by the tax shock resulting from an expansionary policy (with the UK being an exception). This tax shock had a positive impact on real interest rates in the USA for one year, while it was either zero or negative in Canada, the UK, and Australia for three years. Hence, it can be inferred that the IRF results (Figure 1b), showing a negative peak in the real interest rate in the initial period followed by stabilization at zero in subsequent periods, partially support Perotti's findings. In contrast, Abreu and Lima (2022) concluded that a positive shock to public revenue from a contractionary fiscal policy negatively affected the interest rate in the first three periods, followed by stabilization at zero. Similarly, Hebous's (2011) study revealed that, in a small open economy with a floating exchange rate regime, a negative tax shock ex-

erts upward pressure on the interest rate while causing an appreciation in the nominal exchange rate.

Considering that real interest rates in Brazil are approximately equal to nominal interest rates minus projected inflation, real interest rates appear disproportionately high relative to inflation expectations. This disproportionality contributes to contractions in industrial production, commercial sales, and service provision. Therefore, insofar as ICMS is an indirect tax on the consumption of goods and services, a very high real interest rate can negatively impact tax collection.

Electricity — V_3

In the IRF results (Figure 1c), there is no immediate effect on the electricity variable (V_3) from the shock of the ICMS variable (V_7), as indicated by the zero-standard deviation on the y-axis. Subsequently, a negative effect is observed in the first period, followed by a positive peak in the second period. This is followed by a return to negative behavior until the fourth period, with subsequent recovery and stabilization around zero until the sixth period. A negative peak is observed in the seventh period, followed by recovery and stabilization at zero in the eighth period. The two shaded lines do not extend beyond zero on the y-axis in any period, indicating a lack of statistical significance.

As Table 7 shows, ICMS revenue (V_7) Granger-causes electricity consumption (V_3) at the 5% level ($p = 0.017$), whereas the reverse direction is not significant ($p = 0.258$). This unidirectional link is advantageous for identification because it reduces simultaneity: fiscal policy affects the GDP proxy, yet the proxy does not feed back into tax revenue, allowing cleaner inference on independent fiscal shocks. Based on the IRF results (Figure 1c), tax revenue shocks (ICMS variable — V_7) over the eight periods resulted in alternating positive and negative effects on the GDP proxy (electricity variable — V_3). This pattern may reflect the absence of periodic reassessments of tax benefits, both to recalibrate tax burden reduction levels and to revoke ineffective ICMS benefits that no longer positively impact the Santa Catarina economy. This conclusion aligns with Perotti's (2004) findings that the effects of tax reductions on GDP weaken over time.

Various studies have shown differing effects of tax shocks on GDP. For instance, Blanchard and Perotti (2002) found that positive tax shocks had negative effects on GDP. Conversely, Abreu and Lima (2022) observed initial negative effects followed by positive effects and stabilization in later periods. Romer and Romer (2010) concluded that a 1% increase in the tax burden led to consistently contractionary negative effects on GDP over 12 periods, with a peak negative impact of around –3%. Simionescu and Albu (2016) noted a positive long-term influence on GDP despite short-term negative effects from VAT rate increases.

Negative tax shocks, on the other hand, tend to boost GDP growth, as indicated by Hebous (2011). Bank (2011) found that a 1% reduction in net tax revenue had a contemporaneous effect of 0.01% on GDP, gradually increasing over seven periods before stabilizing around zero. Cloyne (2013) showed that a 1% reduction in the tax burden caused a contemporaneous effect of 0.6% on GDP, peaking around the twelfth period before stabilizing back to the initial percentage by the sixteenth period. In the context of Brazil, Ilzetzki (2011) found that tax reductions initially had negative impacts on GDP, with an inflection point around the fourth period leading to sustained positive effects until stabilization around zero by the twenty-fourth and final period, as supported by the IRF results (Figure 1c).

Exports — V_4

The IRF results (Figure 1d) indicate no contemporaneous effect on the exports variable (V_4) in response to the shock to the ICMS variable (V_7), as shown by the zero standard deviation on the y-axis. Subsequently, there is a positive effect in the first period, followed by a decreasing trend until reaching negative and positive peaks in the fifth and sixth periods, respectively. Thereafter, there is another decline followed by stabilization around zero in the eighth period. The shaded lines do not extend beyond zero in any of the periods, indicating a lack of statistical significance.

The Granger causality results in Table 7 reveal no significant link between ICMS revenue (V_7) and exports (V_4); p-values of 0.304 and 0.162 in both directions exceed the 0.05 significance level. This absence of causality likely stems from the ICMS exemption on export transactions, which limits the tax's direct influence on trade flows. Although exports are not taxed by ICMS, due to the principle of non-cumulative nature, states are obliged to authorize transfers of tax credits accumulated in operations preceding exports to third-party establishments. These transfers negatively impact ICMS collection, reducing the tax payable by benefiting third parties and/or the exporters themselves.

Cloyne (2013) found that negative tax shocks initially caused a positive effect on exports, followed by a downward trend with a negative peak in the sixth period, supplanted by a recovery path with a positive peak in the eleventh period, stabilizing positively over the remaining periods, out of a total of 16. Cloyne (2013) also found that imports increased significantly after the negative tax shock, whereas positive effects on exports were mostly insignificant. According to the author, this

likely occurred because exports are driven, in the short term, primarily by external demand, which depends, in turn, on the real exchange rate. Thus, the IRF result (Figure 1a), showing a positive peak in the exchange rate variable (V_1) during the second period, aligns with Cloyne's (2013) reasoning, as exchange rate appreciation favors imports.

Within the scope of contractionary fiscal policy, Blanchard and Perotti (2002) found that positive tax shocks had insignificant negative effects on exports and imports. In contrast, Romer and Romer (2010) found that exports increased substantially after a 1% positive tax shock, with peaks of 5% between the third and fifth periods. However, the IRF results (Figure 1d) corroborate the study by Cloyne (2013).

Imports — V_5

The IRF results (Figure 1e) show no immediate effect on the imports variable (V_5) in response to the shock to the ICMS variable (V_7), as indicated by the zero standard deviation on the y-axis. Unlike the previous IRF analysis (Figure 1d), where V_5 initially responded negatively, there is a notable shift in behavior from the second period onward. An upward trend is observed, with a positive peak in the sixth period, followed by a sharp decline and a negative peak in the seventh period, ultimately stabilizing at zero in the eighth period. The confidence intervals lie outside zero on the y-axis in the first and seventh periods, indicating statistical significance during these time frames. Noteworthy similarities in behavior between V_4 and V_5 emerge from the fourth period onward, characterized by sharp declines in the fifth and seventh periods and positive peaks in the sixth period. Additionally, parallels can be drawn with the effects observed in the IRF analysis (Figure 1c) concerning the electricity variable (V_3).

The Granger causality test results (Table 7) indicate a significant unidirectional relationship from ICMS revenue (V_7) to imports (V_5), with a p-value of 0.003 ($\alpha \leq 0.05$). In the reverse direction, V_5 does not Granger-cause V_7 ($p = 0.229$). This contrasts with the absence of causality between ICMS and exports (V_4) and can be attributed to the fact that imports are subject to ICMS taxation, whereas exports are exempt. Cloyne (2013) observed that negative tax shocks notably increased imports, particularly when compared to exports. The study identified an initial positive effect extending across all periods, with a positive peak between the sixth and eighth periods, followed by a decline that stabilized around 1% in the final period, out of a total of 16. The IRF results (Figure 1d), unlike those of Cloyne (2013), display an initial negative impact but share similarities regarding positive effects throughout subsequent periods. In contrast, Romer and Romer (2010), faced with a positive tax shock equivalent to 1% of GDP, observed a significant decrease in imports, with a negative peak (–10.07%) in the ninth period, out of a total of 20.

In conclusion, the IRF results align with the notion that the import sectors represent the most positively impacted by ICMS exemptions (Table 2). This suggests that imports in Santa Catarina are sensitive to tax burdens, manifesting alternating negative and positive peaks in response to ICMS shocks.

Employment — V_6

In the IRF results (Figure 1f), no contemporaneous effect on the employment variable (V_6) is observed as a consequence of the shock to the ICMS variable (V_7), as indicated by the zero standard deviation (y-axis). Over the eight periods, shocks in V_7 caused insignificant effects in V_6, with a tendency to stabilize at zero, except in the first and fourth periods, which present negative and positive peaks, respectively. Additionally, the shaded lines do not lie outside zero in any of the periods, indicating reduced statistical precision and a lack of significance.

The Granger causality test results (Table 7) show a unidirectional relationship from employment (V_6) to ICMS (V_7), with a significant p-value of 0.000 ($\alpha \leq 0.05$). In contrast, V_7 does not Granger-cause V_6 ($p = 0.967$). This suggests that changes in employment tend to precede variations in ICMS revenue, possibly reflecting the influence of labor market conditions on taxable activity. In the classic Keynesian view, the behavior of aggregate demand is the main factor in determining employment and GDP (Abreu & Lima, 2022). Hebous (2011) found that the employment rate appears to increase after an expansionary fiscal shock. However, Romer and Romer (2010) observed that if GDP develops normally, without innovations (exogenous shocks), the employment rate does not usually change significantly.

Therefore, considering the set of insignificant results obtained for the employment variable (V_6), it can be inferred that the expansionary fiscal policy in the state of Santa Catarina, through the granting of tax exemptions, has not had the expected effect on employment. This conclusion corroborates the findings of Castilho and Silveira (2009), which indicate that importing companies and high-technology industries generate few jobs, and of Pontes (2011), who found that a random tax shock — such as an increase in tax exemptions — proved ineffective in fostering industrial employment growth in the state of Ceará. These results suggest the inadequacy of expansionary tax policy as an instrument of countercyclical policy.

The mismatch becomes clearer when employment statistics are compared with the distribution of

tax incentives. Import-oriented trade and industry together absorb 74.46% of Santa Catarina's projected ICMS expenditures (Table 2), a share justified in the Budget Guidelines Law on the grounds of job creation. Yet RAIS-Vínculos microdata (1997–2020) reveal that industry sustains only 32% of formal jobs, while import-related trade and logistics account for just 4% and 7%, respectively. Taken together, these figures underscore the modest employment returns on otherwise generous tax breaks.

ICMS — V_7

The IRF results (Figure 1g) show a notable departure from previous IRFs, with a positive and significant contemporaneous effect on the ICMS variable (V_7) following its own shock, as evidenced by the non-zero standard deviation on the y-axis. Initially, the V_7 shock induces a negative and significant peak in the first period, followed by a recovery with an inflection point around the second period. Subsequently, V_7 stabilizes with minimal variations around zero by the eighth period. The narrow confidence intervals extend beyond zero on the y-axis during the initial impact and in the first period, indicating statistical precision and significance during these time frames. These results highlight the sensitivity of ICMS collection to the shock, particularly evident in the initial impact and during the first and second periods.

Blanchard and Perotti (2002) examined the effects of a positive tax shock on itself, with findings that partially align with the IRF results in Figure 1g. Specifically, despite no contemporaneous impact, they observed a positive and significant effect in the first period. Although the authors did not find a significant negative effect, a tendency toward stabilization was observed, slightly below zero in the fifth and last period. Similarly, Cavalcanti and Silva (2010) noted that a 1% positive shock to tax revenue produced a positive and significant effect in the first period, followed by stabilization at zero in the twelfth period. Ilzetzki (2011) found similar results for a 1% shock, with a positive and significant effect in the first period and subsequent stabilization at zero over 24 periods. Peres and Ellery (2009) also discovered comparable effects with net taxes, indicating an initial positive and significant impact followed by a negative effect and eventual stabilization at zero.

Despite the expansionary fiscal policy in Santa Catarina, fluctuations in tax revenue may arise from both positive and negative shocks influenced by forgone revenue values (see Appendix A). The effectiveness of expansionary policy in stimulating and strengthening the state economy determines the potential impact of these shocks. However, a key observation is that tax revenue tends to stabilize over time, suggesting that exogenous shocks to tax revenue lose effectiveness as time progresses.

Inflation — V_8

In the IRF results (Figure 1h), a negative contemporaneous effect on the inflation variable (V_8) is evident following a shock to the ICMS variable (V_7), as indicated by the non-zero standard deviation on the y-axis. Initially, a positive effect is observed in the first period (inflection point), followed by stabilization around zero until the fourth period. Subsequent positive and negative peaks occur in the fifth and seventh periods, respectively, before stabilizing at zero in the eighth period. The confidence intervals, although wide, do not extend beyond zero on the y-axis in any period, indicating reduced statistical precision and a lack of significance.

The Granger causality test results (Table 7) indicate a bidirectional relationship between ICMS revenue (V_7) and inflation (V_8), with V_7 Granger-causing V8 ($p = 0.046$) and V8 Granger-causing V_7 ($p = 0.001$), both statistically significant considering $\alpha \leq 0.05$. These findings suggest mutual temporal dependence between the two variables. Cloyne (2013) examined inflation responses to a negative tax shock, observing an initial negative and insignificant impact followed by recovery. An inflection point shortly after the fourth period led to an upward and positive effect, stabilizing around 1% in the final period, out of a total of 16. These findings align with those obtained in the IRF depicted in Figure 1h. Conversely, Simionescu and Albu (2016) highlighted that a positive shock to value-added tax (VAT) increased inflation rates and the budget deficit in Romania.

Taken together, the results of this research suggest that Santa Catarina's expansionary fiscal policy has had limited and statistically insignificant effects on inflation. Although, in theory, tax benefits might stimulate aggregate demand — particularly if cost reductions are passed on to consumers — this dynamic was not observed in the analyzed period. The findings contrast with Attílio's (2022) assertion that expansionary fiscal policy can boost GDP while causing inflation and currency appreciation. In the case of Santa Catarina, however, the modest inflationary response and the weak GDP proxy effects indicate that the policy failed to generate sufficient demand pressure to trigger monetary tightening or crowding-out effects, as described by Abreu and Lima (2022).

The statistically insignificant responses of inflation, interest rates, and employment are consistent with neoclassical and public-choice perspectives, which predict limited long-term effects of fiscal incentives once agents adjust their expectations. Empirical evidence from other contexts supports this interpretation:

Zodrow and Mieszkowski (1986) and Brueckner (2000) report marginal or null employment effects from subnational tax reliefs, while Slemrod (1990) and Brennan and Buchanan (1980) show that tax competition and fiscal illusion often neutralize expansionary outcomes. In Santa Catarina, these neutral dynamics are also evident in practice. Despite successive ICMS incentive programs, formal employment in industry and import-related trade expanded only marginally, representing 32% and 11% of total jobs, respectively, even though these sectors received about 74% of all projected tax waivers (Table 2). Likewise, the impulse-response functions indicate that inflation and interest rates quickly returned to equilibrium after initial fiscal shocks, suggesting that the effects of tax incentives were temporary and largely anticipated by market participants. These qualitative patterns reinforce that the non-significant results observed here are theoretically coherent rather than anomalous.

Table 8 synthesizes the findings, providing an interpretive overview of how each macroeconomic variable responded to the fiscal shock represented by ICMS revenue (V_7). This summary helps consolidate the empirical evidence from Granger causality tests and impulse response functions, offering a more integrated understanding of the policy effects. By translating complex dynamics into simplified insights, the table reinforces the broader patterns observed in the analysis and highlights sectoral asymmetries in the impacts of ICMS tax incentives.

Table 8. Interpretive summary of macroeconomic effects of ICMS (V_7) shocks.

Response variable	Simplified explanation
Exchange rate (V_1)	Tax benefits led to real appreciation, lowering import costs and boosting short-term ICMS via ports, but undermining export competitiveness.
Interest (V_2)	ICMS incentives showed minimal influence on interest rates, indicating limited transmission to credit or monetary policy.
Electricity (V_3)	The weak response suggests that ICMS incentives lacked strategic targeting to effectively stimulate economic activity.
Exports (V_4)	No significant effect was observed, likely due to ICMS exemptions on exports and the stronger influence of global demand and exchange rate dynamics.
Imports (V_5)	Imports showed a strong response, reflecting Santa Catarina's port infrastructure and the ICMS levied on foreign goods.
Employment (V_6)	No significant impact was detected, likely due to the low job-creation potential of incentivized sectors and structural rigidities in the labor market.
ICMS (V_7)	Revenue experienced a short-term increase following incentives, but the effects quickly dissipated due to the absence of structural economic changes.
Inflation (V_8)	Price levels remained stable, indicating that inflation was driven more by broader economic conditions than by changes in ICMS revenue.

Note. Elaborated by the authors.

CONCLUSION

The objective of this article was to analyze the effects of ICMS tax benefits (the state value-added tax on the circulation of goods and services) on the economic development of Santa Catarina. To this end, a standard vector autoregressive (VAR) model was employed, incorporating Granger causality tests and impulse response functions (IRFs). The analysis drew on monthly time series data from 1997 to 2020, covering ICMS revenue and key macroeconomic indicators.

Drawing on Keynesian insights (Blanchard & Perotti, 2002; Cavalcanti & Silva, 2010; Dornbush et al., 2011), this study hypothesized that an expansionary fiscal policy — centered on ICMS tax benefits — would foster Santa Catarina's macroeconomic development. Yet, the VAR results contradict this expectation. ICMS revenue shocks produce only brief episodes of exchange rate appreciation and transient import surges; their effects on the GDP proxy (electricity consumption), interest rates, and exports are weak or statistically insignificant; they do not accelerate inflation; and, crucially, they leave formal employment unchanged. This pattern reflects the limited labor absorption of the incentivized sectors, particularly capital-intensive manufacturing and logistics.

These findings suggest that Santa Catarina's expansionary tax policy may stimulate trade flows and generate a short-term fiscal boost, but it falls short of delivering sustained gains in output and employment. This mismatch can be attributed to three main factors: (1) incentives are concentrated in sectors with low employment elasticity; (2) Brazil's rigid labor regulations suppress hiring responses even amid increased demand; and (3) the absence of regular program evaluations allows benefits to persist without evidence of effectiveness.

Additional Bayesian estimates (Appendix G) confirmed the robustness of these findings under alternative priors, showing that Bayesian regularization attenuates amplitude without changing the direction of responses. Complementary VECM results (Appendix H) further reinforced this consistency by validating the long-run relationships implied by the data and reproducing the same qualitative short-run responses to ICMS shocks.

In sum, the results support a nuanced interpretation: while ICMS incentives can yield short-term trade gains

and sector-specific advantages, they do not constitute an effective countercyclical instrument for broad-based economic development or employment generation. These findings resonate more with neoclassical theory, which emphasizes the long-run neutrality of fiscal policy and warns that tax incentives may distort resource allocation, crowd out private investment, and reduce economic efficiency (Mertens & Ravh, 2014), than with the Keynesian stimulus hypothesis originally posited. Furthermore, the persistence of ineffective tax benefits without rigorous ex post evaluation lends support to the public choice perspective (Buchanan, 1975), which views fiscal decisions as vulnerable to rent-seeking behavior and political capture, often resulting in enduring privileges that fail to promote the public good.

Future research could: (1) compare Santa Catarina's experience with that of states adopting stricter cost–benefit criteria, thereby clarifying the trade-offs involved in subnational tax competition; (2) incorporate a structural VAR (SVAR) extension with sign restrictions as a robustness test, since this framework allows for the identification of more consistent causal relationships and the detection of structural shocks in fiscal and tax policy with greater precision; and (3) expand the analysis by integrating time-series trends and exploring multi-region VAR applications, in line with reports from the Organisation for Economic Co-Operation and Development (OECD), which emphasize the growing interdependence of subnational tax policies and the challenges of global tax competition.

The methods and findings of this study offer a valuable reference for public policymakers — especially tax administrators — as well as professionals in the fields of taxation, accounting, and law. Table 9 outlines policy recommendations for public officials and legislators derived from the study's conclusions.

Table 9. Policy recommendations for public authorities on the allocation of tax incentives.

Recommendation	Rationale
Prioritize job-intensive sectors in tax incentive policies.	Incentives should target sectors with higher employment capacity — such as services, construction, agribusiness, and small-scale industry — to maximize social and economic returns.
Establish expiration dates and regular review cycles for tax benefits.	Tax incentives should be temporary and subject to annual review by specialized tax auditors through cost-benefit analyses aligned with the Budget Guidelines Law (LDO). This allows for timely adjustments or revocations to enhance effectiveness in employment, growth, and revenue.
Standardize and disclose tax expenditure data.	Adopt uniform, transparent methods for calculating and reporting tax expenditures, following best practices — such as those implemented in Santa Catarina — to improve accountability and facilitate interstate comparisons.
Foster cooperation between government, legislature, and civil society.	Expanding stakeholder participation in tax policy discussions helps curb rent-seeking and ensures that incentives are linked to productivity and innovation rather than special interests.
Enforce compliance with national rules on tax benefits.	Authorities must apply sanctions for unauthorized tax incentives, as established by Complementary Law 160/2017 (Lei Complementar, n. 160, 2017) and Constitutional Amendment 132/2023 (Emenda Constitucional n. 132, 2023). Audit courts should ensure oversight and promote fiscal discipline.

Note. Elaborated by the authors.

Future perspectives on the 2023 Brazilian tax reform

The 2023 tax reform (Emenda Constitucional n. 132, 2023) introduced the tax on goods and services (IBS), a destination-based VAT designed to gradually replace ICMS and other subnational levies. Although existing ICMS-linked benefits remain valid until 2032, the reform significantly alters fiscal dynamics. The IBS, managed by a national governing committee with equal state and municipal representation (Lei Complementar n. 214, 2025), promotes shared control, uniform rules, and cooperative federalism.

This structure reduces the effectiveness of Santa Catarina's traditional strategy of using interstate tax incentives to attract businesses, especially for outbound operations. To remain competitive, the state will need to invest in real assets such as logistics infrastructure and skilled labor. Overall, the IBS is expected to reduce tax distortions, improve equity, and increase legal certainty, fostering predictability and discouraging unilateral incentives.

To ease the transition, the reform created a Fiscal Benefits Compensation Fund, allocating around USD 31 billion from 2025 to 2032 to offset valid incentives granted before May 31, 2023. Managed by the Federal Revenue Service, the fund faces challenges, including budget limits and unclear eligibility criteria.

A further concern involves tax enforcement. By merging with ICMS and ISS tax bases, the IBS expands oversight responsibilities, which poses challenges for smaller municipalities with limited administrative capacity, potentially undermining effective implementation.

Finally, this study contributes to the fiscal policy literature by presenting empirical evidence — based on time-series analysis — of the macroeconomic effects of ICMS incentives in Santa Catarina. The results highlight the limitations of expansionary tax policy within a decentralized fiscal framework and offer timely guidance for public authorities involved in implementing and refining the 2023 tax reform, especially considering that the IBS allows for differentiated tax treatments.

REFERENCES

Abreu, T. F. R., & Lima, E. C. R. (2022). Multiplicadores fiscais no Brasil identificados com restrições de sinais e de zeros. *Nova Economia*, *32*(3), 647–685. https://doi.org/10.1590/0103-6351/6934

Afonso, J. R. R., Ferreira, S. G., & Varsano, R. (2002). *Fiscal competition: A bird's eye view*. Discussion Text n. 887. IPEA.

Alves, R. S., Rocha, F. F., & Gobetti, S. W. (2019). Multiplicadores fiscais dependentes do ciclo econômico: O que é possível dizer para o Brasil? *Estudos Econômicos*, *49*(4), 635-660. https://doi.org/10.1590/0101-41614941rfs

Ameyaw, B., Oppong, A., Abruquah, L. A., & Ashalley, E. (2017). Causality nexus of electricity consumption and economic growth: An empirical evidence from Ghana. *Open Journal of Business and Management*, *5*, 1–10. https://doi.org/10.4236/ojbm.2017.51001

Attílio, L. A. (2022). Estudo da política fiscal do Brasil: Análise empírica com o GVAR (1980–2019). *Revista Brasileira de Economia*, *76*(4), 467–489. https://doi.org/10.5935/0034-7140.20220020

Auerbach, A. J., & Gorodnichenko, Y. (2012). Measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, *4*(2), 1–27. https://www.aeaweb.org/articles?id=10.1257/pol.4.2.1

Bank, A. (2011). *Effects of discretionary fiscal policy: New empirical evidence for Germany*. Working Paper n. 470. Leibniz University Hannover, Faculty of Economics.

Barros, G. S., N., & Correia, F. M. (2019). Fiscal multipliers in Brazil: A sensitivity analysis on the structural identification procedure. *Modern Economy*, *10*, 2175-2200. https://doi.org/10.4236/me.2019.1010137

Bay, A. G. N. M. (2018). Energy consumption and economic growth nexus in Mozambique: 1975-2016. *American Journal of Energy Research*, *6*(1), 19–22. https://doi.org/10.12691/ajer-6-1-3

Blanchard, O., & Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *The Quarterly Journal of Economics*, *117*(4), 1329–1368. https://www.jstor.org/stable/4132480

Bozdogan, H. (1987). Model selection and Akaike's Information Criterion (AIC): The general theory and its analytical extensions. *Psychometrika*, *52*(3), 345–370. https://doi.org/10.1007/BF02294361

Brennan, G., & Buchanan, J. M. (1980). *The power to tax: Analytical foundations of a fiscal constitution*. Cambridge University Press.

Brueckner, J. K. (2000). Fiscal decentralization in developing countries: The effects of local government behavior. *World Development, Annals of Economics and Finance*, *1*(1), 1–18. https://www.files.ethz.ch/isn/45958/2.pdf

Buchanan, J. M. (1975). Public finance and public choice. *National Tax Journal*, *28*(4), 383–394. https://www.jstor.org/stable/41863132

Bueno, R. L. S. (2022). *Econometria de séries temporais*. Cengage Learning.

Busato, M. I., & Martins, N. M. (2022). *Multiplicadores fiscais no Brasil: Entre consensos e dissensos*. Texto para discussão (5), Cátedra Celso Furtado. Universidade Federal do Rio de Janeiro.

Caldara, D., & Kamps, C. (2017). The analytics of SVARs: A unified framework to measure fiscal multipliers. *Review of Economic Studies*, *84*(3), 1015–1040. https://doi.org/10.1093/restud/rdx030

Campos, R. H., Ferreira, R. T., & Kloeckner, R. (2015). Vertical tax competition in Brazil: Empirical evidence for ICMS and IPI in the period 1995–2009. *Economia*, *16*(1), 111–127. https://doi.org/10.1016/j.econ.2015.03.004

Carvalho, H. C., Afonso, A., & Mazzon, J. A. (2023). Tax compliance in the wild: Critical review of nudging and proposition of an integrative framework. *BAR-Brazilian Administration Review*, 20(1), e220040. https://doi.org/10.1590/1807-7692bar2023220040

Castilho, F. R., & Silveira, R. F. (2009). Brazilian states tax war explained by the property right theories of law and economics - fake redistributive policies leading to underdevelopment. *Law & Business Review of the Americas*, *15*(2), 353-376. https://scholar.smu.edu/cgi/viewcontent.cgi?article=1404&context=lbra

Cavalcanti, M. A. F. H., & Silva, N. F. C. (2010). Dívida pública, política fiscal e nível de atividade: uma abordagem VAR para o Brasil no período 1995-2008. *Economia Aplicada*, *14*(4), 391-418. https://doi.org/10.1590/S1413-80502010000400007

Cloyne, J. (2013). Discretionary tax changes and the macroeconomy: New narrative evidence from the United Kingdom. *American Economic Review*, *103*(4), 1507–1528. Https://doi.org/10.1257/aer.103.4.1507

Dornbush, R., Fisher, S., & Startz, R. (2011). *Macroeconomics*. McGraw-Hill.

Emenda Constitucional n. 132 (2023). Emenda Constitucional, n. 132, de 20 de dezembro de 2023. Altera o Sistema Tributário Nacional. https://www.planalto.gov.br/ccivil_03/constituicao/emendas/emc/emc132.htm

Enders, W. (1995). *Applied Econometric Time Series*. John Wiley & Son.

Erber, F. S. (2011). As convenções de desenvolvimento no governo Lula: Um ensaio de economia política. *Revista de Economia Política*, *31*(1), 31-55. https://doi.org/10.1590/S0101-31572011000100002

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, *37*(3), 424-438. https://doi.org/10.2307/1912791

Hayek, F. A. (1990). *O Caminho da Servidão*. Instituto Liberal.

Hebous, S. (2011). The effects of discretionary fiscal policy on macroeconomy aggregates: A reappraisal. *Journal of Economic Surveys*, *25*(4), 674–707. https://doi.org/10.1111/j.1467-6419.2010.00659.x

Ilzetzki, E. (2011). *Fiscal policy and debt dynamics in developing countries*. Policy Research Working Paper 5666. The World Bank.

Keynes, J. M. (1935). *The General Theory of Employment, Interest, and Money*. International Relations and Security Network. https://www.files.ethz.ch/isn/125515/1366_keynestheoryofemployment.pdf

Koop, G., & Korobilis, D. (2010). Bayesian multivariate time series methods for empirical macroeconomics. *Foundations and Trends in Econometrics*, *3*(4), 267–358. https://dx.doi.org/10.2139/ssrn.1514412

Kraft, J., & Kraft, A. (1978). On the relationship between energy and GNP. *The Journal of Energy and Development*, *3*(2), 401-403. https://www.jstor.org/stable/24806805

Lei n. 18.170, de 27 de julho de 2021. (2021). Lei Nº 18.170, de 27 de julho de 2021. Dispõe sobre as diretrizes orçamentárias para o exercício financeiro de 2022 e estabelece outras providências. https://leis.alesc.sc.gov.br/ato-normativo/21006

Lei Complementar, n. 24, de 7 de janeiro de 1975. (1975). Lei Complementar, n. 24, de 7 de janeiro de 1975. Dispõe sobre os convênios para a concessão de isenções do imposto sobre operações relativas à circulação de mercadorias, e dá outras providências. https://www.planalto.gov.br/ccivil_03/leis/lcp/lcp24.htm

Lei Complementar n. 160, de 7 de agosto de 2017. (2017). Lei Complementar, n. 160, de 7 de agosto de 2017. Dispõe sobre convênio que permite aos Estados e ao Distrito Federal deliberar sobre a remissão dos créditos tributários, constituídos ou não, decorrentes das isenções, dos incentivos e dos benefícios fiscais ou financeiro-fiscais instituídos em desacordo com o disposto na alínea "g" do inciso XII do § 2º do art. 155 da Constituição Federal e a reinstituição das respectivas isenções, incentivos e benefícios fiscais ou financeiro-fiscais; e altera a Lei no 12.973, de 13 de maio de 2014. https://www.planalto.gov.br/ccivil_03/leis/lcp/lcp160.htm

Lei Complementar n. 214, de 16 de janeiro de 2025. (2025). Lei Complementae n. 214, de 16 de Janeiro de 2025. Institui o Imposto sobre Bens e Serviços (IBS), a Contribuição Social sobre Bens e Serviços (CBS) e o Imposto Seletivo (IS); cria o Comitê Gestor do IBS e altera a legislação tributária. https://www.planalto.gov.br/ccivil_03/leis/lcp/lcp214.htm

Litterman, R. B. (1986). Forecasting with Bayesian vector autoregressions – five years of experience. *Journal of Business & Economic Statistics*, *4*(1), 25–38. https://doi.org/10.1080/07350015.1986.10509491

Lütkepohl, H. (1993). *Introduction to Multiple Time Series Analysis*. Springer-Verlag.

Maindonald, J. H. (2007). Least squares computations based on the Cholesky decomposition of the correlation matrix. *Journal of Statistical Computation and Simulation*. https://doi.org/10.1080/00949657708810155

Matheson, T., & Pereira, J. (2016). *Fiscal multipliers for Brazil*. International Monetary Fund. Working Paper n. 79.

Mattos, E., Rocha, F., & Maluf, J., Jr. (2017). Fiscal strategic interaction in Brazil: An analysis of Fiscal War of Ports. *Revista Brasileira de Economia*, *71*(2), 177–193. https://doi.org/10.5935/0034-7140.20170009

Mello, L. (2008). The brazilian "tax war": The case of value-added tax competition among the states. *Public Finance Review*, *36*(2), 169–193. https://doi.org/10.1177/1091142107299252

Mertens, K., & Ravh, M. O. (2014). A reconciliation of SVAR and narrative estimates of tax multiplier. *Journal of Monetary Economics*, *68* (Supplement), S1–S19. https://doi.org/10.1016/j.jmoneco.2013.04.004

Mountford, A., & Uhlig, H. (2009). What are the effects of fiscal policy shocks? *Journal of Applied Econometrics*, *24*(6), 960–992. https://doi.org/10.1002/jae.1079

Narayan, P. K., Narayan, S., & Prasad, A. (2008). A structural VAR analysis of electricity consumption and real GDP: Evidence from the G7 countries. *Energy Policy*, *36*(7), 2765–2769. https://doi.org/10.1016/j.enpol.2008.02.027

Organisation for Economic Co-operation and Development (OECD). (2018). *Subnational public-private partnerships: Meeting infrastructure challenges*. OECD. https://doi.org/10.1787/9789264304864-en

Organisation for Economic Co-operation and Development (OECD). (2023). *Tax policy reforms 2023: OECD and selected partner economies*. OECD. https://doi.org/10.1787/d8bc45d9-en

Parys, S. V., & James, S. (2010). The effectiveness of tax incentives in attracting investment: panel data evidence from the CFA Franc zone. *International Tax and Public Finance*, *17*, 400–429. https://doi.org/10.1007/s10797-010-9140-1

Peres, M. A. F., & Ellery, R. G., Jr. (2009). Efeitos dinâmicos dos choques fiscais do governo central no PIB do Brasil. *Pesquisa e planejamento econômico*, *39*(2), 159–206. http://repositorio.ipea.gov.br/handle/11058/5116

Perotti, R. (2004). Estimating the effects of fiscal policy in OECD countries. *IGIER Working Paper n. 276.*

Pontes, P. A. (2011). *Três ensaios sobre guerra fiscal e incentivos estaduais para industrialização* (Tese de Doutoramento). Escola de Administração de Empresas de São Paulo, Fundação Getúlio Vargas, Brasil.

Ramey, V. A., & Shapiro, M. D. (1998). Costly capital reallocation and the effects of government spending. *Carnegie-Rochester Conference Series on Public Policy*, *48*(1), 145–104. https://doi.org/10.1016/S0167-2231(98)00020-7

Ramey, V. A. (2019). Ten years after the financial crisis: What have we learned from the renaissance in fiscal research? *Journal of Economic Perspectives*, *33*(2), 89–114. https://doi.org/10.1257/jep.33.2.89

Romer, C. D., & Romer, D. H. (2010). The macroeconomic effects of tax changes: Estimates based on a new measure of fiscal shocks. *American Economic Review*, *100*(3), 763–80. https://doi.org/10.1257/aer.100.3.763

Simionescu, M., & Albu, L.–L. (2016). The impact of standard value added tax on economic growth in CEE-5 countries: Econometric analysis and simulations. *Technological and Economic Development of Economy*, *22*(6), 850–866. https://doi.org/10.3846/20294913.2016.1244710

Sims, C. A. (1993). A nine variable probabilistic macroeconomic forecasting model. In J. H. Stock, & M. W. Watson (Eds.) *Business cycles, indicators, and forecasting* (pp. 179–214). University of Chicago Press.

Slemrod, J. (1990). Optimal taxation and optimal tax systems. *Journal of Economic Perspectives*, *4*(1), 157–178. https://doi.org/10.1257/jep.4.1.157

Stock, J. H., & Watson, M. W. (2001). Vector Autoregressions. *Journal of Economic Perspectives*, *15*(4), 101–115. https://doi.org/10.1257/jep.15.4.101

Surrey, S. S. (1970). Tax incentives as a device for implementing government policy: A comparison with direct government expenditures. *Harvard Law Review*, *83*(4), 705-738. https://doi.org/10.2307/1339837

Taylor, J. B. (1995). The monetary transmission mechanism: An empirical framework. *Journal of Economic Perspectives*, *9*(4), 11–26. https://doi.org/10.1257/jep.9.4.11

Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of Political Economy*, *64*(5), 416–424. http://www.jstor.org/stable/1826343

Tomazzia, E. C., & Meurer, R. (2009). O mecanismo de transmissão da política no Brasil: Uma análise em VAR por setor industrial. *Economia Aplicada*, *13*(4), 371–398. https://doi.org/10.1590/S1413-80502009000400002

Wilson, J. D. (1999). Theories of tax competition. *National Tax Journal*, *52*(2), 269–304. https://www.journals.uchicago.edu/doi/abs/10.1086/NTJ41789394

Zang, C., Zhou, K., Yang, S., & Shao, Z. (2017). On electricity consumption and economic growth in China. *Renewable and Sustainable Energy Reviews*, *76*, 353–368. https://doi.org/10.1016/j.rser.2017.03.071

Zodrow, G. R., & Mieszkowski, P. (1986). Pigou, Tiebout, property taxation, and the underprovision of local public goods. *Journal of Urban Economics*, *19*(3), 356–370. https://doi.org/10.1016/0094-1190(86)90048-3

Authors

Amery Moisés Nadir Junior

Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Contabilidade

Campus Universitário, Trindade, CEP 88040-380, Florianópolis, SC, Brazil

amerymnj@gmail.com

Anete Alberton

Universidade do Vale do Itajaí, Programa de Pós-Graduação em Administração

Rua Uruguai, n. 458, Centro, CEP 88302-901, Itajaí, SC, Brazil

anete@univali.br

José Alonso Borba

Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Contabilidade

Campus Universitário, Trindade, CEP 88040-380, Florianópolis, SC, Brazil

j.alonso@ufsc.br

Kleverton Clóvis de Oliveira Saath

Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Economia

Campus Universitário, Trindade, CEP 88040-380, Florianópolis, SC, Brazil

klevertonsaath@gmail.com

Authors' contributions

1st author: conceptualization (equal), formal analysis (equal), investigation (equal), methodology (equal), writing - original draft (lead), writing - review & editing (lead).

2nd author: conceptualization (equal), methodology (equal), writing - review & editing (supporting).

3rd author: conceptualization (equal), methodology (equal), supervision (lead), writing - review & editing (supporting).

4th author: conceptualization (equal), data curation (lead), formal analysis (equal), investigation (equal), methodology (equal), validation (lead).