FISCAL DESCENTRALIZATION AND ECONOMIC PERFORMANCE IN BRAZIL: AN INVESTIGATION USING PAEG/GTAP

Marcos Spínola Nazareth[1]

Ângelo Costa Gurgel[2]

Wilson da Cruz Vieira[3]

ABSTRACT

The core of a federal system is to provide a stable structure of decentralization. In Brazil, there has been sequential periods of decentralization and centralization with impacts on the country's economic performance. The most recent literature predicts problems of incentives in both centralization and decentralization, called the twin dilemma of federalism. Specifically, three conditions are necessary to solve this structural dilemma and have the market-preserving federalism type: (*i*) subnational governments autonomy in tax and supply public goods (fiscal decentralization); however, (*ii*) they must face hard budget constraints, which means that they must bear all the consequences of their fiscal policies; and (*iii*) a common market is ensured in the national territory. To teste this for Brazil an applied general equilibrium model was constructed to represent the Brazilian 2011 economic environment under a decentralized institutional structure would simulate the implementation of fiscal decentralization disciplined by hard budget constraint and factors mobility. The mains results confirmed the hypothesis that the Brazilian economy will increase its economic performance, measured by the GDP and welfare of families, although there have been losses in the North and Northeast regions.

KEYWORDS: Market-preserving Federalism; Hard Budget Constraint; Applied General Equilibrium Model

JEL CLASSIFICATION: H77

---

[1] PhD candidate in Applied Economics at Federal University of Viçosa, Brazil.
[2] Professor, Sao Paulo School of Economics, Brazil.
[3] Professor, Agricultural Economics Department at Federal University of Viçosa, Brazil.

1 INTRODUCTION

Considering the main goal of a federal government system is to provide a stable structure of political and fiscal decentralization, analyzing its economic unfolding is especially important, according to Weingast (1995), it was a fundamental factor associated with the strong economic development of many nations of the Western world in the last centuries[4], especially the *market-preserving* type, which limits the ability of governments to violate the functioning of markets and be discretionary over time[5].

In Brazil, it is always remarkable in the literature the various changes that the federative arrangement has undergone over more than a century since the first republican constitution of 1891 until the present constitutional regime. In all, six constitutions have greatly changed the "rules of the game" for political agents in the three spheres of government, affecting extensively the country's economic performance. The works of Resende and Afonso (2004) and Serra and Afonso (1999) discuss this aspect widely. There has been sequential periods of decentralization and centralization with the Constitutions marking the turning of the "pendulum" into one of the directions and always as a kind of reaction to the problems generated by the previous period, with possible impacts on the country's economic performance[6].

The last federative arrangement agreed in 1988, for example, according to Resende (2001), presented a strongly decentralized character due to the devolution of political and fiscal autonomy to the states and municipalities, with new constitutional attributions and functions. The tax system was reformulated to include states and municipalities, and there was an increase in the volume of resources passed on to regional and local governments through intergovernmental transfers, favoring states and municipalities in the North and Northeast in order to try to minimize chronic regional disparities in Brazil.

However, as other occasions with similar consequences, the transmission of public burdens to regional governments has not been made explicitly and clearly. There were several overlaps of assignments between spheres and no requirements were established for goals, efficiency and external control. The result was a considerable increase in state and municipal government spending year after year. It is enough to mention that primary expenditures of states and municipalities jumped from 8% to 16% of GDP between 1988 and 2000 (Cossio, 2002). It is a recognized fact in the literature of the Brazilian public sector that this strongly affected the efficiency of the economic stabilization policies of the period[7].

In fact, the most recent literature predicts problems of incentives in both centralization and decentralization. Fiscal centralization tends to distance the government's spending decisions from citizens' preferences, generating allocative inefficiencies of public resources, and favors excessive reliance on subnational units of federal resources, generating several problems such as fiscal illusion and the flypaper effect[8] and false perception of financial security as a possible Union bailout.

---

[4] See, for instance, Wallis & Weingast (2005); North & Weingast (1989).

[5] Weingast analyzes the cases of England, United States and the recent Chinese case in the eastern world.

[6] Throughout its history, Brazil had 7 constitutions: 1824 (Imperial Constitution), 1891, 1934, 1937, 1946, 1967, and 1988.

[7] Another factor that seriously undermined the state adjustment were the monetary instruments that governors had, such as state banks to finance deficits and freedom to issue securities debt.

[8] The flypaper effect states that the expenditures of subnational governments increase more when the resources come from transfers than if they had been obtained through own tax collection. The mechanism that allows this result is the fiscal illusion of taxpayers.

On the other hand, fiscal decentralization may lead to an increase in subnational fiscal deficits due to jurisdictional competition; increase in local public expenditures due to the externalities and spillovers with the consequent underestimation of the cost of public goods and services that can generate a free riding behavior and common resource problem[9]; and likely aggravation of interregional inequalities due to the repercussion of socioeconomic disparities in the capacity of own revenue generation between jurisdictions.

According to Weingast (2005), three conditions are necessary to solve this structural dilemma of every federative system, called the twin dilemma of federalism, and to have the market-preserving federalism (MPF) type: *i*) subnational governments should have priority in the responsibility for providing public goods and tax autonomy; however, (*ii*) not only, but especially subnational governments must endure hard budget constraints, which means that they must bear all the consequences of their fiscal policies, preventing transfers of financial losses to other units or spheres; and (iii) a common market is ensured, preventing governments from using their prerogatives to impose trade barriers against inputs, goods and services from other regions, that is, there is free factors mobility, goods and services in the national territory.

Therefore, considering that in Brazilian federalism, in general: *i*) the central government holds the political and economic protagonism; *ii*) despite the advances of the Fiscal Responsibility Law, states and municipalities still have degrees of freedom to be large and in deficit[10]; and (*iii*) there is a common market; arises the following question: what if the Brazilian federation presented all the conditions simultaneously of the MPF implying a fiscal decentralization more accentuated with institutional limits would actually improve economic performance as this theory predicts?

In order to answer this key-question an applied general equilibrium model was constructed to represent the Brazilian 2011 economic environment under a decentralized institutional structure in two spheres of government, implementing shocks that, adapted to the possibilities of the model and data, would simulate the implementation of fiscal decentralization disciplined by hard budget constraint and factors mobility.

Thus, experiments were conducted that simulated changes in the mentioned conditions: *i*) increases in the proportion of own resources available to the regional governments and reduction in intergovernmental grants; *ii*) reduction of the regional governments size through the transfers to households, simulating fiscal surpluses or hard budget constraints; and, finally, *iii*) implementation levels of factors mobility.

The mains results confirmed the hypothesis that the Brazilian economy will increase its economic performance, measured by the GDP and welfare of families, with the implementation in Brazil of a fiscal federalism of the market-preservation type, although there have been losses for the GDP in the North and Northeast regions.

Testing for Brazil the MPF hypothesis via simulations by computable general equilibrium (CGE) is entirely new. The usage of CGE in the literature about federalism is still small and very rare in Brazil. Moreover, these experiments are literature MPF most recent necessities to test its theoretical formulations.

---

[9] The well-known "tragedy of the commons": an uncooperative result in contexts in which economic agents use some common resource. That is, excessive and, therefore, sub-optimal consumption of the resource.

[10] Presently, several Brazilian states face serious fiscal crises.

For this purpose, this paper contains five more sections, in addition to this introduction: the next two sections present theoretical framework. Then we have the PAEG Federal model with the inclusion of the decentralized government and income transfer variables among the agents. In section five, the results are discussed; and, finally, the conclusion with some final considerations and policy suggestions.

2 DECENTRALIZATION THEOREM

The classic Oates Decentralization Theorem (Oates, 1972), taking government as a benevolent agent, a typical assumption of first generation models, asserts that differences in needs and preferences between communities that compose a nation make the provision of public goods by a decentralized government increases the welfare of taxpayers. This theoretical postulate is reinforced if there is free factors mobility that induce a similar competition to those that occur with private goods.

According to Tiebout (1956), "the government´s revenue-expenditure pattern for goods and services is expected to adapt to consumer´s preferences." This process would be analogous to the allocation of resources in the private market through the price system. Thus, taxpayers-voters through "voting with their feet" would induce efficient allocation of revenue and public spending between jurisdictions.

Therefore, in fact, Oates's Theorem points out that decentralization can improve allocative efficiency in the economy, however only if there are no negligible externalities between jurisdictions. In the presence of spillover effects, the theoretical prediction Pareto's efficient allocation of resources by the "fiscal equivalence"[11] principle or "preference matching" will not occur (Martinez-Vaquez *et al*, 2016). In short, in the absence (or negligible presence) of economies of scale and interjurisdictional externalities, the theorem predicts that the level of welfare will be higher, considering several population subgroups, the more heterogeneous the supply of public goods compared to a single uniform supply for all these groups.

Hence, fiscal decentralization will achieve its objectives[12]: if the degree of heterogeneity of the population groups that compose a nation is high; if the central government can achieve little or no gain in scale with the provision of a public good; if there are low levels of externalities and free-riding behaviors that undermine the correct assessment of costs and benefits; and if there are few restrictions on jurisdiction competition and factor mobility.

However, perhaps because of all difficulties involved in measuring all these effects together, and even more the net result, most of the empirical studies so far have not been successful in proving that fiscal decentralization contributes decisively to the increase of the economic performance of a nation (Xie et al, 1999). There is more consensus in the literature on the beneficial effects of recomposing local public expenditures (Martinez-Vaquez *et al*, 2016).

Even so, it is obvious that the proposition that fiscal decentralization increases economic efficiency has an indirect correspondence with the conditions that provide economic growth: greater impact on socio-

---

[11] "there is a need for a separate government for every collective good with a unique boundary, so that there can be a match between those who receive the benefits and those who pay for it. This match we define as 'fiscal equivalence'" (Olson, 1969).

[12] The theory proposes this analysis should be done separately for each service or public good with the purpose of defining which would remain in the hands of central government and which ones should be "decentralized".

economic variables, quality of spending, public transparency, institutional environment, etc. (Martinez-Vaquez *et al*., 2016), much more linked to the works inserted in the second-generation tradition.

In this respect, Xie et al (1999) intended to show in a more sophisticated way how the form of public expenditures allocation between spheres of government could affect the economy growth rate by adapting Barro's growth model with the inclusion of three spheres of government, deriving the economy optimum growth rate due to a certain degree of fiscal decentralization. Nevertheless, in the empirical analysis the results were not conclusive, certainly due to problems of endogeneity (probable correlation of the government expenditures shares with the dependent variable).

Boex & Edwards (2016) highlight the difficulties to make a good measurement of the degree of fiscal decentralization of a federation. Often, this is an obstacle and imposes a series of limitations on empirical research on the theme. Moreover, as Martinez-Vaquez et al. (2016) point out, it should not be surprising that studies using different hypotheses, ways of measuring decentralization, estimation and specification techniques produce results of little convergence, with the aggravating constant problem in the models: endogeneity; and when it is treated, it is not with good instrumental variables.

However, decentralization can encourage fiscal discipline. Providing all levels of governments with sufficient tax autonomy and fiscal responsibility, while the advantages of horizontal and vertical competition hinders the monopolistic power of Leviathan. Although, it is worth mentioning that the decentralized arrangement is more sensitive to the soft budget constraint problem (Martinez-Vaquez *et al*, 2016).

3 MARKET-PRESERVING FEDERALISM

In order to obtain a stable federal system and to solve some of the theoretical and empirical difficulties presented above, de Figueiredo and Weingast (2005) affirm that the implementation of fiscal decentralization must obey two elements: the central government must have strong enough to detain and punish potential free-riders. However, there must also be constitutional restrictions on it so that it does not invade their political and fiscal autonomy and independence. This ideal arrangement is called self-enforcing federalism.

Nonetheless, they point out that turning federalism into self-enforcing is no trivial because it implies resolving a fundamental trade-off*:* mechanisms that mitigate one dilemma typically exacerbate another one. A very weak national government will allow subnational units free-riding behaviors. At the end, the federation will be disintegrated. On the other hand, with a very strong Union the long-term trend is the federation also dissolve because the central government compromises the independence of states and municipalities.

Thus, for Weingast (2005), all federations, although distinct in many aspects, face two fundamental dilemmas: which factors prevent the federal government from dissolving federalism by centralizing power; and which factors prevent subnational units from acting as free-riders exporting to the whole federation the inefficient fiscal policies. How the different federal institutional arrangements deal with these dilemmas affects the incentives of the various spheres of government, which, in turn, affects their economic performance and the stability of the federalist regime over time.

Notably, the question has been put in terms of how a federal system can be market-preserving[13], that is, capable of stimulating the growth of economic activity consistently over time (Weingast, 2014; Weingast, 2009; Weingast, 1995). Consequently, according to Riker (1964), a federal regime can present two basic characteristics: a) hierarchical state with at least two spheres of government under the same land and people, with a well delineated scope of authority and autonomy; and b) the autonomy of each government is institutionalized in a way that makes federal restrictions self-enforcing.

These two first conditions prevent the central government´s actions in favor of centralization over time. Something needs to provide durability to the limits of central government, particularly making this option attractive to it. In this perspective, the institutionalized decentralization of power in smaller spheres of government would make it difficult for the center to intervene excessively, thus solving one side of the dilemma. However, they do not say much about authority and jurisdiction over certain matters. Therefore, they are necessary, but not sufficient, conditions for a federalism that makes an economy to prosper[14].

Thus, there is a subset of federal systems called market-preserving federalism (MPF). A federalism, according to Weingast (2009), belongs to this subset if it possesses the following additional characteristics: *i)* subnational governments should have primacy in the responsibility for providing public goods and for the economy regulation with adequate tax autonomy to fulfill those functions; however; *ii)* lower levels of government must face hard budget constraint (HBC), which means to bear all the consequences of their fiscal and monetary policies, preventing transfers of financial losses to other units or spheres, and generations[15]; and *iii)* a common market is ensured, preventing regional units from using their prerogatives to impose trade barriers against inputs, goods and services from other regions, that is, there is free factor mobility, goods and services in the national territory.

Some of these conditions reveal some of the principles implicit in the First-Generation Fiscal Federalism (FGFF) such as the benefits of efficiency for decentralization (Oates, 1972), inter-jurisdictional competition (Tiebout, 1956), and the alignment of skills according to the characteristics of public goods (Musgrave, 1959). Thus, the MPF extends and adapts the FGFF lessons to the context of rational politicians and bureaucrats, which were subjected to incentives. This perspective helps to identify the incentives generated by the type of decentralization carried out, such as the Brazil case, in addition to other anomalies inherent to the federative system, such as the flypaper effect.

The literature associated to MPF states that subnational governments in which a substantial part of the revenues comes from own resources, that is, the existence of strong fiscal decentralization, tends to be more transparent to citizens, to provide public services more efficiently, to foster economic activity and be less corrupt. In contrast, financially dependent governments are subject to higher levels of corruption, lobbying and resources inefficient allocation (Weingast, 2014).

At the same time, there is also concern that there are no monetary instruments available to the subnational spheres, such as monetary issues or facilitated loans, to cover fiscal deficits, including avoiding

---

[13] Or *market-enhancing* federalism.
[14] Condition 1 defines a federal government system. Strictly, Brazil meets them. Therefore, they will be taken as given in this work.
[15] In fact, there must be strong constitutional restrictions on monetary policy and not receive financial bailouts from the federal sphere.

bailouts by the Union. The objective is to create hard budgetary constraints and avoid free-rider behavior, since the Union bailout sends out debt costs to all states, resulting in a typical common resource problem.

As for the existence of factor mobility, it introduces competition between the subnational units for labor and capital. Restrictions to the Union and responsibility for regulating the economy in lower jurisdictions make the units choose to supply public goods that favor economic activity and more in accordance with the preference of citizens. Moreover, according to Weingast (2009), there is a large decrease of losses from rent-seeking activities and lobbying, because the influence of them is only at the local level, causing the impaired groups to move between jurisdictions.

Therefore, the MPF would tend to solve incentive problems because it seeks, as far as possible, to align public expenditure decisions and their respective and strict cost with the citizen beneficiary's preferences, minimizing the various problems of externalities, making it possible to obtain the efficient results predicted by decentralization theorem, improving the fiscal profile of every public sector and all the positive consequences on the nation's economy arising from it.

In conclusion, the MPF affirms that in order to take advantage of the benefits of fiscal decentralization in the economic performance of a country, or in other words, to assert the decentralization theorem, under the postulate of Leviathan governments, it is necessary to create an environment that simultaneously gathers to the spheres of government the same three assumptions that, under normal conditions, usually seek to structure for private agents: decision-making autonomy (fiscal decentralization), financial responsibility (hard budget constraint) and competition (factor mobility).

4 PAEG FEDERAL MODEL

This paper uses a static multiregional applied equilibrium model to study fiscal policy interfederative changes. Specifically, the model PAEG (General Equilibrium Analysis Project for the Brazilian Economy). The PAEG is an applied general equilibrium model capable of representing the Brazilian great region's economies and analyzing economic effects of shocks in fiscal variables (Teixeira *et al*., 2013)

The PAEG is based on the *Global Trade Analysis Project* - GTAP model and database. However, it adopts the basic structure of the GTAPinGAMS model, originally created by Rutherford (2010). The GTAPinGAMS model uses the same database, being elaborated as a non-linear complementarity problem in the GAMS (General Algebraic Modeling System) programming language. One of the great advantages of this version is flexibility because it allows data aggregation different from the GTAP standard.

As well as GTAP, the PAEG is a multiregional and multisector economic model built in order to analyze the Brazilian economy in a regional manner, where each of the 5 major regions is represented by an intermediary and final demand structure, composed of selected sectors and public and private spending on goods and services (Teixeira *et al*., 2013). It is fully integrated with the Global Trade Analysis Project (GTAP) model and database which includes the flows of global economic transactions through the matching of national input-output tables.

The PAEG is based on neoclassical microeconomic assumptions for the behavior of economic agents: the representative consumer and the government seek to maximize their welfare subject to a budget constraint, and firms combine intermediate inputs and primary factors of production, aiming to minimizing costs, given the technology[16].

Furthermore, as well as in the GTAPinGAMS model, a simple additional assumption is made: investment demand and international capital flows are considered exogenously fixed at the base year level. Thus, changes in the real exchange rate must occur to accommodate changes in export and import flows aftershocks, keeping the balance of payments constant.

The total allocation of production factors does not change, but they are mobile between sectors and between Brazilian regions. As there is no unemployment factor and prices are flexible, it operates at full employment. Government consumption may change with alterations in the price of goods, just as revenue from taxes is subject to changes in the level of activity and consumption.

In Teixeira *et al.* (2013); Pereira (2011); Gurgel (2002); Rutherford & Paltsev (2000); Rutherford (1999); and Hertel (1997), we find the complete exposition of the behavioral and equilibrium equations of the PAEG model and its original sources: GTAP and GTAPinGAMS

However, as in the standard PAEG the government agent is unique in each region, it was necessary to disaggregate into two, federal government and regional government, only for the five main Brazilian regions, modeling them separately to allow the simulations and analyzes intended. In addition, in order to refine the spending patterns of these agents, making modeling more realistic, the income transfer values between governments and households were included in the matrix[17].

Therefore, the following changes in the equations of the corresponding economic model were performed: introduction of revenues and expenditures of the government spheres separately in the accounting identities and zero profit conditions and incorporation of the income transfer variables in the private agent's budget constraint and the two governments' equations.

Thereby, below is the description of the model with its main equations and extensions implemented for the five Brazilian regions case that makes it, in fact, a variation of the original, called PAEG Federal.

4.1 Model Aggregation

Tables 1 and 2 below present the notation for model dimensions and aggregations adopted, including sets of sectors and goods, countries and regions, production factors and governments. It is worth mentioning, once again, that the division into two governments and the inclusion of income transfer variables occurs only for the Brazilian regions. In all others, the model resumes its original form. The basic aggregation of the PAEG Federal follows the same as the original one composed of 19 sectors and 12 regions.

---

[16] The microeconomic and macroeconomic closure rules of the PAEG model are well documented in Teixeira *et al.* (2013) and are the same from GTAP*in*GAMS (Lanz & Rutherford, 2016).

[17] The other regions of the global model remain with a single government and without these additional variables. Thus, maintaining for these regions all identities and rules of behavior equal to the base model and different from what will be presented next.

Table 1 – Database set indexes

Index	Description
i, j	Sectors and goods
r, s	Countries or regions
g	Government units (federal and regional)
f	Production Factors (capital and labor)

Source: adapted from Teixeira *et al* 2013.

Table 2 - Aggregations of sectors, regions and production factors

Sectors		Regions	
paddy rice	pdr	Brazil	BRA
cereal grains	gro	Brazil regiao NORTE	NOR
oil seeds	osd	Brazil regiao NORDESTE	NDE
sugar cane	c_b	Brasil regioa CENTRO-OESTE	COE
animal products nec	oap	Brasil regioa SUDESTE	SDE
raw milk	rmk	Brasil regioa SUL	SUL
other agricultural products	agr	Rest of Mercosul	RMS
food products	foo	USA	USA
Textiles	tex	Rest of Nafta	RNF
wearing apparel leather products	wap	Rest of Americas	ROA
wood products	lum	European Union	EUR
paper products publishing	ppp	China	CHN
chemical rubber plastic prods	crp	Rest of the world	ROW
other manufacturing	man		
electricity gas manufacture distribution water	siu	**Factors of production**	
Construction	cns		
Trade	trd	capital	cap
Transport	otp	labor	lab
Services	ser		

Source: adapted from Teixeira *et al* 2013.

In addition to the five large Brazilian regions, the aggregation includes the Mercosur countries (RMS): Argentina, Uruguay and Paraguay. The other Latin American countries form another region, called Rest of America (ROA). The United States is a single region and Canada and Mexico are treated as the rest of NAFTA (NAF). About the European Union, 25 member countries (EUR) will be considered, not considering, therefore, the entry of the last three[18]. China is also treated in a disaggregated manner (CHN), and the other countries contained in the GTAP database are assembled in the Rest of the World (ROW).

4.2 Identity Functions: balance in the market of goods and factors

---

[18] Bulgaria, Romania e Croatia.

The first identity function is shown in equation (1): the sum of exports ($vxmd_{irs}$), international transport service (vst_{ir}), intermediate demand ($vdfm_{ijr}$), household consumption ($vdpm_{ir}$), investments ($vdim_{ir}$), and federal government consumption ($vdgm_{irF}$), and regional ($vdgm_{irR}$)[19] performed in domestic market of good and services is necessarily equal to the value of the domestic aggregate product (vom_{ir}):

$$vom_{ir} = \sum_s vxmd_{irs} + vst_{ir} + \sum_j vdfm_{ijr} + vdpm_{ir} + vdim_{ir} + vdgm_{irF} + vdg_{irR} \qquad (1)$$

Likewise, aggregated demand for imported goods (vim_{ir}) gets its value: from the sum of intermediate demand of the domestic sectors ($vifm_{jir}$), private consumption ($vipm_{ir}$), investiments ($viim_{ir}$), federal government consumption ($vigm_{irF}$), and regional government consumption ($vigm_{irR}$). Hence, the accounting identity for this flow is:

$$vim_{ir} = \sum_j vifm_{ijr} + vipm_{ir} + vigm_{ir} + vigm_{irF} + vigm_{irR} \qquad (2)$$

The equilibrium in the factor market is given by an identity, relating the sum of the economic sectors demand for primary factors of production with the income that is destined to families ($evom_{fr}$):

$$\sum_i vfm_{fir} = evom_{fr} \qquad (3)$$

Similarly, the equilibrium conditions of the international market require the region r to export the good i (vxm_{ir}) in the same quantity as the sum of imports of the same good from all trading partners ($vxmd_{irs}$).

$$vxm_{ir} = \sum_s vxmd_{irs} \qquad (4)$$

As such, the equilibrium conditions apply to international transport services. The balance in the transport service market j requires that the sum of services for the export of all regions (vst_{ir}) equals the sum of all bilateral flows of transport services acquired in the import of goods ($vtwr_{jirs}$). In other words, the value of international trade margins should be equal to both the international transport service and the value of international transport sales:

$$\sum_r vst_{rj} = \sum_{isr} vtwr_{jirs} \qquad (5)$$

Thus, the balance between supply and demand is closed in all goods and factor markets, taking into account one of the conditions for the consistency of an applied general equilibrium model with data base.

---

[19] Where F and R indicate federal government and regional government, respectively, if $r \in (Brasil)$ for this and the next equations.

4.3 Budget constraint equations: income balance

The new budget constraint of the private agent in the PAEG Federal model has on the left side the income of the production factors ($evom_{fr}$), discounted the payments of federal taxes (R_{rF}^{HH}), regional taxes (R_{rR}^{HH}), federal social contributions (CS_{rF}^{HH}), and regional social contributions (CS_{rR}^{HH}) adding the federal net interest receipt (JR_{rF}^{HH}), the regional net interest receipt (JR_{rR}^{HH}), federal social benefits (BS_{rF}^{HH}), regional social benefits (BS_{rR}^{HH}), in addition of a variable of income transfer between households and regional governments (tau_{rR}) which may be positive or negative depending on the simulated shock[20]; relating to the final consumption expenditure (vpm_r) and investments (vim_r):

$$evom_{fr} - R_{rF}^{HH} - R_{rR}^{HH} - CS_{rF}^{HH} - CS_{rR}^{HH} + JR_{rF}^{HH} + JR_{rR}^{HH} + BS_{rF}^{HH} + BS_{rR}^{HH} + tau_{rR} = vpm_r + vim_r \qquad (6)$$

As for the government, there are now in the Federal version of the PAEG model two equations of budget constraint, one for the Union and another for the regional government. In the federal case, total public expenditure (vgm_{rF}) must be equal to federal taxes flows (represented by "F" index) indirect in production and export (R_{irF}^Y), in consumption (R_{rF}^C), in import (R_{irF}^M), in federal government demand (R_{rF}^F) and regional government (R_{rF}^R) and the factors (R_{rF}^{HH}). Federal government income also includes receipts from social contributions (CS_{rF}^{HH}) less the social benefit payments (BS_{rF}^{HH}) to households, net interest payments (JR_{rF}^{HH}) and net transfers to regional governments (TR_{rF}^R), as well as transfer from abroad (vb_{rF}). Both in the standard PAEG and in the Federal, vb_{rF} is absorbed by the federal government according to the country's external result. Then, the constraint equation takes the following form:

$$vgm_{rF} = \sum_i R_{irF}^Y + R_{rF}^C + \sum_i R_{irF}^M + R_{rF}^F + R_{rF}^R + R_{rF}^{HH} + CS_{rF}^{HH} - BS_{rF}^{HH} - JR_{rF}^{HH} - TR_{rF}^R + vb_{rF} \qquad (7)$$

The budget constraint of the regional government is defined in a similar way with basically a difference: removing vb_{rF}, including the tau_{rR}. Thus, the total regional public expenditure (vgm_{rR}) must be equal to the tax collection (represented by the index "R") indirect in production and export (R_{irR}^Y), in consumption (R_{rR}^C), in import (R_{irR}^M), on federal government demand (R_{rR}^F) and regional government (R_{rR}^R) and the factors (R_{rR}^{HH}). The income of regional governments also includes receipts from social contributions (CS_{rR}^{HH}) less payment of social benefits (BS_{rR}^{HH}) to households, net interest payments (JR_{rR}^{HH}) and net receipts of Union transfers ($TR_{rF}^R = TR_{rR}^F$), in addition of the variable of income transfer between households and regional governments (tau_{rR}) previously defined. Therefore, the restriction equation takes the following form:

$$vgm_{rR} = \sum_i R_{irR}^Y + R_{rR}^C + \sum_i R_{irR}^M + R_{rR}^F + R_{rR}^R + R_{rR}^{HH} + CS_{rR}^{HH} - BS_{rR}^{HH} - JR_{rR}^{HH} - TR_{rR}^F + tau_{rR} \qquad (8)$$

---

[20] Additional details below.

Considering that the consistency of the model requires that changes in agent revenues (expenses) should be compensated by equivalent changes in their expenses (revenues), it is worth mentioning that the regional governments' surplus (deficits) simulations foreseen in this work were implemented through the *tau* variable that transfers (receives) these resources to the families. In practice, the size of these governments in the economy is diminished (increased). This artifice was taken as an estimation of the (simulated) changes in government financing needs and, therefore, the required variations in the taxation and purchase (sale) of securities with households[21].

Accordingly, in the constructed model, the second condition for the consistency of the database is achieved: the agents' income balance.

4.4 Zero profit conditions and decision structure

Finally, there is a third set of identities in the model, according to equations (9) to (16) below, which shows how income is exhausted by each of the "productive units" corresponding to the third condition of database consistency: economic profit equals to zero:

$$Y_{ir}: \sum_f vfm_{fir} + \sum_j \left(vifm_{jir} + vdfm_{jir}\right) + R^Y_{irF} + R^Y_{irR} = vom_{ir} \tag{9}$$

$$M_{ir}: \sum_s (vxmd_{isr} + \sum_j vtwr_{jisr}) + R^M_{irF} + R^M_{irR} = vim_{ir} \tag{10}$$

$$C_r: \sum_i (vdpm_{ir} + vipm_{ir}) + R^C_{irF} + R^C_{irR} = vpm_r \tag{11}$$

$$GF_r: \sum_i (vdgm_{irF} + vigm_{irF}) + R^{GF}_{irF} + R^{GF}_{irR} = vgm_{rF} \tag{12}$$

$$GR_r: \sum_i (vdgm_{irR} + vigm_{iR}) + R^{GR}_{irF} + R^{GR}_{irR} = vgm_{rR} \tag{13}$$

$$I_r: \sum_i vdim_{ir} = vim_r \tag{14}$$

$$FT_{fr}: evom_{fr} = \sum_i vfm_{fir} \tag{15}$$

$$YT_j: \sum_r vst_{jr} = vt_j = \sum_{irs} vtwr_{jirs} \tag{16}$$

Thus, the presented equations indicate the presence of market equilibrium for all goods and factors, income balance of economic agents and zero profit, according to the presuppositions that define the model.

---

[21] A kind of anticipation of the actions predicted in the "Ricardian equivalence" according to which current taxpayers consider that government indebtedness, as a mechanism for financing their expenditures, is equivalent to raising taxes for future generations.

Furthermore, the structure of the optimization problems of each economic agent, the respective technological decision trees, and the equations derived from the equilibrium conditions of this study are exactly the same as the standard PAEG model[22], except for the addition of the g index in the tax variables that indicates the break-up into two types of government for the Brazilian regions as can be seen in Table 5 below, and then left to the interested reader to consult the reference literature cited above.

In addition, two things stand out: the extensions presented in the model so far alter the volume of behavioral variables but not the decision structure, and all parameters of substitution elasticities at each level of choice of the technological trees are removed from the database of GTAP version 9[23].

Finally, variables on level that define equilibrium (the model determines the value of all variables except the international capital flow, the relative prices of goods and factors (the equilibrium conditions of the model determine optimal relative prices) and the taxes, subsidies and tariffs incident on the model, with their respective parameters and rating in GAMS are exactly the same as the standard PAEG model.

4.5 Database and simulations

The PAEG Federal model used the regionalized database for the Brazilian economy, compatible with GTAP 9.0. The PAEG 4.0 aggregation (the newest version of the database) is composed of 19 activities, 12 regions (including the 5 major Brazilian regions) and 2 primary factors, representing the economic environment of 2011 with a single government for public consumption and tax revenues for each region.

Therefore, federal and regional public expenditures and tax revenues were disaggregated. This procedure was carried out based on the various public finance reports of the entire government sector for the year 2011, released by the National Treasury Secretariat (STN) and by IBGE. It is important to note that disaggregation has maintained a regional level of government, in the sense that information for states and municipalities within each major region will be aggregated[24].

The taxes, subsidies and tariffs for Brazil in the regional matrixes followed the pattern of PAEG model, disaggregated by the specific tax that composes each category with the following specifications, revised and enlarged by Pereira (2011) [25]:

   a) Product tax: social contributions, economic contributions and other revenues and subsidies on activities;
   b) Tax on the production factors: IRPF, IRPJ, IOF, IPTU and ITR;
   c) Tax on domestic intermediate inputs: ICMS, IPI, ISS and other national taxes;
   d) Tax on imported intermediate inputs: II, IPI (linked to imports);
   e) Domestic consumption tax: ICMS, IPI, ISS and other national taxes;
   f) Imported consumption tax: II, IPI (linked to imports);

---

[22] As well as GTAPinGAMS.
[23] See Aguiar *et al.* (2016).
[24] Palermo et al (2013) and Porsse (2008) use the same procedure of grouping the data of the states and municipalities in the same agent, also calling it regional government in the social accounting matrix.
[25] The complete methodology for obtaining the regional tax rates is found in Pereira (2011).

g) Export subsidies;

h) Import tariffs.

Table 3 shows the distribution of taxes by government sphere as currently practiced in Brazil.

Table 3 - Distribution of taxes by government spheres

Sphere of Government	Tribute Description
Central	IR; ITR; IPI; II; IE; IOF; Social and Economic Contributions *
Regional	ICMS; IPVA; ITCMD; IPTU; ISS e ITBI**

Source: authors.
* Income tax; Tax on Rural Territorial Property; Taxes over industrialized products; Import tax; Export Tax; and Tax on Credit, Exchange and Insurance Operations.
** Tax on the Circulation of Goods and Services; Motor Vehicles Property Tax; Tax on *causa mortis* transfer (Inheritance) and donation; Urban Land and Territorial Tax; Any Service Tax; and *Inter-Vivo* Property Transfer Tax.

In addition, the variables of income transfers among the agents of the economic system of the matrix were included in the database, making it a typically Social Accounting Matrix[26], compatible with the official aggregated information of the Integrated Economic Accounts published by IBGE aiming to refine the pattern of government spending and make modeling more realistic.

The standard code of PAEG model, written in MPSGE, has also undergone modifications in order to adapt it to the new data and the required shocks[27]. The Mathematical Programming System for General Equilibrium (MPSGE), developed by Thomas Rutherford (Rutherford, 1999), is a programming language developed to solve economic equilibrium models of the Arrow-Debreu type. The MPSGE, using the GAMS programming language as an interface, also allows access to and modification of both the database and the basic GTAP model, according to the purposes of the research.

 Thereby, we intended to construct scenarios that allowed to test, in a satisfactory and consistent way, the hypothesis of the research that with the presence of the three specific conditions for the existence of a market-preserving federalism (MPF), the final product of the Brazilian economy and the welfare of consumers will be greater than in any other situation

Considering that, currently, the real situation of Brazil in the three points is tax centralization, soft budget constraint and some degree of factor mobility, two representative levels of intensity were defined for each of the three conditions to be implemented. They are shown in Table 7 below. Thus, there are eight combinations of possible scenarios, the last being MPF[28]. Table 8 presents the order and type of each one of them which will be used as a reference for presenting the results.

In Table 4, for fiscal decentralization at level 1, the current distribution of tax collection and transfers between government spheres in the database was simply maintained. For level 2, a moderate degree of

---

[26] For a review concepts related to Social Accounting Matrices, see Pyatt (1999).
[27] The complete data matrix and the GAMS code of the Federal PAEG model can be shared with those interested.
[28] This research was limited to two levels of intensity so that the number of possible scenarios did not increase too much. In the case of three levels for each condition, for example, there would be 27 possible scenarios. As it will be shown in the next section, some tests were done with more levels, and the direction and evidence of the results were not substantially altered.

deconcentration was implemented: it was defined that participation in federal government taxes would be 30% and in regional governments 70%, same share of final public demand split in the database, and reduction of 50 p.p. in the volume of intergovernmental transfers from that to these.

For budget constraints, the levels of fiscal results obtained through simulations materialize regional government reactions to the conditions of institutional incentives discussed in the previous section: credible budget rules, low probability of bailouts, political conditions, etc. Therefore, a soft budget constraint consisted in allowing regional governments to incur fiscal deficits of the order of 1.6% of GDP and hard budget constraint corresponding to the obligation to deliver a surplus of 1.6% of GDP. Within the constructed model, this would be equivalent to a 10% increase and reduction of these governments, respectively, through financial transfers to households[29].

Finally, factor mobility at level 1 considered the PAEG mobility pattern in which households allocate capital and labor to the most attractive regions after the shock, but remunerate them in the same region of origin. Naturally, at level 2, the remuneration in the region for which it was migrated is maintained, a more realistic hypothesis, although with adjustment via variations in nominal prices.

Table 4 – Degrees of intensity of the conditions to be simulated

Fiscal Decentralization (FD)	
1	Without alterations to the budget distribution between government spheres
2	FG with 30% and RGs 70% of taxes and reduction by 50 p.p. of transfers from the FG to the RGs*

Budget constraint (BC) – variation in the size of regional governments	
1	**Soft**: Increase of 10% of RGs in the economy (equivalent to a deficit of 1.6% of GDP)
2	**Hard**: Reduction of 10% of RGs in the economy (equivalent to a surplus of 1.6% of GDP)

Factor Mobility (FM)	
1	without mobility (PAEG standard)
2	imperfect mobility

Source: authors.

*(FG) – Federal Government; (RG) – Regional Government

Table 5 – Scenarios implemented

Scenarios	FD	BC	FM
1	1	1	1
2	1	2	1
3	2	1	1
4	2	2	1
5	1	1	2
6	1	2	2
7	2	1	2
8	**2**	**2**	**2**

Source: authors.

---

[29] Considering that regional government participation in GDP is 16% in the database.

As far as the assumptions about mobility are concerned, the restriction on the migration of factors between the Brazilian regions considered here seeks basically to capture the family, cultural, geographical and financial restrictions, although in the real-world there are no legal impediments to the free factor mobility in the national territory under a federal regime of government.

It should be noted that the possibility of migration of production factors within the national territory is one of the hallmarks of any federative government system. However, this does not imply, as already mentioned, absence of restrictions and the lack of mobility between national borders, as occurs for example in free trade agreements.

5 RESULTS AND DISCUSSION

Initially, to get an idea of the major trends of the impacts generated in the GDP and welfare of the Brazilian economy of the three conditions of market-preservation federalism (MPF), each of them was simulated separately in the base model constructed for the PAEG Federal.

From Table 6, it can be noted that only the implementation of fiscal decentralization is enough to increase Brazil's GDP by 0.001% and welfare by 0.47%. On the other hand, getting regional governments to face hard budget constraints, but without fiscal decentralization and limited factor mobility, leaves the general welfare at the same level and the GDP incurs a fall of 0.007%. In the case of free factor mobility, the aggregate welfare increases 3.55% and the Brazilian product falls by 0.002%.

Table 6 – Percentage variations per MPF condition

Regions	FD		BC		FM	
	Welfare	GDP	Welfare	GDP	Welfare	GDP
NOR	0.432	-0.081	1.774	-0.037	4.969	-0.008
NDE	0.523	-0.095	1.585	-0.037	5.203	-0.002
COE	0.442	0.004	0.459	-0.006	3.422	-0.005
SDE	0.326	0.038	-0.193	0.020	2.773	0.004
SUL	0.936	-0.009	1.600	-0.043	4.851	-0.012
RMS	0.001	-0.001	0.000	-0.001	-0.005	0.000
USA	0.000	0.000	0.000	0.000	0.000	0.000
RNF	0.000	0.000	0.000	0.000	0.000	0.000
ROA	0.000	0.000	0.000	0.000	-0.002	0.000
EUR	0.000	0.000	0.000	0.000	0.000	0.000
CHN	0.000	0.000	0.000	0.000	-0.001	0.000
ROW	0.000	0.000	0.000	0.000	0.000	0.000
BRA	0.4667	0.0010	0.0000	-0.0065	3.5545	-0.0016

Source: research results.

This is a first indication of the crucial importance, in relation to the other conditions, of implementing fiscal decentralization as a necessary condition (but not sufficient) for improving economic efficiency in Brazil when it is discussed federative pact reforms, which is the case today. In other words, to achieve economic

gains, it is not enough to require fiscal austerity of states and municipalities and eliminate any barriers to factor mobility without first granting them real tax autonomy and reduction of dependence on Union transfers. Guedes and Gasparini (2007), for example, show how the high participation of these transfers in the budgets of states and municipalities can reverse the positive effects of decentralization.

Besides, this data empirically corroborates the emphasis that the literature of fiscal federalism commonly confers on this point in relation to others. Moreover, in a way, it also confirms the existence of difficulties to understand the phenomenon seen in section 2, considering each of the conditions taken in isolation tends to diverge directions or levels. Additionally, if we observe the findings by Brazilian region, the discrepancies are deepened. For example, it is noteworthy that the North and Northeast regions incur significant declines in their GDP (0.081 and 0.091) with the implementation of decentralization, distinct from the other two cases, confirming the recurrent caveats in the literature regarding the possible detrimental effects of this type of regime for poorly developed regions in countries with great economic heterogeneity. This discussion will be resumed later.

Henceforth, the variations of the other non-Brazilian regions will be removed from the tables because, in addition to not being the focus of this study, they are usually zero or close to that, as can be easily seen from the results already presented, pattern repeated in almost all other simulations made. In a way, this was a predictable result since the shocks implemented are directly related to the governments, entities that have little transaction in terms of economic activity with the external sector. Nevertheless, in an analysis from the perspective of an economic general equilibrium model, this also means that the rearrangement of prices after the shocks did not affect sectors or the composition of demand of the agents that implied significant variation in the international trade of the Brazilian economy.

The next tables (7, 8 and 9) present the percentage changes in GDP and welfare for four levels of fiscal decentralization and budget constraint and three for factor mobility. The purpose was to show the trend (or trend reversal) results for each "direction"[30], with the aim of choosing with reasonable certainty the upper and lower limits of the degrees implemented for each condition to be used in the joint analysis of the possible combinations, as presented in section three. However, the tests were carried out in two "extreme" cases: in the baseline of scenarios 1 and 8.

Starting from Table 7, what can be seen is that in the aggregate, both in scenario 1 (with soft budget constraint and without factor mobility) and in scenario 8 (with hard budget constraints and factor mobility), the greater the decentralization fiscal performance is better the economic performance and better the welfare of households, to the point that, in case of scenario 1, the sharp degree of decentralization, even not being accompanied by the implementation of the other two conditions, reverses the table of losses in GDP. Regionally, the pattern is the same, except for the GDP of the North and Northeast regions, reaffirming preliminary indications pointed above. Naturally, this also indicates GDP gains in other regions are sufficient to reverse the losses in these two regions.

---

[30] Higher degree on the one hand and smaller on the other.

Table 8 shows that the requirement that subnational units deliver better fiscal results increases aggregate GDP performance and in all regions in both scenarios, except for the Northeast region in scenario 8, and considerably improves welfare of households, without exceptions. Therefore, the imposition of tougher subnational fiscal rules tends to favor all regions indistinctly.

Giuberti (2014), Nakaguma and Bender (2006), and Giuberti (2005) reinforce this finding for Brazil by demonstrating that rules under the Fiscal Responsibility Law, which seek to impose Hard Budget Restrictions, are effective in reducing subnational deficits, although the character, to use the term of the MPF literature, self-enforcing of that law profile or the type of fiscal rule governing the financial relationship between Union and subnational entities is more important over the years (Pires and Bugarin , 2003).

Table 7 – Percentage changes for levels of fiscal decentralization

	Fiscal Decentralization - Scenario 1							
	without FD		low		moderate		accentuated	
	Welfare	GDP	Welfare	GDP	Welfare	GDP	Welfare	GDP
NOR	-2.676	-0.043	-2.619	-0.062	-2.571	-0.082	-2.530	-0.100
NDE	-2.830	-0.039	-2.524	-0.066	-2.235	-0.097	-1.952	-0.126
COE	-3.979	-0.010	-3.345	-0.007	-2.553	0.003	-1.755	0.013
SDE	-4.605	0.017	-3.790	0.030	-2.919	0.042	-2.044	0.055
SUL	-2.787	-0.044	-1.994	-0.035	-1.069	-0.024	-0.137	-0.013
BRA	-3.7143	-0.0093	-3.0581	-0.0050	-2.3390	-0.0003	-1.6174	0.0046
	Fiscal Decentralization - Scenario 8							
	without FD		low		moderate		accentuated	
	Welfare	GDP	Welfare	GDP	Welfare	GDP	Welfare	GDP
NOR	2.647	-0.197	2.220	-0.637	1.683	-1.148	1.089	-1.682
NDE	2.733	-0.293	2.648	-0.685	2.397	-1.199	2.067	-1.754
COE	0.313	-0.022	0.964	-0.019	1.894	0.095	2.851	0.222
SDE	-0.772	0.130	0.167	0.260	1.176	0.394	2.204	0.537
SUL	2.163	-0.073	3.080	0.010	4.192	0.139	5.331	0.277
BRA	0.5397	-0.0010	1.2032	0.0071	1.9326	0.0171	2.6654	0.0277

Source: research results.

Finally, in Table 9, it can be observed that for Scenario 1, without factor migration, the variations are negative in all cases, except for the GDP of the Southeast. The imperfect factor mobility worsens the welfare of the Central-west and Southeast regions and the aggregate, and reduces the losses of the others, and the perfect mobility slightly reverses this trend[31]. In the case of GDP, only the Southeast region is benefited, including pulling the aggregate together. Aggregate GDP goes from a loss of 0.0093 to a loss of 0.0038 and then 0.040. Again, the perfect mobility slightly reverses the initial movement.

In scenario 8, with imperfect mobility, the Welfare improves in the Northeast, South and aggregate and worsens in the others. For GDP, losses only in the North and Northeast regions. The activation of perfect mobility accentuates the trend in some regions and reverts in others.

---

[31] In PAEG model, the perfect mobility factor considers the adjustment via response to variation in real prices.

In general, the evidence is that the introduction of factor mobility substantially increases the GDP of the Southeast and improves the Welfare of the North and Northeast regions. Later, with the reinforcement of the other simulations, this issue will be resumed with more detail. Anyway, from these results, since there was no change in the direction of evidences, using only two representative levels of each condition of *market-preserving* federalism is enough to test the theoretical hypothesis of the work[32]. The chosen ones are shown in Table 5 above.

Table 8 – Percentage changes for levels of budget constraint

	Budget Constraint - Scenario 1							
	deficit 3.2%		deficit 1.6%		surplus 1.6%		surplus 3.2%	
	Welfare	GDP	Welfare	GDP	Welfare	GDP	Welfare	GDP
NOR	-4.902	-0.046	-2.676	-0.043	1.774	-0.037	4.000	-0.034
NDE	-5.038	-0.040	-2.830	-0.039	1.584	-0.037	3.791	-0.036
COE	-6.198	-0.012	-3.979	-0.010	0.459	-0.006	2.678	-0.005
SDE	-6.812	0.015	-4.605	0.017	-0.193	0.020	2.013	0.022
SUL	-4.980	-0.044	-2.787	-0.044	1.599	-0.043	3.792	-0.043
BRA	-5.8422	-0.0107	-3.7143	-0.0093	0.5414	-0.0065	2.6691	-0.0051
	BC - Scenario 8							
	deficit 3.2%		deficit 1.6%		surplus 1.6%		surplus 3.2%	
	Welfare	GDP	Welfare	GDP	Welfare	GDP	Welfare	GDP
NOR	-5.022	-1.181	-2.787	-1.170	1.683	-1.148	3.918	-1.137
NDE	-4.184	-1.173	-1.991	-1.181	2.397	-1.199	4.590	-1.208
COE	-4.890	0.015	-2.629	0.042	1.894	0.095	4.155	0.121
SDE	-5.447	0.400	-3.239	0.398	1.176	0.394	3.384	0.392
SUL	-2.437	0.127	-0.227	0.131	4.192	0.139	6.401	0.142
BRA	-4.4686	0.0125	-2.3349	0.0140	1.9326	0.0171	4.0664	0.0187

Source: research results.

Thus, the findings for the 8 (eight) simulations or shocks in the initial equilibrium of the Brazilian economy for the year 2011 defined in the previous section are presented in the following tables. Table 10 shows the findings for scenarios 1 and 2, as shown in the previous section. What is common in these scenarios is that there is no change in the budget distribution of governments and no mobility of factors. What sets them apart is the soft budget constraint in the first case and hard in the second one.

We can observe in scenario 1, that the welfare and GDP of all regions fall (except the GDP of the Southeast), and in the aggregate these negative variations were of the order of 3.71% and 0.009%. That is, when a more realistic modeling for the Brazilian economy is introduced in the base model of the PAEG, including the variables of income transfers between the agents and the spheres of regional governments, but

---

[32] It is worth noting that for the fiscal decentralization and budget constraint conditions more levels could be defined, but for the factor mobility only the three mentioned, only in the latter condition there was some reversal (at the "third" level). However, since the results in all simulations were very close to imperfect and perfect mobility and there would be no possibility of testing a fourth level to check the consistency of the trend reversal, we opted for the imperfect one because it is more realistic

maintaining the same current structure of distribution of actual resources[33] (without fiscal decentralization), the evidence is that there is a worsening in the allocation of resources in the economy. This also explains the exclusivity of the Southeast results because the disaggregation of the model captures with a little more precision the economic performance differential of this region.

Table 9 – Percentage changes for levels of factor mobility

	FM - Scenario 1					
	without FM		Imperfect FM		Perfect FM	
	Welfare	GDP	Welfare	GDP	Welfare	GDP
NOR	-2.676	-0.043	-1.832	-0.227	-1.864	-0.222
NDE	-2.830	-0.039	-1.686	-0.298	-1.742	-0.281
COE	-3.979	-0.010	-4.154	-0.053	-4.187	-0.043
SDE	-4.605	0.017	-5.176	0.134	-5.150	0.126
SUL	-2.787	-0.044	-2.222	-0.073	-2.228	-0.071
BRA	-3.7143	-0.0093	-3.7158	-0.0038	-3.7155	-0.0040
	MF - Scenario 8					
	without FM		Imperfect FM		Perfect FM	
	Welfare	GDP	Welfare	GDP	Welfare	GDP
NOR	1.879	-0.076	1.683	-1.148	1.681	-1.117
NDE	2.172	-0.097	2.397	-1.199	2.372	-1.153
COE	1.915	0.008	1.894	0.095	1.879	0.122
SDE	1.505	0.046	1.176	0.394	1.188	0.372
SUL	3.342	-0.022	4.192	0.139	4.187	0.142
BRA	1.9286	0.0025	1.9326	0.0171	1.9327	0.0168

Source: research results.

Table 10 – Percentage changes in scenarios 1 and 2

Scenario 1				Scenario 2		
Regions	Welfare	GDP		Regions	Welfare	GDP
NOR	-2.676	-0.043		NOR	1.774	-0.037
NDE	-2.830	-0.039		NDE	1.584	-0.037
COE	-3.979	-0.010		COE	0.459	-0.006
SDE	-4.605	0.017		SDE	-0.193	0.020
SUL	-2.787	-0.044		SUL	1.599	-0.043
BRA	-3.7143	-0.0093		BRA	0.5414	-0.0065

Source: research results.

This first result is already relevant, since it is a confirmation of the hypothesis of this study, as it shows evidence of the veracity of its opposite: the governmental financial centralization associated with soft budget constraint, feature of Brazilian federalism, and with a great restriction for factor migration, something very

---

[33] Larger portion of the tax collection in the hands of the Federal Government and financial dependence of the regional transfer units of the Union.

likely in a country with continental dimensions and strong ties of regional identity of all kinds, worsens the economic performance of the nation.

In Scenario 2, with the imposition of hard budget constraints to regional governments, positive changes in welfare are already obtained in all regions and in the aggregate, except in the Southeast region (in fact, it was in the same direction as the other ones but not enough to revert the losses in earnings). The gain in the aggregate was 0.54. The GDP continues to suffer from negative changes, but now smaller than scenario 1, that is, there has been an improvement in the allocation of resources.

This is evidence of the importance of subnational fiscal austerity, largely neglected in public debates in Brazil on long-term fiscal reforms and in the implementation of credible and enforceable fiscal rules and fiscal institutes. The recent case in Brazil of the approval of a spending ceiling only for the Federal Government and the ineffectiveness of the Fiscal Responsibility Law to contain the indebtedness of several states makes this evident. In addition, it corroborates, as shown above, the previous results and, generally, the empirical literature for Brazil, that higher levels of budget constraints improve the efficiency of the economy, or inversely, lower levels worsen the economy (Rangel, 2002).

Table 11 presents the findings for scenarios 5 and 6. They have the following characteristics similar to the previous scenarios: without fiscal decentralization and with budget constraint, soft in one scenario and hard in the other. The difference is the inclusion of factor mobility in both cases, an important element in generating good economic incentives for subnational units, very emphasized by the literature of federalism since its inception.

Table 11 – Percentage changes in scenarios 5 and 6

Scenario 5				Scenario 6		
Regions	Welfare	GDP		Regions	Welfare	GDP
NOR	-1.832	-0.227		NOR	2.647	-0.197
NDE	-1.686	-0.298		NDE	2.733	-0.293
COE	-4.154	-0.053		COE	0.313	-0.022
SDE	-5.176	0.134		SDE	-0.772	0.130
SUL	-2.222	-0.073		SUL	2.163	-0.073
BRA	-3.7158	-0.0038		BRA	0.5397	-0.0010

Source: research results.

Therefore, in Scenario 5 (without fiscal decentralization, a soft budget constraint and no factor mobility) compared to Scenario 1 (Table 10), what is seen is a "worsening of losses" in GDP in all regions, except for the Southeast region that had a substantial economic performance (from 0.017 to 0.134), although not enough to reverse the result for Brazil that remained negative. Certainly, this is indicative that the well-known economically favorable conditions of production that determine prices of goods and services in this region become even more attractive in the new equilibrium with the inclusion of factor mobility for households who hold capital and labor considerably, affecting their GDP.

Concerning welfare, the results reveal that the inclusion of only one condition of the MPF was enough to improve welfare in the North, Northeast and South, worsening in the Center-west and Southeast and slightly in Brazil, although all remain negative (in relation to scenario 1 of Table 10). This can probably be explained by the fact that the losses of production factors to the Southeast were offset by relative gains in transfers of income from the federal government that make up the household budget, especially in the cases of the North and Northeast.

In Scenario 6, with the imposition of hard budget constraints, the welfare of all regions of Brazil (and consequently in the aggregate) rises, thus confirming an obvious theoretical postulate that demanding from surplus governments improves the economic situation of households in terms of disposable income to consume, since they will have to, in theory, pay less taxes. Although, to affect more substantially the GDP other mechanisms need to act, which in this work, will be the implementation of fiscal decentralization. Again, this reinforces the evidences previously found (and the body of empirical evidence in the literature) for the disciplining role of solid fiscal rules.

In this respect, as for GDP, the results were consistent with the previously displayed pattern of change from scenario 1 to scenario 2: improvement in GDP performance in all regions, except for a drop in the Southeast. However, it must be said that by comparing Scenario 6 to Scenario 2, factor mobility increased GDP losses in all regions, except for the Southeast region again. Aggregate GDP reached a slightly lower level of loss. This means that subnational fiscal austerity with mobility and without fiscal decentralization increases even more the attractiveness of the Southeast region to the production factors, albeit offset by the approximately inverse movement of private income gain.

Although this seems counterintuitive at first sight, this result is consistent with the income formation of the households shown in the previous section, where a good part of the income does not depend directly on the local productive activity, but comes from the transfer received from governments, especially federal, which increases Its revenue due to the increase in GDP in the Southeast.

The next two tables (12 and 13) present the findings for the implementation of fiscal decentralization (moderate) case with the features presented in section 4. The immediate consequence is that the Union greatly reduces its spending capacity, reducing consumption expenses and income transfers to households and to regional governments.

In the case of scenarios 3 and 4 (table 12), we return the hypothesis of restriction in the factor mobility. Comparing scenarios 3 and 1 (from Table 10) where the conditions of budget constraints and factor mobility are the same, the result to be highlighted is the improvement in welfare in all regions and, naturally, in the aggregate. As for GDP, there was a worsening of losses in the North and Northeast with decentralization and improvement in the other ones and in the aggregate.

In scenario 4, in comparison to scenario 3, with the HBC activation, there is a reversal of welfare losses, as always, except that this time, accompanied by fiscal decentralization, these gains are substantial, with the Southeast region obtaining a positive variation for the first time and the aggregate welfare of Brazil reaching its highest level so far, with a positive variation of 1.93%. This may suggest that fiscal

decentralization has complemented the already well-known positive effects of austerity policies by improving the adjustment of government choices to household preferences.

Table 12 – Percentage changes in scenarios 3 and 4

Scenario 3				Scenario 4		
Regions	Welfare	GDP		Regions	Welfare	GDP
NOR	-2.571	-0.082		NOR	1.879	-0.076
NDE	-2.235	-0.097		NDE	2.172	-0.097
COE	-2.553	0.003		COE	1.915	0.008
SDE	-2.919	0.042		SDE	1.505	0.046
SUL	-1.069	-0.024		SUL	3.342	-0.022
BRA	-2.3390	-0.0003		BRA	1.9286	0.0025

Source: research results.

In terms of GDP, improvement for all regions (in fact, the variation in the Northeast was the same) and aggregate, which also reached its highest level so far (+ 0.003%). In practice, fiscal decentralization with a budget constraint, in fact, as the theory predicts (Oates, 2005), even without mobility, significantly increases the efficiency of resource allocation in the Brazilian economy.

Contrasting scenario 4 with scenario 2 (in which there is no fiscal decentralization) the variations in welfare are higher in all regions. In the case of GDP, worse only in the North and Northeast. Certainly, the losses of the latter with fiscal decentralization (here and in scenario 3 in relation to 1) are possibly due to the general decrease of federal government expenditures due to tax decentralization, including a drop in the transfer of income to households and to regional governments, considering that the Union spends proportionally more in these regions, in theory, with the aim of equalizing the historical regional income inequalities punctuated in the introduction.

Once again, the Southeast region, which concentrates most of the productive activity of the country and, therefore is the net financier of the federal government, that is, it is responsible for the greater share of the its collection and receives much less resources of income transfers via households and regional government (because of the regional income equalization policy via constitutional transfer), is the largest beneficiary with the decrease in available resources of the Union, although less so than with the presence of factor mobility.

In any case, the evidence points broadly to a general improvement in the economy with fiscal decentralization, even though for the North and Northeast it has only turned into benefits for the households. Works such as Guedes and Gasparini (2007), and Gadelha (2012) have found similar results for Brazil using econometric models, that is, beneficial effects of decentralization in the national economy.

Finally, the results for the last two scenarios are presented in Table 13, being the eighth the specific test for the highest degree of the market-preservation federalism hypothesis. They show fiscal decentralization with factor mobility and soft budget constraint in case 7 and hard in case 8.

Initially, contrasting Scenario 7 with Scenario 5 (Table 11), fiscal decentralization worsened the welfare and GDP of the North and Northeast, and favored the Center-west, Southeast and South regions,

although the variations were all negative for the welfare. In production, the variations were negative for the two regions of welfare loss and positive for the others, and the aggregate GDP performance surpassed scenario 4 (higher until then), reaching a positive mark of 0.014.

Table 13 – Percentage changes in scenarios 7 and 8

Scenario 7				Scenario 8		
Regions	Welfare	GDP		Regions	Welfare	GDP
NOR	-2.787	-1.170		NOR	1.683	-1.148
NDE	-1.991	-1.181		NDE	2.397	-1.199
COE	-2.629	0.042		COE	1.894	0.095
SDE	-3.239	0.398		SDE	1.176	0.394
SUL	-0.227	0.131		SUL	4.192	0.139
BRA	-2.3349	0.0140		BRA	1.9326	0.0171

Source: research results.

This suggests that the "net effect" of factor mobility is greater than the hard budget constraint, although the de facto evidence is that simply the implementation of an institutional change that combines substantial fiscal decentralization and reduction in constraints on factor mobility or demand for fiscal austerity is already capable of raising the country's economic performance. In addition, it confirms the fact that the economic attractiveness, given a positive shock in the economy, of the productive sectors of the Southern regions, especially Southeast, are larger than the northerners.

Thus, the insertion of a hard budget constraint (scenario 8) corroborates what has been exposed so far and definitively supports the theoretical formulation of market-preserving federalism by raising GDP performance even more, reaching the highest level of increase of all the scenarios (0.017%) and significantly improving the welfare of all Brazilian regions, including the North and Northeast (although not the highest level they have ever achieved), mitigating the damaging effects of capital and labor migration. The aggregate welfare of families also reached its highest level in this scenario (1.93%). Hillbrecht (1997) found similar evidence for Brazil even before the advent of the Fiscal Responsibility Law.

Figure 1 below summarizes the findings for the Brazilian aggregate GDP. Three observations stand out: *(i)* the most important is the acceptance of the work hypothesis that market-preserving federalism (scenario 8 - highest degree) generates a greater economic performance than in all other experiments and its exact counterpart, the worst result (scenario 1 - lowest degree); *(ii)* hard budget constraint always improves economic efficiency (scenarios 1 to 2; 3 to 4; 5 to 6; and 7 to 8); and *(iii)* fiscal decentralization is more crucial than the other two conditions (2 to 3; 6 to 7; 5 to 3; and 6 to 4) and more important factor mobility than HBC.

Figure 2, however, condenses the findings for the general welfare of Brazilian households. The pattern detected is almost the same as GDP: confirmation of the market-preserving federalism hypothesis due to the greater positive variation for scenario 8 and lower for scenario 1, and again, hard budgetary constraint always increases welfare. However, now the order of importance of each condition changes slightly: hard budget
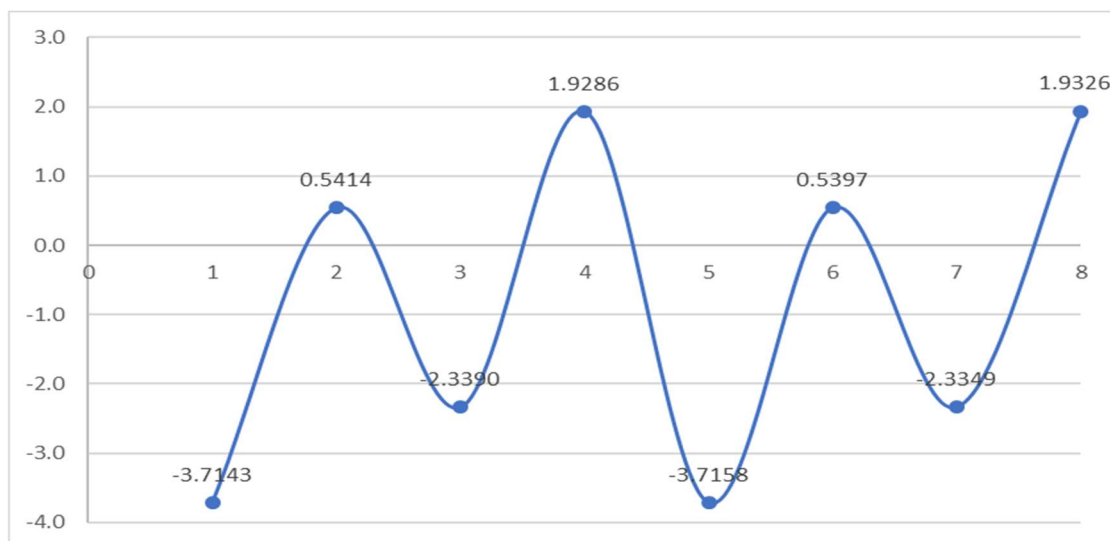
constraint on household welfare is more decisive, then fiscal decentralization and then factor mobility, where these two last conditions together are always better than only one, except in scenario 7.

Figure 1 – Variation of Brazilian GDP for each scenario
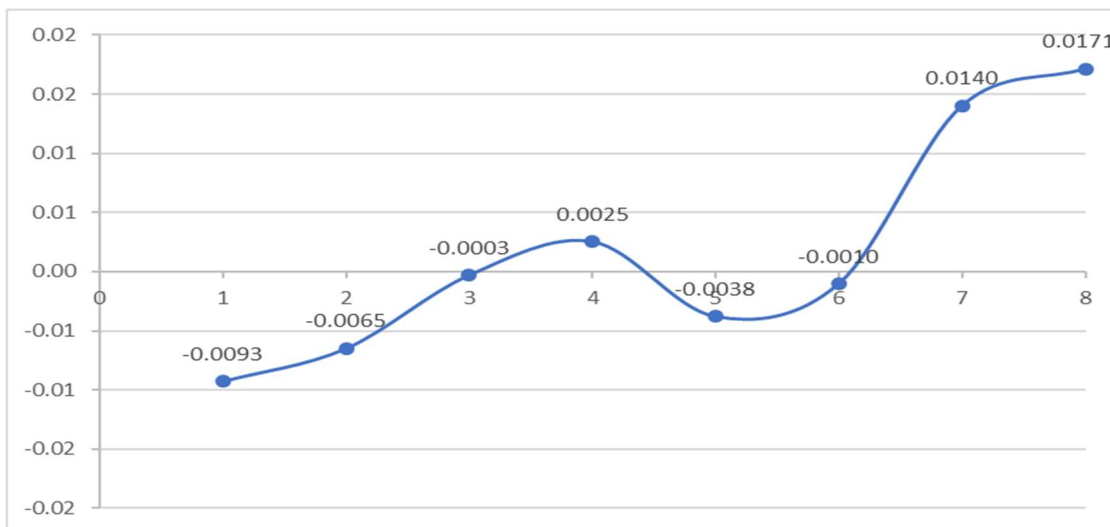
Source: research results.

Figure 2 – Variation in the Brasilian aggregate welfare for each scenario

Source: research results.

Therefore, in general, the results confirmed the MPF hypothesis: the granting of greater tax autonomy to the regional governments monitored or disciplined by imposition of hard budget constraints and factor mobility increased GDP and welfare. Although at the regional level the results were unequal and in different directions as predicted in the literature. The North and Northeast regions obtained higher losses in GDP due to the migration of factors as expected.

This phenomenon tends to occur, as in fact has happened in Brazil in the last decades (with the drastic reduction of migration costs), and the expectation of a segment of the theory is that, over time, governments

that lose labor and capital act to reverse this framework in order to create a favorable environment to economic activity. In Brazil, the excessive and prolonged use of transfer mechanisms to regional income equalization neutralizes this reaction, because tax losses are continually compensated and, in a way, rewarded. Callado (2005) did not find indications that these policies reach the redistributive goals that are being promoted.

On the other hand, Rodden and Rose-Ackerman (1997), to a certain extent, foresee this result when affirming that the MPF tends to exaggerate the regional disparities. In this direction, Cossio (2002) has shown that interregional socioeconomic differences in Brazil can be a serious impediment to overcoming fiscal crises in Brazilian federalism. As well as Simonassi and Cândido Junior (2008) found results indicating that the fiscal performance of states in Brazil is substantially influenced by the high social, political and economic discrepancies between Brazilian regions.

6 FINAL REMARKS

The main objective of this work was to conduct experiments by computable general equilibrium to test empirically for Brazil the validity of the main proposition of market-preserving federalism, which is: given certain conditions in the federative system, there will be economic gains for the nation. In the Brazilian case, it means implementing greater fiscal decentralization, "disciplined" through the imposition of hard budget constraints and greater factor mobility.

The results confirm the hypothesis that the Brazilian economy increases its performance, measured by the GDP and welfare of the households, with the adoption of fiscal federalism of the market-preserving type. Consequently, the problems constantly generated by decentralization in Brazil can be minimized if fiscal realignment between government spheres is anchored by solvency rules and factor mobility.

In the case of welfare, it represented direct gains for households in terms of increased income to consume more and thus gains in utility, a direct consequence of the reduction of the federal government in the economy (due to fiscal decentralization) and fiscal austerity of regional governments and indirect via factor migration. Particularly the implementation of the last two conditions always favored the welfare of the North and Northeast regions.

The other scenarios presented generally proved the urgent need to accomplish a true fiscal decentralization as *a sine qua non* condition to improve economic efficiency, proving the decisive importance of subnational fiscal autonomy in relation to the other conditions. However, in many cases, such institutional change has not benefited the North and Northeast regions, confirming the literature's concerns about the possible aggravation of interregional inequalities.

In this aspect, the reduction of the restrictions of factor mobility tends to worsen the GDP results of the North and Northeast regions, suggesting a structural competitive disadvantage in relation to others, even though it improves the welfare of these families.

Certainly, this fact occurs because the current structure of income transfer between agents has embedded a historical policy of regional income equalization in function of the known and historical problems of income inequalities in the national economy. Thus, this may suggest that, in a sense, because of these

redistributive policies, instead of attracting "good" capital and labor linked to production (which migrate to other regions) end up attracting capital and labor associated with income gains. This may lead one to reflect that these historical policies of regional income equalization only solve the problem "artificially" without effectively attacking its causes and without providing adequate grounds for a solid economic development.

On the other hand, the imposition of an environment that provides hard budget constraint proved to be predominantly beneficial in all scenarios and regions. Thus, the seriousness of the adoption of fiscal austerity policies for states and municipalities was highlighted, which is neglected in public debates in Brazil on long-term fiscal reforms and in the implementation of credible fiscal rules and fiscal institutes. The recent case in Brazil of approving a spending ceiling for only the Federal Government, the withdrawal of state and municipal officials from pension reform, and the ineffectiveness of the Fiscal Responsibility Law to contain the indebtedness of several states makes this evident.

Accordingly, policy recommendations are derived naturally from these conclusions. Some of the institutional changes to be applied to spheres of government in Brazil that could sustain a more consistent economic performance over time would be, for example: granting real tax autonomy to subnational governments, with little dependence on revenues from transfers, that is, the tax base itself should be approximately equal to available income and high indebtedness restriction to finance checking account expenditures. Indeed, the checking account deficit could be either constitutionally limited or by rationing on the capital market or by some combination of the two, with no prospect of Union financial bailouts[34].

Finally, to adopt measures that minimize restrictions on the free movement of capital, labor, goods and services between regions, favoring a competitive determination of the optimal choice of tax burden and public expenditure (including composition: capital expenditures vis-à-vis current expenses) of governments in order to foster local economic activity. This could be accomplished by improving legal certainty in general (increasing the probability of closing good work and investment contracts) and spending on transport and telecommunications infrastructure, to give a few examples.

However, some of the limitations of this work are obvious and should generate parsimony in the applications of its conclusions. The first and most important one is it was operated in a comparative statics environment with exogenous investment in the base year. It is natural that a market-preserving federalism test in a dynamic structure generates more robust results, and may even be able to elucidate the question of increasing regional disparities, that is, if over time the governments of the North and Northeast would respond positively or not to the disciplinary effects of fiscal decentralization and factor migration, creating a more favorable environment for economic activity.

Certainly, another limitation is the aggregation of data into a single regional government, condensing states and municipalities that are jurisdictional by region. Although there is a reasonable approximation of what would occur (and what is possible with the data presently), it is a fact that the decision-making sphere of governments does not take place at this level, losing the possibility of capturing differences of results within the regions (within each region there are states with very different fiscal profiles). Ideally, with the

---

[34] As political incentives almost always induce contrary behavior, a law could be voted upon by strictly prohibiting the Union from rescuing any government financially.

disaggregation of interregional matrices for all Brazilian states and municipalities, much more realistic models could be used.

Finally, it is suggested to continue the work of disaggregating the data of the Brazilian interregional matrixes that is being carried out here and there by the Brazilian research community of the area, perhaps in a way that could access the information in a centralized way in order to fulfill this gap.

In any case, further investigations on the impacts of the MPF on regional inequalities has proved to be a good suggestion for future works. This is a matter of extreme relevance because of its historical, conflictive character and potential to change the direction of vital economic reforms to the Brazilian economy.

REFERENCES

Aguiar, Angel, Badri Narayanan, & Robert McDougall. (2016). An Overview of the GTAP 9 Data Base. *Journal of Global Economic Analysis*, 1(1): 181-208.

Boex, J., & Edwards, B. (2016). The (Mis-) Measurement of Fiscal Decentralization in Developing and Transition Countries: Accounting for Devolved and Nondevolved Local Public Sector Spending. *Public Finance Review*, *44*(6), 788-810.

Callado C. M. (2005). *Sobre a História e estrutura atual do Federalismo Fiscal no Brasil.* Tese de Doutorado. Universidade de Colônia, Alemanha.

Cossio, F. A. B. (2002). *Ensaios sobre Federalismo Fiscal no Brasil*. Rio de Janeiro, RJ. Tese de doutorado. Pontifícia Universidade Católica do Rio de Janeiro – PUC-Rio, 165 p.

de Figueiredo, R. J. P.; Weingast, B. R. (2005). Self-Enforcing Federalism. *The Journal of Law, Economics and Organization*, 21(1): 103-135.

Gadelha, S. R. (2012). Analisando o Impacto da Descentralização Fiscal na Saúde Pública: Evidência Empírica para os Municípios Brasileiros (2000-2009). Texto para Discussão, n. 012. Tesouro Nacional.

Giuberti, A. C. (2014). Instituições Orçamentárias e Resultado Fiscal do Governo Federal Brasileiro. In *Anais do XLI Encontro Nacional de Economia*. ANPEC-Associação Nacional dos Centros de Pós-graduação em Economia.

Giuberti, A. C. (2005). *Efeito da lei de responsabilidade fiscal sobre os gastos dos municípios brasileiros*. São Paulo, SP. Dissertação de mestrado. Universidade de São Paulo – USP, 54 p.

Guedes, K. P., & Gasparini, C. E. (2007). Descentralização fiscal e tamanho do governo no Brasil. *Economia Aplicada*, *11*(2), 303-323.

Gurgel, A. C. (2002). *Impactos econômicos e distributivos de mudanças nas relações comerciais da economia brasileira na presença de economias de escala*. Viçosa: UFV, 2002. 198 p. Tese (Doutorado em Economia Aplicada) – Universidade Federal de Viçosa.

Hillbrecht, R. (1997). Federalismo e a união monetária brasileira. *Estudos Econômicos*, 27(1): 53-67.

Hertel, T. W. (ed.). (1997). *Global trade analysis: modeling and applications*. Cambridge University Press, Cambridge and New York.

Lanz, B., & Rutherford, T. F. (2016). GTAPinGAMS: Multiregional and Small Open Economy Models. *Journal of Global Economic Analysis*, *1*(2), 1-77.

Martinez-Vazquez, J., Lago-Peñas, S., & Sacchi, A. (2016). The impact of fiscal decentralization: A survey. *Journal of Economic Surveys,* 0(0): 1-35.

Musgrave, R. (1959). *The theory of public finance*. New York, McGraw-Hill. 628 p.

Nakaguma, M. Y.; Bender, S. (2006). A Emenda da Reeleição e a Lei da Responsabilidade Fiscal: impactos sobre ciclos políticos e performance fiscal dos Estados. *Economia Aplicada*, São Paulo, 10 (3): p. 377-397, julho-setembro.

North, D. C.; Weingast, B. R. (1989). Constitutions and commitment: the evolution of institutional governing public choice in seventeenth-century England. *The Journal of Economic History*, 49(4): 803-832.

Oates, W. E. (1972). *Fiscal Federalism*. New York, Harcourut Brace Jovanovich. 256 p.

Olson, M. (1969). The principle of" fiscal equivalence": the division of responsibilities among different levels of government. *The American economic review*, *59*(2), 479-487.

Palermo, P. U.; Porsse, A. A. Portugual, M. S. (2013). Impactos Regionais da Reforma Tributária: Lições de uma Análise EGC para o Rio Grande do Sul. *Pesquisa e Planejamento Econômico*, 43(3): 585-624.

Pereira, M. W. G. (2011). *Efeitos de políticas tributárias e de liberalização comercial sobre a competitividade setorial das macrorregiões brasileiras*. Viçosa: UFV, 2011. 148 p. Tese (Doutorado em Economia Aplicada) – Universidade Federal de Viçosa.

Pires, H. A. A.; Bugarin, M. S. (2003). Metas de déficit: Transferências intergovernamentais e o controle do endividamento dos Estados. *Revista Brasileira de Economia*, 57(4): 775-794, out/dez.

Porsse, A. A. (2008). Aumento do ICMS no Rio Grande do Sul, em 2005: uma Análise de Equilíbrio Geral Computável. *Ensaios FEE*, 28(especial): 701-726.

Pyatt, G. (1999). Some relationships between T-accounts, input–output tables and social accounting matrices. *Economic Systems Research*, *11*(4), 365-387.

Rangel, M. A. (2003). *Resgates financeiros, restrição orçamentária fraca e postura fiscal nos estados brasileiros*. Rio de Janeiro, BNDES.

Rezende, F.; Afonso, J. R. (2004). A federação brasileira: fatos, desafios e perspectivas. *Federalismo e integração econômica regional–desafios para o Mercosul.* Rio de Janeiro: Konrad Adenauer, 301-362.

Resende, F. (2001). *Finanças Públicas*. São Paulo, Atlas. 384 p.

Riker, W. H. (1964). *Federalism: Origin, operation, significance*. Boston, Little, Brown. 169 p.

Rutherford, T. F. (2010). *GTAP7inGAMS*. Center for Energy Policy and Economics, Department of Management, Technology and Economics, ETH Zurich.

Rutherford, T. F., Paltsev, S. V. (2000). *GTAPinGAMS and GTAP-EG: global datasets for economic research and illustrative models*. Boulder: Department of Economics - University of Colorado. 64 p. (Working Paper).

Rutherford, T. (1999). Applied general equilibrium modeling with MPSGE as a GAMS subsystem: an overview of the modeling framework and syntax. *Computational Economics*, 14, p.1-46.

Rodden, J.; Rose-Ackerman, S. (1997). Does Federalism Preserve Markets? *Virginia Law Review*, 83(7):1521-72.

Serra, J.; Affonso, J. R. R. (1999). Federalismo fiscal à brasileira: algumas reflexões. *Revista do BNDES*, 6(12): 3-30.

Simonassi, A. G.; Cândido Júnior, J. O. (2008). *Desempenho Fiscal e os impactos sobre as responsabilidades fiscal e social nos Estados e Regiões brasileiras*. Texto para Discussão**,** n. 1323, IPEA.

Teixeira, E. C.; Pereira, M. W. G.; Gurgel, A. C. (2013). *A Estrutura do PAEG***.** Campo Grande: Life Editora.

Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of Political Economy*, 64(5): 416-424.

Wallis, J. J.; Weingast, B. R. (2005). *Equilibrium Impotence: Why the States and Not the American National Government Financed Economic Development in the Antebellum Era*. No. w11397. National Bureau of Economic Research.

Xie, D., Zou, H. F., & Davoodi, H. (1999). Fiscal decentralization and economic growth in the United States. *Journal of Urban Economics*, *45*(2), 228-239.

Weingast, B. R. 2014. Second generation fiscal federalism: political aspects of decentralization and economic development. *World Development*, 53: 14-25.

Weingast, B. R. (2009). Second generation fiscal federalism: The implications of fiscal incentives. *Journal of Urban Economics*, 65(3): 279-293.

Weingast, B. R. (2005). The performance and stability of federalism: an institutional perspective. In: C. Ménard; M. M. Shirley (eds.), *Handbook of New Institutional Economics*. New York, Spring, p. 149-172.

Weingast, B. R. (1995). The economic role of political institutions: market-preserving federalism and economic development. *Journal of Law, Economics, & Organization*, 11(1): 1-31.