Post-2008 Brazilian Fiscal Policy: an Interpretation through the Analysis of Fiscal Multipliers

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Abstract

The global crisis that erupted in 2007 led many countries to embark on counter-cyclical fiscal policies as a way to cushion the blow of a depressed aggregate demand. Advocates of discretionary measures emphasize that fiscal policy can indeed stimulate the economy. The main goal of this work is to assess whether the fiscal policies pursued by the Brazilian government in the aftermath of the 2008 crisis succeeded in bringing the economy back on track in a sustainable fashion. To this end, the fiscal multipliers of five different shocks are studied in a small open-economy New Keynesian framework. Our results point to the government spending and public investment as the most effective fiscal tools for combating the crisis. However, the highest fiscal multiplier turned out to be the one associated with excise tax reductions. Interestingly, contrary to the government's expectations, this policy of lowering taxes on manufactured durable goods (IPI) was found to be neutral at a longer horizon as it was not applied horizontally to all sectors of the economy.

Key-words: DSGE Models, Fiscal Multipliers, New Keynesian Model.
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1   Introduction

In 2008 the Brazilian government, in an attempt to unleash more resources to households so as to increase private consumption, widened the existing range of

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top marginal rates in which the personal income tax was structured. In addition, it lowered the tax on manufactured products (IPI) in the acquisition of cars and trucks. On the spending side, public investment plans as well as government current expenditure growth were maintained throughout the year 2009 in the midst of falling fiscal revenues owing to the economic slowdown (Moreira, 2010).

Also, with the aim of boosting aggregate demand, the Brazilian government launched the so-called PAC 2 in March 2010 with an estimate of around R\$ 1,59 trillions. This program, which was an extension of the Growth Acceleration Program (Programa de Aceleração do Crescimento – PAC[1]–, in Portuguese) created in January of 2007, projected investments of R\$ 503,9 billions up until 2010.

This article aims to shed some light on the discussion about the effects of the post-2008 Brazilian fiscal policy. Specifically, we set out to examine whether this fiscal expansion had a positive (and permanent) effect on the economic activity by focusing on the analysis of the fiscal multiplier on each sort of stimulus considered, namely tax cuts on consumption, on labor income, on capital gains, government consumption and investment shocks[2]. The baseline model we employ is a small open-economy New Keynesian one in which both public spending and tax shocks are included and the parameters have been estimated through Bayesian methodology.

Seeking to understand, analyze and compare the effects of expenditure- and revenue-based fiscal policies on the Brazilian economy over the post-crisis period of 2008, a standard DSGE model (with the main frictions of this methodology) has been developed and estimated. The model features public capital stock as an input, thus allowing for the analysis of the effects of shocks to public investment on the marginal productivity of private inputs and on the GDP. It is worth noting that the aggregate demand policy put in place through PAC 2 was found to be the main lever to overcome the crisis. On the other hand, the IPI exemption from durable-goods consumption proved useless in the end, even though its impact multiplier was the greatest one in our study. The reason for this unsuccessful result lies in the way this measure was implemented, since it was only focused on the durable goods sector.

The remainder of the paper is organized as follows: Section 2 introduces the model, sections 3, and 4 explain the data, calibration and estimation of the structural parameters, respectively. Section 5 presents the results and section 6 con-

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[1]PAC is a Brazilian federal government's program consisting of a set of economic policies (investment in infrastructure, housing, transport, energy and water, among others) targeted at contributing to the acceleration of Brazilian economic growth.

[2]We have opted to leave the shock to net transfers to households out of our work for this variable plays an important adjustment role in the stationarity of public debt.

cludes.

2 Fiscal multiplier: definition and literature

This section intends to lay out the fiscal multiplier definition used throughout this paper, as well as present the national and international literature covering the topic at hand.

Definition 2.1 (Fiscal multiplier)**.** It is the ratio of a change in output (ΔY) to an exogenous change in fiscal policy (increase in public spending, ΔG, or tax cut, ΔT)). There are different sorts of multipliers:

$$\text{Impact multiplier} = \frac{\Delta Y_t}{\Delta G_t}$$

$$\text{Multiplier at horizon N} = \frac{\Delta Y_{t+N}}{\Delta G_t}$$

$$\text{Cumulative multiplier} = \frac{\sum_{j=0}^{N} \Delta Y_{t+j}}{\sum_{j=0}^{N} \Delta G_{t+j}}$$

In discussing the values of the multipliers associated with each fiscal policy measure, we choose to work with the latter as it is the most common one used within the literature.

Due to the rapid development of the fiscal policy literature, it is now well accepted that the size of the fiscal multipliers is influenced by several factors. Every time the government carries out an expansionary fiscal policy, a bit of that effect is saved and/or used to buy imports (this is referred to as leakages in the literature). These leakages are greater when it comes to tax exemptions than in the case of public spending, as the latter impacts the aggregate demand directly. That said, some relevant variables that account for the size of those leakages are the marginal propensity to consume, the marginal propensity to import, liquidity-constrained agents (non-Ricardian households) and the existence of automatic stabilizers, among others. The way the monetary authority reacts to the fiscal shock is also decisive, as if it accommodates the ensuing demand expansion – by holding the basic interest rate constant in response to this higher aggregate demand –, investment and consumption will fall less than in the case the central bank pursues a tighter monetary policy (lower crowding-out effect).

Finally, it can be interesting to present the expected values for the fiscal multipliers. A "rule of thumb" is a public-spending multiplier ($\frac{\Delta Y}{\Delta G}$) between 1 and 1,5

for the large economies, between 0,5 and 1 for medium-size economies, and smaller than 0,5 in case of small economies (the Brazilian case). Overall, multipliers associated with tax revenues, public investment or income transfers amount to half of the value of the spending multipliers. Having negative fiscal multipliers is possible, especially if the fiscal boost worsens the public debt sustainability (Spilimbergo et al, 2009).

The national literature is relatively scant, and this scarcity grows when it comes to articles employing DSGE models to address this issue. However, two articles can be deemed as the pioneers in closing this gap. The first one is Moura (2015), where the author uses a DSGE model to derive present-value multipliers related to public consumption and investment. Although the aforementioned model has significant strengths, its main weakness has to do with the fact that the author does not consider distortionary taxes into the model, which does not contribute to enriching the debate. His results show that, in spite of the effect of public consumption on GDP being positive on impact, the long-run effect is smaller than unity in all the scenarios analyzed (for some parameterizations the said effect was even negative). According to the author, the cause of this low long-run value resides in the need of fiscal adjustment, leading to future decreases in public consumption and investment. On the contrary, not only does the government investment have a positive impact on the economy in the short run, but its long-run effect exceeds the unity. This is because the bigger stock of public capital brings about productivity gains for the whole economy.

The second paper is Cavalcanti and Vereda (2014) in which they quantify and compare the macroeconomic impacts of several kinds of public spending – purchases of goods and services, investments, social transfers and public wages and salaries –, under different fiscal rules. This work is however limited in the sense that the analysis relies on a calibrated but not estimated DSGE model for the Brazilian economy. The chief results obtained by those authors indicate that, under rules of tax-based fiscal consolidations, the larger positive short-run effect on GDP arises from the increase in public employment, whereas the most negative effect associates itself with income transfers. On the other hand, under fiscal rules for some spending item, there does not exist any type of public outlay that gives rise to a significant positive impact on GDP in the short run. In the medium run, the best way to make GDP grow is via increases in public investment, which can lead to substantially greater-than-unity multipliers, depending on the fiscal rule in use. In addition, under a permanent balanced budget policy, the majority of public expenditure items yield negligible or even negative multipliers, as opposed to positive ones when a policy of delayed or partial fiscal adjustment is conducted.

In the international literature, DSGE models are relied upon even more intensely in the study of fiscal multipliers. Zubairy (2010) estimates a DSGE model with fiscal features using Bayesian techniques for the U.S. economy. The author finds a public-spending multiplier of 1,12, in contrast to the tax exemptions from labor income and capital income, whose multipliers are 0,13 and 0,33, respectively. Christiano et al. (2009), by means of a DSGE model, seek to obtain a greater-than-one multiplier when the economy is at the zero lower bound. They come up with a multiplier effect which is substantially larger than one, this result being fully consistent with the behavior of the main macroeconomic variables over the 2008 crisis. Woodford (2010) also tackles shocks to government expenditures. Throughout this article, the author aims at providing an explanation for the main factors determining the efficiency of fiscal stimulus on output and employment by using a New-Keynesian model. Results show that delays in the price and wage adjustment can raise the size of public-spending multipliers, and that its value would be bigger than one as long as the monetary authority keeps interest rates unchanged. Meanwhile, that value can be far lower if the monetary authority bids up interest rates in response to a rise in spending.

It may also be worth reviewing some articles that do not resort to DSGE models in accounting for the effectiveness of fiscal policies and their associated multipliers for the case of Brazil. Cavalcanti and Silva (2010) attempt to understand the effects of fiscal policy for this economy over a period spanning 1995 to 2008 by making use of a VAR model that emphasizes the role of public debt in the efficiency of fiscal policy. Their results suggest that there exists an explicit role of public debt in the evolution of the fiscal variables over economic activity. Therefore, a fiscal shock influencing public debt should engender future movements in public expenditures and revenues which tend to attenuate the initial effects of the shock.

Mendoça et al. (2009) deploy data spanning from 1995 to 2007 so as to investigate the effects of fiscal shocks on the Brazilian economy. Their results imply that private consumption and interest rates rise as government spending unexpectedly goes up. Nevertheless, output is very likely to fall. These results point to the presence of crowding-out effects between public spending and private investment. As regards the expansionary shock to revenues, it is possible for output to drop in the short run, but a positive reaction of this variable is likely to materialize in the longer run.

Peres and Ellery Junior (2009) examine the dynamic effects of shocks to federal fiscal variables on the economic activity in Brazil for the post-Real-Plan period by utilizing a Structural VAR comprising output, public spending and net taxes. These authors compare their results with those found in the international literature for

the case of the American economy and other OCDE countries and come to the conclusion that they are similar in that the output response to fiscal shocks is positive but small in both economic areas.

Fantinatti (2015) looks into the policy of tax exemption applied to the IPI on durable goods during the post-crisis 2008 period. His results underline the fact that fiscal boosts in the sector of durable goods were unimportant, and apparently the best tax-exemption policy would be to foster the sector of non-durable goods on account of two main reasons: the share of non-durable goods over GDP; and the assumption that government consumption is biased towards non-durable goods, which renders fiscal adjustment less imperative.

3 The model

Our model follows the New-Keynesian tradition and, in addition to price frictions, it features wage rigidity. It also encompasses non-Ricardian agents, habit formation in consumption, investment adjustment cost, cost of servicing a growing net foreign debt, and variable capital utilization. This section intends to describe the economy under discussion by focusing first on households, then presenting firms, next the government and ending with the external sector.

3.1 Households

There is a continuum of households indexed by $j \in [0,1]$. A share ω_R of this continuum of households indexed by $R \in [0, \omega_R)$ have access to financial markets, and they behave as Ricardian agents, that is, they maximize their intertemporal utility. The remaining share of households indexed by $NR \in [\omega_R, 1]$ cannot save and simply consume their after-tax disposable income. This type of agent is referred to as non-Ricardian household in the literature.

3.1.1 Determining consumption and saving of the Ricardian household

The representative ricardian household is assumed to maximize its inter-temporal utility by choosing consumption, savings, investment and leisure. As for the saving decision, she can choose between three different instruments – physical capital, foreign bonds and government bonds, indexed by j. In other words, this agent elects how much to consume, how much to work and how much to save and invest by accumulating financial assets and physical capital in order to maximize the discounted

stream of expected utility.

The stand-in consumer's formal problem boils down to,

$$\max_{C_{R,j,t}, K^P_{j,t+1}, U_{j,t}, I^P_{j,t}, B_{j,t+1}, B^F_{j,t+1}} E_t \sum_{t=0}^{\infty} \beta^t S^P_t \left[\frac{(C_{R,j,t} - \phi_c C_{R,j,t-1})^{1-\sigma}}{1-\sigma} - S^L_t \frac{L^{1+\varphi}_{R,j,t}}{1+\varphi} \right] \tag{1}$$

subject to her budget constraint,

$$P_t(1+\tau^c_t)(C_{R,j,t} + I^P_{j,t}) + \frac{B_{j,t+1}}{R^B_t} + R^F_{t-1} S_t B^F_{j,t}$$

$$= W_t L_{R,j,t}(1-\tau^l_t) + R_t U_{j,t} K^P_{j,t}(1-\tau^k_t) - P_t K^P_{j,t} \left[\Psi_1(U_{j,t}-1) + \frac{\Psi_2}{2}(U_{j,t}-1)^2 \right]$$

$$+ B_{j,t} + S_t B^F_{j,t+1} - \frac{\chi_{BF}}{2} \left(B^F_{j,t+1} - B^F_{j,ss} \right)^2 S_t + \omega_R TRANS_{j,t} P_t \tag{2}$$

and to the following law of motion for capital,

$$K^P_{j,t+1} = (1-\delta)K^P_{j,t} + I^P_{j,t} \left[1 - \frac{\chi}{2} \left(\frac{I^P_{j,t}}{S^I_t I^P_{j,t-1}} - 1 \right)^2 \right] \tag{3}$$

The intertemporal preference shock:

$$\log S^P_t = (1-\rho^P)\log S^P_{ss} + \rho^P \log S^P_{t-1} + \varepsilon_{P,t} \tag{4}$$

onde $\varepsilon_{P,t} \sim N(0, \sigma^P)$

The quality of investment shock:

$$\log S^L_t = (1-\rho^L)\log S^L_{ss} + \rho^L \log S^L_{t-1} + \varepsilon_{L,t} \tag{5}$$

where $\varepsilon_{L,t} \sim N(0, \sigma^L)$

Com choque nas condições de investimento:

$$\log S^I_t = (1-\rho^I)\log S^I_{ss} + \rho^I \log S^I_{t-1} + \varepsilon_{I,t} \tag{6}$$

onde $\varepsilon_{I,t} \sim N(0, \sigma^I)$

where E_t is the expectations operator, $\beta \in (0,1)$ is the intertemporal discount factor, C_R denotes consumption, L_R denotes labor, S^P refers to the intertemporal shock, S^L is the shock on labor supply, ψ is the marginal disutility of labor and σ

is the coefficient of relative risk aversion.

Regarding the budget constraint, P is the general price level, I^P is private investment, B is a one-year government bond, B^F is a one-year foreign bond, R^B is the rate of return on the government bond (basic interest rate), R^F denotes the world interest rate, S is the nominal exchange rate, W is the wage, R is the return to capital, K^P is the private stock of capital, U is the capital utilization rate, χ is a parameter governing the adjustment cost's sensitivity, $TRANS$ is the net income transfers to households by the government, τ_c, τ_l, τ_k stand for the consumption tax rate, labor-income tax rate and capital-income tax rate, respectively. The term $\left[\frac{\chi_{BF}}{2} \left(B_{t+1}^F - B_{ss}^F \right)^2 S_t \right]$ represents a stationarity-inducing technique (Schmitt-Grohé e Uribe, 2003).

We adopt the convention that B_t and B_t^F are the nominal bonds issued in (t-1) and matured in t. For convenience, all bonds are regarded to be one-period bonds. Hence, both B_{t+1}, B_{t+1}^F and K_{t+1} are decided in t.

Solving the Ricardian household's problem, we are left with the following first-order conditions:

$$\lambda_{R,j,t} P_t (1 + \tau_t^c) = S_t^P \left(C_{R,j,t} - \phi_c C_{R,j,t-1} \right)^{-\sigma}$$

$$-\phi_c \beta E_t \left[S_{t+1}^P \left(C_{R,j,t+1} - \phi_c C_{R,j,t} \right)^{-\sigma} \right] \tag{7}$$

$$Q_t = \beta E_t \left\{ (1-\delta) Q_{t+1} + \lambda_{R,j,t+1} R_{t+1} U_{j,t+1} (1 - \tau_{t+1}^k) \right.$$

$$\left. -\lambda_{R,j,t+1} P_{t+1} \left[\Psi_1 (U_{j,t+1} - 1) + \frac{\Psi_2}{2} (U_{j,t+1} - 1)^2 \right] \right\} \tag{8}$$

$$\frac{R_t}{P_t} = \left(\frac{1}{1 - \tau_t^k} \right) \left[\Psi_1 + \Psi_2 (U_t - 1) \right] \tag{9}$$

$$\lambda_{R,j,t} P_t (1 + \tau_t^c) - Q_t \left[1 - \frac{\chi}{2} \left(\frac{I_{j,t}^P}{S_t^I I_{j,t-1}^P} - 1 \right)^2 - \chi \left(\frac{I_{j,t}^P}{S_t^I I_{j,t-1}^P} \right) \left(\frac{I_{j,t}^P}{S_t^I I_{j,t-1}^P} - 1 \right) \right]$$

$$= \chi \beta E_t \left[\frac{Q_{t+1}}{S_{t+1}^I} \left(\frac{I_{j,t+1}^P}{I_{j,t}^P} \right)^2 \left(\frac{I_{j,t+1}^P}{I_{j,t}^P} - 1 \right) \right] \tag{10}$$

$$\frac{\lambda_{R,t}}{R_t^B} = \beta E_t \lambda_{R,t+1} \tag{11}$$

$$\beta R_t^F E_t \left(\lambda_{R,t+1} S_{t+1}\right) = \lambda_{R,t} S_t \left[1 - \chi_{BF} \left(B_{j,t+1}^F - B_{j,ss}^F\right)\right] \tag{12}$$

3.1.2 Determining consumption and saving of the non-Ricardian household

The non-Ricardian household's behavior is simpler owing to her liquidity constraint which does not enable her to maximize her utility intertemporally. Thus, the non-Ricardian agent's consumption must match her current income each period. In reality, even without access to "credit", this kind of agent would be able to carry over current income into the future (by saving). In order to make the model more tractable, this agent will be also assumed to be unable to save. Therefore, the problem faced by this non-Ricardian consumer is:

$$\max_{C_{NR,j,t}} E_t \sum_{t=0}^{\infty} \beta^t S_t^P \left[\frac{(C_{NR,j,t} - \phi_c C_{NR,j,t-1})^{1-\sigma}}{1-\sigma} - S_t^L \frac{L_{NR,j,t}^{1+\varphi}}{1+\varphi} \right] \tag{13}$$

subject to her budget constraint,

$$P_t(1 + \tau_t^c)C_{NR,j,t} = W_t L_{NR,j,t}(1 - \tau_t^l) + (1 - \omega_R)TRANS_t P_t \tag{14}$$

The first-order condition is the following:

$$\lambda_{NR,j,t} P_t(1 + \tau_t^c) = S_t^P \left(C_{NR,j,t} - \phi_c C_{NR,j,t-1}\right)^{-\sigma}$$

$$-\phi_c \beta E_t \left[S_{t+1}^P \left(C_{NR,j,t+1} - \phi_c C_{NR,j,t}\right)^{-\sigma} \right] \tag{15}$$

3.1.3 Wage setting

The household's choice over the wage level entails the assumption that this agent supplies differentiated labor under a monopolistically competitive framework. This service is sold to a representative labor aggregator which combines all those different labor services (L_j) into a single input (L) by means of the Dixit-Stiglitz technology.

$$\max_{L_{j,t}} W_t L_t - \int_0^1 W_{j,t} L_{j,t} dj \tag{16}$$

subject to the following technology:

$$L_t = \left(\int_0^1 L_{j,t}^{\frac{\psi_W - 1}{\psi_W}} dj \right)^{\frac{\psi_W}{\psi_W - 1}} \tag{17}$$

The first-order condition is given by:

$$L_{j,t} = L_t \left(\frac{W_t}{W_{j,t}} \right)^{\psi_W} \tag{18}$$

This equation represents the household j's demand for labor. Plugging the latter into the preceding technology (17) results in the aggregate wage level:

$$W_t = \left(\int_0^1 W_{j,t}^{1-\psi_W} dj \right)^{\frac{1}{1-\psi_W}} \tag{19}$$

In each period, a share $1 - \theta_W$ of households, which are randomly and independently chosen, set their wage in an optimal manner. The remaining households, θ_W, follow a sticky-wage rule ($W_{j,t} = W_{j,t-1}$). In taking the decision to pick their wage level in the period t, the wage-setting households are aware they face the probability θ_W^N of the wage being fixed for N periods in the future, regardless of whether the household makes the optimal choice $W_{j,t}^*$ in the current period. Accordingly, the household seeks to solve the following problem:

$$\max_{W_{j,t}^*} E_t \sum_{i=0}^{\infty} (\beta \theta_W)^i \left\{ -S_{t+i}^P S_{t+i}^L \frac{L_{Z,j,t+i}^{1+\varphi}}{1+\varphi} - \lambda_{Z,t+i} \left[-W_{j,t}^* L_{Z,j,t+i} (1-\tau_{t+i}^l) \right] \right\} \tag{20}$$

where $Z = \{R, NR\}$.

subject to the household js demand for labor (17).

Solving that problem yields the following first-order conditions for both the Ricardian and non-Ricardian households:

$$W_{j,t}^* = \left(\frac{\psi_W}{\psi_W - 1} \right) E_t \sum_{i=0}^{\infty} (\beta \theta_W)^i \left[\frac{S_{t+i}^P S_{t+i}^L L_{R,j,t+i}^{\varphi}}{\lambda_{R,j,t+i}(1-\tau_{t+i}^l)} \right] \tag{21}$$

$$W_{j,t}^* = \left(\frac{\psi_W}{\psi_W - 1} \right) E_t \sum_{i=0}^{\infty} (\beta \theta_W)^i \left[\frac{S_{t+i}^P S_{t+i}^L L_{NR,j,t+i}^{\varphi}}{\lambda_{NR,j,t+i}(1-\tau_{t+i}^l)} \right] \tag{22}$$

Because a share $1 - \theta_W$ of the households elect the same nominal wage, $W_{j,t}^* = W_t^*$, and the remaining share, θ_W, receive the same wage as in the preceding period, the aggregate nominal wage can be written as follows:

$$W_t = \left[\theta_W W_{t-1}^{1-\psi_W} + (1-\theta_W) W_t^{*1-\psi_W} \right]^{\frac{1}{1-\psi_W}} \tag{23}$$

The gross wage-inflation rate can be defined as:

$$\pi_{W,t} = \frac{W_t}{W_{t-1}} \tag{24}$$

3.1.4 Combining consumption and labor

Aggregate consumption and labor, respectively, are given by:

$$C_t = \omega_R C_{R,t} + (1 - \omega_R)C_{NR,t} \tag{25}$$

$$L_t = \omega_R L_{R,t} + (1 - \omega_R)L_{NR,t} \tag{26}$$

3.2 Firms

3.2.1 Final Good Producer (Retail)

From an aggregate perspective, monopolistic competition involves, among other things, confronting the fact that consumers purchase a great variety of goods with the need of modeling in which the consumer is assumed to buy only a specific kind of good (a bundle comprised of all goods). This aggregate good is sold by a perfectly competitive retail firm. In other words, all the retailers are assumed identical to each other.

With the target of producing a bundle, the retailer must buy a large amount of wholesale goods. These are the inputs used in its production process. Thus, the retail firm acquires a great variety of wholesale goods (clothing, electronics, etc.) and bundles them into a final good (a basket of goods) which will be sold to the final consumer. In order to pose the problem faced by the retailer and solve for it, we must first describe its production technology. The aggregation technology is given by the Dixit-Stiglitz aggregator (Dixit e Stiglitz, 1977).

$$Y_t = \left(\int_0^1 Y_{j,t}^{\frac{\psi-1}{\psi}} \, dj \right)^{\frac{\psi}{\psi-1}} \tag{27}$$

where Y_t is the retailers' output over periods t, and $Y_{j,t}$ for $j \in [0,1]$ is the wholesale good j. $\psi > 1$ refers to the elasticity of substitution between wholesale goods.

It should be noted that the price of each wholesale good is taken as given by the retailer. Knowing that P_t and $P_{j,t}$ denote the nominal prices of the retail good and the wholesale good j, respectively, the representative retail firm's maximization problem takes the form:

$$\max_{Y_{j,t}} P_t Y_t - \int_0^1 P_{j,t} Y_{j,t} dj \tag{28}$$

Substituting the aggregator (27) into the last equation (28) leads to the following expression:

$$\max_{Y_{j,t}} P_t \left(\int_0^1 Y_{j,t}^{\frac{\psi-1}{\psi}} dj \right)^{\frac{\psi}{\psi-1}} - P_{j,t} \int_0^1 Y_{j,t} dj \tag{29}$$

By taking the first-order condition of the above problem, we get:

$$Y_{j,t} = Y_t \left(\frac{P_t}{P_{j,t}} \right)^{\psi} \tag{30}$$

This function portrays the demand for the wholesale good j, which rises with aggregate demand (Y_t) and is inversely related to its relative price level.

Plugging equation (30) into equation (27) yields the aggregate price level:

$$P_t = \left[\int_0^1 P_{j,t}^{1-\psi} dj \right]^{\frac{1}{1-\psi}} \tag{31}$$

3.2.2 Intermediate Good Producer (wholesale)

Taking into account that domestic output is given by $Y = \{C, I^P, G, X\}$, an intermediate-good producing firm solves its problem in three steps: First, it chooses labor and capital so as to produce domestic inputs; right after, in order to determine the level of its output, it chooses between domestic inputs versus imported inputs; finally, it sets the price of the good it sells.

In the first step, the firm operates under perfect competition and produces a domestic input, $INP_{j,t}^D$, using the following technology:

$$INP_{j,t}^D = A_t K_{j,t}^{P \ \alpha_1} L_{j,t}^{\alpha_2} K_{j,t}^{G \ \alpha_3} \tag{32}$$

where α_1, α_2 and α_3 stand for the share of private capital, labor and public capital in the production of domestic inputs, A_t captures the economy's level of technology which obeys the following law of motion:

$$\log A_t = (1 - \rho_A) \log A_{ss} + \rho_A \log A_{t-1} + \varepsilon_t \tag{33}$$

where $\varepsilon_t \sim N(0, \sigma^A)$.

Hence, the firm's goal is to minimize the cost of production:

$$\min_{K_{j,t}^P, L_{j,t}} L_{j,t} W_t + R_t K_{j,t}^P \tag{34}$$

subject to the prior technological restriction (31).

It is not difficult to show that the first-order conditions with respect to $K_{j,t}^P$ and $L_{j,t}$ are:

$$L_{j,t} = \alpha_2 \frac{INP_{j,t}^D}{\frac{W_t}{P_t^D}} \tag{35}$$

$$U_t K_{j,t}^P = \alpha_1 \frac{INP_{j,t}^D}{\frac{R_t}{P_t^D}} \tag{36}$$

The marginal cost is given by:

$$P_t^D = \left(\frac{1}{A_t K_{j,t}^{G\,\alpha_3}}\right) \left(\frac{W_t}{\alpha_2}\right)^{\alpha_2} \left(\frac{R_t}{\alpha_1}\right)^{\alpha_1} \tag{37}$$

In the second step, as already mentioned, the firm engages in decision-making regarding the choice between using domestic inputs versus imported ones by means of the following technology:

$$Y_{j,t} = \left[(\omega_D)^{\frac{1}{\psi_D}} \left(INP_{j,t}^D\right)^{\frac{\psi_D-1}{\psi_D}} + (1-\omega_D)^{\frac{1}{\psi_D}} \left(IMP_{j,t}\right)^{\frac{\psi_D-1}{\psi_D}}\right]^{\frac{\psi_D}{\psi_D-1}} \tag{38}$$

where ω_D represents the share of the domestic input in the production of the intermediate good, and ψ_D is the elasticity of substitution between domestic inputs and imported ones.

So the firm's problem at this stage can be formally stated as:

$$\min_{INP_{j,t}^D, IMP_{j,t}} INP_{j,t}^D P_t^D + IMP_{j,t} S_t P_t^F \tag{39}$$

subject to the above technology:

By solving the previous problem, we obtain the following first-order condition:

$$INP_{j,t}^D = \omega_D \left(\frac{MC_{j,t}}{P_t^D}\right)^{\psi_D} Y_{j,t} \tag{40}$$

e,

$$IMP_{j,t} = (1-\omega_D) \left(\frac{MC_{j,t}}{S_t P_t^F}\right)^{\psi_D} Y_{j,t} \tag{41}$$

And the marginal cost is

$$MC_{j,t} = \left[\omega_D P_t^{D\,1-\psi_D} + (1-\omega_D)\left(S_t P_t^F\right)^{1-\psi_D}\right]^{\frac{1}{1-\psi_D}} \tag{42}$$

3.2.3 Pricing *a la Calvo*

The third step of this problem amounts to setting the price of its good. This wholesale firm decides how much to produce in every period according to the Calvo rule (Calvo, 1983). There is a probability θ that the firm keeps the price of the good

fixed in the next period ($P_{j,t} = P_{j,t-1}$) and a probability $(1-\theta)$ that it sets the price optimally ($P_{j,t}^*$). Once the price has been set in period t, there is the probability θ that this price will remain fixed in period t+1, a probability θ^2 that this price will remain fixed in period t+2, and so on. Accordingly, this firm should take into account these probabilities when setting the price of its own good. The problem of the firm that adjusts the price of the good in period t is:

$$\max_{P_{j,t}^*} E_t \sum_{i=0}^{\infty} (\beta\theta)^i (P_{j,t}^* - MC_{j,t+i}) Y_{j,t+i} \tag{43}$$

subject to the demand for good $Y_{j,t}$ (30).

The following first-order condition is obtained by rearranging further the preceding equation:

$$P_{j,t}^* = \left(\frac{\psi}{\psi-1} \right) E_t \sum_{i=0}^{\infty} (\beta\theta)^i MC_{j,t+i} \tag{44}$$

It is worth noting that all wholesale firms setting their prices share the same markup over the same marginal cost. This means that in all periods $P_{j,t}^*$ the price is the same for all $(1-\theta)$ firms adjusting their prices.

Combining now the pricing rule (31) with the assumption that all price-changing firms set an equal price and that price-maintaining firms leave the price unaffected – since they share the same technology –, yields the overall final price:

$$P_t = \left[\theta P_{t-1}^{1-\psi} + (1-\theta) P_t^{*\,1-\psi} \right]^{\frac{1}{1-\psi}} \tag{45}$$

3.3 Government

In our model the government comes into the picture by splitting itself into two different entities: a fiscal authority and a monetary authority. The former is held responsible for conducting fiscal policy, while the latter pursues the price stability through a Taylor rule.

3.3.1 Fiscal authority

The fiscal authority is tasked with taxing households' income and issuing debt to finance its outlays, namely: current expenditure, G_t; public investment, I_t^G; and net transfers to households, $TRANS_t$. So the government's budget constraint can be represented by:

$$\frac{B_{t+1}}{R_t^B} - B_t + T_t = P_t G_t + P_t I_t^G + P_t TRANS_t \tag{46}$$

The overall tax collection would be:

$$T_t = \tau_t^c P_t(C_t + I_t^P) + \tau_t^l W_t L_t + \tau_t^k(R_t - \delta)K_t^P \tag{47}$$

The fiscal authority has three expenditure-based fiscal policy tools at its disposal: G_t; I_t^G; and $TRANS_t$. On the revenue side, the tools the fiscal authority falls back on are: τ_t^c; τ_t^l; and τ_t^k. All these instruments follow the same fiscal policy rule:

$$\frac{Z_t}{Z_{ss}} = \left(\frac{Z_{t-1}}{Z_{ss}}\right)^{\gamma_Z} \left(\frac{B_t}{Y_{t-1}P_{t-1}} \quad \frac{Y_{ss}P_{ss}}{B_{ss}}\right)^{(1-\gamma_Z)\phi_Z} S_t^Z \tag{48}$$

where γ_Z and ϕ_Z are parameters capturing the importance of these fiscal policy tools relative to public debt sustainability, and the importance of the rule debt level relative to GDP, respectively, and $Z = \{G_t, I_t^G, TRANS_t, \tau_t^c, \tau_t^l, \tau_t^k\}$.

The fiscal shock can be expressed as:

$$\log S_t^Z = (1 - \rho_Z)\log S_{ss}^Z + \rho_Z \log S_{t-1}^Z + \varepsilon_{Z,t} \tag{49}$$

where $\varepsilon_{Z,t} \sim N(0, \sigma^Z)$.

Likewise, the stock of public capital evolves according to the well-known law of motion:

$$K_{t+1}^G = (1 - \delta_G)K_t^G + I_t^G \tag{50}$$

where δ_G denotes the rate of depreciation of public capital.

3.3.2 Monetary authority

The Central Bank's task is twofold: to foster output growth and to attain price stability. In order to accomplish this dual goal, it pursues a simple Taylor rule:

$$\frac{R_t^B}{R_{ss}^B} = \left(\frac{R_{t-1}^B}{R_{ss}^B}\right)^{\gamma_R} \left[\left(\frac{\pi_t}{\pi_{ss}}\right)^{\gamma_\pi} \left(\frac{Y_t}{Y_{ss}}\right)^{\gamma_Y}\right]^{(1-\gamma_R)} S_t^m \tag{51}$$

where γ_Y and γ_π are the sensibilities of the interest rate to output and to the inflation rate, respectively, and γ_R is a stabilization parameter. S_t^m is the monetary shock, which abides by the following expression:

$$\log S_t^m = (1 - \rho_m)\log S_{ss}^m + \rho_m \log S_{t-1}^m + \varepsilon_{m,t} \tag{52}$$

where $\varepsilon_{m,t} \sim N(0, \sigma^m)$.

3.4 External sector

The external sector is represented by the demand for the exported good, by the equilibrium condition of the balance of payments, and by the law of motion governing the movement of the foreign interest rate and the import price level. The export demand obeys a rule which depends on a stabilization component, on the real exchange rate and on a stochastic component:

$$\frac{X_t}{X_{ss}} = \left(\frac{X_{t-1}}{X_{ss}}\right)^{\gamma_X} \left(\frac{S_{t-1}/P_{t-1}}{S_{ss}/P_{ss}}\right)^{(1-\gamma_X)\phi_X} S_t^X \tag{53}$$

where γ_X is a stabilization parameter, ϕ_X is the sensibility of exports to the real exchange rate and S_t^X is the shock to export demand, which is given by:

$$\log S_t^X = (1 - \rho_X) \log S_{ss}^X + \rho_X \log S_{t-1}^X + \varepsilon_{X,t} \tag{54}$$

where $\varepsilon_{X,t} \sim N(0, \sigma^X)$.

The external-sector balanced condition (balance of payments) can be stated as:

$$S_t \left(B_{t+1}^F - R_{t-1}^F B_t^F\right) = P_t^F S_t IMP_t - P_t X_t \tag{55}$$

The laws of motion for foreign interest rates and import price level are defined as:

$$\log R_t^F = (1 - \rho_{RF}) \log R_{ss}^F + \rho_{RF} \log R_{t-1}^F + \varepsilon_{RF,t} \tag{56}$$

where $\varepsilon_{RF,t} \sim N(0, \sigma^{RF})$.

$$\log P_t^F = (1 - \rho_{PF}) \log P_{ss}^F + \rho_{PF} \log P_{t-1}^F + \varepsilon_{PF,t} \tag{57}$$

where $\varepsilon_{PF,t} \sim N(0, \sigma^{PF})$.

3.5 Equilibrium condition of the model

Finally, to close the model, the good-market equilibrium condition is given by:

$$Y_t = C_t + I_t^P + I_t^G + G_t + X_t \tag{58}$$

4   Data

We then proceed to estimate the model using quarterly data spanning from 2002Q1 to 2014Q4 (52 data points). We use 14 model variables as observables (P, $TRANS$, RTL, RTKp, RTC[3], R^B, Y, G, C, X, IMP, R^F, S and L) which they are described in the Table 1. We have chosen this set of observables due to data availability and their relevance to our research purposes. Furthermore, a large set of observables mitigates the problem of identification.

Table 1: Observables variables of the model. Source: Own calculations.

Variable	Series	Source
P	Series constructed using the IPCA (%a.m.)	IBGE/SNIPC
TRANS	Benefícios assistenciais (LOAS e RMV) R$ (milhões)	Min. Fazenda/STN
RTL	IR - pessoas físicas R$ (milhões)	Min. Fazenda/SRF
RTKp	IR - pessoas jurídicas R$ (milhões)	Min. Fazenda/SRF
RTC	ICMS and IPI R$ (milhões)	Min. Fazenda/SRF
R^B	Selic Over (% a.m.)	BCB Boletim/M. Finan.
Y	PIB - preço de mercado - R$ (milhões)	IBGE/SCN 2000 Trim.
G	Consumo final - adm. pública - R$ (milhões)	IBGE/SCN 2000 Trim.
C	Consumo final - famílias - R$ (milhões)	IBGE/SCN 2000 Trim.
X	Exportações - R$ (milhões)	IBGE/SCN 2000 Trim.
IMP	Importações - R$ (milhões)	IBGE/SCN 2000 Trim.
L	Horas pagas - indústria - índice (média 2006 = 100)-SP	Fiesp
R^F	Estados Unidos - taxa de juros (% a.a.)	Fundo Monetário Internacional, International Financial Statistics
S	Taxa de câmbio - R$ / US$ - comercial - compra - média	Banco Central do Brasil, Boletim, Seção Balanço de Pagamentos (BCB Boletim/BP)

5   Calibrated parameters, prior and posterior

In this section we pursue a two-tier approach: the parameters not directly related to the questions which we endeavor to answer throughout this article are calibrated, while those relevant parameters for the analysis of the shock propagation are estimated using the Bayesian methodology. The main calibration procedure employed here is to pick up the values of parameters from other relevant articles in the DSGE model literature. Table 2 summarizes the calibration of the parameters.

Given the prior distributions of the parameters, we estimate the posterior distributions using a Markov chain process via the Metropolis-Hastings algorithm with 100.000 iterations, a scale value 0,3 to be used for the jumping distribution, and 10 parallel chains for Metropolis-Hastings algorithm. The results of the Bayesian estimation are shown in Table 3 and Figure 1.

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[3]$RTL = \tau_l WL$, $RTKp = \tau_k RKp$ and $RTC = \tau_c(C + Ip)$.
where RTL, RTKp and RTC are revenue collected from the taxes on labor income, on capital gains and on consumption.

Table 2: Calibration of the Parameters. Source: Own calculations.

Parameters	Value	Source
β	0,985	Cavalcanti and Vereda (2010)
σ	2	Cavalcanti and Vereda (2010)
ψ	1,5	Cavalcanti and Vereda (2010)
α_1	0,3	Mussolini (2011)
α_2	0,6	Mussolini (2011)
α_3	0,1	Mussolini (2011)
δ	0,025	Cavalcanti and Vereda (2010)
δ_G	0,025	Cavalcanti and Vereda (2010)
ω_R	0,6	Castro et al (2011)
$\frac{B_{ss}^F}{Y_{ss}}$	-0,1	Sensitivity Analysis (Iskrev, 2010)
$\frac{B_{ss}}{Y_{ss}}$	1	Sensitivity Analysis (Iskrev, 2010)
$\frac{TRANS_{ss}}{Y_{ss}}$	0,1	Sensitivity Analysis (Iskrev, 2010)
ψ_2	1	Sensitivity Analysis (Iskrev, 2010)
χ	1	Sensitivity Analysis (Iskrev, 2010)
ψ_1	$(1 + \tau_{ss}^c)\left[\frac{1}{\beta} - (1 - \delta)\right]$	Sensitivity Analysis (Iskrev, 2010)
γ_G	0	Sensitivity Analysis (Iskrev, 2010)
ϕ_G	0	Sensitivity Analysis (Iskrev, 2010)

These graphs are especially relevant in that they present key results, but they can also serve as tools to detect problems or build additional confidence in ones results. First, the prior and the posterior distribution should not be excessively different from one another. Second, the posterior distributions should be close to normal, or at least not display a shape that is clearly non-normal. Third, the green mode should not be too far away from the mode of the posterior distribution. Overall, it is worth pointing out that the estimates proved to be quite satisfactory.

6 Results

This section analyzes the dynamic properties of the model by focusing on the shocks decomposition of the GDP and the fiscal multipliers.

6.1 Shocks Decomposition

One way to assess the effects of the different shocks on GDP fluctuations is to look into the decomposition of these shocks (Figure 2). Two variables were found relevant in accounting for the output behavior: current spending and public investment. Both performed similarly, reducing output over the period 2003 to 2006, as a strong fiscal adjustment was under way. However, during the period in which the Growth Acceleration Programs (PAC, in Portuguese) prevailed – PAC1 and PAC2

Table 3: Posterior distribution of the model. Source: Own elaboration.

Parameter	prior mean	post. mean	90% HPD interval	prior	pstdev
Fiscal Parameters					
τ_{ss}^c	0,160	0,1735	0,1714 0,1751	beta	0,0100
τ_{ss}^l	0,170	0,1600	0,1568 0,1626	beta	0,0100
τ_{ss}^k	0,080	0,0850	0,0811 0,0891	beta	0,0100
γ_{TRANS}	0,500	0,6105	0,5643 0,6471	beta	0,1000
γ_{τ^c}	0,500	0,6907	0,6597 0,7204	beta	0,1000
γ_{τ^l}	0,500	0,5882	0,5621 0,6170	beta	0,1000
γ_{τ^k}	0,500	0,6194	0,5885 0,6407	beta	0,1000
ϕ_{TRANS}	-0,500	-0,3028	-0,3527 -0,2511	unif	0,2887
ϕ_{τ^c}	0,500	0,7655	0,6942 0,8680	unif	0,2887
ϕ_{τ^l}	0,500	0,0122	0,0000 0,0320	unif	0,2887
ϕ_{τ_k}	0,500	0,0136	0,0000 0,0363	unif	0,2887
Others Parameters					
χ_{BF}	-0,003	-0,0049	-0,0050 -0,0048	unif	0,0014
γ_X	0,500	0,4495	0,4219 0,4890	beta	0,1000
ϕ_X	0,500	0,1017	0,0357 0,1751	unif	0,2887
ω_D	0,850	0,8328	0,8284 0,8361	beta	0,0100
ψ_D	5,000	3,9686	3,7094 4,0924	gamma	0,5000
ϕ_{INSD}	0,850	0,8929	0,8813 0,9099	beta	0,0500
θ	0,750	0,7313	0,7259 0,7361	beta	0,0100
θ_W	0,750	0,7380	0,7365 0,7412	beta	0,0100
ψ	10,000	12,2681	11,0836 13,3990	gamma	5,0000
ψ_W	10,000	1,0389	1,0137 1,0628	gamma	5,0000
ϕ_c	0,800	0,7959	0,7929 0,7995	beta	0,0100
γ_R	0,500	0,4212	0,3883 0,4520	beta	0,1000
γ_Y	0,500	0,4175	0,3981 0,4334	gamma	0,0500
γ_π	3,000	3,1749	3,1341 3,2170	gamma	0,1000
Autoregressive Components					
ρ_a	0,500	0,5565	0,5120 0,6016	beta	0,1000
ρ_G	0,500	0,5843	0,5486 0,6387	beta	0,1000
ρ_{IG}	0,500	0,6364	0,5989 0,6657	beta	0,1000
ρ_{TRANS}	0,500	0,4282	0,4103 0,4467	beta	0,1000
ρ_{τ^c}	0,500	0,5427	0,4807 0,5896	beta	0,1000
ρ_{τ^l}	0,500	0,3871	0,3461 0,4300	beta	0,1000
ρ_{τ^k}	0,500	0,5076	0,4783 0,5330	beta	0,1000
ρ_m	0,500	0,4610	0,4408 0,4968	beta	0,1000
ρ_P	0,500	0,4035	0,3517 0,4407	beta	0,1000
ρ_L	0,500	0,4793	0,4302 0,5331	beta	0,1000
ρ_I	0,500	0,5057	0,4701 0,5476	beta	0,1000
ρ_X	0,500	0,6380	0,5951 0,6831	beta	0,1000
ρ_{RF}	0,500	0,4166	0,3790 0,4516	beta	0,1000
ρ_{PF}	0,500	0,7184	0,6807 0,7760	beta	0,1000
Exogenous Shocks					
ε	1,0	0,1253	0,1176 0,1350	invg	Inf
ε_G	1,0	0,1270	0,1176 0,1417	invg	Inf
ε_{IG}	1,0	0,6446	0,4557 0,8049	invg	Inf
ε_{TRANS}	1,0	0,6525	0,5214 0,8381	invg	Inf
ε_{τ^c}	1,0	0,3863	0,3297 0,4554	invg	Inf
ε_{τ^l}	1,0	0,1984	0,1685 0,2309	invg	Inf
ε_{τ^k}	1,0	0,2153	0,1835 0,2467	invg	Inf
ε_m	1,0	0,1252	0,1176 0,1370	invg	Inf
ε_P	1,0	0,4101	0,2959 0,5511	invg	Inf
ε_L	1,0	0,3359	0,2274 0,4490	invg	Inf
ε_I	1,0	0,5873	0,4563 0,6939	invg	Inf
ε_X	1,0	0,1412	0,1177 0,1581	invg	Inf
ε_{RF}	1,0	0,1234	0,1176 0,1324	invg	Inf
ε_{PF}	1,0	0,1486	0,1229 0,1716	invg	Inf

Figure 1: Priors and posteriors.
Source: Own calculations.

were initiated in 2007 and 2010, respectively –, government expenditure and public investment played an important role in boosting aggregate demand.

Over the period under analysis, tax-exemption policies did not yield significant results. It is noteworthy to mention that an active IPI excise tax reduction (on manufactured durable goods) was conducted over the 2008 post-crisis period. Table 4 exhibits the variations in the IPI tax rate for the case of automobiles. In December 2008 and May 2012 a sizeable tax cut on this item was implemented. According to Fantinatti (2015), this kind of fiscal exemption measures turn out to be unsuccessful when it comes to stimulating GDP growth. Given this policy, while it is true that households tend to increase their purchases of durable goods, they also cease to acquire non-durable goods if the intertemporal budget constraint is to be respected. So the boost that ensues from having lower taxes is offset by a reduction in demand for non-durables. Additionally, there would still be a negative side-effect stemming from the need to engage in fiscal belt-tightening to compensate for the lower tax collection. In a nutshell, the effect of this tax-exemption policy on consumption seems negligible when one looks at the GDP shock decomposition, the main reason being that the stimulus fell on a relatively poor-performing sector.

Table 4: Changes in the IPI tax rates for automobiles.
Source: RFB e Ministério da Fazenda *apud* Fantinatti (2015).

Type of vehicle	Aliquot before the crisis	dez/ 2008	out/ 2009	nov/ 2009	abr/ 2010	mai/ 2012	jan/ 2013	jan/ 2014	jan/ 2015
1.0 ethanol,	7,0%	0,0%	1,5%	3,0%	7,0%	0,0%	2,0%	3,0%	7,0%
1.0 to 2.0 ethanol,	11,0%	5,5%	6,5%	7,5%	11,0%	5,5%	7,0%	9,0%	11,0%
1.0 to 2.0 gasoline,	13,0%	6,5%	8,0%	9,5%	13,0%	6,5%	8,0%	10,0%	13,0%

6.2   Fiscal Multipliers Analysis

After having carried out a qualitative examination of the fiscal policy outcomes in the preceding section, we now turn to gauging the effects of each fiscal measure from a quantitative perspective. Figure 3 illustrates the fiscal multipliers for each fiscal shock.

The results are in accordance with what was presented in Section 2, namely, in the small-economy case the multipliers should be smaller than 0,5 (it is worth remarking that these would be even smaller if there were a pressing need to put the fiscal house in order to keep public debt stable (Spilimbergo et al, 2009). The greatest multiplier found in this work was that of the consumption-tax excise reduction. Its associated value was 0,08 on impact, with this number falling steadily over 12 quarters on the grounds of the need to adjust other fiscal tools, since the

falling tax revenues led to a growing public debt (perceived effect by Moura (2015) and by Cavalcanti e Silva (2010)). This growth was, however, temporary and the multiplier resumed growing.

The second-largest multiplier is the one associated with public spending. On impact, its value was 0,04. The ensuing fiscal adjustment caused this value to drop (for the same reason as in the case of the preceding multiplier), bottoming out at 0,025 and then bouncing back thereafter until reaching a stable level. Concerning the public-investment multiplier, its value on impact was smaller than the earlier figures, 0,01, it thereon embarked on a downward path (thereby mimicking somehow the behavior of the prior fiscal measures' multipliers) but its upward trajectory after the rebounding was steeper than those of the previous fiscal policies. The reason is that a positive shock to public investment eventually renders firms more productive when the investment turns into capital stock (In the same way as in Moura (2015)).

The only income-tax measure yielding a positive multiplier is the tax exemption from labor income. On impact, the value was modest – 0,005 –, but in the longer run this number improved due to the increase in the households' labor supply. The same policy applied to capital income gave rise to a negative result at any horizon.
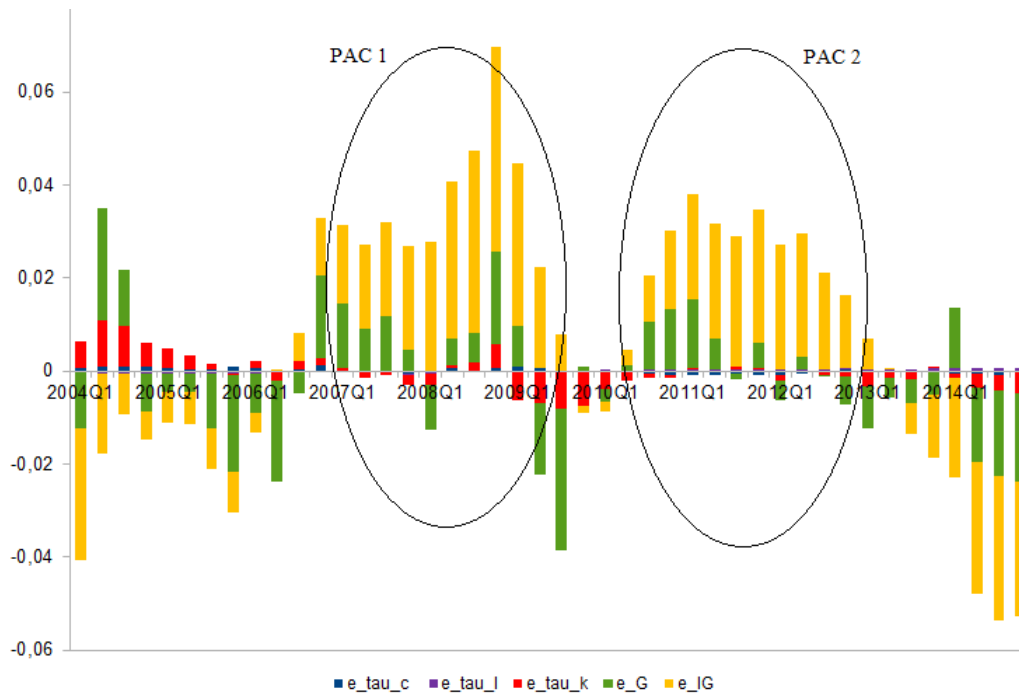

Figure 2: GDP Shocks Decomposition
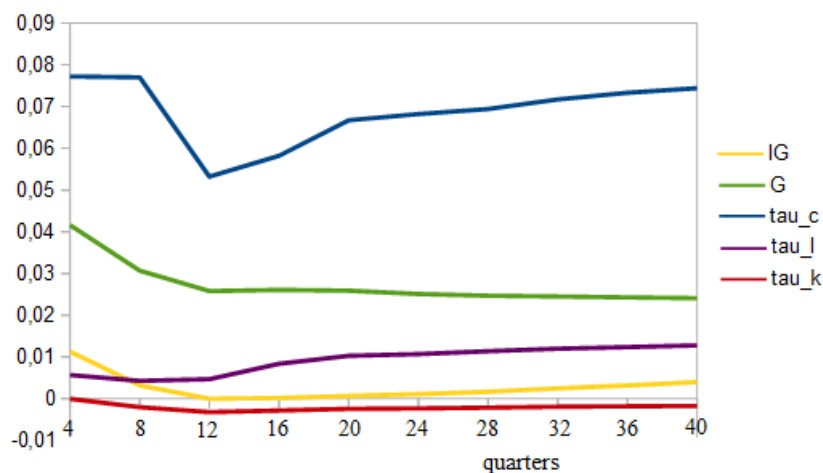Source: Own calculations.

Figure 3: Fiscal multipliers for each fiscal shock
Source: Own calculations.

7 Conclusions

This article intended to make a contribution to the discussion about the effects of the Brazilian fiscal policy after the 2008 crisis. In this vein, a shocks decomposition for Brazilian GDP as well as a multiplier analysis of each fiscal shock were undertaken under the framework of a New Keynesian model.

The spending-based measures were the most successful in affecting GDP over the whole period studied, primarily because of PAC2, whose actual goal was to bolster aggregate demand. It is worth mentioning that stimulus program led to a positive result only up until 2013. Actually, the systematic reduction of this multiplier that followed from that year onwards contributed to deterioration of the Brazilian economy.

However, these tools were not the only ones the government availed itself of to prop up aggregate demand. It also resorted to tax exemptions from durable goods consumption without much success, as already underscored above. The main reason for this policy to have failed is that this fiscal stimulus was only targeted at the durable-goods sector, which caused the consumption of non-durable goods to decrease. This latter effect ended up offsetting the positive impact of this policy on economic activity. As already laid out before, should this tax-exemption policy be applied in an horizontal way to all sectors of the economy, the result would be the most efficient one among all fiscal measures under study.

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