

Does government spending composition matter for welfare? The case of Brazil

Abstract: The aim of this work is to contribute to studies about welfare consequences of a given structure of government expenditure by analysing the effects of two alternative measures of public spending, income transfers and investment in public capital, on household welfare. To this end, we use DSGE modeling. Our results show that government spending biased towards public investment, coupled with reduced current public expenditure, is the option yielding the greatest returns to the economy as a whole. Even though households are found to be worse off throughout a time span of 10 quarters, the larger output that ensues from this policy measure will render future generations better off. Thus, if policymakers care equally about all generations, they will elect to undertake public investments, while if more weight is attached to present generations than to future ones, they will be more willing to embark on income transfers.

Keywords: DSGE Models, Welfare, Public Expenditure and Income Transfers.

Código JEL: C63, E37, E62.

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1. Introduction

Brazil has witnessed six decades of unprecedented expansion of its public sector. Available data indicate that, between 1948 and 2012, total public expenditures rose from 17% of GDP to 40% (IMF, 2013). Several studies dealing with the dynamic behavior of this variable have been conducted. Among them, it is worth highlighting Wagner's contributions (Bird, 1970), and Peacock and Wiseman (1970), who put forward some hypotheses targeted at explaining the time evolution of the public sector. Both articles reveal the shortcomings that a pure empirical strategy for identifying the drivers of the expansion of government expenditures would present.

It may be worthwhile to emphasize, however, that the size of the government does not tightly associate itself with the level of efficiency with which this operates. As a matter of fact, there are countries whose public sectors account for more than 50% of GDP (generally viewed as big governments) and yet, they rank pretty high on the lists measuring the most efficient states around the world. Examples of this are the Scandinavian countries. By the same token, countries with low government spending to GDP ratios, such as many in Latin America or Africa, are often cited as those with more sclerotic and inefficient public sectors.

So, the main lesson to be learned from this circumstance can reduce to "it is not really about how much the government can and does actually spend as a proportion of GDP, but about how it does that and what sort of expenditure it prioritizes over the alternatives". That is to say, irrespective of how much the public sector may have grown over time, the key policy variable that may be decisive in providing information about the effect of the size of the public sector on welfare is the composition of government spending, so particular attention should be devoted to it. However, it is worth pointing out that in an intertemporal framework assessing consumer welfare in a post-shock situation is a tad more intricate than it may seem.

In effect, increases in current government spending are thought to lead to lower economic growth over time (and eventually to lower welfare) than say a higher investment in public infrastructure, which are known to have a positive impact on total factor productivity. But in the short run the former fiscal policy is assumed to have a greater impact on consumer welfare than the latter. Nevertheless, as any other economic agent, the government is also subject to a (both intra- and inter-temporal) budget constraint, implying that there clearly is an opportunity cost in terms of the expenditure item foregone every time the policymaker makes a decision as to which spending item, and by how much, should be increased. In this regard, it is constantly faced with the trade-off arising from the desirability of choosing one type of public expense over the remaining ones, which inevitably leaves some groups of people unsatisfied.

Although this literature for Brazil comprises a myriad of studies on how tax changes affect welfare over time (Paes and Bugarin, 2006; Mussolini and Kanczuk, 2011; Cavalcanti and Silva, 2010), there still is a gap concerning the welfare effects of variations in the composition of government expenditures. With the purpose of helping fill this void, this work aims to assess the effect of two kinds of government expenditures on the main macroeconomic variables. For that matter, two government spending shocks embedded in a DSGE model are considered. The first shock takes the form of government transfers of income to households⁴. The second one involves the government increasing public investments⁵. The model parameters will be calibrated and estimated using Bayesian approach⁶ and the focus will be placed on the analysis of the impulse-response functions⁷.

These two different spending items have not been chosen in a vacuum, and thus the rationale for using them in our paper is that government transfers are the tools

⁴ Income transfer programs are meant to raise the income of the poor until some minimum acceptable level is reached.

⁵ In Economics, investment refers to the use of capital in the production process so as to increase production capacity. Public investment concerns the capital invested by the public sector in order to improve people's quality of life. For example, investment in infrastructure such as roads, bridges, hospitals, ports, sanitation and schools, which gives rise to higher potential growth and better life perspectives overall, hinges almost exclusively on public investment. Other uses include public investments in social, urban, transport and productive factors.

⁶ The estimation of DSGE models poses some major challenges. Initially, calibrating the parameters was common practice. However, this approach is deemed to be inappropriate as the values obtained through it are always conditional on a particular model. In this regard, DSGE models estimation via Bayesian methodology has become the primary tool among macroeconomists, for it is known to be powerful, coherent and sufficiently flexible, and it is the one we opt for in this article.

⁷ Impulse response functions trace the effect of a one-time shock to each of the endogenous variables. These responses are obtained as follows: initially, all variables must be at their steady-state levels. At some time $t = 0$, an endogenous variable takes a value equal to its steady-state level over an increase (impulse) in size equal to one standard deviation, and are calculated as all variables evolve after that.

on which the Brazilian fiscal authorities have relied on a permanent basis for reducing income inequality and poverty, which have long plagued the country. The leading transfer program in Brazil is the famous Bolsa-família⁸, which stands out in lifting people out of poverty at a relatively low cost. In addition to this, there are several other transfer programs whose records in terms of efficiency leave a lot to be desired and are casually considered potential sources of waste and corruption (for example, many of the subsidies that the Brazilian Development Bank, BNDES⁹, disburses to some sectors of the economy are said to fall into this category¹⁰). On the other hand, owing to the pitiable state in which public infrastructure, such as roads, highways, bridges, ports, etc. are in the country, public investment is often brought up in casual conversations as an integral part of more comprehensive package aimed at putting the Brazilian economy back on the growth track, as well as it is also called for by prominent economists and analysts alike as one of the main levers policymakers should fall back on in order to accomplish the aforementioned goal. Not only is this measure taken to be a stabilization policy, since it succeeds in stimulating the economy in the short run, but it is also a growth policy in that it raises productivity and therefore long-run growth.

It should be mentioned that there exists an article akin to ours where the authors, by means of a DSGE model applied to Euro-Area countries, attempt to account for the welfare behavior of reallocations of expenditures between different public spending items (Straub and Tchakarov, 2007).

The literature distinguishes two different avenues through which public expenditures can be introduced into DSGE models. On one hand, government expenditures can be thought of as a component of aggregate spending, which entails that households' utility will not be affected by them. This is the approach chosen for example by Christiano and Eichenbaum (1992) and Ljungqvist and Sargent (2004), to mention just a few. Among the Brazilian authors who opt for this strategy, we should stress Castro et al. (2011), Gadelha and Divino (2013a), and Gadelha and Divino (2013b). It is worth pausing a bit here to briefly comment on these three latter articles since the Brazilian economy constitutes the focus of our work.

The first article covers in detail a medium-sized DSGE model named SAMBA developed by economists from the Central Bank of Brazil. It is a small open economy model combining standard features - price and wage stickiness, adjustment costs, habit formation, Ricardian and Non-Ricardian consumers -- with more specific characteristics of the Brazilian economy - country-specific fiscal rule, administered prices, etc. The authors find that the impulse-responses to standard shocks are well-behaved and fall within the range it would be expected for this economy. By allowing for distortionary taxes and pro-cyclical fiscal policy rules, the articles by Gadelha and Divino seek to improve over the model by Galí, López-Salido and Vallés (2007) in order to see whether the "government spending puzzle"¹¹ holds in the Brazilian economy. They find no evidence of it whatsoever. Interestingly, they also uncover a negative relationship between hours worked and a positive productivity shock, as well as a well-defined pro-cyclical behavior of fiscal revenues and spending.

On the other hand, assuming that government spending is neutral to individuals' utility does not appear to be the most suitable conjecture. An alternative route is to think of public expenditures as goods consumed by private agents, therefore entering households' utility function. Our work pursues this latter approach by employing the functional form used by Mussolini and Kanczuk (2011), Barro (1981), Aschauer (1985) and Aiyagari et al. (1992), whereby household's aggregate consumption is a linear combination of private consumption and government consumption¹². Despite this government's crucial role in carrying out investment in infrastructure to support the private sector, there are few references about this topic.

⁸ Bolsa-família, or in English, Family Allowance, is a transfer program of the Brazilian government, seeking to provide financial aid to poverty-stricken Brazilian families conditional on having their children attend school and vaccinated. Its primary goals are to both reduce poverty and raise human capital.

⁹ From its site: "The Brazilian Development Bank (BNDES) is the main financing agent for development in Brazil. The Bank offers several financial support mechanisms to Brazilian companies of all sizes as well as public administration entities, enabling investments in all economic sectors. In any supported undertaking, from the analysis phase up to the monitoring, the BNDES emphasizes three factors it considers strategic: innovation, local development and socio-environmental development."

¹⁰ It is dubbed Bolsa-empresário.

¹¹ The "government spending puzzle" refers to the positive response of private consumption to a positive shock to government spending. According to RBC postulates, the opposite effect should prevail.

¹² It should be acknowledged that not all economists agree on this assumption as being completely reasonable. However, it does not seem odd at all to assert that better public services - enhanced public safety, sanitation, transit, etc. - lead to more satisfied people, increasing their level of utility.

During the 1970s, several theoretical studies incorporated public capital into the aggregate production function, some examples being those by Arrow and Kurz (1970), Weitzman (1970) and Pestieau (1974). This notwithstanding, it was not until after Barro (1990) that these initial ideas were recovered. Over the following years, a number of articles in the same spirit as the former such as Barro and Sala-i-Martin (1992), Finn (1993), Glomm and Ravikumar (1994), Cashin (1995) and Bajo (2000), among others, followed suit. As for empirical studies that deploy this same approach, one can highlight Mera (1973), Ratner (1983) and Aschauer (1989).

The results we obtain in this article are the following: the shock to public investment boosts economic growth and thus future consumer welfare, at the expense of present welfare. On the contrary, the income-transfer shock increases welfare on impact, but has a negative effect on growth, thereby leading to lower future welfare. When a policy consisting of higher public investment combined with decreased current government spending is carried out, intertemporal welfare is maximized.

In addition to this introduction, this work is structured as follows. The next section describes the DSGE model, the subsequent one conducts the empirical analysis, and the two final sections present the results and conclude, respectively.

2. Model

The model consists of an economy inhabited by three sorts of economic agents. The first one is the representative household who chooses the value of its intertemporal consumption and the amount of labor it is willing to offer. It also owns the capital stock which firms rent to use it in their production processes. The representative household's sources of income are wages and returns on capital in exchange for labor services and renting services, respectively.

The second agent is the representative firm that combines capital and labor to produce output and sell it on the market. An important feature of our model is the environment in which the representative firm operates. The market structure is assumed to be monopolistic competition, that is, the firm enjoys market power in that it is able to set the price over the marginal cost and make an extraordinary profit (mark-up). The third agent is the Government which finances its aggregate spending through tax collection, and whose decision over the kind of expenditure it leans toward determines the final composition of its spending. Specifically, the latter can be grouped into three different categories: current public spending, income transfers, and public investment. Finally, two additional features of the model bear mentioning: the economy is closed, and there is no financial system.

¹³ We have opted to leave frictions, such as price and wage rigidities, consumption habits, adjustment costs, and financial frictions, out of our model. These absences do not affect the results. However, monopolistic competition constitutes a crucial element in our article as one of our primary targets is to look into the behavior of Brazilian firms' mark-ups in the face of a change in the public spending composition.

2.1 Households

There is a continuum of infinitively-lived identical households that maximize their utility stemming from consumption and leisure¹⁵. In particular, the stand-in consumer's lifetime utility is represented by:

$$E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t + \eta G_t)^{1-\sigma}}{1-\sigma} - \frac{L_t^{1+\psi}}{1+\psi} \right] \quad (1)$$

¹⁴ The Brazilian economy can be regarded as a relatively closed one, so it is safe to say that this strong assumption is applicable in our work.

¹⁵ The total available time is split into hours of leisure and of work (Leisure + Work = 1), so the decision about how many hours are devoted to leisure amounts to choosing how much time to work.

where E is the expectations operator, β is the discount factor, C is consumption, L is the number of hours worked, G is the current government expenditure, η is the sensitivity of the utility to current government expenditure, σ and ψ are the parameters that measure the elasticity of marginal utility of consumption with respect to its level and the marginal disutility of work relative to the labor supply, respectively.

In addition, the representative consumer faces the following budget constraint in every period:

$$(C_t + I_{p,t})(1 + \tau_c)P_t = W_t L_t (1 - \tau_l) + R_t K_{p,t} (1 - \tau_k) + trans_t \quad (2)$$

where I_p denotes private investment, W is the wage, R is the return on capital, K_p is the stock of private capital, $trans$ is the income transfers to households by government, τ_c , τ_l , τ_k are tax rates on consumption, on labor income and on capital income, respectively, and P refers to the price level that is normalized to one, $P=1$.

Private capital accumulates according to the following rule:

$$K_{p,t+1} = (1 - \delta_p) K_{p,t} + I_{p,t} \quad (3)$$

where δ_p is the depreciation rate of private capital.

The consumer then maximizes (1) subject to (2) which yields the following first order conditions:

$$(C_t + \eta G_t)^\sigma L_t^\psi = \left(\frac{1 - \tau_l}{1 + \tau_c} \right) W_t \quad (4)$$

$$1 = \beta E_t \left\{ \left(\frac{C_{t+1} + \eta G_{t+1}}{C_t + \eta G_t} \right)^{-\sigma} \left[(1 - \delta_p) + \left(\frac{1 - \tau_k}{1 + \tau_c} \right) R_{t+1} \right] \right\} \quad (5)$$

2.2 Firms

As mentioned above, firms behave in a monopolistically competitive fashion. The economy's productive sector is divided into two parts: an intermediate-good sector, and a final-good sector.

The intermediate-good sector is composed of a large number of firms, each producing slightly differentiated goods, and deciding the quantity of productive factors to be hired and the price they are willing to charge.

This setup relies on the works by Cassou and Lansing (1998), Lansing (1998), Baxter and King (1993) and Ambler and Paquet (1996), where the public capital stock is inserted into the production function.

In the final-good sector, there exists one company in charge of aggregating the intermediate goods into a single good that will be consumed by economic agents. Thus, the production function is depicted by the following expression:

$$Y_t = A_t K_{p,t}^{\alpha_1} L_t^{\alpha_2} K_{g,t}^{\alpha_3} \quad (6)$$

where K_g is the stock of public capital, α_1 , α_2 , α_3 are participations of capital, of labor and of public capital in the production of good j , respectively¹⁶.

Total factor productivity, A ¹⁷, follows a stochastic log-linear AR(1) described below:

$$\log A_t = \rho \log A_{t-1} + \varepsilon_t \quad (7)$$

where $\varepsilon \sim (0, \sigma_\varepsilon)$.

The stock of public capital obeys the law of motion:

$$K_{g,t+1} = (1 - \delta_g) K_{g,t} + I_{g,t} \quad (8)$$

where I_g is the government's investment in public capital assets, and δ_g is the depreciation rate of public capital.

The demand for inputs functions are directly derived from the firms' profit-maximizing behavior:

$$L_t = \left(\frac{\phi - 1}{\phi} \right) \left(\frac{\alpha_2}{\alpha_1 + \alpha_2} \right) \left(\frac{Y_t}{W_t} \right) \quad (9)$$

¹⁶ Firms are subject to constant returns to scale, $\alpha_1 + \alpha_2 + \alpha_3 = 1$, based on Cassou and Lansing (1998), corroborated by empirical studies by Aschauer (1989) and Ai and Cassou (1995).

¹⁷ The results ensuing from the productivity shock will not be presented here, because our goal is to focus only on shocks to government expenditures.

$$K_t = \left(\frac{\phi-1}{\phi} \right) \left(\frac{\alpha 1}{\alpha 1 + \alpha 2} \right) \left(\frac{Y_t}{K_{g,t}} \right) \quad (10)$$

where ϕ is the elasticity of substitution among differentiated goods.

2.3 Government

The government enters the picture by spending on current expenditure items (G), by giving transfers of income (trans), by undertaking public investments ($I_{g,t}$) and by collecting taxes. Income transfer payments follow a stochastic process described below:

$$trans_t = \chi_{Tr} S_t^{Tr} Y_t \quad (11)$$

with,

$$\log S_t^{Tr} = \rho_{Tr} \log S_{t-1}^{Tr} + \varepsilon_{Tr,t} \quad (12)$$

where S_t^{Tr} is stochastic and χ_{Tr} is a static parameter that accounts for income transfers as a share of GDP and $\varepsilon_{Tr} \sim (0, \sigma_{\varepsilon Tr})$.

By the same token, the government investment follows,

$$I_{g,t} = \chi_{Ig} S_t^{Ig} Y_t \quad (13)$$

wherein,

$$\log S_t^{Tr} = \rho_{Tr} \log S_{t-1}^{Tr} + \varepsilon_{Tr,t} \quad (14)$$

where $\varepsilon_{Ig} \sim (0, \sigma_{\varepsilon Ig})$, S_t^{Tr} is stochastic and χ_{Ig} is the static parameter capturing the share of public investment in GDP.

In all periods, by assumption, the government must abide by its budget constraint. Thus:

$$(C_t + I_{p,t}) \tau_c P_t + W_t L_t \tau_l + K_{p,t} \tau_k (R_t - \delta_p) = G_t P_t + trans_t + I_{g,t} P_t \quad (15)$$

Lastly, the aggregate equilibrium condition (aggregate demand = aggregate supply) must be met:

$$Y_t = C_t + G_t + I_{g,t} + I_{p,t} \quad (16)$$

3. Empirical Analysis

In this section we proceed to present the empirical part of our study. It begins by describing the data used in the estimation of the standard deviation parameters included in the stochastic shocks. It next shows the calibrated parameters, priori and posteriori of the parameters to Bayesian estimation.

3.1 Data

We estimated the model using quarterly data spanning from 2003Q1 to 2013Q4 (44 data points). We use 3 model variables as observables: GDP (Y); government consumption (G); and government revenues on consumption $((C + I_p) \tau_c P)$. To prepare the data for the model estimation, we deflated using the IPCA, detrended and seasonally adjusted non stationary series using the software X12-ARIMA¹⁸ and applied first log-difference¹⁹.

3.2 Calibrated Parameters, Priori and Posteriori Distributions

We resort to calibrating the parameters which are not directly related to the shocks,

¹⁸ X12-ARIMA was developed by US Census Bureau as an extended and improved version of the X11-ARIMA method of Statistics Canada. The program runs through the following steps. First the series is modified by any user-defined prior adjustments. Then the program fits a regARIMA model to the series in order to detect and adjust for outliers and other distorting effects for improving forecasts and seasonal adjustment. The program then uses a series of moving averages to decompose a time series into three components. In the last step a wider range of diagnostic statistics are produced, describing the final seasonal adjustment, and giving pointers to possible improvements which could be made.

¹⁹ first log-difference $(X_t) = \ln \left(\frac{X_t}{X_{t-1}} \right)$

whereas those relevant ones for the analysis of the shocks propagation are estimated via Bayesian methodology. With regard to these Bayesian estimations, the prior distribution reflects the beliefs about the values of the parameters. A large standard deviation of these values implies little confidence in the priori value used. In order to conduct a proper estimation of the distribution parameters, we avail ourselves of the mean and standard deviation values in common use in the Brazilian economic literature.

The data regarding the factor shares corresponding to both capital and labor²⁰, the value of ρ , and the sensitivity of preferences relative to public expenditure (η) were taken from Mussolini (2011), on the grounds of the close similarities this abovementioned work and ours exhibit.

Private and public depreciation values (δ_p and δ_g , respectively), the intertemporal discount rate (β), the parameters measuring the elasticity of marginal utility of consumption with respect to its level and the marginal disutility of labor relative to the amount of working hours supplied (σ and ψ) were obtained from Cavalcanti and Vereda (2011). In this article these authors take a in-depth look at the dynamic properties of a DSGE model for Brazil, so these priori values can therefore be considered to have tested reliability.

Similarly, we take the static parameter that accounts for public investment as a share of GDP (χ_{ig}) from Resende (2001) as he describes in detail the composition of the Brazilian public expenditures at the end of the 1990s. According to this author, the average shares of government expenditure (in percentage terms) throughout the period were: social security, 53%; public goods, 18,1%; education spending, 17,3%; and public infrastructure, 2,3%. So making use of a sensitivity parameter of around 2,3% of GDP in our study seems to be warranted.

Finally, our study rests on Araújo and Ferreira (1999) as regards tax rates on consumption (τ_c), on labor income (τ_l) and on capital income (τ_k). Concerning the elasticity of substitution between the differentiated goods (ϕ), we use the same figure as in Araújo et al. (2006). Hence, Table 1 shows the calibrated parameters of the model. We employ the series “Benefícios Assistenciais (LOAS e RMV²¹)” and “Custeio e Investimento” so as to calculate the parameter values of χ_{tr} using the relationship $\frac{trans}{Y} = 0.007$, respectively. Table 2 shows the posterior distributions.

Table 1. Calibrated parameters and prior distribution of the model

Parameter	Average	Source
α_1	0.32	Mussolini (2011)
β	0.985	Cavalcanti and Vereda (2011)
σ	2	Cavalcanti and Vereda (2011)
ψ	1.5	Cavalcanti and Vereda (2011)
δ_g	0.025	Cavalcanti and Vereda (2011)
δ_p	0.025	Cavalcanti and Vereda (2011)
τ_l	0.1730	Araújo and Ferreira (1999)
ϕ	6	Araújo et al (2006)

Source: Prepared by the authors.

²⁰ $\alpha_2 = 0.6$, so $\alpha_3 = 0.4 - \alpha_1$

²¹ The terms LOAS and RMV stand for “Lei Orgânica de Assistência Social” (Organic Law of Social Assistance in English) and “Renda Mensal Vitalícia” (Monthly Annuity in English), respectively.

Table 2. Posterior distribution of the model.

Parameter	Average	Confidence Interval
τ_c	0.1899	0.1037 0.2815
τ_k	0.0744	0.0077 0.1382
χ_{Ig}	0.0008	0.0001 0.0015
χ_{Tr}	0.0072	0.0018 0.0120
η	0.3885	0.2687 0.5259
ρ	0.8431	0.6294 0.9528
ρ_{Ig}	0.7234	0.6011 0.8613
ρ_{Tr}	0.5619	0.4197 0.6865
ε_A	0.1299	0.1176 0.1425
ε_{Ig}	3.2963	1.5147 5.4509
ε_{Tr}	1.0962	0.2976 2.2215

Source: Prepared by the authors.

4. Results

This section examines the welfare consequences of the model. It seeks to answer some questions such as: how do variables behave in response to shocks? Does the representative household gain or lose in terms of welfare after a given shock? Is the model stable in the sense that the endogenous variables end up returning to their steady states? If so, do these variables completely adjust within a reasonable time span?

²² Compensating Variation is the amount of consumption to be delivered or withdrawn from consumers under the new rules to maintain the same level of utility they enjoyed previously. Thus, the variation of consumption is measured as the value CV solving for the following equation which represents the instantaneous utility function of the agent:

$$U(C, G, L) = U(C_{shock}, G_{shock}, L_{shock}, VC)$$

$$\frac{(C + \eta G)^{1-\sigma}}{1-\sigma} \frac{L^{1+\psi}}{1+\psi} = \frac{(VC + C_{shock} + \eta G_{shock})^{1-\sigma}}{1-\sigma} \frac{L_{shock}^{1+\psi}}{1+\psi}$$

Variables with subscript * are measured at steady state, while the variables with subscript (shocks) are evaluated after occurrence of shocks (Ferreira and Araujo, 1999).

²³ It considers a measure that would be "ideal" for welfare changes. So it would like to have a measure of the change in utility resulting by any policy. Suppose there are two endowment $U(C, G, L)$ and $U(C_{shock}, G_{shock}, L_{shock}, VC)$. It is convenient to think of $U(C, G, L)$ as the value at steady state and $U(C_{shock}, G_{shock}, L_{shock}, VC)$ as an amendment. Then, the obvious measure of change of welfare involved in the passage $U(C, G, L)$ to $U(C_{shock}, G_{shock}, L_{shock}, VC)$ is only the difference in indirect utility:

$$\Delta Welfare = \left[\frac{(C_{shock} + \eta G_{shock})^{1-\sigma}}{1-\sigma} \frac{L_{shock}^{1+\psi}}{1+\psi} \right] - \left[\frac{(C + \eta G)^{1-\sigma}}{1-\sigma} \frac{L^{1+\psi}}{1+\psi} \right]$$

If this difference in utility is positive (negative), then the policy change increases (decreases) the welfare of households (Varian, 1992).

²⁴ Composition of household consumption (C), and government consumption (G), hereinafter the composition of spending.

4.1 Welfare Analysis

Although the main objective of the present work is to identify the effects of (by their very nature permanent) changes in the composition of government expenditures on welfare, we only deal with temporary shocks. Nevertheless, it is our view that the response of the macroeconomic variables to such shocks provides an intuitive way to gauge welfare variations. These changes in welfare come about through both the intertemporal - i.e., how consumption evolves over time as a result of stochastic shocks - and the intratemporal channels - i.e., how demand for leisure reacts to such shocks.

In order to measure these changes, two different methodologies are utilized. The first one, due to Ferreira and Araujo (1999), draws upon the concept of compensating variation of consumption (VC)²²; and the second one consists of the difference between the utility function of households after each shock and the utility function of households at steady state ($\Delta Welfare$)²³.

In regards to the shock to public investment (Figure 1.a), the fall in current spending (Figure 1.b) helps the representative agent balance its budget (Equation 18). Since a rise in public investment must be accommodated by cutting another spending item, it is noticeable that even with an increase in private consumption (Figure 1.c), total consumption (sum of private and public consumption)²⁴ goes down (Figure 1.d). The decreasing levels of the latter variable and leisure both drag down welfare levels (Figure 1.e). Output rises, however (Figure 1.f), thereby allowing for a greater future welfare. On the other hand, the shock to income transfers (Figure 1.g) leads to higher total consumption (Figure 1.d), even though government expenditure falls (Figure 1.b). Additionally, it is worth mentioning that, as a result of this shock, households supply less labor (more leisure) (Figure 1.h), which makes them better off at present (Figure 1.e), but

worse off in the future via a lower output (Figure 1.f).

The results also show that, as far as the public investment shock is concerned, the compensating variation is positive (Figure 1.i), because the lower current expenditure (Figure 1.b) should be offset by a greater value of private consumption (see equation in footnote 15). In this respect, households would find this fiscal policy undesirable, thus advocating against its implementation. Regarding the shock on income transfers, it becomes clear that the compensating variation is negative (Figure 1.i). This transfer policy is welfare-improving as both consumption and leisure are greater after the shock (Figure 1.e), and hence, it would be advocated for by households.

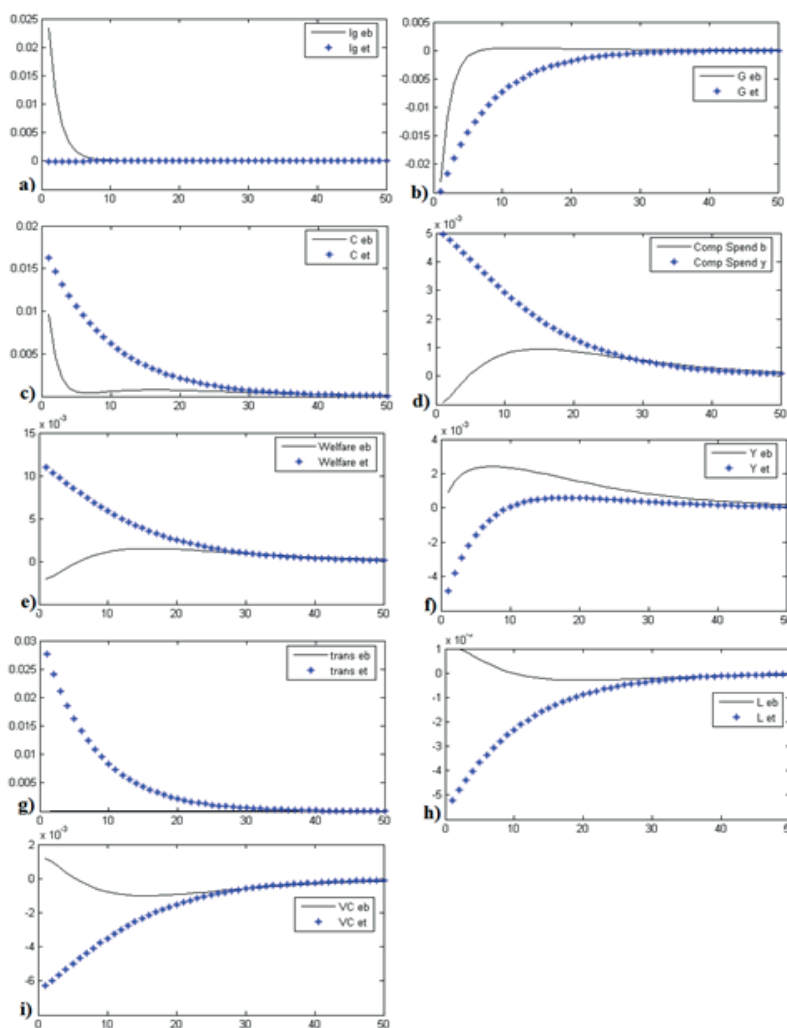
In summary, the fall in consumer welfare triggered by the public investment shock is compensated for by an increase in output, whereas the welfare gain resulting from the shock to income transfers reduces output. In the first case, consumers would engage in intertemporal consumption substitution, giving rise to a replacement of present welfare for future welfare as they take advantage of the higher output growth. In the second case, households would be better off by consuming more at present, even if this preference for today's consumption harms economic growth.

The decision to work is tantamount to deciding how to spend time. An optional use of the available time is to spend it on enjoyable leisure activities. The alternative to it is to work. Hence, one can characterize the decision whether or not to work as a choice between leisure and work²⁵. It follows then that shocks on total consumption will exert an influence over the supply of labor in the wake of a change in household income.

On impact, the public investment shock lowers welfare by squeezing total consumption (Figure 1.d). In the transition of these variables towards their steady states, to raise private consumption and make up for the decline in government consumption, households supply more labor. This excess of labor depresses the wage level. Correspondingly, workers are less willing to work than before the shock, which pushes wages back up. This process whereby wages increase as labor supply decreases is referred to as income effect (IR).

²⁵ Leisure can be thought of as an asset, which would be a function of the opportunity cost, level of funds available, and preferences. Thus, the first question that arises is: "What is the opportunity cost of leisure?" The cost of spending hours watching television is basically the amount of money that the person would receive if it was working. Accordingly, the opportunity cost of an hour of leisure amounts to the wage paid for a working hour. Funds availability is then a crucial variable to be taken into account when it comes to the analysis of leisure, and it associates itself to the variable family income. Preferences determine the degree at which households will demand more or less leisure, given a change in income or wage (Ehrenberg and Smith, 2000).

Figure 1 - Welfare analysis: Impulse-Response Functions are comprised of black curves representing the shock to public investment, and of blue curves which represent the shock to income transfer.



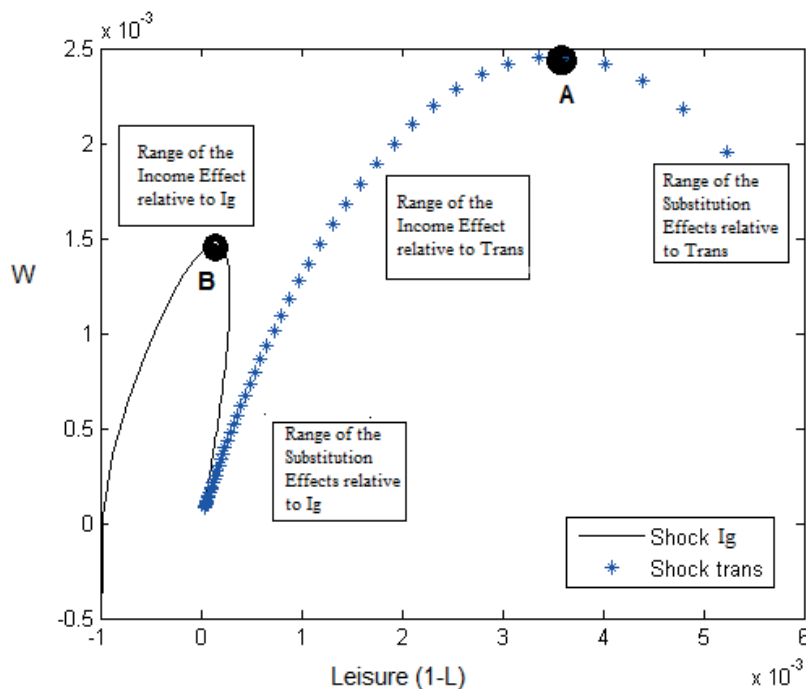
Source: Prepared by the authors.

As for the transfer shock, a higher income prompts households to consume more (Figure 1.c), with this consumption level exceeding its steady state. As a consequence, they seek to improve their welfare by demanding more leisure. This is also known as an income effect (Figure 1.h). These two effects are similar, but differ from the source from which they arose. The first one comes from an increased level of wages, while the second one is caused by the shock to income transfers.

Still on the analysis of households' preferences over changes in wages and income, it proves helpful to use the locus wage-leisure to find out the points of occurrence of income and substitution effects. Figure 2 presents the locus wage-leisure for both shocks. The two curves are divided into sections of predominance of income and substitution effects. Points A and B are the turning points between these effects. From the far right on the graphs until points A and B, there are stretches with predominance of substitution effect; from these turning points up to the far left, the income effect prevails. Initially, both curves behave in the same way: if households are initially allocated more leisure,

increasing wages lead to higher demand for labor (substitution effects). By contrast, if households receive less leisure in their allocation, so they have little, wages and demand for labor will be inversely related (income effect). Nevertheless, when households are hit by an income transfer shock, their demand for labor becomes less sensitive to the increased level of wages. This is due to the fact that income transfers bring forth the desired level of consumption. For this reason, those wages corresponding to the inflection points are around twice as large concerning the shock to income transfers as those associated with the shock to public investment.

Figure 2 - Locus wage-leisure.



Source: Prepared by the authors.

5. Conclusions

In this study we address the effects of two alternatives sorts of government expenditures on the main macroeconomic variables. To this end, two different government spending shocks in a DSGE model are considered. The first shock can be thought of as the government providing households with income transfers. The second one translates into public investment projects being carried out.

The public investment shock curtails welfare on impact, but it also propels output growth (and an increased output), thus enabling greater welfare in subsequent periods. By contrast, the shock to income transfers pushes welfare up, but also causes output to decline, which hurts future welfare. So if the policymaker chose to encourage public capital accumulation, it would be faced with an intergenerational distribution of welfare towards the future generations, who would benefit from this new government expenditure composition, and against the current generations, who could consume less. This would be the case of a policymaker placing the same weight across all generations. On the contrary, a policymaker who would care more about current generations than future ones would find herself deciding to spend more on current spending than on investment projects. So, as laid out above, a composition of government expenditures biased towards public investment and against current expenditure yields greater returns to the economy overall. Even though welfare drops for some time (ten years) until it

reaches its initial steady state again, future generations will benefit from a larger output as far as welfare is concerned.

Assuming that Brazil may be categorized as an "impatient" society, whose representative citizen's discount rate would supposedly be relatively high by international standards, individuals would support political parties which would favor "big governments" (abundant income transfers) where there could be little room for public investment in infrastructure. Welfare would not then be maximized from an intertemporal point of view. Those politicians who would attempt to reverse this ever-increasing trend in current government spending would be penalized at the polls, so these large governments would somehow perpetuate themselves. By contrast, a benevolent social planner with a lower discount rate than the representative household would be expected to pursue a more "optimal" fiscal policy as far as welfare is concerned. It would give priority to growth-enhancing investments over income transfers.

At the current conjuncture, Brazil finds itself in a profound fiscal crisis and the new government repeatedly announces that current public spending growth must be reduced and must match up that of fiscal revenues as a way to slash public debt and revert its perverse dynamics. At the same time, they stress the importance for public investments to be at the center of their long-run growth strategy, although at the moment the lousy fiscal situation makes it impossible for these investments to be undertaken. It is fair to say that this new fiscal policy mix is proving more difficult to come into force than expected.

A suggestion for future work could be to embed the financial sector into the model and relax the assumption of a government balanced budget. This would allow one to handle the composition of the financing sources and debt from an intertemporal perspective.

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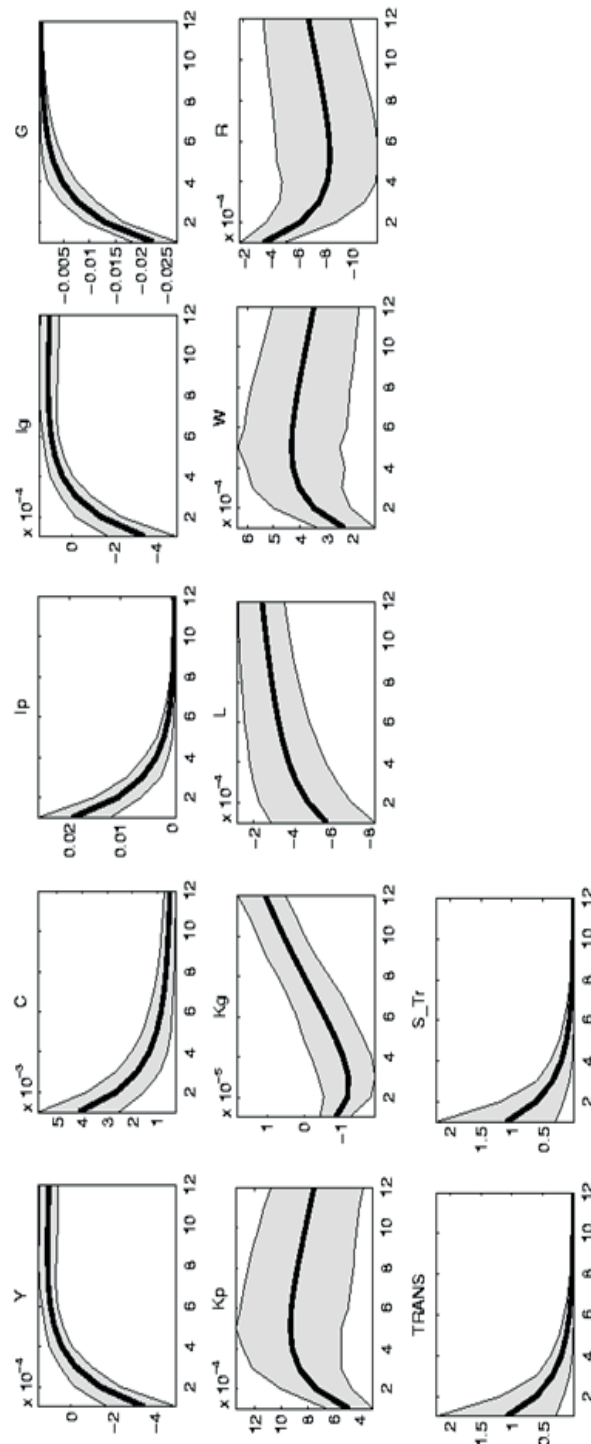
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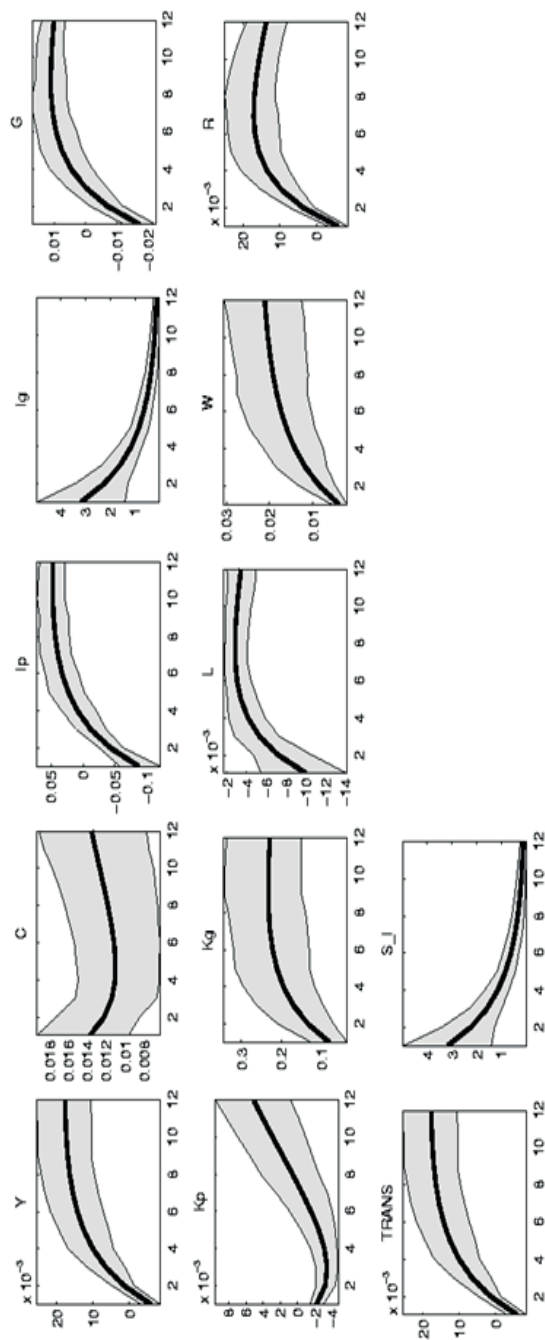
A. Appendix

Figure 3 - Graphics of simulations in Dynare - Income Transfers.



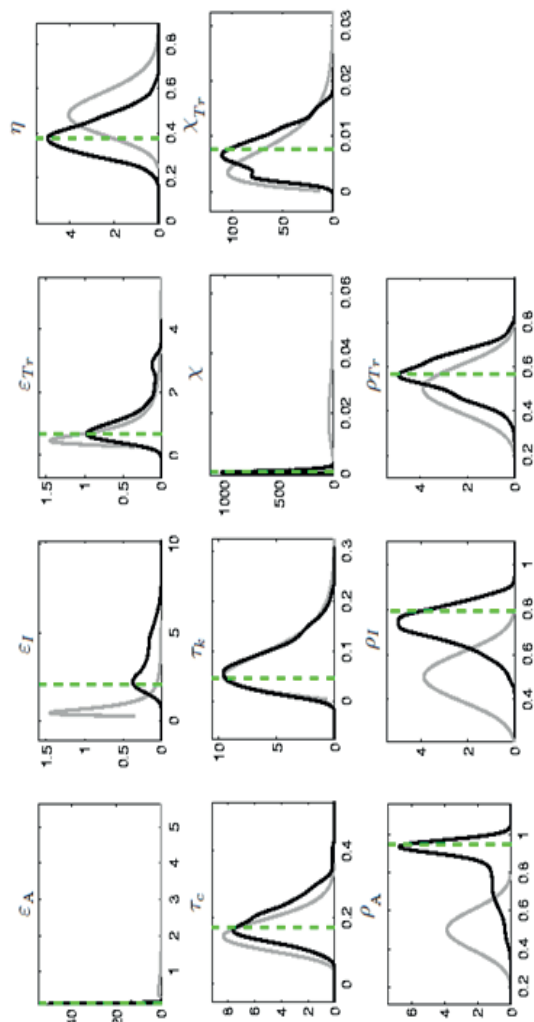
Source: Prepared by the authors.

Figure 4 - Graphics of simulations in Dynare - Public Investment.



Source: Prepared by the authors.

Figure 5 - Distributions priori and posteriori model.



Source: Prepared by the authors.