






Effects of Bolsa Família on rural welfare: a computable general equilibrium analysis

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Abstract

This article analyzes the effects of the Bolsa Família Program on the economic well-being of rural families in Brazilian macro-regions, contributing to the debate on income transfer programs. The objectives of the study are to analyze the impact of the Bolsa Program on the economic well-being of families living in rural areas in each Brazilian macro-region and the impact of government transfers on the prices of primary factors. The results indicate that, although the program is initially efficient in promoting the fight against inequality, gains in terms of economic well-being are minimal, as well as a reduction in the price of the labor factor, thus, it is suggested that, in the long term, in addition to the effects of the Bolsa Família Program becoming milder, transfers from the Bolsa Família Program to through labor market policies in rural areas occur. The effects of real public spending with the Bolsa Família Program on rural families in Brazilian regions, considering rural families, are low, but positive and higher than unity, which confirms the guiding hypothesis of the research.

Keywords: social programs; income transfer; Bolsa Família Program; rural families.

JEL Code: I38; R13; P25

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Efeitos do bolsa família no bem-estar rural: uma análise de equilíbrio geral computável

Este artigo analisa os efeitos do Programa Bolsa Família sobre o bem-estar econômico das famílias rurais nas macrorregiões brasileiras, contribuindo para o debate sobre programas de transferência de renda. Os objetivos do estudo são analisar o impacto do Programa Bolsa no bem-estar econômico das famílias que vivem em áreas rurais em cada macrorregião brasileira e no impacto das transferências governamentais sobre os preços dos fatores primários. Os resultados indicam que, embora o programa seja inicialmente eficiente na promoção do combate à desigualdade, ganhos em termos de bem-estar econômico são mínimos, bem como redução do preço do fator trabalho, assim, sugere-se que, a longo prazo, além dos efeitos do Programa Bolsa Família se tornando mais branda, ocorra a transferência do Programa Bolsa Família para através de políticas de mercado de trabalho em áreas rurais. Os efeitos de um gasto público real com o Programa Bolsa Família nas famílias rurais das regiões brasileiras, considerando as famílias rurais, são baixos, mas positivos e superiores à unidade, o que confirma a hipótese norteadora da pesquisa.

Palavras-chave: programas sociais; transferência de renda; Programa Bolsa Família; famílias rurais.

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Introduction

Rural inequality is a serious problem in Brazil and indicates a poor distribution of income, and this inequality contributes to a reduction in the income of the rural population. In this context, the discussion of agricultural policies should consider new strategies to improve the distribution of income and reduce poverty in the countryside. Much of the choice of these strategies depends on understanding the sources of income inequality (MARIANO; LIMA, 1998). The impacts on the social welfare of income transfer programs for Brazilian rural families are widely discussed, so it is important to know their impact on the economic well-being of families, analyzing the true rate of return of each real transferred from the government to the families in the different Brazilian regions.

Since poverty is a social phenomenon of difficult measurement, there is a strong discussion about the appropriate instruments to measure its magnitude. To achieve the eradication of poverty, it is necessary to know how such poverty is distributed geographically and the elements to be considered in its assessment. Public policies that target poverty must rather precisely specify its causes and location. Rural poverty is in many ways different from urban poverty, and the reasons are possibly different, leading to a distinction in the way of reducing or eradicating it. Thus, it is important to evaluate the specificities of the rural area, which is an important exercise to treat rural poverty in a correct way (DEUS *et al.*, 2015).

The analysis of the efficiency of the social programs of income transfer for the families of the rural areas in Brazil should consider that it is a country with a continental dimension, internally guarding deep social and economic differences between the Brazilian regions and that the focus of this type program allows its activities to be concentrated in the regions with the largest number of people in the poverty situation (COTTA; PAIVA, 2010). Considering that the incidence of the Bolsa Família Program is different among the Brazilian regions, and its focus is on the poorest population (CURY; LEME, 2007) and that rural poverty presents high spatial concentration in Brazil (MALUF; MATTEI, 2011), it is regional analysis due to the specificities of the different Brazilian regions.

The present study aims to analyze the impact of the Bolsa Família Program on the economic well-being of families living in rural areas in each Brazilian macro-region and the impact of government transfers on the prices of primary factors (capital and labor). In addition to the contribution to the debate on income transfer programs for families living in rural areas of Brazil, the present research intends to collaborate with the theme by adopting an analysis of different income classes in the Brazilian regions.

To achieve the proposed objectives, it uses an Applied Model of Computable General Equilibrium, the Brazilian General Economic Equilibrium Analysis Project (PAEG), a regionalized general equilibrium model, which disaggregates the consumption of the families of the regions by income class and stratum geography (urban and rural) as well as the income formation of each class. The PAEG database regionalized for the Brazilian economy for the year 2011, compatible with the database 9.0 of the GTAP9. The GTAP database presents Input-Output matrices (MIPs) for 140 countries / regions, including Brazil, 57 sectors and five primary factors.

Despite the debate about state intervention in the economy, it is true that in most countries, developed or developing, there are governments that act actively in the economic system, and the logic behind this intervention lies in the fact that the market is not capable of, by itself, solve all the problems generated by it. Among the most serious problems is the income discrepancy between the richest and poorest sections of society (SANTOS, 2008).

Public policies have a fundamental role in the development of countries and regions, since they stimulate and encourage vital sectors, such as agriculture and education (MATTOS; TEIXEIRA; FONTES, 2011; SUELA *et al.*, 2020; SUELA *et al.*, 2022). Among the several studies that study the recent evolution of income inequality in Brazil, there is still no consensus on which income-generating elements are most responsible for their reduction, however, the main hypotheses raised fall on official income transfer programs and job market.

Since the beginning of the 21st century Brazil has experienced a reduction in the level of inequality and poverty, this fall can be explained by the growth of formal employment and public policies. The main government program in this regard is the conditional income transfer program, the Bolsa Família Program (BFP). It is a direct income transfer program, aimed at families living in poverty and extreme poverty in Brazil, so that they can overcome the situation of vulnerability and poverty. The program seeks to guarantee these families the right to food and access to education and health. Throughout Brazil, more than 13.9 million families are served by Bolsa Família (WEISSHEIMER, 2018).

The recent fall in income inequality in Brazil was not restricted to urban areas, and there was also a sharp drop in rural areas. Rural poverty fell continuously and significantly, the rural middle income grew more than the urban during this period. Thus,

rural areas have a significant contribution to the indicators of decline in national inequality, both due to the decrease in the average income gap between urban and rural areas, as well as to the sharp fall in inequality in rural areas (HELFAND; ROCHA; VINHAIS, 2009). The existence of social policies that reach the rural populations, in the mold of the Bolsa Família Program, allow this population to improve the quality of life (GRISA; SCHNEIDER, 2014).

For Helfand, Rocha and Vinhais (2009) there are three implications of public policies in rural areas: first, because of the higher incidence of poverty, transfers of income through programs such as Bolsa Família have become even more important for the fall poverty and inequality in rural areas than in urban areas. Second, the growth of pension and pension income was an important factor in explaining the increase in total income and the fall in poverty in this period. Finally, the income of work has a great participation of the formation of the income of the Brazilian rural families. Important policies are to contribute to the competitiveness of family farming, to improve the quality of jobs and wages in agriculture, and to the access of the rural poor to better paid non-agricultural jobs.

Mocelin (2011), considers that the BFP managed to advance as a policy mainly due to the articulation in different areas. According to the author, the program induces the democratization of socially produced wealth, reduces inequality, and provides autonomy for families. Access to the Program was an effective alternative to minimize rural poverty, however, regarding autonomy, the author realized the need for articulation with other policies. The author affirms that there is a need for advances in relation to access to health for the beneficiaries analyzed, as well as processes of education complementary to regular education capable of breaking the cycle of poverty.

Silva *et al.* (2017) emphasizes the need for productive inclusion policies associated to the BFP that ensure the permanence of the population in the rural environment, since, due to the low level of education, their inclusion in the urban labor market is impaired, thus favoring informality and low remuneration. The authors emphasize that, in rural areas, the beneficiaries, most of the time, live on their own properties, performing activities that guarantee access to food and some income. For the authors, then, the positive aspects of the BFP are evident both in their initial objectives and in their impact in other sectors, although, despite the wide coverage and the positive results, the program needs special attention when it comes to emancipation of beneficiary families, since a large part of the rural beneficiaries are still very dependent on income transfer and are not able to get out of the poverty situation in which they live.

Cavalcanti *et al.* (2016) notes that in all regions and Brazil there are negative results on the hours worked and the income of the beneficiaries of the program compared to eligible families, but do not receive the program. So, the authors consider that there is a disincentive effect to work for Brazil and regions. Faria (2015) considers that it is important to emphasize that the different ones emphasize the positive effects of BPF on the immediate role of poverty alleviation, since they promote the stimulation of access to social rights and access to regular income through transfers of income, which include beneficiaries in the economic circuits through consumption. However, the author says that studies are very frequent in the concern that overcoming poverty and social integration depend on the creation of sustainable employment and income strategies.

Methodology⁶

To achieve the proposed objectives, the analytical instruments used will be quantitative in nature, an Applied Model of General Equilibrium. According to Najberg, Rigolon and Vieira (1995), this type of model presents aspects of macroeconomic models and input-output models, these are economic models applied with the objective of capturing all the existing relationships in the economic system. They can portray both direct and indirect effects caused by changes in economic policies, as well as technological changes, income distribution, taxes, subsidies, etc., so the use of this model allows to obtain the total variation in the level of good economic response in response to a social income transfer program.

Through mathematical relations, according to Gurgel and Campos. (2006), the applied general equilibrium models propose to portray the way an economy works. Differently from the general equilibrium models, there are also the analyzes made through partial equilibrium, but the latter method considers that the policy only impacts on the sector to which it was implemented, disregarding other sectors of the economy, and thus the estimates and conclusions obtained can be misleading and overrated. General Equilibrium relations demonstrate the behavior of economic agents in markets for goods, services, and factors of production.

The analytical set used was PAEG, an analytical set of static general equilibrium, multiregional and multisectoral and was elaborated based on GTAP in GAMS (RUTHERFORD; PALTSEV, 2000; RUTHERFORD, 2005). In the PAEG, the data base for the Brazilian economy was disaggregated to represent its five major regions (Central West, North, Northeast, South and Southeast), keeping GTAP data intact for other regions of the world, and data from trade flows between Brazil and other regions of the world.

The general structure of the PAEG suggests that domestic production (vom_{ir}) is distributed among exports ($vxmd_{irs}$), international transport services (vst_{ir}), intermediate demand ($vdfm_{ijr}$), private consumption ($vdpm_{ir}$), investment ($vdim_{ir}$) and government consumption ($vdgm_{ir}$). The accounting identity for domestic production is represented by the following equation:

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

Imported goods (vim_{ir}) are used in intermediate consumption ($vifm_{ijr}$), private consumption ($vipm_{ir}$) and government consumption ($vigm_{ir}$), therefore:

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

Y_{ir} production includes intermediate inputs, both domestic and imported, mobile production factors (vfm_{fir} , f , m) and government consumption (public agent) ($vdgm_{ir}$). The income of the factors of production is distributed to the representative agent. The equilibrium of the market of factors of production is given by the following equation (where the value of the payment of the factors of production is related to their income):

⁶ Based on: Teixeira (2013) and Wolf (2016)

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

The equilibrium conditions in international markets (between supply and demand) imply that exports of goods i by region r (vxm_{irs}) equals imports of the same good by all other trading partners ($vxml_{irs}$), as follows:

$$vxm_{ir} = \sum_s vxml_{irs} \quad (4)$$

The aggregate supply of transport service j , vt_j , is equal to the value of transport services in exports:

$$vt_j = \sum_r vst_{jr} \quad (5)$$

In the transport services market, the balance between supply and demand equals the supply of these services to the sum of bilateral flows of transport services acquired in imports of goods, $vtwr_{jisr}$:

$$vt_j = \sum_{isr} vtwr_{jisr} \quad (6)$$

Tax flows consist of indirect taxes on production and export (R_{ir}^Y), consumption (R_r^C), government demand (R_r^G) and imports (R_{ir}^M). Government income still includes direct taxes on the representative agent, HH, represented by R_r^{HH} , as well as transfers abroad, vb_r . Thus, the government's budget constraint can be described as:

$$vgm_r = \sum_i R_{ir}^Y + R_r^C + R_r^G + \sum_i R_{ir}^M + R_r^{HH} + vb_r \quad (7)$$

The budgetary constraint of the representative agent, HH, relates the income of production factors, discounted from tax payments to consumption and private investment expenditures, as follows:

$$\sum_f evom_{fr} - R_r^{HH} = vpm_r + vim_r \quad (8)$$

In previous identities, we visualize market equilibrium (supply equals demand for all goods and factors of production) and income balance (net income equals net expenses). A third set of equations represent net operating profits in sectors of the economy. Considering an economy in perfect competition and constant returns to scale, where the costs with intermediate inputs and factors of production and equals the value of production, and economic profits, to zero. This condition is applied to each of the productive sectors and activities.

The equilibrium condition of production equals the value of the aggregate product (vom_{ir}) to the sum of the payments of the net primary factors of the tax (vfm_{fir})

plus the sum of the imported aggregate ($vifm_{jir}$) and domestic intermediate ($vdfm_{jir}$) demands and the taxes double the production (R_{ir}^Y):

$$Y_{ir}: \sum_f vfm_{fir} + \sum_j (vifm_{jir} + vdfm_{jir}) + R_{ir}^Y = vom_{ir} \quad (9)$$

The total value of imports (vim_{ir}) shall be equal to the value of exports of goods ($vxmd_{isr}$) plus the sum of international transport services ($vtwr_{jisr}$) and import tariffs (R_{ir}^M), as follows:

$$M_{ir}: \sum_s (vxmd_{isr} + \sum_j vtwr_{jisr}) + R_{ir}^M = vim_{ir}; \quad (10)$$

The condition of equilibrium of private consumption is established in the equality between private expenditure (vpm_r) and the sum of domestic ($vppm_{ir}$) and imported ($vipm_{ir}$) demands plus private consumption taxes (R_{ir}^C):

$$C_r: \sum_i (vdpm_{ir} + vipm_{ir}) + R_{ir}^C = vpm_r; \quad (11)$$

In government consumption, equilibrium requires that government spending (vgm_r) be equal to aggregate domestic government demands ($vdgm_{ir}$) and imported ($vigm_{ir}$) plus government consumption taxes, as follows:

$$G_r: \sum_i (vdgm_{ir} + vigm_{ir}) + R_{ir}^G = vgm_r \quad (12)$$

The equilibrium condition of the investment equals the total value of the investments (vim_r) to the sum of the domestic value of the investments ($vdim_{ir}$), as follows:

$$I_r: \sum_i vdim_{ir} = vim_r \quad (13)$$

The equilibrium in the factor market implies that the equality of factor income ($evom_{fr}$) must be equal to the value of factor payments, as follows:

$$FT_{fr}: evom_{fr} = \sum_i vfm_{fir} \quad f \in s \quad (14)$$

In the transport sector, the value of international trade margins should be equal to both the international transport service and the value of international transport sales:

$$YT_j: \sum_r vst_{jr} = vt_j = \sum_{irs} vtwr_{jirs} \quad (15)$$

The relationships presented above show the economic identities of the model, however, do not describe the behavior of economic agents. To understand the functioning of the model, it is necessary to describe how the agents and sectors behave. The aggregation of PAEG sectors and regions is presented in Table 1.

Table 1 – Aggregation between regions and sectors for PAEG

Sectors	Regions
Rice (pdr)	Brazil - North Region (N)
Corn and other cereals (gro)	Brazil - Northeast Region (NE)
Soybeans and other oil seeds (osd)	Brazil - Central-West Region (CE)
Sugar cane, beet, sugar industry (c_b)	Brazil - Southeast Region (SE)
Meat and live animals (oap)	Brazil - South Region (SUL)
Milk and dairy products (rmk)	Rest of Mercosur (RMS)
Other agricultural products (agr)	United States of America (USA)
Food products (foo)	Rest of America (ROA)
Textile Industry (tex)	Europe (EUR)
Clothing and footwear (wap)	China (CHN)
Wood and furnishings (lum)	Rest of the world (ROW)
Paper, pulp and paper industry (ppp)	
Chemicals, rubber and plastic industry (crp)	
Manufactured (man)	
Electricity, gas, water distribution (siu)	
Construction (cns)	
Trade (trd)	
Transportation (otp)	
Services and Public Administration (adm)	

Source: Teixeira et al. (2013).

The model represents the production and distribution of goods and services in the world economy. Each region is represented by a final demand structure, composed of public and private expenditure on goods and services. The model is based on optimizing behavior, when consumers seek to satisfy their needs (maximization of welfare, subject to budget constraint), considering fixed levels of investment and production of the public sector.

The productive sectors combine intermediate inputs and primary factors of production - capital, labor (skilled and unqualified), land and natural resources - in order to minimize costs, given the technology. The database includes bilaterian flows of trade between countries and regions, as well as transport costs, import tariffs and export taxes (or subsidies).

The supply of firms is defined by an optimization problem and aims at minimizing unit costs, by combining primary input inputs and intermediate inputs, domestic and imported. At first, firms decide the combination of primary factors that will be employed, and the decision is made based on the elasticity of substitution between the factors of production that make up the added value. Afterwards, companies acquire intermediate input baskets, deciding between domestic and imported goods taking into account the elasticity of substitution.

The production block represents the combination of goods and services for consumption by the model households. This block combines domestic and imported commodities to form an aggregate consumption index for each of the 10 family classes in each sub-region of Brazilian regions. This means that it is possible to represent the consumption preferences specific to each family class.

The aggregate regional consumption block, specific for households in Brazilian regions, aggregates the total consumption basket of each household in the same region into a single regional total consumption, priced by the consumer price index. The consumption of each family depends on its income formulation. The sum of the

consumption of each income class of the region forms the total consumption. Thus, if any shock that increases the remuneration of a specific factor, increases the budget of families who have in the formulation of income such factor, increasing the consumption of that income class.

The aggregate government consumption block, block g , which as the household consumption block, combines domestic and imported commodities to form an aggregate government consumption index. The production block aggregates bilateral imports originating in different regions and transport trade expenditures. This block shows that the aggregate of imports that is formed by the commodities produced in the different regions, considering the subsidies and taxes on exports in the producing regions to the importing region and the tariffs on imports charged by the importing region of the goods originating in the region.

In the production block responsible for allocating factors between different regions, in response to changes in the economy, factor type allocations from all regions are available as inputs to be transformed into regional factors that will be used specifically in each of the regions. The inputs (factors) presented have elasticity of substitution equal to zero, that is, Leontief.

The elasticities define that the categories of the different regions are always combined in fixed proportions, according to an initial regional allocation, and then distributed to as several different rules a Cobb-Douglas function of transformation between regions, that is, it is not possible to free movement of capital or labor from one region to another, rather than differences in factor remuneration, since the characteristics and composition of the factors in each region are not the same. However, this block makes it possible to represent the degree of factor mobility between regions, as there is a change in the remuneration relative to one region in relation to more.

The optimization problem presented here defines a production function with constant elasticity of substitution (CES), in which added value components (primary production factors) can be substituted, being such a process determined from an elasticity of. The intermediate inputs and added value are combined from a Leontief function, in which they cannot be substituted for each other. Each intermediate input in this Leontief function is a combination of a domestic and imported portion of the same good, from a CES function of substitution elasticity.

The consumption of public administration is represented in the model by a Leontief aggregation composed of domestic and imported goods. The different composite goods are not interchangeable, however, domestic and imported components of each good respond to prices and are substitutable. The consumption of the private agent can be represented by a problem of minimization of the cost of given level of aggregate consumption, as follows.

The final demand of the model is characterized by a Cobb-Douglas function among composite goods, formed by the aggregation of domestic and imported goods. The mathematical relationships presented above describe the various optimization processes that occur in the general equilibrium model to be used in the present study. Besides these relations it is worth mentioning that the conditions of equilibrium between supply and demand in the markets, zero profit and equilibrium between income and expenses of agents complete the process of computational equilibrium.

In the PAEG model, the measurement of results is given through parameters and calculations of the impacts of the implemented scenario. The measure of

equivalent variation⁷ is the parameter that stores the result of the percentage change in well-being, this measure makes it possible to indicate the increase in the utility of domestic consumers in terms of increased consumption. The variable that denotes the level of activity of the block of production of private consumption, represents the welfare index of the model.

The closure of the PAEG model considers the total supply of each production factor fixed, but ensures mobility between sectors, within a region. Mobility can be total, partial or non-existent, and the present study will analyze all three situations. The land factor is specific to the agricultural and livestock sectors, while natural resources are specific to some sectors (mineral resource extraction and energy).

The model considers that there is no unemployment; therefore, factor prices are flexible. From the demand side, investments and capital flows are kept fixed, as well as the balance of payments balance. Thus, changes in the real exchange rate must occur to accommodate changes in export and import flows after shocks. Government consumption may change with changes in the prices of goods, just as revenue from taxes will be subject to changes in the level of activity and consumption.

Source and data treatment

For the development of the research the PAEG regionalized database for the Brazilian economy for the year 2011 - PAEG 4.0, compatible with the database 9.0 of the GTAP9 was used.

The disaggregation of Brazilian households in the PAEG model allows to evaluate the distributive impacts of social policies of income transfer and not only the aggregate effects, although PAEG data are based on the Brazilian input-output matrix of 2011. In the database of the model, the household expenditure data are based on (Brazilian Statistics Institute) IBGE's 2008-2009 household expenditure data (POF 2008-2009).

Rural and urban incomes were disaggregated by income class so as not to alter the original net household income data by region, which includes: a) income from primary factors; b) transfer between government and families; c) household savings (if negative means that households are "lending" to the financial system, and are not using to consume, if positive, means that households are owed, i.e. borrowing to consume).

The strategy to disaggregate net household income by region and by geographic stratum in the PAEG database was as follows:

- Disaggregate the sources of income (Capital, Labor and Transfers) in the income of rural families in the Brazilian regions;
- Obtain the share of rural income participation in the total income in the PAEG database, and divide between rural and urban income according to the share of participation in the original data;
- After applying the portion of these sources to obtain the income for each family (rural and urban), the income of all these sources was added for each family of each stratum, in order to define the gross income of the families;
- As the net income must be equal to the total consumed, thus, the difference between the consumption and the gross income of the families

7 See: Varian (1992).

was calculated, this difference was considered the saving (or debt) of each family;

- At the end of the disaggregate, the PAEG model will have twenty family groups, ten rural and ten urban.

The income classes contained in the model are presented below⁸ in Table 2:

Table 2 – Classes of revenue in Brazil, according to IBGE

Class 1	up to US\$ 239.52
Class 2	more than US\$ 239.52 up to US\$ 359.28
Class 3	more than US\$ 359.28 up to US\$ 598.80
Class 4	more than US\$ 598.80 up to US\$ 718.56
Class 5	more than US\$ 718.56 up to US\$ 958.08
Class 6	more than US\$ 958.08 up to US\$ 1197.60
Class 7	more than US\$ 1197.60 up to US\$ 1796.41
Class 8	more than US\$ 1796.41 up to US\$ 2395.21
Class 9	more than US\$ 2395.21 up to US\$ 3592.81
Class 10	over US\$ 3592.81

Source: IBGE (2011).

Since household consumption data did not previously divide the rural and urban strata, the strategy to disaggregate the consumption of rural households without altering the original PAEG database was based on data from the POF 2008-2009 (IBGE, 2011):

- a) Divide the families in each Brazilian state by geographic stratum (rural and urban);
- b) To add the states in Brazilian regions (North, Northeast, South, Southeast and Center-West);
- c) Divide the families in each income class in the Brazilian regions;
- d) Disaggregate the consumption of the urban families, see the proportion of consumption of these families of the total in the original database and obtain the rural consumption with the remaining portion.

Analytical scenario

In the PAEG model, a "key" is created to activate the disaggregation of the income and the income of the families of each region by income class (*fam_bra*), this key disaggregates both agricultural families and urban families and must be activated for the functioning of the model analyzed and a parameter is created, *trans_shck* (*fam_bra*), that represents the governmental transfers for each class of income (rural and urban) in each Brazilian region.

Shocks using the parameter *trans_shck* greater than 1 mean an increase in government transfer, through social programs for families, and less than 1, means a reduction of transfers from the government to the families, and it can be specified at

⁸ It was used the exchange rate of US\$ 1.00 = R\$ 1.67 (value for the year 2011).

the moment of the shock and the region. the class of income attained, for example: the shock $trans_shck$ ("F3", "sul") = 0.75 reduces by 25% the transfers of the government to the income class three of the urban geographic stratum of the South; while the shock $trans_shck$ ("uF1", "nde") = 1.25 increases transfers through social programs different from income class one of the rural geographic strata of the Northeast region by 25%.

The way adopted to evaluate the impact of Bolsa Família on the economic well-being of each income class of rural families in the Brazilian regions, after analyzing the initial data of the model, without any shock, was to verify the portion that the Program has transfers to each of these families and to withdraw that portion of the total government transfers.

Results

Impact of the bolsa família program on the income of rural families in the brazilian regions

The Bolsa Família Program was withdrawn from the rural family income by income class according to its share of the total income from government transfers through social programs for each income class, from each region of Brazil. The magnitude of the withdrawal (the applied shock) of this transfer can be seen in Table 3.

Table 3 – Participation of the Bolsa Família Program in total transfers through social programs for rural families in the Brazilian regions

Income Class	COE	NDE	NOR	SDE	SUL
1st	33.25%	72.61%	57.89%	37.63%	26.21%
2nd	20.61%	48.30%	53.48%	29.30%	24.59%
3rd	27.43%	34.42%	32.13%	23.93%	13.45%
4th	14.19%	21.97%	28.01%	20.26%	13.49%
5th	9.88%	19.22%	21.80%	9.09%	5.21%
6th	8.42%	13.37%	16.16%	7.29%	5.43%
7th	3.88%	7.64%	11.63%	2.50%	1.86%
8th	3.18%	4.10%	7.79%	1.94%	0.87%
9th	0.97%	4.34%	5.17%	0.75%	0.91%
10th	0.67%	1.67%	1.06%	0.15%	0.29%

Where NOR is the Northeast region; NDE is the Northeast region; COE is the Center-West region; SDE is the Southeast region; SUL is the South region.

* Income transfers from federal social programs according to POF (2008-2009): Bolsa Família; Continuous Benefit Benefit and Child Labor Eradication Program.

Source: Elaborate by the authors (2023).

For being a social program for low-income families, the Bolsa Família Program must reduce its share of income from social programs of government transfer to rural families as the total income increases, that is, the class increase. However, once the transfer is passed according to per capita income, it is understandable that this participation decreases and does not reach zero, the following situation occurs: families from a certain region may be larger, so the family income of the last income class, being divided by the members of each family assure the benefit granted by the government.

It can be seen from Table 3 that, in general, families from all income classes received the Bolsa Família Program (BFP), this is because Bolsa Família is passed on to families by per capita income and the Family Budget Survey (POF) total income of the family unit. Analyzing the table 3, it can be observed that families from the rural areas that are in income classes from 1 to 6 have a significant portion of transfers from the Bolsa Família program, between 16.16% and 72.61% of total transfers government through social programs. The regions where the poorest families are most dependent are the Northeast and North regions, 72.61% and 57.89% respectively, the region where the program has the lowest incidence of transfers is the South, with 26.21% of transfers to the poorest families coming from BFP.

The implementation of the Bolsa Família Program is a government expense, once it transfers to families, through social programs, a value that could otherwise be consumed by the government. Therefore, such spending has an impact on the value of the primary factors (capital and labor) of each region. Since the model considers that the government spends all its disposable income, negative values in factor prices basically indicate that government is failing to consume in sectors that are intensive in that factor. The variation in factor prices due to transfers through the Bolsa Família Program is presented in Table 4.

The Bolsa Família Program raises the disposable income for the lowest income rural families to spend and reduces a portion of the resource available to the government to spend. The pattern of spending by the poorest households is relatively higher with food (proceeds) and agricultural products relative to government, while the pattern of government spending by the input-output matrix is much larger with the service sector than with agribusiness, in relation to the poorest families.

Table 4 – Impact of the Bolsa Família Program on the price of factors

Factor	Variation	COE	NDE	NOR	SDE	SUL
Capital	%ch	0.001	0.007	0.006	0.001	0.001
Labor	%ch	-0.002	-0.017	-0.022	-0.001	0.000

Source: Elaborate by the authors (2023).

It turns out that the service sector is more labor intensive than the industrial sectors of agribusiness and the agricultural sector itself, which are, compared to the services sector, more capital intensive. Their shock then shifted the composition of final demand in the economy towards less service consumption, which is relatively more labor intensive, and more consumption of agribusiness goods, which are relatively more capital intensive.

As a consequence, the demand for labor is reduced and the demand for capital is increased. As the model adopts a closing of full employment of the factors, without possibility of increases or reductions in the stock of capital and labor factors, lower demand for labor reduces the relative remuneration of this factor, and greater demand for capital raises the relative remuneration of capital.

An important detail is that the increase in government spending does not generate more investments in any sector, since the closing of the static model is to keep investments (in quantum) unchanged (exogenous). The increase in government spending generates greater demand for capital-intensive products, not larger investments in the economy.

The poorest families have as main source of income the labor factor, while the richest, the capital factor. So, in most of the Brazilian regions, when the government is

passing on the value of the Bolsa Família Program to rural families and reducing investment in labor-intensive sectors. Cacciamali and Camillo (2009) point out that labor income is the main source of income for low-income families. Moreover, it represents, over time, the main mechanism of inequality reduction. Therefore, in the long term, the effects of the program tend to be mild, precisely because it interferes negatively in the price of the important factors in the income formation of low and high income families, which was also pointed out by Muniz (2018) which claim that in the long run, by the income of capital being extremely concentrated in the upper income families, the trend would be a cooling off of the distributive effects of politics.

Zylberberg (2008) emphasizes that income transfer programs, such as the Bolsa Família Program, should be considered emergency programs, since their effects would not be sustained in the long term, a conclusion shared by Muniz (2018), who asserts that the impacts of The Bolsa Família Program reduce income inequality only momentarily. That is, if the families that benefit from the program can not emerge from the income class, the effects of the program would be artificial, with a fixed term, and would not be sustained.

Effects of the family grant program on the consumption and economic well-being of rural families in Brazilian regions

Once the Bolsa Família Program is a direct monetary transfer to rural families, it has a direct impact on the degree of utility of the consumption of those who receive it, thus impacting the economic well-being of these families, the effects of Bolsa Família Program in the economic well-being and in the consumption of the families of the Brazilian regions can be observed in Table 5.

Table 5 – Impacts of the withdrawal of the Bolsa Família Program on the economic well-being and consumption * of rural families in the Brazilian regions

Income Class	COE		NDE		NOR		SDE		SUL	
	welfare	cons.	welfare	cons.	welfare	cons.	welfare	cons.	welfare	cons.
1st	1.00	1.74	2.68	53.49	3.075	10.29	1.23	8.68	0.18	0.70
2nd	0.67	2.07	2.04	45.40	3.262	21.06	1.05	14.18	0.40	1.63
3rd	0.58	7.03	1.82	76.51	1.9	45.69	0.55	36.18	0.21	3.51
4th	0.34	2.34	1.06	21.25	2.463	18.40	0.35	13.83	0.11	1.52
5th	0.18	3.24	0.85	23.50	1.358	23.90	0.19	15.17	0.09	1.94
6th	0.18	1.75	0.56	10.87	0.827	10.93	0.14	11.01	0.07	1.53
7th	0.12	1.67	0.39	8.45	0.567	10.85	0.04	8.59	0.03	1.76
8th	0.04	0.51	0.26	1.75	0.375	2.76	0.03	3.34	0.01	0.38
9th	0.02	0.25	0.19	1.69	0.12	1.77	0.01	1.44	0.01	0.53
10th	0.01	0.25	0.06	1.39	0.032	1.17	0.005	1.52	0.009	0.50

Where: COE is the Midwest region; NDE is the Northeast region; NOR is the North region; SDE is the Southeast region; and SUL is the southern region.

the economic well-being is presented in percentage variation;

* As the model data is in US\$ bi, the data has been passed to US\$ million.

Source: Elaborate by the authors (2023).

It can be observed in the table that the families of the first income classes, those who have a larger portion of the Bolsa Família Program in the income, are those that have the greatest increase in consumption, and consequently a positive impact of economic well-being. As the income classes increase, that is, higher the family income, the lower the impact of the Bolsa Família Program on the income formation of the families, and the lower the impact on the economic well-being of the families, however, a smaller impact on economic well-being does not necessarily mean a smaller increase in the consumption of these families, for example, in the South region an increase in the economic well-being of the families of the ninth income class is of 0.01%, representing an increase of US\$ 0.53 million, while in the families of the eighth income category, the well-being suffers an impact of 0.01%, representing a higher consumption of US\$ 0.38 million.

The families that go until fifth income class, with incomes of up to \$ 958.08, have a greater positive impact on the consumption and well-being, with emphasis on the families of the North and the North east. It should be noted that, despite having a greater gain in percentage terms, the rise of well-being in the North region in terms of consumption is lower than those presented in the Northeast region. The Southeast region is the third to win most in terms of well-being, followed by the Center-West and, lastly, the South.

The results agree with those of Resende and Oliveira (2008), which indicate that income transfer programs significantly increase the consumption of the lower income families, representing an immediate improvement in the welfare of the poorest families. Rocha (2005), Rocha (2018) and Silva and Filho (2018) agree on the increase of the most significant consumption for poorer families and regions, that is, that income transfer programs fulfill the function of alleviating poverty, increasing consumption and well-being of the families of the lowest income classes, the greater the insufficiency of income, the greater the benefits produced by the Bolsa Família Program.

Return of government spending with Bolsa Família Program (rural families) to the Brazilian GDP

Once the effects of the transfer of government (via the Bolsa Família) on the consumption and economic well-being of rural households in the Brazilian regions have been analyzed, it is important to know the effect of each real of this transfer on GDP, the multiplier effect of Bolsa Família program of government transfers to rural households in GDP and its main aggregates can be seen in Table 6.

Table 6 – Effects of transfers to households through Bolsa Família Program on GDP and themain aggregates in each Brazilian region

Region	Multiplier	G ($\Delta\%$)	C ($\Delta\%$)	I ($\Delta\%$)	X ($\Delta\%$)	M ($\Delta\%$)
COE	1.0021	0.0190 (-0.066)	0.0207 (0.021)	-	0.0031 (0.009)	0.0028 (0.009)
NDE	1.0103	0.2339 (-0.502)	0.2410 (0.160)	-	0.0264 (0.071)	0.0232 (0.047)
NOR	1.0088	0.1402 (-0.809)	0.2460 (0.246)	-	0.0199 (0.064)	0.0162 (0.060)
SDE	1.0085	0.1067 (-0.063)	0.1364 (0.019)	-	0.0200 (0.008)	0.0183 (0.008)
SUL	1.0016	0.0120 (-0.025)	0.0145 (0.009)	-	0.0026 (0.002)	0.0036 (0.004)

Where: COE is the Midwest region; NDE is the Northeast region; NOR is the North region; SDE is the Southeast region; and South is the southern region.

Source: Elaborate by the authors (2023).

When analyzing the effects of the Bolsa Família Program on the aggregates of GDP, it is necessary to accept the assumptions of the model, it is an open (multiregional) economy with a flexible exchange rate, the consumption generated by the transfer of government to rural families is divided into private consumption and imported consumption, which tends to increase. It is important to note that government spending is negative in all regions because it represents government spending on the Bolsa Família Program, assuming that this spending is no longer consumed by the government in other sectors of the economy to become a transfer to these families.

The effect of each dollar transferred from the government to the families via Bolsa Família Program is higher in the Northeast region, being US\$ 1,0103 billion. The effect of Bolsa Família on consumption in the economy in general is US\$ 0.2410 billion, which means a 0.160% increase in consumption in the region, government expenditures have a negative impact of US\$ 0.2339 billion, which means higher government spending, representing a 0.502% increase in spending. There is an increase in imports of US\$ 0.0232 billion, and an increase of US\$ 0.0264 billion in exports.

In the South region, the multiplier effect of Bolsa Família on GDP is US\$ 1,006 for each dollar invested in the program with rural families. Government spending has a negative impact of US\$ 0.0120 billion, which represents a 0.025% increase in government spending. There is an increase in consumption of US\$ 0.0145 billion, a positive impact of 0.009%. Exports increase by US\$ 0.002 billion while imports increase by US\$ 0.004 billion.

The Central West region has a GDP multiplier effect of 1,002. Consumption in the region has a positive impact of US\$ 0.0207 billion, an increase of 0.021% in initial consumption. Government spending increases by US\$ 0.0190 billion, a variation of 0.066% negative on government spending. There is an increase of US\$ 0.0031 billion in exports, and an impact on imports from the region of US\$ 0.0028.

The GDP multiplier in the Southeast region is 1,0085. Consumption increases by US\$ 0.1364 billion, a general increase of 0.019% in consumption in the region. Government spending increases by 0.063%, an increase (negative impact) of expenditures of \$ 0.1067 billion. Exports increase US \$ 0.0200 million, and imports increase US \$ 0.0183 billion in the region.

The North region has an increase in consumption, US\$ 0.2460 billion (0.246% more), has a GDP multiplier of 1,0088, so each dollar spent by the government with the Bolsa Família Program generates an increase of US\$ 1,0088 in GDP. Government spending is impacted by 0.809%, an increase in spending of US\$ 0.1402 billion. Imports increase 0.060%, US\$ 0.0162 billion with exports increasing 0.064%, an increase of US\$ 0.0199 billion.

Neri, Vaz and Souza (2013), consider that if the expansion of the transfer is compensated by an equivalent reduction in government spending, the multiplier effects on the product tend to be small, even if it contributes to the reduction of inequality, justifying that this is due to the fact that other government expenditures would have a direct impact on the product, while transfers through Bolsa Família would first impact household incomes and subsequently influence the production of economic activities.

Previous research (MOSTAFA; SOUZA; VAZ, 2010; NERI; VAZ; SOUZA, 2013) concluded that the multiplier effects of the Bolsa Família Program on GDP are positive, superior to unity if we consider the impact on the Brazilian economy, however, this study, considering the influence of the external market on the regional economy, refutes the authors' analysis when they affirm that the regional multiplier effects of the Bolsa Família Program on GDP would be greater.

Conclusions

The results show that there are undesirable effects on the income of the factors, which may affect the income distribution of the program in the long term. On the other hand, the mechanisms by which these effects occur are still not properly understood. There is a need to deepen the analysis of the way the labor market organizes itself in the face of the financial contributions of the Bolsa Família program to better guide the program and thus be possible to propose measures for its improvement.

Only at a first moment is the Bolsa Família Program effective in promoting the fight against rural inequality, since it is a monetary transfer, in kind, that has as immediate impact the increase of income, consumption and the economic well-being of the families, and those that are not served by the program, not reducing the consumption capacity or reducing the income of these families. However, the direct effects on dependent families in terms of economic welfare are virtually the same as those of government transfers to households, government transfers have small effects on households.

One worrying fact about the impact of the Bolsa Família Program on household income was the change in factor prices. Government-to-household transfers reduce the labor price, the factor with the largest share of the income of poorer households, and raise the price of capital, which has a larger share in the income formation of households with high incomes. In other words, the effects of the program in the long run, in addition to becoming milder, increase the gap between the richest and poorest sectors of society. While lower-income families are assisted by the Program, they have guaranteed the consumption and maintenance of economic well-being, but at the same time, they reduce the ability to increase income due to the devaluation of wages.

It is notorious that transfers from the Bolsa Família Program are linked to policies in the labor market, with the professional qualification of those who receive them, for example, since a less qualified workforce tends to receive a lower salary. Consideration should be given to the ability of families to move up from the income

class, requiring less and less income transfers over time, and for future research it is suggested to analyze the capacity of the to raise the families of the income class, which would collaborate with the theme in order to verify if the impact has the capacity to increase the income to the point of making the beneficiary family change of class, thus avoiding the dependency of the families that receive the benefit and reducing their impact on inequality.

The analysis of the research considering the PAEG model suggests the acceptance that the model is inserted in a scenario of perfect competition and full employment in the use of factors of production. Moreover, it is a static model and, therefore, without the evolutionary characteristics of the investment to increase the productive capacity. Thus, for future research it is suggested to analyze the program's ability to raise families of income class in a dynamic general equilibrium model, which would collaborate with the theme when verifying if the impact has the capacity to increase income to the point of making the beneficiary family change class, thus avoiding the dependency of the families receiving the benefit and reducing their impact on inequality.

The analysis of the macroeconomic effects of the Bolsa Família Program on the GDP of the regions suggests that consumption is not only internal, considering the flexible exchange rate, the effects of the program also have unfolding in the external market of the region. It is necessary to analyze that the fact that the government spends on transfers causes at the same time spending in other sectors of the economy to reduce. Such facts justify that the effects of a dollar spending by the government in the Bolsa Família Program on the GDP of the Brazilian regions are low, but positive and greater than unity.

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