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# The Impacts of Income Transfer Programs on Income Distribution and Poverty in Brazil: An Integrated Microsimulation and Computable General Equilibrium Analysis

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# ABSTRACT

A persistent and very high-income inequality is a well known feature of the Brazilian economy. However, from 2001 to 2005 the Gini index presented an unprecedented fall of 4.6 percent combined with significant poverty reduction. Previous studies using partial equilibrium analysis have pointed out the importance of federal government transfer programs in this inequality reduction. The aim of this research is to evaluate the efficiency of the two most important cash transfer programs, “Bolsa Família” and “BPC”, in achieving their purpose of alleviating poverty and reducing the inequality in Brazil’s income distribution using an integrated modeling approach, the CGE-MS model. The simulation results confirm the importance of these programs in reducing inequality from 2003 to 2005. However, the effect on poverty alleviation was not strong. Finally, the methodological approach allows the identification of some important economic facts that were not presented in previous analyses, such as the issue of taxation structure that finances these policies.



**Key words**: computable general equilibrium model, microsimulation model, income distribution, cash transfer program, fiscal policy, Brazil.

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## 1. Introduction

It is widely known that the Brazilian economy has historically presented one of the most unequal income distributions in the world, with a Gini index around 0.60 until the beginning of this decade.[1] It is also known that inequality in income distribution is the main determinant of the country's high poverty level, being that the average income level of a secondary determinant (that is, the poverty level) does not decline significantly when the country grows because the income gains are very unequally distributed, and as such is mostly appropriated by non-poor families (Barros *et al*, 2001). According to *Barros et al* (2007b), without changes in income inequality, the country should have presented a balanced growth of 14.5 percent and 22 percent to achieve the same observed reductions of poverty and extreme poverty levels, respectively, from 2001 to 2005. They also show that each decline of 1 percent in the inequality degree (Gini index) has the same impact on the poverty and extreme poverty levels as balanced growth rates of 2.4 percent and 4.0 percent, respectively. Thus, falls in income inequality have stronger effects on poverty than economic growth.

In addition to high inequality in income distribution, Brazil also manifests significant levels of poverty and severe poverty. In 2005, around 34.1 percent (or 60 million) and 13.2 percent (or 23 million) of the Brazilian population were, respectively, poor and extremely poor (Barros *et al*, 2007b). Due to the historically unequal income distribution and the very large number of people in poverty and extreme poverty, the Federal Government has been providing income to these people by means of transfer programs as a broad poverty alleviation strategy.

There are many kinds of income transfer programs in Brazil, such as *Bolsa Família* (*BF*), *Benefício de Prestação Continuada* (*BPC*), several retirement benefits and pensions, *Abono PIS/PASEP* and *Salário Família*. This research analyzes the first two programs (*BF* and *BCP*) because they are the main cash transfer programs specifically designed as social policies with the purpose of poverty (and inequality) reduction, and both programs have called the attention of several research from different scientific fields. In the next two paragraphs we present a summary of the characteristics of these programs (their full description and data are presented in Appendix D).

*Benefício de Prestação Continuada* is a social assistance benefit guaranteed by the Federal Constitution of 1988 and has been implemented since 1996. This benefit aims to aid the elderly who are not included in the public social security system and the disabled who cannot support themselves despite their families' financial care. Both beneficiary groups comprise 2.9 million of Brazil's current population, with government expending a budget of R$ 11.63 billion (or 0.5% of GDP) for BPC in 2006. The benefit consists of a cash transfer amounting to one minimum wage (R$

[1] See Barros *et al.* (2007a) and Hoffmann (2006a) for more details.

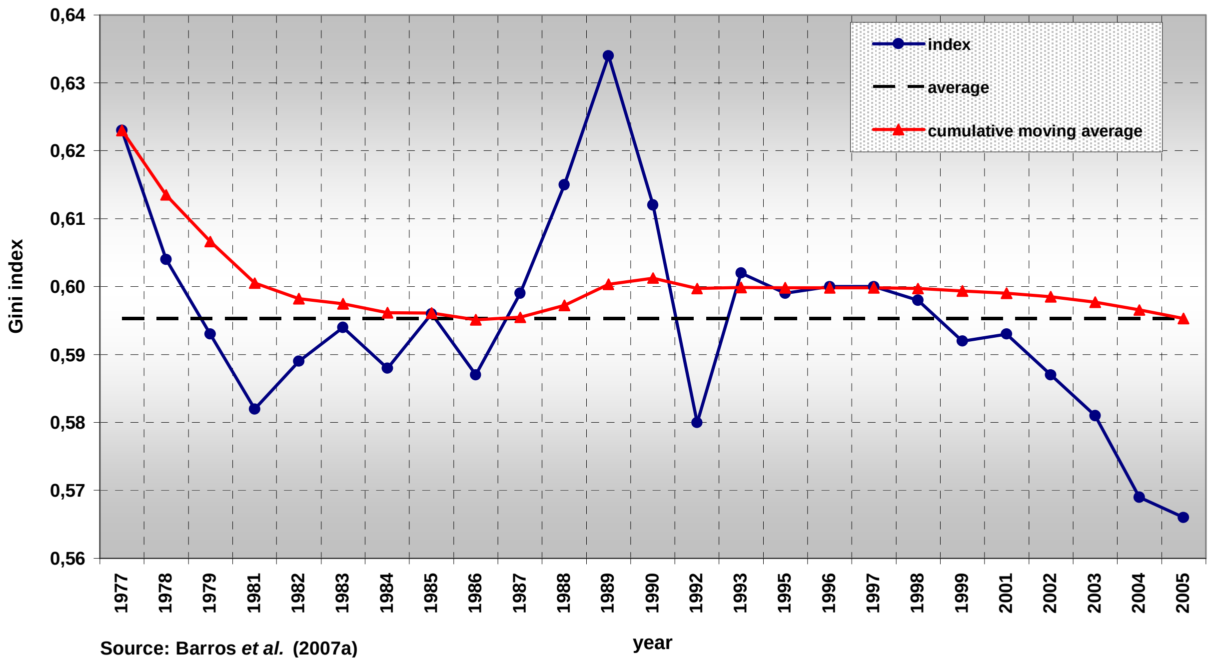
415), and the beneficiary's family per capita income must be less than a quarter of the minimum wage.

The *Bolsa Família* program was created in October 2003 and is presently the federal government's main transfer program. It is a consolidation of four other former programs that were already existing: *Bolsa Escola* (since 2001), *Bolsa Alimentação* (since September 2001), *Auxílio Gás* (since December 2001), and *Cartão Alimentação* (since 2003). Since then, the program has been expanded to incorporate new beneficiary groups. *Bolsa Família* is directed towards extremely poor and poor families with a household per capita income under R$ 120 in 2008. The families receive a transfer of R$ 62 and a variable amount of R$ 20 per child with a maximum of R$ 60 (or three occurrences); hence, the full benefit is placed at R$ 122.

Unlike the *BPC*, *Bolsa Família* is a conditional cash transfer program and requires the fulfillment of some requirements for the benefit concession, like 85 percent school attendance for children in schooling age, the actualization of vaccination for children under six years old, and regular visits to the health center for both pregnant and breastfeeding women. In 2007, *Bolsa Família* had a total of 11,048,348 beneficiary families and R$ 9.26 billion worth of transfers (equivalent to 0.4% of GDP).

Despite the historical stability presented by the inequality in income distribution in Brazil, recent studies show empirical evidence that this inequality has declined in an expressive, accelerated and continuous way from 2001 to 2005, as shown in the chart below.

**Figure 1.1: Temporal evolution of inequality in per head income distribution in Brazil**




Source: Barros *et al.* (2007a)

Recent studies also show that the *Bolsa Família* and *BPC* income transfer programs have played an important role in this process. At one point, 22.9 percent of the decline in the inequality of income distribution was due to the implementation and enhancement of these programs.

While in 2001 the Gini index was close to its average value for the last 30 years (0.592), in 2005 it achieved its lowest magnitude. According to Barros *et al* (2007a), from 2001 to 2005, the Gini index value declined from 0.593 to 0.566, corresponding to a 4.6 percent reduction in the inequality degree. This inequality is the main determinant of poverty in Brazil, yet we should also expect that its reduction has caused a similar effect in the country's poverty level. Barros *et al* (2007b) reports that the reduction of inequality in Brazil's income distribution from 2001 to 2005 induced declines in the poverty and the extreme poverty levels of around 3.3 and 2.7 percentage points, respectively. Once the poverty and extreme poverty levels decreased by 4.6 and 3.4 percentage points, respectively, the fall in the inequality had respectively caused 73 percent and 80 percent of these reductions.

To add, the more immediate impacts of these programs on income distribution and poverty point towards better perspectives, as stressed by UNDP (2006, p. 272):

> *"The good news is that extreme inequality is not an immutable fact of life. ...a large social welfare program - "Bolsa Família" - has provided financial transfers to 7 million families living in extreme or moderate poverty to support nutrition, health and education, creating benefits today and assets for the future."*[2]

Considering the existing information on inequality in income distribution for 124 countries, almost 95 percent of these present an income distribution less concentrated than the Brazilian experience (Barros *et al*, 2006; Hoffmann, 2006a; and UNDP, 2006).

Once there are different programs, resources should be primarily allocated to those that have stronger impacts in terms of poverty and income inequality reduction,[3] hence the need for assessing program effects. In order to do this, some researchers use the methodology of comparing program participants (the treatment group) with a control group of people with similar characteristics that are relevant to program participation; that is, they run counterfactual simulations whose construction determines the evaluation design. These evaluation designs can be classified into two categories: experimental and quasi-experimental. Both evaluations vary in feasibility, cost, and the degree of clarity and validity of results (Rawlings and Rubio, 2003).

Experimental control designs involve the random assignment of individuals into beneficiaries (treatment group) and non-beneficiaries (control group); any difference with the control group is due

[2] At the end of 2006, Ministério do Desenvolvimento Social reported that the number of beneficiary families reached 11.1 million.

to chance, not to selection. Thus, experimental designs are usually regarded as the most reliable evaluation method and yielding the easiest-to-interpret results (Freeman and Rossi, 1993; Grossman, 1994; Rawlings and Rubio, 2003). When randomization is not feasible, a quasi-experimental design can be constructed by generating a control group i.e., using statistical matching to select non-beneficiaries based on observable characteristics.

Experimental and non-experimental designs have been used in impact evaluations of conditional cash transfers in some Latin American countries. To evaluate the *Programa de Educación, Salud y Alimentación* (PROGRESA) in Mexico, evaluators applied an experimental design with panel data that randomly assigned localities into treatment and control groups. A similar design was used to evaluate impacts of the *Programa de Asignación Famíliar* (PRAF) in Honduras, and of the *Red de Protección Social* in Nicaragua at the municipal and census area levels, respectively.[4]

In contrast to the abovementioned programs, the *Programa de Erradicação do Trabalho Infantil* (PETI) in Brazil was evaluated using a quasi-experimental design with a single-cross section. This program was first implemented only in a few municipalities in the state of Pernambuco and later expanded to other states, including Bahia and Sergipe. Once the evaluation was planned after the program commenced, and it was not possible to randomly allocate the municipalities into treatment and control groups, then the treatment group was composed of three participating municipalities in separate states, and the comparison group of three similar municipalities was not included in the program.[5]

Other methodologies such as partial equilibrium and decomposition analysis were also used to evaluate similar impacts. Some studies that used these methodologies shed light on the issue about the impacts of transfer programs on income inequality and poverty in Brazil. A few of these studies are reviewed here in order to show how this research can contribute to address some knowledge gaps on this subject.

By simulating the impacts that some income transfer programs would have – whether they were applied to their entire target population considering the rules for each program – Rocha (2005) points out that the more recent programs would be more efficient in reducing poverty if the transfer values were much higher and the target population much larger.

Hoffmann (2006b) evaluates the impacts of the income transfer programs on poverty and income inequality at national and regional levels. The study points out that 31 percent of the decline in Brazil's inequality from 2002 to 2004 was due to the aforementioned programs. In the country's

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[3] As explained in the first paragraph of the Introduction, the reduction in income inequality generates an additional effect that helps reduce poverty and reinforce the program's desired impacts.
[4] Further details can be found in Rawlings and Rubio (2003).
[5] *Idem*.

Northeast region, these programs accounted for 87 percent of the estimated decline in income distribution for the same period.

Barros *et al* (2007c) estimated that *Bolsa Família* induced around 11.8 percent of the income inequality fall from 2001 to 2005, while *BPC* would have caused around 11.1 percent of this reduction. However, these empirical evidences were found by means of partial equilibrium or decomposition approaches. In this sense, they did not take into account some systemic (general equilibrium) effects induced by these programs as well as the feedback impacts from the economic system on household income. When poor families receive the income transfer, they increase their consumption expenditure, which tends to induce firms to produce more and, to some extent, employ more workers. When these people receive their payments, a new round of additional effects induced by their spending goes on. Then, the original amount of transfer induces the generation of a higher amount of income in the economy due to a multiplier effect. In other words, the poor families not only benefit from receiving transfers but also can benefit from the secondary effects induced by expending the original transfers.

These demand effects are enhanced when we take into account the differences in the expenditure patterns of Brazilian families differentiated by income level. Among the poor urban Brazilian households, the food expenditure was 40 percent of total consumption. On the other hand, the richest Brazilian households' consumption standards are totally different; their food expenditure was just 12 percent, while health and education private services accounted for nearly 20 percent (Cury *et al*, 2006).

Also, the relevance of the general equilibrium effects is justified by the size and evolution of the transfer programs between 2001 and 2005. In the same period, the total expenditure in the main targeted transfer program (*Bolsa Família*) increased 300 percent. According to the last Brazilian Central Government report (*Perfil das Famílias Beneficiárias do Bolsa Família*), in 2007 11 million families (around one in each five in the country) are program beneficiaries, reaching 45.8 million individuals (around one fourth of the population).

On the other hand, we also expect that program effects are sensitive to the budget sources that are financing this specific public expenditure. As mentioned before, the increased amount in the transfers were financed in specific ways. Also, during 2003-2005 some important changes were introduced in the fiscal system. For example, in the social security budget, the sharpest revenue increase came from PIS-COFINS taxes (accounting for a 30% rise in their GDP ratio), which in 2003-2004 were used to levy imports. Instances like this changed the size and composition of the fiscal sources that were financing the programs and reinforced the general equilibrium impacts derived from the programs' recent evolution.[6]

Additionally, when the income of poor families increases, it is possible that this additional income can cause some people to reduce their labor offer and trim their working hours. If this happens, the abovementioned effects induced by expending the transfers would be less than expected.

However, this negative effect of transfers on willingness to supply labor does not have empirical support until now. According to Medeiros *et al* (2007), the rate of participation in the labor market among program beneficiaries is 73 percent for the first poorest decile of distribution, 74 percent for the second and 76 percent for the third, while the same rate is 67 percent, 68 percent and 71 percent, respectively, for people that live in households with no beneficiaries. These authors also evaluated the effects of *Bolsa Família* on the labor supply of four demographic groups: female heads of families, female non-heads of families, male heads of families and male non-heads of families. They found that only the beneficiary women heads of families have a lower likelihood of participating in the labor market than non-beneficiary women.

CEDEPLAR (2006, *apud* Medeiros *et al*, 2007), also found positive effects of *Bolsa Família* on labor supply. According to this research: (i) Adults in households with beneficiaries presented a participation rate 3 percent higher than adults in households with no beneficiaries; (ii) The positive impact is higher among women at 4 percent than among men at 3 percent; and (iii) The program reduced by 6 percent the chances of women quitting their jobs. However, Tavares (2008) found evidence of an adverse effect of *Bolsa Família* on beneficiary mothers' willingness to participate in the labor market. As we can see, there is some evidence that *Bolsa Família* can reduce labor market participation only among beneficiary mothers, yet this effect is not consensual even in this case.

From the above discussion, it is clear that changes in transfer programs imply modification in both relative prices and quantities that can be far from being negligible. In this sense, it is not clear which would be the final prevailing effects.

Proving that a specific methodology is unequivocally superior to others is not an easy task to do. Despite this, given the systemic consequences induced by the changes in these programs on markets and on financing sources, we believe that using a CGE model integrated to a Microsimulation model (CGE-MS model) for evaluating the impacts of *Bolsa Família* and *BPC*

[6] In this research we identified in the Federal Brazilian Budget (*Orçamento Geral da União*) the specific expenditure items related to the transfer programs. The first classification level for expenditure items is identified by a system of 4 digit codes, named "programas". For example, Bolsa Família has the code "1335" and can also be divided into a second classification level with 4 more digits, called "subprogramas". On the other hand, each "programa"/"subprograma" is earmarked with its own revenue source. In this case, it is a system of 3 digit identification codes, called "fonte". See Section 4 and Appendix D for more details about this subject.

programs will generate information that will enhance the debate on the effects of these programs on poverty and inequality. This study believes that the model will capture some systemic effects that are not considered by the methodologies used in other studies.

This final report is organized in five sections, including this introduction. Section 2 presents a brief literature review of the CGE-MS integration methodology. In the third section we describe the adopted methodology, including all the steps of CGE-MS integration and their solution. The research questions, the implemented simulations and results are presented in section 4. The last section presents the conclusion and the final remarks. Appendices A, B, C and D supplement this report with the equations used in the CGE model, intermediate results, and data on the transfer programs.

**2. Review of literature on CGE and Microsimulation integration.**

The first assessments on the issue of the distributional and poverty effects of economic policies using CGE models was formally presented by Adelman and Robinson (1978) in a book applied to South Korea. This book was remarkable for combining one of the first CGE models with the treatment of income distribution through a highly disaggregated model. Dervis *et al* (1982) and Gunning (1983) followed the same path, introducing new modeling techniques to this issue. A number of different approaches were developed after these initial studies, and this section briefly presents some characteristics of these methodologies and highlights their main advantages and drawbacks.[7]

The first approach is characterized by a CGE model with representative households (CGE-RH). This method utilizes distributional analysis by comparing the changes in income of these representative households (RHs) as generated by the CGE model between the different groups of RHs and applying these changes to households' income using survey data to compare between distributive indicators before and after policy implementation. Poverty analysis is made by applying the changes in income of the RH(s) generated by the CGE model on household survey data to compare ex ante and ex post poverty indicators.[8]

However, this approach is disadvantageous because it either assumes no changes in intra-group income distribution, or that the changes in intra-group distribution follow an exogenously fixed

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[7] We are considering the same categories proposed by Savard (2003), where more details can be found.

[8] Dervis *et al* (1982), de Janvry *et al* (1991), Chia *et al* (1994), Decaluwé *et al* (1999a), Colatei and Round (2001) and Agenor *et al* (2001) present evaluations based on this approach. Following this methodology, Coady and Harris (2004) evaluated the income (or welfare) effects of the conditional cash transfer program Progresa in Mexico, which has been used as reference for similar programs implemented in other developing countries. In this study, they point to the importance of evaluating this kind of policy with this methodology in order to distinguish the direct from the indirect income (welfare) effects. Before, partial equilibrium approaches could only capture the former effects generated by the transfers, but not the latter effects due to the impact of cash transfers and their financing on the level and composition of demand and supply.

statistical law between the mean ($\mu$) and the variance ($\sigma^2$) of the income distribution. This drawback is more serious when the analysis is performed with a CGE model using just one RH. In this case the impacts on poverty are evaluated by applying the change of income of the RH on all households in the survey data. As a consequence, this approach does not capture both inter- and intra-group effects because it just changes the mean ($\mu$) but not the variance ($\sigma^2$) of the distribution.

Despite these disadvantages, this approach can easily be implemented by simulating the economic policy with a CGE model and using the simulation outputs to make distributional and poverty analysis.

The second approach is called integrated multi-households CGE (CGE-IMH) modeling and consists of incorporating as many households as are present in income and expenditure household surveys (or a large sample of them) to the CGE model.[9]

Compared to the CGE-RH, this method has the advantage of allowing changes in intra-group income distribution and not requiring pre-definition of household groups, which gives more flexibility to poverty and income distribution analysis since the household groupings can be defined in more and different ways.

Nonetheless, the large size of the model can complicate its numerical solution and the conciliation of data from household income or expenditure surveys and national accounts, due to under- or over-reported variables in the household surveys.

According to Bonnet and Mahieu (2000, *apud* Savard, 2003), the above limitations could be overcome by using microsimulation which is required to analyze income distribution (dispersion) effects.

Thus, in order to better assess distributional and/or poverty effects of economic policies, Bourguignon *et al* (2003) presented a CGE model integrated to a microsimulation (MS) model by a top-down method that permits the decomposing of CGE results to their micro or individual components. The CGE model is solved first and the changes in the vector of prices, wages, and aggregate employment variables are transmitted to the MS model, which calculates the variations in individual wages, self-employment incomes, and employment status that would be consistent with the set of macro variables generated by the CGE model. In this sense, the top-down model assesses the distributive and poverty impacts from the shock or the policy change simulated in the CGE model.

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[9] Decaluwé *et al* (1999b), Cockburn (2001), and Boccanfuso *et al* (2003) applied this approach to perform poverty and income distribution analysis.

Despite providing richness in household behavior and presenting extreme flexibility in modeling specific behaviors as household decisions and labor market switching rules, the reactions of households are not fed back and thus not taken into account by the CGE model.

Thus, in order to better assess the distributional and/or poverty effects of economic policies Savard (2003) and Muller (2004) proposed the methodology of using a CGE model linked to an MS model with a bi-directional linkage between them that would guarantee a convergence of solutions for both models.

## 3. Methodology

This section describes the methodology used in this research. The following three subsections describe the CGE model, the microsimulation model, and the integration between the CGE and the MS models.

### *3.1. The CGE Model*

This section briefly describes some characteristics of the CGE mode, (as they are standard features) and emphasizes the presentation on the labor market, the household income formation process and government expenditure. Further details on this model can be found in Appendix A.2.[10]

The CGE model is used for a single country and recognizes 42 domestic sectors,[11] 8 families,[12] the Government, and the external sector. The model takes the hypothesis that the Brazilian economy is an international price taker but that the movement of its export prices can affect the external demand for Brazilian goods through an export demand equation. Foreign product supply does not face any constraint to attend to Brazilian demands. The supply of the 42 domestic sectors is represented by a function that converts 7 types of labor,[13] capital and intermediate inputs into products that are sold as imperfect substitutes in the domestic and international markets.[14]

Concerning demand for products, the utility-maximizing families choose their consumption levels according to a Cobb-Douglas function. Families and firms demand domestic and imported goods according to the Armington (1969) hypothesis. Firms demand commodities to fulfill their production

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[10] The CGE model used in this research is an extension of the one presented by Cury *et al* (2005) where further details can be found. This is a result of a series of developments made in the model proposed by Devarajan *et al* (1991), as can be seen in Cury (1998), Barros *et al* (2000) and Coelho *et al* (2003).
[11] These 42 sectors are listed in Appendix B.
[12] Poor urban families headed by active individual (F1), poor urban families headed by non-active individual (F2), poor rural families (F3), urban families with low average income (F4), urban families with medium income (F5), rural families with medium income (F6), families with high average income (F7), and families with high income (F8), which have a significant income proportion from no-wage source.
[13] Unskilled informal (L1), skilled informal (L2), formal with low skill (L3), formal with average skill (L4), formal with high skill (L5), public servant with low skill (L6) and public servant with high skill (L7).
[14] The SAM used in this research is fully described and documented by Cury *et al* (2006), which can be requested by e-mail with the authors.

requirements of intermediate inputs according to the technical coefficients from the input-output matrix. The Government expenditure faces the fixed budget amount registered for the base year according to a Cobb-Douglas utility function.

### *3.1.1. The Labor Market*

Firms demand the seven types of labor, classified according to contract status and schooling.[15] It is assumed that firms aim at maximizing profits under technological conditions imposed by the production function, in an environment where prices of inputs, production factors (labor and capital) and output are beyond their control. Therefore, as a result of this maximization, for each type of worker a specific demand curve is defined by the condition that their marginal productivities equal their wages:[16]

$$P_i * \partial X_{il} / \partial F_{il} = W_{il} \tag{3.1.1}$$

This research uses a CGE model integrated to an MS model. In the latter, each individual chooses between offering or not offering his labor in the market after comparing the observed wage in his sector to his reservation wage. Thus, the labor supply by type of worker is generated by the MS model and communicated to the CGE model, where it is exogenous.[17]

The labor market equilibrium in the integrated CGE-MS model (employment and wage), for each type of worker *l*, is determined by $E^l$, the intersection point between the labor demand ($L^d$) and the occupational level $\left(Lsl^*_{MS}\right)$, which is calculated by the MS model and transmitted to the CGE model. The difference between the economically active population ($L^0$) and the employment level (*L*), ($L^0$ – *L*), is the excess of labor supply that corresponds to the involuntary unemployment level (*U*) in the economy.[18]

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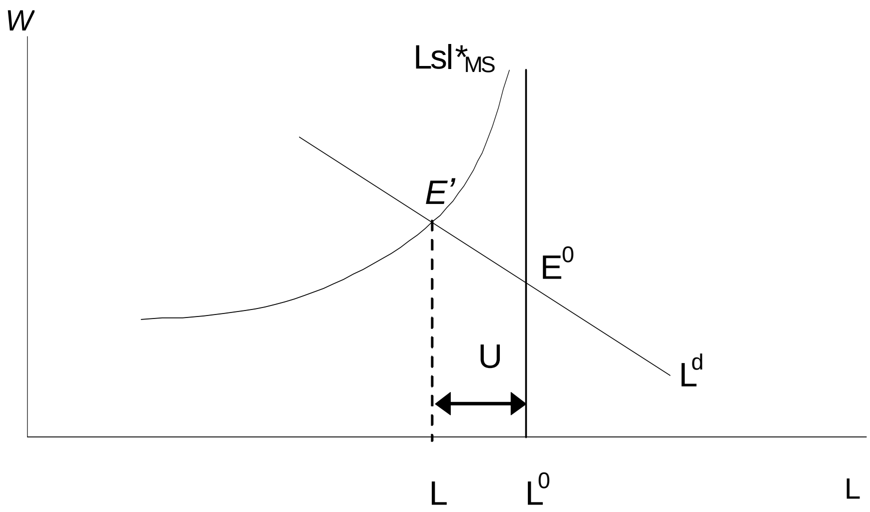
[15] The labor treatment that follows is applied for the five types of private workers. The two types of public servants follow the traditional labor market closure of CGE models with either wage or employment being fixed. Therefore, there is no substitution between public servants and the private kinds of workers in the sectors where there are no public companies. In the sectors where public and private firms co-exist, the changes in the public-private composition of labor are related to the changes in the public-private composition of the sectoral representative firm.

[16] The derivative of the profit function with relation to the factor demand must be equal to the factor's price (first order condition).

[17] Further details on the determination of labor supply by type of worker are presented in Section 3.2.

[18] In previous versions of this CGE model an alternative specification of the labor market was adopted, in which involuntary unemployment was captured by a wage curve as proposed by Blanchflower and Oswald (1990, 1994).

**Figure 3.1: Equilibrium in the labor market by type of worker**




It deserves to be mentioned that the CGE model assumes that this market equilibrium mechanism does not describe the adjustments for the two types of public servants considered in the model. In Brazil, public servants are hired by means of official examination for a governmental post and their working contract includes a job stability clause. Therefore, it is assumed that their employment levels are fixed and that the disequilibria in their labor markets are adjusted by changes in wages.

The labor market closure is not formulated by sector, but rather by type of labor. In this sense, the adjustment mechanism is from the aggregate to the sectoral level. After an economic shock, first we have the definition of the aggregate levels of labor supply, wages and unemployment for each type of labor by the interaction of their aggregate demand and supply curves, as explained earlier. To define the employment and wage levels in each sector, it is assumed that the sectoral differentiation of wages is exogenous, remaining the same as in the model's base year, which implies in-sector imperfect segmentation in the labor market.

The hypothesis implicit in the adopted mechanism is that workers with similar observed productive characteristics (schooling and contract status) are paid differently according to their sector of employment. The idea is to capture the fact that, despite the abovementioned similarities, the workers have other characteristics such as profession type and sector-specific training or qualifications which do not permit their migration from sector(s) paying lower wages to sector(s) paying higher wages to induce the equalization of sectoral wages for each kind of worker. Pinheiro and Ramos (1995) showed that the wage differentials among sectors in Brazil have been stable for a long time.

The wage of each kind of worker in each sector ($W_{li}$) is obtained by the interaction between the average wage for each type of labor ($W_l$) and an exogenous variable for the relative wage differentials among the sectors. With this information, and using a sector- and labor type-specific demand curve (equation 3.1.1), we can also determine the sectoral employment level of each type of labor ($F_{il}$), which is aggregated by a Cobb-Douglas function to define the sector *i*'s composite labor. [19]

### *3.1.2. The Income Transfer Mechanisms*

This section presents the formation process of income flows received by families and firms. The remuneration of capital is paid to firms and the labor earnings to workers. In each sector, the payments to capital are distributed to the firms according to their initial share in the total earnings of capital.

The eight types (*h*) of families receive earnings from the seven types (*l*) of labor according to the shares ($\varepsilon_{hl}$) of these workers in these families, which also receive the income transferred by firms (*YK*) according to the family *h*'s share in these income flows ($\varepsilon_{hk}$).[20] Finally, the families also receive net remittances from abroad ($RE_h$), adjusted by the exchange rate (*R*), and transfers from the Government (*TG*), in the form of payment of benefits (direct income transfers) and other transfers (essentially domestic debt interest) that are allocated to the families according to the initial shares ($\theta_{ht}$). [21] Therefore, the family *h's* income is:

$$\boldsymbol{Y_h = \varepsilon_{hl} * W_l + \varepsilon_{hk} * YK + (pindex) * \theta_{hk} * TG + R * RE_h} \qquad (3.1.2)$$

### *3.1.3. The Government*

The Government spends by consuming ($\sum_i CG_i$) and transferring resources to the economic agents. It plays a very important role in the process of determining secondary income, once it directs a share of its transfers to firms as interests on the domestic debt and also demands products. Similar to families, the sharing of government transfers to the types of firms follows the proportions observed in the base year ($\theta_k$). Finally, it also transfers resources abroad (*GE*) and its total expenditure is:

$$GG = \sum_i CG_i + pindex * (\theta_{ht} + \theta_k) * TG + R * GE \qquad (3.1.3)$$

To face all expenditures, the Government relies on three types of collections: (1) direct taxes levied on firms' and families' income ($\phi_h$ and $\phi_k$, respectively), and (2) indirect taxes on domestic and

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[19] Equation 2.1 in Appendix A.

[20] The firms are classified into small (self-employed people) and large (other firms). The large firms transfer interest, dividends and others, and house rental, to families.

imported goods (proportional to production (*X*), domestic sales (*D*), imports (*M*) and value added (*VA*) amounts). Besides these sources, it also receives transfers from abroad (*gfbor*) and finally, the balance of the social security system (*SOCBAL*).[22] Thus, the Government's total revenue is:

$$RG = \sum_h \phi_h * Y_h + \sum \phi_k * YK + \sum_i (\eta_i * X_i) + \sum_i (\xi_i * D_i) + \sum_i (\pi_i + \sigma_i) * VA_i + \sum_i (\mu_i + \kappa_i + \gamma_i) * M_i + R * gfbor + SOCBAL \quad (3.1.4)$$

where $\eta_i$ are the tax rates on production, $\xi_i$ and $\pi_i$ are, respectively, the sector *i*'s PIS-COFINS rates on domestic sales value (cumulative regime) and on value-added (non-cumulative regime), $\sigma_i$ and $\kappa_i$ are, respectively, the ICMS-IPI tax rates on value-added and imports, $\mu_i$ is the tariff on imports, while $\gamma_i$ are the PIS-COFINS rates on imports of commodity type *i*.

An eventual lack of government resources is defined as a government deficit that, together with domestic private (firms and families) and foreign savings, defines the amount of resources spent as investments.

The indirect tax revenue (INDTAX) from domestically produced goods is given by:

$$INDTAX = \sum_i (\eta_i * (PX_i * X_i)) + \sum_i (\xi_i * (PD_i * D_i)) + \sum_i ((\pi_i + \sigma_i) * (VA_i)) \quad (3.1.5)$$

where $PX_i * X_i$ is the production value, $PD_i * D_i$ is the gross revenue value from domestic sales and $VA_i$, $\eta_j$, $\xi_i$, $\sigma_i$ and $\pi_i$ were presented in equation (3.1.4).

The other equation that contributes to Government revenue and deserves to be mentioned is the one describing the indirect taxes on imports revenue, which is given by:

$$TARIFF = \sum_i (pwm_i * R).(\mu_i + \kappa_i + \gamma_i) * M_i \quad (3.1.6)$$

where $pwm_i$ is the external price of imports (in US$), $\mu_i$ is the tariff on imports, $\kappa_i$ is ICMS-IPI rates on imports and $\gamma_i$ are the PIS-COFINS rates on imports.

### *3.1.4. CGE Model Closures*

The identities that define the model closures are described in the equation list in section 2 of Appendix A. For the price system, the nominal exchange rate (variable R) is exogenous. On the

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[21] These transfers include the social security benefits as well as other programs such as unemployment benefits, income transfer social programs, and other cash benefits.

[22] In fact, social security is treated as an agent apart from the Government in the model, not only because of the considerable amount of resources that it handles in Brazil, but also because of the contributions that it applies on either the company's income (here again in a different form) or on the installments of the added value of labor.

other hand, the price index (PINDEX) is endogenous. In the external closures, foreign savings (FSAV) is also exogenous, which implies a fixed balance of trade.

On the side of the public sector, the government consumption (GDTOT) is fixed exogenously but the total public deficit (GOVSAV) is variable. Also, on the Savings side, the marginal propensity to save (MPS) is exogenous. In the Savings – Investment relationship, the model can be classified as "*savings driven"* where the total Investment (INVEST) is determined by the total Savings. The capital stock is fixed which means that the produced investment goods are not affecting their current capacity on the economy. Finally, the factor labor closure is fully described in sub-section 3.1.1.

### *3.2. The Microsimulation Model*

This section describes the specification of the household income model used for the microsimulation. The initial hypothesis for using a microsimulation model is the fact that public income transfers can induce changes in individuals' behavior, especially concerning their willingness to participate in the job market and their level of expenditure. The application of a microsimulation model will allow for evaluating the effects of the programs *Bolsa Família* and *BPC* on the individual's willingness to supply labor, and also on poverty and income distribution indicators, considering a nationally representative sample of the population.[23]

The microsimulation model adopted in this research is based on the procedure proposed by Savard (2003). The main adaptation for this model is the use of another segmented labor market.[24] As described before, we will assume five segments with flexible wage that adjusts with labor supply and demand. For the unemployed, the reservation wage of each individual determines its potential choice between offering (or not) his labor in the market. Furthermore, a worker decides to quit the job market if the observed wage is lower than his reservation wage.

The procedure used to estimate the microsimulation model is applied to individuals in active age (over 10 years old) belonging to the five types of factors (L1 to L5) that have the wages paid in the private sector as the main source of income. In Brazil, once the public servants' (factors L6 and L7) working contract includes a job stability clause, it is assumed that their employment levels are fixed.[25]

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[23] Since the database used in this work, the National Research of Sample by Domicile (PNAD), does not have information about the domicile's expenditures, the microsimulation model will be reduced to the analysis of the individual's labor offer. See Appendix B for further details.

[24] In Savard (2003), the labor market is segmented in two types: one with a fixed wage and another one with a flexible wage. Therefore, an individual could alter across three states (observing the implicit costs of choosing each one of them): offering her workforce in each one of the two markets or getting unemployed by choice.

[25] The Brazilian labor market also has a segment of non-flexible wages. However, this segment is formed primarily by public sector workers with job stability clauses. These workers who belong to the factors L6 and L7 are not included in the MS model, but they are agents in the CGE model.

A prior concern regarding the individuals' reservation wage estimation is the issue related to labor supply identification. In principle, the expansion of income transfers exogenously affects the willingness to supply labor of various demographic groups in different ways. Thus, it is necessary to estimate an equation for individual labor supply, identified by the number of individuals' work hours, as a function of the individual wage-hour after changes in income transfers for each demographic group has been considered. Besides, it is also necessary to correct the potential auto-selection bias to labor supply participation. After applying this procedure, it is possible to properly identify the different reactions of the labor supply to exogenous changes in the size of transfers for individuals in each demographic group. Therefore, the estimation procedure can be described in two steps as follows:

*Step 1*

At this microsimulation stage, we are interested in the individual impact due an income transfers shock, especially for the demographic group of single mothers who are heads of household. This demographic group is the main beneficiary of the *Bolsa Família* and deserves special attention because it is the most sensitive for non-labor income from transfer programs, as found in our MS results.

Our empirical strategy is based on a simpler version in which the worker makes an individual decision. Due to the identification problem of the non-linear budget constraint, we estimated a reduced-form hour equation that depends on the individual wage, the income from transfers programs, other income, and a number of demographic controls. The "other income" variable combines all sources of non-labor income, following Blundell and MaCurdy (1999). This last variable for the married women, for example, is calculated by taking the husband's actual earnings into account. On the other hand, we created another variable that represents the *BPC* and *Bolsa Família* programs in order to capture the effects of the income transfers on labor supply.[26]

The predicted working hours are obtained from the observed and non-observed individuals' characteristics, as well as the family *H*'s characteristics (to which this individual belongs) and his own wage. Therefore, the worker *i*'s predicted hours of work ($h_i^j$) is estimated by the semi-log specification according to Blundell and McCurdy (1999): [27]

$$h_i^j = \alpha_i + \theta_i \log w_i + \beta_i \log Q_i + \delta \log B_i + \gamma_i(Z_i) + u_i, \qquad i = 1,...,n \ \ e \ \ j = 1,2,3 \quad (3.2.1)$$

---

[26] We do not use a household labor supply model that is based on a family joint decision due to various difficulties in identifying the domestic production function (Becker, 1965) from the PNAD data. In this case, we followed the recommendation of Gronau (1986) where the lack of domestic production data should be replaced by family characteristics (such as all types of income) and demographic aspects.

[27] This functional form was proposed because it is consistent with 1) the existence of individuals' preferences by labor and leisure, and 2) the presence of households' budget constraints (Blundell and MaCurdy, 1999).

where $\alpha_i$ , $\theta_i$ , $\beta_i$ , $\delta_i$ and $\gamma_i$ are the parameters to be estimated; $w_i$ is the hourly wage rate for individual *i*; $Q_i$ is the vector of the total household income net of the earnings (including income transfers) received by the individual *i*; $B_i$ is the vector of benefits received (*Bolsa Família* and *BPC*) by individual *i* in 2003; $Z_i$ represents the individuals' observable characteristics; $u_i$ is the random error term, which captures the non-observable characteristics that affect the individual labor supply; and *j* is the individual's demographic group, 1 being for men, 2 for woman head of household with children, and 3 for other women (who are not heads of families). The value of $\theta$ determines the substitution effect related to sensitivity of individual labor supply to changes in wages. The values of $\beta$ and $\delta$ represent the income effect, that is, the impact of non-labor income on labor supply.

The $Z_i$ vector of individual characteristics was composed of the following variables:

$$Z_i = educ, \mathrm{age}, \mathrm{age}^2, \ famsize, \ D_a$$

where *educ* denotes the number of years of schooling, *age* is a *proxy* to the level of experience; *famsize* is the family size in terms of number of individuals (excluding pensioners, domestic servants and their parents), $D_a$ is a dummy for the area where the family's domicile is located (0 for urban and 1 for rural).

The individual working hour is observed just for those that are already employed..Thus, the sample of individuals that present a strictly positive hour of work is not random. However, it is possible that the choice to work is related to the income-dependent variables, either from labor or non-labor (other income sources). Therefore, the situation is typically one of endogenous selection, in which there is a decision to participate or not in the labor market and, given that the individual had decided to work, it is necessary to determine how many working hours he will offer. In order to control for potential selection bias, the procedure proposed by Heckman (1979) is applied, which consists of:

$$\Pr(S_i = 1 \mid \mathbf{z}) = \Phi\{\gamma_i (Y_i Z_i)\} \tag{3.2.2}$$

where: $\Phi$ is a function of accumulated distribution, where $S_i$ is a qualitative variable representing the occupational choice for an individual *i*: this variable will take the value 0 if the individual does not supply work or 1 if otherwise. The variable $\gamma_i$ is a vector of estimated parameters that determine the probability of the individual to take part in the labor market. $Y_i$ is the vector representing the variables related to the labor and non-labor incomes that affect the decision of supplying labor by individual *i*. As before, $Z_i$ are the individual characteristics that determine the probability of participating in the labor market.

The equations (3.2.1) and (3.2.2) are estimated by the two-stage method proposed by Heckman (1979). In this model, equation (3.2.2) is also known as the equation for correcting sample selection bias by non-observables. These equations are run separately for three demographic groups: men, women with children and head of family, and other women, which permit estimating the elasticity of labor supply. The inverse of Mills' ratio $\lambda(\mathbf{z}\gamma)$ is extracted from equation (3.2.2), which will be applied to equation (3.2.1) in a way that the parameters of these equations are going to be consistently estimated.

After estimating the coefficients in (3.2.1) and the inverse of Mills' ratio, it will then be possible to estimate the adjusted working hour of each individual, $\overline{h}_i^{\,j}$, based on the observed and non-observed characteristics. The adjusted working hour is then applied to the individual *i*'s observed wage, $\hat{w}_i$, which results in the adjusted individual *i*'s wage ($w_i$).

*Step 2*

In accordance with the formulated hours of work model, the individual labor supply is a function of individual market wage rates and non-labor income, among other variables. These wage rates can be observed for paid employed individuals. For non-paid persons there is an unobservable wage rate which an individual could potentially receive. According to Heckman (1974) it is possible to express this reservation wage as a function of their individual characteristics as well as non-labor income and other constraints.

Following Savard (2003), the non-observed reservation wage is obtained from the observable and non-observable individual's characteristics, as well as the family *H*'s characteristics to which this individual belongs. Due to the importance of evaluating the reservation wage before and after an income transfer shock, we include non-labor income in the structural reservation wage equation and identify the income transfer variable separately. Therefore, the worker *i*'s reservation log wage, $\overline{w}_i$, is estimated by the equation:

$$\log \overline{w}_i = \alpha_i + \beta_i \log Q_i + \delta \log B_i + \gamma(Z_i) + u_i, \qquad i = 1,...,n \tag{3.2.3}$$

where $\alpha_i$, $\beta_i$, $\delta_i$ and $\gamma_i$ are the parameters to be estimated. The observed wage, $\hat{w}_i$, is the hourly wage adjusted by the procedure described in step 1; $Q_i$, $B_i$ and $Z_i$ are the same variables presented earlier.

Due to the impossibility of observing the wage offer to the sample's individuals who are unemployed, we need to estimate a *probit* model that determines the probability of the individual to take part in the labor market. This probability, $S_i = 1$, is estimated by the function:

$$\Pr(S_i = 1 \mid \mathbf{z}) = \Phi\{\gamma_i (Y_i Z_i D_g)\} \tag{3.2.4}$$

where: $\Phi$ is a function of accumulated distribution; $\gamma_i$ is a vector of estimated parameters that determine the probability of the individual to take part in the labor market; as before, $Z_i$ and $Y_i$ are, respectively, the individual characteristics and the work and non-work income that determine the probability of participating in the labor market; and $D_g$ is a demographic *dummy* (0 for man, 1 for woman that is mother and head of family, 2 for other women).

Finally, the equations (3.2.3) and (3.2.4) are estimated by the two-stage method proposed by Heckman (1979). In this model, equation (3.2.4) is also known as the equation for correcting the sample selection bias by non-observable. From this equation, the inverse of Mills' ratio $\lambda(\mathbf{z}\gamma)$ is extracted, which will then be applied in (3.2.3) in a way that the parameters of these equations are going to be consistently estimated.

After the estimation of coefficients in (3.2.3) and (3.2.4) and the inverse of Mills' ratio, it will be possible to calculate the reservation wage of each individual, $\overline{w}_i^k$ (*k* = 0,1) based on his observed and non-observed characteristics. If the individual belongs to state $k=1$, the reservation wage of worker *i* will be used in comparison with the observed wage, $w_i$ , to select the potential employed or unemployed persons. If he pertains to the state $k=0$, the reservation wage of this individual is obtained to construct a rank of potential newly employed persons.

For each employed person, this procedure applies the following criterion: if the estimated reservation wage $(\overline{w}_i^j)$ is higher than the earned wage ($w_j$) observed in the database, then this person is indicated as potentially unemployed; otherwise, he remains employed, i.e.:

$$\begin{cases} \text{if } \; w_i < \overline{w}_i^k \text{ , individual } i \text{ is potentially unemployed} \\ \text{otherwise} \quad \text{, he is potentially employed} \end{cases}$$

After making this comparison for each employed person, the model determines the Heckman pre-simulation occupational level by private labor type $(HLsl)$ by summing up the number of people originally unemployed with the number of people that would be unemployed according to the Heckman criterion.

It deserves mentioning that this occupational level by private labor type $(HLsl)$ is different from the original level in the database $(Lsl)$, once there are people in the database that work and earn wages lower than their estimated reservation wages. Actually, this happens because these last wages are estimates of the ones that these people could earn in the market according to their own and their families' characteristics. Therefore, merely applying the Heckman procedure to the database changes the occupational level for each labor type.

As proposed by Savard (2003), the selection of individuals who should be unemployed starts with classifying workers according to their reservation wages. Those with the highest reservation wage will be the first to become unemployed if the real wage decreases. If there is positive change in the real wages, the first to be employed will be those with lower reservation wage.

### *3.3. Integration Between The CGE and The MS model*

The impacts of the *Bolsa Família* and *BPC* programs on welfare indicators are assessed with an integrated CGE-MS modeling framework with a bi-directional linkage between them to guarantee convergence of solutions for both models. The communication between these models occurs by means of wages and occupational level of labor. This sub-section describes the way these models are integrated to generate a convergent solution for them.

Running the integrated model involves the following procedure: we first compute the income transfer changes in the MS model and sequentially run the CGE model. By computing the changes of income transfer programs, the MS model simulates the variations in labor supply by type of worker that are communicated to the CGE model.

The basic issue is implementing the variations of labor supply by type of private worker, calculated by the MS model, and of Government expenses that are due to changes in transfer programs in the CGE model, in order to calculate the induced alterations of the average real wage for each type of private worker and the general price index.[28] These last changes are fed back into the MS model, where they serve as exogenous variables, to define a new labor occupational level for each kind of private worker. Again, these are factored into the CGE model as exogenous variables, producing new values for the average real wage for each type of private worker, which, together with the general price index, are then retransmitted to the MS model in order to define labor occupational levels compatible with the new value of the average real wage specific by private worker type.

This iterative process continues until the difference between the values of occupational levels for the private labor types in the CGE model between two consecutive iterative steps are very close to zero. The following illustrates the bi-directional procedure in the case of simulating the implementation of changes in the *Bolsa Família* and *BPC* programs according to each simulation, which will then be described in the next section:

*Step 1*

[28] The model's numeraire is the nominal exchange rate.

The MS model contains data about thousands of individuals, estimates the reservation wage ($\overline{w}_i^j$) for each person *i* in the database, and defines occupational levels for each category of private labor by means of the equations (3.2.3) and (3.2.4), as mentioned in the previous section.

The first step in the integrated solution consists of replacing the values that represent the benefits received from the income transfer programs in 2003 ($B_i$) in the equations (3.2.3) and (3.2.4) by the specific new values of these benefits ($B_i^*$) in each simulation, and then re-estimating to calculate the Heckman post-simulation occupational level for each private labor type ($HLsl_{MS}^*$), which is the occupational level under the simulated conditions.

In order to capture the changes in the occupational level by private labor type due only to the variation in the benefits, isolated from the effects of applying the Heckman procedure to the database, the difference between the Heckman post-simulation occupational level by private labor type ($HLsl_{MS}^*$) and the Heckman pre-simulation level ($HLsl$) is calculated and added to the original occupational level in the database ($Lsl$) to have an occupational level that is compatible with the new values of benefits, that is, a post-simulation occupational level by private labor type calculated by the MS model ($Lsl_{MS}^*$).

*Step 2*

The occupational level after implementing the changes in income transfer programs ($Lsl_{MS}^*$) as well as the new amount of given benefits ($B^*$) are then applied to the CGE model, where

$$B^* = \sum_i \sum_t B_i^t, \quad i = 1,...,n; \quad t = BF, BPC \tag{3.2.5}$$

and $B_i^t$ is the amount of benefits that individual *i* received from *Bolsa Família* and *BPC*.

The new values of taxes that are used to finance the changes in transfer programs ($B^*$) are also applied to the CGE model in order to simulate the changes in the economic environment induced by the variation in income transfer programs. All these changes will induce the economic system to achieve a new general equilibrium and, as part of this process, the labor market will reach equilibrium with new real wage values ($W_{CGE}^*$) for each kind of worker.

*Step 3*

The percentage change in the average real wage ($\Delta W_{CGE}^*$) for each kind of private worker obtained from the simulation using the CGE model is applied on the wages earned by each person *i* in the MS model's database ($w_i$), which belongs to the respective category of worker, defining after-shock values for earned wages ($w_i^*$) by each kind of private worker. For example, if the post-simulation average real wage of worker type l5 (formal with high skill) in the CGE model is 5 percent higher than its initial value, then all wages earned by each one in this category in the MS model's database are raised by 5 percent.

After this, we compare the values of these new individual wages $w_i^*$ with their respective reservation wage amounts ($\overline{w}_i^j$) by means of the Heckman procedure. Using the same previously mentioned criterion for this procedure, we have:

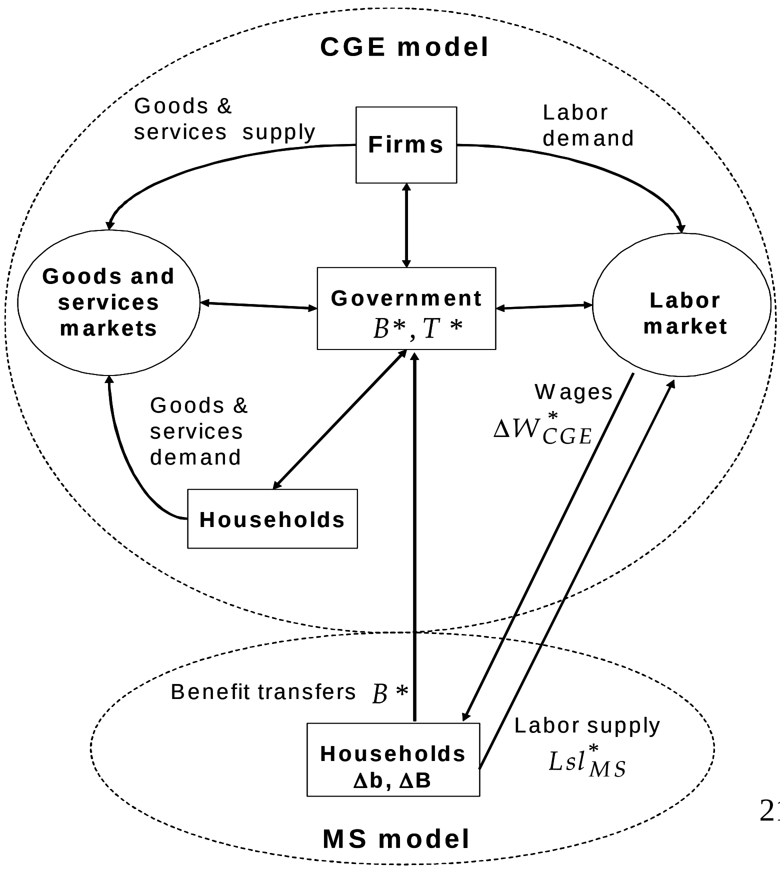
$$\begin{cases} \text{if } w_i^* < \overline{w}_i^j \text{, individual } i \text{ is unemployed,} \\ \text{otherwise , he is employed.} \end{cases}$$

Therefore, after classifying the workers by their reservation wages, those with the highest reservation wage will be the first to become unemployed if the real wage decreases, and in the case of a positive change in real wages, the first to be employed will be those with lower reservation wage. By adding to the initial occupational level the number of people to be employed or unemployed according to this criterion, one obtains a new level of occupation for each private labor type $\left(Lsl_{MS}^*\right)$.

*Step 4*

These new occupational levels are then transmitted to the CGE model as shown in the figure below that illustrates the iterative procedure:

**Figure 3.2**: **MS-CGE Integration**



If the occupational levels calculated by the MS model are different from those in the CGE model, they change the equilibrium of the labor markets, which will present new values for wages and induce changes in the economic environment as a whole until the CGE model reaches a new equilibrium situation. In this sense, step 2 restarts, but without changes in benefits and their financing sources, and this integrated solution procedure loops until the difference between the post-simulation occupational level calculated by the MS model ($Lsl*$) in one round is reasonably close to the one obtained in the previous round.[29]

This association is consistently done with the equilibrium of aggregate markets in the CGE model, which requires that: (i) relative changes in average earnings in the MS model must be equal to changes in wage rates obtained in the CGE model for each private wage group in the labor market; (ii) relative changes in the number of privately waged workers by labor market segment in the MS model must match those same changes in the CGE model; and (iii) changes in the consumption price vector, *p*, must be consistent with the CGE equivalent price indicator.[30]

According to the above procedure, the private labor supply is being modified along simulation iterations; for example, some individuals will be losing their former jobs. If this happens, the share of each household in the total income of each labor category can also change (parameter $\varepsilon_{hl}$ in equation 3.1.2). In order to capture these variations, we incorporate the differences among the parameter $\varepsilon_{hl}$, along the simulation rounds as a shock in the CGE as well, which performs simultaneously with the procedures described in this section.[31]

### *3.4. Non-Labor Income Procedures*

After the models' solutions convergence it is still necessary to treat the non-labor incomes before calculating poverty and inequality indicators. Basically, the variables related to these sources of income in the MS model follow the CGE variations or hold the same value as the household survey, as shown in table 3.1. In the former case, the changes from the CGE model are transmitted to the corresponding variables in the MS model in a unidirectional way.

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[29] In general, the convergent solutions were obtained in the seventh iteration between the models.

[30] The change in consumption prices is transmitted from the CGE model to the MS model through the variations in the real wages by private worker type, which is used as linking aggregate variables between the models.

[31] Specifically for the simulations carried out, the share parameter $\varepsilon_{hl}$ did not present significant differences among the simulation rounds. They are so small that they become visible just in the 4th decimal case. This fact implies that, practically, there was no variation of the shares along the simulation.

**Table 3.1: Integration of CGE-MS model for non labor income (Base 2003)**

| Household Income Source | Procedure in the Microsimulation (PNAD 2003) |
|---|---|
| **Self Employed Income** | CGE results variations of these income sources are applied to the microsimulation model vectors.[32] |
| **Interest, Dividends and Others and House Rental** | CGE results variation of these income flows individualized to the 8 family types in the model are applied to the microsimulation model vectors.[33] |
| **Retiree and Pension Public Benefits** | The same vector value of the microsimulation base year model. |
| **Retiree and Pension Private Benefits** | The same vector value of the microsimulation base year model. |
| **Donation received** | The same vector value of the microsimulation base year model. |
| For each family, the above sources are deflated by a family specific price index (after simulation). [34] | |

## 4. Simulations and Results

This section presents features of the simulation in order to better understand the reported results, which are also presented below.

### *4.1. Description of simulations*

This subsection describes the simulations carried out in this project which are related to the project research questions: what are the impacts of the current income transfer programs on income distribution and poverty in Brazil? Is each program accomplishing its objective of poverty reduction? What would be the impacts of these programs if they have alternative policy designs?

Our simulation objective is to assess the effects of changing the values and the beneficiaries of the programs *Bolsa Família* and *BPC* from the ones presented in 2003 to the ones presented in 2005. We thus proceeded with the simulation as a response to the following question: How would the Brazilian economy in 2003 (base year) behave if it had the same characteristics of the transfer program in the year 2005? To do so, we proceed in the following way.

**Transfer Programs.** We addressed the changes between 2003 and 2005 with similar procedures adopted by Barros *et al* (2007c).[35] However, we construct a specific imputation methodology for the 2005 additional benefits (this is fully explained in Appendix C). Given this information, we then took the benefits share among the eight CGE model families with amounts for each program given by the administrative Federal Budget data, observing the consistency with our SAM data. The values are shown in table 4.1.

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[32] Vector included in the matrix ($\varepsilon_{hk} * YK$) in equation (3.1.2).
[33] Another vector of matrix ($\varepsilon_{hk} * YK$ ) plus Government transfers at equation 3.1.2.
[34] Weighted average of the commodities price changes, whose weights are the shares of the respective commodity expenses in the total consumption expenditure of that family.
[35] For 2003, at micro data level, we used the same adapted household survey, which was provided by those authors.

**Table 4.1: Total amount of benefits for CGE model by family type; changes between 2003 and 2005 (R$ mil)**

| Families | 2003 | | 2005 | | 2005-2003 | |
|---|---|---|---|---|---|---|
| | Bolsa Família | BPC | Bolsa Família | BPC | Total Increase | Share of Benefits in Total Family Income |
| F1 | 777.344 | 675.171 | 1.829.805 | 1.418.757 | 1.796.048 | 4,31% |
| F2 | 35.269 | 19.741 | 88.412 | 255.354 | 288.755 | 3,01% |
| F3 | 616.145 | 302.187 | 1.250.466 | 410.307 | 742.439 | 5,05% |
| F4 | 810.877 | 2.203.557 | 1.861.258 | 4.346.372 | 3.193.196 | 2,32% |
| F5 | 131.450 | 653.335 | 276.218 | 336.645 | -171.922 | -0,11% |
| F6 | 319.388 | 653.445 | 647.264 | 757.034 | 431.464 | 1,09% |
| F7 | 336.965 | 575.066 | 635.454 | 288.837 | 12.259 | 0,00% |
| F8 | 157.558 | 50.428 | 282.481 | 25.328 | 99.823 | 0,04% |
| **Total** | **3.185.000** | **5.132.934** | **6.871.361** | **7.838.638** | **6.392.065** | **0,57%** |

Source: Author's elaboration based on data from Federal Budget and SAM (2003) based model

The table above shows the differences among the benefit amounts in 2005 and 2003. The amount imputed in the 2003 model base year increased the transfers by R$ 6,392 million, which represents 0.57 percent of the total family income in the model. Separately, the program's increase was approximately 116 percent for *BF* and 53 percent for *BPC*. Also, there was an improvement in the targeted group. The poorest families in the CGE model (F1, F2 and F3) increase their *BF* share from 44.9 percent (2003) to 46.1 percent (2005). Despite these improvements, the data show that the *BPC* targeting was much worse than that for the *BF* program (from 19.4% in 2003 to 26.6% in 2005).

The effects of the abovementioned changes are evaluated via the simulations, henceforth referred as SIMU A and SIMU B. The only difference between them is whether the programs are financed or not, before the shock. In SIMU A, the government expenditure in transfers is not financed and government just increases its expenditure in transfers. This choice implies that government is increasing its nominal deficit, which reduces total savings and investment.

**Program Budget Finance at SIMU B**. The expenditure increase of *BF* and *BPC* was financed by the increase in federal government taxes. This choice was made in order to hold almost constant the nominal government deficit and its contribution to the total amount of savings at the CGE level. The justification for this policy arrangement can be explained by the "fiscal responsibility law", which requires that every new expenditure must be explicitly financed at the budget law, which means at the moment the law is approved but before the new expenditure takes place.

In choosing which tax we should increase, we reviewed the 2005 federal budget data extensively to identify the specific tax sources that were financing the *BF-BPC* programs during that year. Table 4.2 summarizes the amounts of each federal tax source, their percentage composition, and the equivalent CGE tax as presented in the CGE model.

**Table 4.2**: **Programs' tax sources in 2005 (R$ mil)**

| Brazil Tax Source | Value | Composition | Equivalent tax in the CGE model |
|---|---|---|---|
| Contribuição para Financiamento da Seguridade Social (COFINS:Code 153) | 7.570.121 | 51.46% | "COFINS" tax and its value added reform |
| Contribuição Provisória sobre Movimentação Financeira (CPMF: Code 155) | 5.265.907 | 35.80% | Direct taxes on firms and households |
| Outros Impostos Diretos (Income Tax and other directed taxes) | 993.630 | 6.75% | Direct taxes on firms and households |
| Impostos sobre Produtos (Mix of Indirect Taxes) | 445.959 | 3.03% | Indirect taxes on Revenue |
| Contribuição Social sobre o Lucro das Pessoas Jurídicas (CSLL: Code 151) | 418.667 | 2.85% | Direct taxes on firms and households |
| Operações de Credito Externas - Em Moeda (code 148) | 15.713 | 0.11% | |
| **Total** | **14.710.000** | **100.00%** | |

From this table[36] we collected the financial share of each tax in the total increase of the programs' expenditure (R$ 6.392.065.000). Thus, the specific CGE taxes below were increased in the following way:

- The direct taxes applied on gross income of the eight CGE families were increased by 2.2 percent. This tax increase was implemented through the coefficient $t_h$, in equation 27 of the model equation list (see Appendix A.2);[37]
- The direct income taxes of the model firms were increased by 2.2 percent. This higher tax was implemented through the coefficient $t_f$ , in equation (28) of the model equation list (Appendix A.2);

Apart from this, we partially replicate the simulation of the PIS-COFINS tax reform, which was implemented by federal government in the same period. From the total revenue generated by this reform, 27.5 percent was appropriated as funding for the programs[38].

### *4.2. Macroeconomic Impacts*

Table 4.3 presents the macro results that formed the background for SIMU A and SIMU B. The analysis first focuses on results from SIMU B once it captures the effects of changes in transfers and in the taxes that were used to finance the transfers, while the results from SIMU A are reported to provide information on the impacts only from the changes in transfer programs.

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[36] The table's total value (R$ 14.710.000) is equivalent to the sum of 2005 *Bolsa Familia* and *BPC* columns in Table 4.1. Briefly, the COFINS tax charges revenue, value-added, and imports. The CPMF tax was collected from all transactions through the banking system (however, it was revoked in 2008). The CSLL charges the net profit (after income tax). A more detailed data about the programs' tax sources are presented in Appendix D of this report.

[37] Generally, an increase in the nominal tax rate on labor income should affect the labor supply. In this case however, the situation was different. The increase was just in the effective rate while the legal rate was held constant. This often occurred due to individual behavior changes. Also, empirically the Brazilian marginal income tax rate is very low for the great majority and there was an increase of just 2.2 % on average.

[38] In this reform, the PIS-COFINS taxes started to be collected by two regimes (cumulative and non-cumulative) associated with domestic flows and were also levied on imports. These changes were simulated in the CGE model and are fully described in a paper by Cury and Coelho (2006).

**Table 4.3: Macroeconomic indicators (percentage change)***

| Macroeconomics indicators | SIMU A (%) | SIMU B (%) |
|---|---|---|
| GDP | –0.02 | –0.46 |
| Consumption | 0.50 | –0.35 |
| Investment | –1.42 | –1.04 |
| Public Sector Deficit | +17.87 | +7.38 |
| Exports | (**) | –0.84 |
| Imports | (**) | –1.07 |
| Employment | –0.11 | –0.48 |
| Price Index | 0.13 | 0.65 |

Note: (*) Real percentage change from the CGE base year. (**) Lower than 0.01%.
Source: Authors' elaboration.

In general, the macro impacts were adverse since they induced a real GDP fall of 0.46 percent and an aggregate employment decrease of 0.48 percent, and generated a price index increase of 0.65 percent. These adverse effects can mainly be attributed to the partial PIS-COFINS tax reform that was one of the financing sources of the transfer programs. The analysis of this tax reform done by Cury and Coelho (2006) provided similar results.

The taxation of the firms' value-added (VA) required firms to either earn higher marginal revenues or decrease marginal costs, which can be done by reducing the VA components. Since the capital is fixed by sector, this implies a lower labor demand that induces a decrease in wages, which subsequently reduces the available income. Particularly, the aggregate consumption fall is due to the decrease in the overall family income despite the rise in income among the poorest households due to the transfer's increase.

The taxation of imports imposed by the fiscal reform increased their prices in the domestic market and induced another adverse effect on aggregate consumption, once this had driven a rise in the composite commodities' prices in the internal market. This relative increase of prices acts as an external shock and induces reductions of the household's and firm's demands.

Exports fell due to the price-responsive behavior of external agents and the model's external closure characteristics. First, the simulation induced an increase in prices of domestically produced commodities, which in turn caused a decrease in external demand for Brazilian commodities. Second, the rise in import prices and the reduction of internal absorption (activity) induced a fall in demand for imported commodities and in exports, which did not lead to a disequilibrium in the trade balance.

The government deficit worsened by 7.88 percent, which showed that the simulated taxation changes were not enough to completely finance the total transfer costs. However, when comparing both simulations, it was noted that the government deficit decreased from 17.87 percent to 7.88

percent. Despite the intention of full financing as designed in SIMU B, the government deficit was not held constant because the tax dead weight losses were incurred during the simulation.[39]

Finally, the comparison between simulations demonstrated the isolated effect of transfers without the tax increases (SIMU A). In this simulation, the GDP is practically stable. The same occurred with internal absorption, but the shock caused a tradeoff between consumption and investment, with the former increasing by 0.5 percent and the latter decreasing by 1.42 percent. This fact can be explained by the increase in income transfer and by the higher public deficit (+17.89 %), consequently reducing total savings. If there is no increase in other sources of savings, the consequent fall in investment can reduce the rate of economic growth in the near future, postponing the negative economic effects.

Besides the former adverse effect, overall SIMU A almost does not change the macro indicators in the short run. Therefore we can conclude that the adverse impacts of SIMU B are due to the simulated program's financing structure.

### *4.3. Impacts on Labor Market*

The changes in income transfer programs from 2003 to 2005 induced a slightly adverse effect on aggregate employment (–0.48%, according to Table 4.3) and on employment by labor type, as shown in table 4.4.

**Table 4.4: Change in employment from the base-year (%)**

| | L1 | L2 | L3 | L4 | L5 | L6 | L7 |
|---|---|---|---|---|---|---|---|
| SIMU A | – 0.13 | – 0.14 | – 0.17 | – 0.06 | – 0.06 | 0,00 | 0,00 |
| SIMU B | – 0.85 | – 0.47 | – 0.47 | – 0.28 | – 0.23 | 0,00 | 0,00 |

**Note: L1**-unskilled informal; **L2**-skilled informal; **L3**-formal with low skill; **L4**-formal with average skill; **L5**- formal with high skill; **L6**- low skilled public servant; **L7**- highly skilled public servant.

The results show that employment fell for all categories of workers in the private sector only. Government employment does not change because the public sector does not follow the behavior of the private sector concerning hiring/firing people; by assumption, their employment levels are fixed and their labor market is adjusted only by means of wages.

Among workers in the private sector, one can see two patterns. The effects would be more pronounced among those allocated in the informal market (L1 and L2) first and next among the less skilled ones in each (informal or formal) market.

[39] We suppose that the government was acting ex-ante and was appropriating just resources to cover the programs' budget. On the other hand, it is reasonable to suppose that the government (ex-ante) did not estimate the probable tax losses. There remains the consideration that during that period, several different shocks were simultaneously changing the economy as a whole.

By our interpretation, with lower imports and an external closure implying fixed balance of goods and services there will be a pressure to overvalue the exchange rate that will tend to make exports more expensive, which will be reinforced by an increase in input prices used to produce exported goods. The sectors in which exports are more sensible to price changes are the most traditional ones. Thus, by exporting less, there would be a tendency for these sectors to produce less and, therefore, to employ less workers, especially the less skilled ones.

The decrease in employment of more skilled workers is due to the fall in the output of sectors that produce goods with higher technological content, thus effectively decreasing the demand for this kind of worker (as employed in automobiles, auto parts, electronic, electrical, and pharmaceutical industries). Given this fact, there is probably a fall in the consumption of families with higher income.

Table 4.5 presents the impacts on real wages by labor type. Recall that the CGE model takes the assumption of rigid sectoral wage differentials, thus the wage structure can only react to a certain type of labor. As a consequence, the changes reported in table 4.5 are for each type of worker without any sectoral desegregation.

**Table 4.5: Change in the average real wage from the base-year (%)**

| | L1 | L2 | L3 | L4 | L5 | L6 | L7 |
|---|---|---|---|---|---|---|---|
| SIMU A | + 0,32 | – 0,12 | – 0,04 | – 0,07 | – 0,09 | – 0,04 | – 0,01 |
| SIMU B | – 1,77 | – 0.96 | – 1,52 | – 0,90 | – 1,61 | – 1,66 | – 1,62 |

Note: **L1**-unskilled informal; **L2**-skilled informal; **L3**-formal with low skill; **L4**-formal with average skill; **L5**- formal with high skill; **L6**- low skilled public servant; **L7**- highly skilled public servant.

Note that the general effect is a real wage fall. The wage of informal workers (L1 and L2) would fall relatively more compared to the wage of formal workers with similar skill levels. The higher reduction in public servants' earnings is due to the assumption that the equilibrium in their labor market is almost exclusively achieved by means of wage adjustments.

Table 4.6 shows the effects on payroll by type of worker (total labor income) representing the former quantity and price effects together. They are stronger among the less skilled workers, especially for those allocated in the informal market.

**Table 4.6: Changes in real payroll from the base-year (%)**

| | L1 | L2 | L3 | L4 | L5 | L6 | L7 |
|---|---|---|---|---|---|---|---|
| SIMU A | + 0,19 | – 0,25 | – 0,21 | – 0,13 | – 0,14 | – 0,04 | – 0,01 |
| SIMU B | –2.62 | –1.43 | –1.99 | –1.18 | –1.84 | –1.66 | –1.62 |

Note: L1-unskilled informal; **L2**-skilled informal; **L3**-formal with low skill; **L4**-formal with average skill; **L5**- formal with high skill; **L6**- low skilled public servant; **L7**- highly skilled public servant.

These effects on payroll are due mainly to the fall in real wages, once the impacts of changes in transfer programs on employment are lower than the real wage changes for each kind of worker.

Again, the comparison between simulations shows that the transfer programs themselves practically do not cause any significant adverse effect. Even the informal unskilled worker (L1) shows a labor income improvement, derived from the fact that there is a production reallocation in favor of more intensive labor sectors. On the other hand, the increase in taxes to finance the programs lead to adverse effects through changes in the relative prices and a less efficient resource allocation with higher unemployment.

Finally, it is important to stress that the convergence procedures affect the final labor market equilibrium. Concerning these effects on payroll therefore, the convergence solution of the CGE and the MS models show that changes in the transfer programs induce general equilibrium effects that initially concentrate on wage (price effects) and, due to the iterative process, are partially reallocated to employment impacts (quantity effects).

Table 4.7 illustrates the process described in the previous paragraph through the evolution of model variables during SIMU B. In the first line, we represent the real wage, price index, and GDP in the first simulation round. In the second line, the same variables are presented for the last round of SIMU B, which is the source of the results reported in this section. For the wage, we realized that the iteration changes the results considerably, lowering the impact on wages. The price index increases while GDP practically does not change, aided by the employment increase, which confirms that the model integration leads to a new set of results.

**Table 4.7: Differences between first and last SIMU B rounds – selected variables (% )**

| | wage L1 | wage L2 | wage L3 | wage L4 | wage L5 | pindex | GDP |
|---|---|---|---|---|---|---|---|
| First round simu B | – 2,16 | – 1,39 | – 1,76 | – 1,29 | – 1,93 | 0.56 | – 0.41 |
| Last round simu B | – 1,77 | – 0.96 | – 1,52 | – 0,90 | – 1,61 | 0,65 | – 0,46 |

### *4.4. Impacts on Income Distribution*

Table 4.8 shows the impacts of changes in transfer programs on inequality indicators. In general, the results confirm the important role of transfer programs in Brazil's recent inequality fall.[40]

**Table 4.8: Inequality indicators from household per capita income (base year 2003)**

| Inequality Indicators | BasicYear | SIMU A | | SIMU B | |
|---|---|---|---|---|---|
| | Original | Results** | Change | Results** | Change |
| Gini Index | 0.5930 | 0.5908 | – 0.37% | 0.5902 | – 0.48% |
| Theil-T Index | 0.7213 | 0.7163 | – 0.69% | 0.7161 | – 0.72% |

Source: from the CGE-MS integration model. (base year: 2003 PNAD survey)

[40] The book published in Brazil and edited by IPEA (Barros *et al*, 2007d) has several chapters aligned with this view.

Focusing on Gini index changes, the fall of –0.48 percent (SIMU B) is slightly lower than the ones reported by other studies that have evaluated the importance of transfer programs to the decrease in inequality using partial equilibrium/decomposition analysis. Barros *et al* (2007c) found that 22.9 percent of the total Gini decrease between 2001 and 2005 was due to *BF* and *BPC*. In the same period, these authors reported a total decrease in the Gini index of –2.6 percent. Therefore, the decrease displayed in table 4.7 accounts for approximately 14 percent (SIMU A) and 19 percent (SIMU B) of the total fall in inequality during that period.

The simulations intended to capture the effects of changes in transfer programs from 2003 to 2005 in a general equilibrium environment. Although the period is different, we found evidence that just the transfer programs (SIMU A) had lower effects on inequality than those reported by other studies that had evaluated the distributive effects of these programs. In the case of SIMU B however, the effect is very similar. These differences are due to fact that the changes in transfers and in their financing taxes had induced a decrease in employment and an increase in prices that are not well captured by partial equilibrium analysis. It is also important to stress that the taxation changes related to the programs contributed to reduce inequality but left some adverse effects as shown below.

Despite the previous comments, we must be careful when comparing these results with previous analyses. As stressed before, they have methodological and simulation design differences, although we tried to replicate these earlier experiments.

Table 4.9 shows the impacts of changes in transfer programs on per head family income. The changes in programs had a slightly adverse effect on the national average household income which was – 0.18 percent in SIMU A, but was magnified to – 0.81% when the changes in taxation related to the programs' expansion were considered in SIMU B. In both simulations, the positive strong effects on the three poorest families were primarily due to the increase in transfer amounts for them. In SIMU B however, the effects were a little lower for each of these same family types. This happens because one of the main resources for expanding these programs was through an increase in income taxes, which does not charge them.

**Table 4.9: Change in household income from the base-year (%)**

| Average household income | Original | SIMU A | | SIMU B | |
|---|---|---|---|---|---|
| | Values (R$) | Values (R$) | Change | Values (R$) | Change |
| National average | 432.36 | 431.59 | -0.18% | 428.84 | -0.81% |
| Family 1 (F1) | 43.88 | 45.89 | 4.58% | 45.76 | 4.28% |
| Family 2 (F2) | 70.20 | 74.90 | 6.70% | 74.89 | 6.69% |
| Family 3 (F3) | 46.87 | 47.89 | 2.17% | 47.78 | 1.94% |
| Family 4 (F4) | 166.42 | 168.19 | 1.06% | 167.67 | 0.75% |
| Family 5 (F5) | 303.65 | 302.57 | –0.36% | 301.23 | –0.80% |
| Family 6 (F6) | 191.94 | 192.31 | 0.19% | 191.76 | –0.09% |
| Family 7 (F7) | 696.64 | 693.84 | –0.40% | 689.33 | –1.05% |
| Family 8 (F8) | 3,015.14 | 2,998.08 | –0.57% | 2,972.50 | –1.41% |

Note: F1 – poor urban families headed by active individuals; F2 – poor urban families headed by non-active individuals; F3 – poor rural families; F4 – urban families with low average income; F5 – urban families with medium income; F6 – rural families with medium income; F7 – families with high average income; F8 – families with high income.

Source: Authors' elaboration.

For the same reason, the effects of the programs' expansion on income of richer families (F7 and F8) were already negative in the first simulation (SIMU A) and were magnified when the changes in taxation were considered.

The effects of the transfer programs' expansion that positively impacts the income of the poorest family types are reflected in SIMU A. This simulation also captures systemic effects induced from these programs, as shown in sections 4.2 and 4.4. Besides capturing these effects, SIMU B also shows the additional negative impacts from the general taxation, and the above results show the effects on the richest families (F7 and F8).

This helps to understand the improvement of the Gini index in SIMU B in relation to SIMU A. Aside from capturing the income increase of the poorest families, it also captures the fall in income of the richest families due to the taxation.

### *4.5. Impacts on Poverty*

The effects of the transfer programs on poverty are presented in table 4.10. Based on observed and simulated income per head household, we calculate three poverty indicators: Proportion of Poor (P0), Income Gap (P1) and Severity of Poverty (P2). To calculate these indicators, we used values for September 2005 estimated by Barros *et al* (2007b) and we deflated these to September 2003 according to the IPCA (*Índice de Preços ao Consumidor Amplo*) index.

**Table 4.10: Poverty indicators - PNAD 2003**

| Poverty Indicators | Base year | SIMU A | | SIMU B | |
|---|---|---|---|---|---|
| | Results* | Results | Change | Results | Change |
| **Poverty Line (Line = R$ 143,70)** | | | | | |
| P0 | 0.3299 | 0.3256 | –1.29% | 0.3271 | –0.84% |
| P1 | 0.1599 | 0.1579 | –1.26% | 0.1593 | –0.38% |
| P2 | 0.1061 | 0.1047 | –1.28% | 0.1060 | –0.08% |
| **Extreme Poverty Lines (Line = R$ 71,84)** | | | | | |
| P0 | 0.1485 | 0.1473 | –0.83% | 0.1485 | 0.01% |
| P1 | 0.0777 | 0.0766 | –1.38% | 0.0778 | 0.18% |
| P2 | 0.0578 | 0.0569 | –1.52% | 0.0580 | 0.40% |

Source: Authors' elaboration.

The general reduction in poverty indicators (P0, P1 and P2) shows that the changes just in transfer programs (SIMU A) had positive effects on poverty and on extreme poverty. Although the impacts are positive, they are lower than the income of the poorest families showed in table 4.8 because the transfers are concentrated on families that receive them. On the other hand, some poor families lose their labor income due to the unemployment generated in the economy

From the results in table 4.10 we also see that the impacts of programs on poverty were reduced by the changes in taxation conducted to finance their expansion (SIMU B); that is, the changes in taxation generated some adverse impacts in the markets that affected the poor population and, in a more intensive way, the extremely poor individuals. As we have seen previously in section 4.4, the impacts on employment were stronger among the less skilled workers (L1 and L3) and the informal workers (L1 and L2). Despite these impacts, their wages have also decreased significantly. These workers are prevalent among the poorest families, which also show a high dependence on labor income. Therefore, despite the increase in the received benefits, some families experienced adverse effects from job losses and wage reduction that were induced by the changes in taxation.

Specifically in the case of SIMU B, the programs' expansion did not have an impact on the extreme poverty level. However, the income gap and severity of extreme poverty have worsened. One fact that helps to understand this phenomenon is the deterioration of non-labor income due to the price increase, which especially affected the family F2, whose income is basically derived from social security benefits.

## 5. Conclusions and Recommendations

In the last two sections of this report, we presented the methodological approach and the main results of the simulations. From the methodology, it was emphasized that the general equilibrium effects cannot be neglected, not only to evaluate the effects brought by the transfer increases, but mainly to address the economic impacts originated in the tax structure that finances this social expenditure. Without the CGE component of this integrated approach, many economic facts, reported in the simulation results, could not be identified.

On the other hand, the MS model allows the individualization and the treatment of individuals and families. In view of this, we implemented the individual imputation of the transfer benefits and the respective labor supply reaction, whose system inside the MS model greatly improved the treatment of the labor market. Also, without the MS model, we could not generate more realistic results about poverty and inequality than those obtained with models that include representative agents.

Then there is the integration between these models (CGE and MS). Throughout the interaction in the labor market, the employee's reactions to wage movements were better captured, allowing for a set of price and quantity adjustments with economic consequences for the entire system. Without these, the simulation effects would be more concentrated on quantity adjustments that rarely fit the empirical data of this type of shock.

The aim of the simulations presented here was to investigate the role of the two most important Brazilian cash transfer programs in reducing inequality. Our main objective was to provide information that could help answer the project's main research questions: What are the impacts of the current income transfer programs on poverty/inequality? To what extent does each program accomplish its objective of poverty/inequality reduction? What would be the impacts of these programs if they have alternative policy designs?

Adopting the same strategy as the presentation of our results, we emphasized the impacts of SIMU B, which in our opinion can better represent the costs and benefits of the analyzed policies, since the simulation captures the effects of changes in transfers and in taxes that were used to finance them.

The macro results that formed the background for both simulations showed that, in general, the impacts were adverse for several macro indicators, among them GDP, employment, and price index. However, it is important to emphasize that the adverse results came mainly from the tax increases instead of the transfer policies. Also, the identification of this fact is a direct contribution of the study's integrated approach.

Starting with the first question, the results confirmed the importance of *Bolsa Família* and *BPC* programs for the recent reduction in income inequality in Brazil. The results of SIMU B showed that practically 1/5 of the fall in inequality between 2003 and 2005 can be attributed to the adopted policies. Also, the results were very similar to those reported by other studies that used partial equilibrium/decomposing analysis. However, taxation alone (as shown in SIMU B) had a major role in this process. Again, this finding is another result derived from our methodology.

The results were also positive for the poverty indicators. However, the transfer policy contribution, especially in SIMU B, had a smaller impact than its inequality effect. The transfers itself (SIMU A) generated positive impacts, but the changes in taxation to finance program expansion practically offset the former effect, particularly in the case of extreme poverty indicators. The family income components that contributed to this process include labor income through higher unemployment, and non-labor income through the fall of social security benefits in real values.

In general, the results also demonstrated that the two analyzed programs have achieved their objective of reducing poverty and inequality. However, the simulation data in section 4.1 showed that *Bolsa Família* targeted its beneficiaries better, concentrating its benefits on poor families. On the other hand, *BPC* does not show the same concentration pattern. As shown in Appendix C and D however, the main problem in this regard lies in the program administration that has not correctly enforced the criteria established by its legal instruments.

Finally, we did not formally exercise simulations with alternative simulation designs because the research results indicated that there are other issues more important than the "benefits alternative" models. This fact was also reinforced by the minor impacts of the programs' current design on labor supply. On the other hand, it became evident that the taxation structure of the transfer programs plays an important role in the final welfare impacts. In our opinion, this issue should deserve more attention in a policy research agenda that could explore different strategies to finance the programs instead of cutting some government expenditure that neither improves income distribution nor reduces poverty.

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## Appendix A: CGE Model

### *A.1. The CGE Model – complementary description*

#### *A.1.1. The Product Supply*

Foreign product supply is modeled as being totally elastic,[41] while sectoral domestic supply is represented by a three-step nested production function with three types of inputs: labor, capital and intermediate inputs.[42] First, amounts of types of labor ($F_l$), given by the first order firm's profit maximization conditions are combined in a composite labor ($Ld_i$) for each sector *i*, by a Cobb-Douglas function with constant returns to scale:[43]

$$Ld_i = \prod_l F_{il}^{\beta_{il}} \tag{A.2.1}$$

where $\beta_{il}$ is the share of each type of labor: unskilled informal (L1), skilled informal (L2), formal with low skill (L3), formal with average skill (L4), formal with high skill (L5), public servant with low skill (L6) and public servant with high skill (L7).[44]

Second, in each sector *i*, aggregated labor ($Ld_i$) and capital ($K_i$) [45] are associated by a constant elasticity of substitution (CES) function to obtain the production level ($X_i$):

$$X_i = a_i^D \left[\alpha_i Ld_i^{(\rho_{it}-1)/\rho_{it}} + (1-\alpha_i) K_i^{(\rho_{it}-1)/\rho_{it}}\right]^{\rho_{it}/(\rho_{it}-1)} \tag{A.2.2}$$

where $a_i^D$ is the CES shift parameter, $\alpha_i$ is the *i* sector's labor share in the production value and $\rho_{ip}$ is the elasticity of substitution between capital and labor.

Finally, in the third step the various intermediate input levels ($INT_i$) are obtained by a Leontief production function (e.g., fixed proportion to sector *j* total product, $X_j$):[46]

$$INT_i = \sum_j a_{ij} * X_j \qquad \text{(A,2.3)}$$

where $a_{ij}$ is the technical coefficient of input *j* in sector *i*.

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[41] Thus, Brazilian demands for imported goods are fully satisfied without facing external supply constraints.
[42] The model represents the 42 sectors of activities listed in Appendix B.
[43] This means that an identical increase of every type of worker results in an identical increase of the aggregate worker.
[44] Also, there are two more types of employers that are treated as labor and enter in the Cobb-Douglas aggregation.
[45] The model closure adopted in the simulations determines that the sectoral levels of capital are fixed.
[46] It is worth mentioning that Devarajan *et al* (1991) makes use of only the first and third steps, by combining capital with labor and value added with intermediate inputs in this order.

Domestic producers react to the relative prices in domestic and international markets and the domestic output is divided by a constant elasticity of transformation (CET) function with imperfect substitution between products sold in these markets:

$$X_i = a_i^T * \left[\gamma_i * E_i^{(\rho_{it}+1)/\rho_{it}} + (1-\gamma_i) * D_i^{(\rho_{it}+1)/\rho_{it}}\right]^{(\rho_{it}+1)/(\rho_{it})} \quad \text{(A.2.4)}$$

where $X_i$, $E_i$ and $D_i$ are, respectively, the domestic sector *i*'s total output, exported volume and sales to internal market. $a_i^T$ and $\gamma_i$ are model's parameters and $\rho_{it}$ is the elasticity of transformation.[47]

*A.1.2. Demand for products*

*A.1.2.1. Families*

Families are classified according to per head household income, level of urbanization and household head characteristics: poor urban families headed by active individual (F1), poor urban families headed by non-active individual (F2), poor rural families (F3), urban families with low average income (F4), urban families with medium income (F5), rural families with medium income (F6), families with high average income (F7), and families with high income (F8).

They choose commodities' consumption levels to maximize utility subject to a budget constraint according to a Cobb-Douglas functional form (similar to the production function presented earlier).[48]

Families and firms demand domestic and imported goods as imperfect substitutes that differ according to their source (domestic or external), as proposed by Armington (1969), and their utility levels are measured (in product quantity) by a CES function:

$$Q_i = a_i * c\left[\delta_i * M_i^{(\rho_{ic}-1)/\rho_{ic}} + (1-\delta_i) * D_i^{(\rho_{ic}-1)/\rho_{ic}}\right]^{\rho_{ic}/(\rho_{ic}-1)} \quad \text{(A.2.5)}$$

where $M_i$ is the imported volume of good *i* and $D_i$ is the consumption of the domestic good *i*. $a_i c$ and $\delta_i$ are parameters, while $\rho_{ic}$ is the Armington elasticity of substitution between $D_i$ and $M_i$.[49] Finally, $Q_i$ indicates the utility derived from the consumption of good *i*.[50]

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[47] There are no empirical estimates of Brazilian export elasticities using a CET structure for a highly disaggregated sectoral specification. Therefore, it was adopted from the same procedure used in Cury (1998, pp. 112-113), which departed from the elasticities estimated by Roland-Holst *et al* (1994) to the American economy.

[48] Actually, this utility maximization can happen along the consumers' lifetime. From the point of view of most practical applications, the maximization is on the goods and services available in a given period.

[49] These elasticity values were estimated for the same sectors considered in the model by Tourinho *et al* (2002).

[50] It can be interpreted as the quantity of a hypothetical composite good that would be demanded by consumers.

The external agents demand domestic goods, reacting to changes in relative prices as well. Similarly to the import demand function, the exports demand arises from a CES utility function that represents the imperfect substitution between products from the external regions and Brazil.

*A.1.2.2. Firms*

Firms demand commodities to satisfy their production requirements of intermediate inputs according to the technical coefficients from the input-output matrix. Due to the static nature of accumulation in the capital market, investments are only important for product demand.

Similar to consumption, investment is characterized as the purchases of certain goods and can be considered as a final consumption undertaken by firms. The total savings represents this amount of resources and a share of it corresponds to investment in stocks of finished goods, while the remaining parcel represents the net investment required to expand production. The first share is defined based on a fixed proportion to the sectoral output, while the second is distributed exogenously among the sectors, reflecting information from the input-output tables (goods by sector of origin).

It is considered that investment goods are being produced but not used as increments of capital stocks. Thus, the model closure is closer to a medium-run type: constant capital stock, price flexibility and existence of involuntary unemployment in equilibrium.

*A.1.2.3. Government*

The Government consumption (GC) is derived from maximization of a Cobb-Douglas utility function subject to the budgetary constraint corresponding to the total expenditure that is fixed according to the total amount registered for the base year.

## *A.2. Full List of Equations and Variables in the CGE Model*

### *A.2.1. The Price Block*

1) $P_im = PW_im \,.\, (1 + t_im + txc_im + tic_im) \,.\, R$

2) $P_ie = PW_ie \,.\, (1 + t_ie) \,.\, R$

3) $P_iq = (P_id \,.\, D_i + P_im \,.\, M_i) / Q_i$

4) $P_ix = (P_id \,.\, D_i + P_ie \,.\, E_i)/ X_i$

5) $P_iv = (P_ix * \{1 - t_ix - t_isoc - t_ipriv - t_iprivmg - t_ivalix - t_ivalcx - [t_ixc \,.\, ((P_ix \,.\, X_i - P_ie \,.\, E_i) / P_ix \,.\, X_i)]\} - \Sigma_j P_jq \,.\, a_{ji}) / (1 + t_ivalc + t_ivali)$

6) $P_ik = \sum_j P_jq \,.\, b_{ji}$

7) $PINDEX = \sum_i pwts_i \,.\, P_iq$

*A.2.2. The Block of Production or Quantities*

8) $Ldi = \prod_l F_{il}{}^{**\beta li}$

9) $X_i = a_i^D . [\alpha_i . Ld_i^{**(\rho ip-1)/(\rho ip)} + (1 - \alpha_i).K_i^{**(\rho ip-1)/(\rho ip)}]^{**(\rho ip)/(\rho ip-1)}$

10) $INT_i = \sum_j a_{ij} . X_j$

11) $WF_l . WFDIST_{il} . F_{il} = (P_iv - mg_i). \beta_{li} . \alpha_i . X_i .Ld_i^{**(\rho ip-1)/(\rho ip)} /[\alpha i . Ld_i^{**(\rho ip-1)/(\rho ip)} + (1 - \alpha_i). K_i^{**(\rho ip-1)/(\rho ip)}]$

12) $X_i = a_i^T . [\gamma_i . E_i^{**(\rho it+1)/(\rho it)} + (1 - \gamma_i).Di^{**(\rho it+1)/(\rho it)}]^{**(\rho it+1')/(\rho it)}$

13) $E_i = D_i .\{[P_ie . (1 - \gamma_i)/ P_id . \gamma_i]^{**}[^{(1/\rho it)-1}]$

14) $E_i = econ_i .[PW_ie/pwse_i]^{**(-\eta i)}$

15) $Q_i = a_i^c . [\delta_i . M_i^{**(\rho ic-1)/(\rho ic)} + (1 - \delta_i). Di^{**(\rho ic-1)/(\rho ic)}]^{**(\rho ic)/(\rho ic-1)}$

16) $M_i = D_i [P_id . \delta_i /P_im . (1 - \delta_i)]^{**(\rho ic)}$

17) $VALADD_i = (P_iv .(1 + t_ivalc + t_ivali) .X_i) + (X_i . P_ix .t_i privmg))$

18) $WR_l = WF_l / (PINDEX)$

19) $\log(WR_l) = a + rb . \log(U_l)$

*A.2.3. The Flow of Income Block*

20) $Y_l = \Sigma_i Wf_l . WFDIST_{il} . F_{il} + \Sigma_{inst} INSTWG_{inst} . R$

21) $YFCTR_l = \Sigma_i Wf_l . WFDIST_{il} . F_{il}$

22) $KINCi = P_iv . X_i . (1 + t_ivalc + t_ivali) - \Sigma_l WF_l . WFDIST_{il} . F_{il}$

23) $KINCSM_i = smcoef_i .KINCi$

24) $YH_h = \Sigma_l \varepsilon_{hl}.Y_l + \varepsilon_{h,smfirm.}YDSFIRM + \Sigma_{ho} \theta_{hho} .YD_h + \theta_{h,firm} . YDFIRM + PINDEX . gtranph . gtrant + PINDEX.strant_{(h)} + remith_{(h)} . R$

25) $YFIRM = \Sigma_i( KINCi - KINCSM_i ) + \Sigma_i t_ipriv . P_ix . X_i + \Sigma_i t_iprivmg . P_ix . X_i + \Sigma_{ho} \theta_{firm,ho} .YD_{ho} + PINDEX. gtranp_{(firm)}. gtrant + t_{(firms,w)} .R + intflf_{(firm)} .YDFIRM + intflf_{(smfirm)} .YDSFIRM$

26) $YSMFIRM = \Sigma_i KINCSM_i + PINDEX. gtranpi_{(smfirm)}. gtrant$

27) $YD_h = (1 - t_h - tsoce_h - \theta_{firm,h} ). YH_h - R. intflh_{(h)}$

28) $YDFIRM = (1 - t_f - pinstax_{(firm)}). YFIRM - R. intfli_{(firm)} - DEPREC - intflf_{(firm)} .YDFIRM$

29) $YDSMFIRM = (1 - t_{(smfirm)} - pinstax_{(smfirm)}). YSMFIRM$

30) $TARIFF = \Sigma_i pw_im . Mi . (t_{im} + t_{im}xcm + t_{im}icm). R$

31) $INDTAX = \Sigma_i P_ix .X_i .t_ix + \Sigma_i t_ix .[P_ix . X_i - P_ie . E_i ] + \Sigma_i (t_ivalc + t_ivali) .VALADDNEW$

32) $EXPSUB = \Sigma_i Pw_ie .Ei .t_{ie} .R$

33) $DIRTAX = \Sigma_h t_{hh}.YH_h + t_f.YFIRM + tsmfirm. YSMFIRM$

34) $DEPREC = \Sigma_i\, depr_i\, .P_i k\, .K_i$

35) $HHSAV = \Sigma_h\, MPS_h\, .\, YD_h$

36) GR = TARIFF + INDTAX + DIRTAX + gfbor. R + SOCBAL – EXPSUB

37) $SAVING = HHSAV + GOVSAV + DEPREC + mpsi_{(firms)}\, .YDFIRM + FSAV\, .R$

38) $SOCBAL = \Sigma_I\ tsoc_i.P_i x.X_i + pinstax_{(firm)}\ YFIRM + pinstax_{(smfirm)}\ YSMFIRM + PINDEX.\ gtranpi_{(prev)}.gtrant - PINDEX\ .\ \Sigma_h\ strant(h)$

39) $GOVSAV = GR - \Sigma_i\, Piq\ .\ GDi - gtrant\ .PINDEX - R.gfdebser$

*A.2.4. The Block of Income and Expenditures*

40) $CD_i\ .P_i q = \beta_{ih}\ .\Sigma_h\ (1\text{-}MPS_h)\ [1 - \Sigma_{ho}\ \theta_{hoh} - ihcoef_{\ (firm,h)}\ ]\ YDh$

41) $GDi = \beta_i^G.\ GDTOT$

42) $DSTi = dstr_i.Xi$

43) $FXDINV = INVEST - \Sigma_i\, P_i q\ .DST_i$

44) $P_i k\ .DK_i = kshr_i\ .\ FXDINV$

45) $IDi = \Sigma_j\ b_{ij}\ .\ Dk_j$

*A.2.5. The Block of Market Equilibrium*

46) SAVING = INVEST

47) Qi = INTi + CDi + GDi + IDi  + DSTi

48) $\Sigma_i\, pw_i m\ .Mi + intfli_{(firm)} + \Sigma_h\, intflh_{(h)} + gfdebser = \Sigma_i\ Pw_i e\ .Ei + \Sigma_h\ remith_{(h)} + \Sigma_I\ remithl_{(l)} + remiti_{(firm)} + gfbor - FSAV$

49) $\Sigma_i\, F_{il} = (1\text{-}\ Ul).FS_l$

50) $RGDP = \Sigma_i\ (\ CDi + GDi + IDi + DSTi + Ei - Mi)$

*A.2.6. The Block of Identities and Model Closures*

51) R.FX = R.L

52) FSAV.FX = FSAV.L

53) $MPS.FX_{(h)} = MPS.L_{(h)}$

54) GDTOT.FX = GDTOT.L

55) $FS.FX_{(l)} = FS.L_{(l)}$

56) $U.FX_{(l)} = U.L_{(l)}$

57) $WFDIST.FX_{\ (i,L)} = WFDIST.L_{(i,L)}$

58) $K.FX_{(\ i\ )} = K.L_{(\ i\ )}$

### *A.2.7. List of Variables in the model Equations*

| Variable | Description | Variable | Description |
|---|---|---|---|
| CDi | Consumption of households | Pie | Price of exported goods |
| CG | Government consumption | Pik | Price of capital goods |
| DEPREC | Capital depreciation | Pim | Price (in R$) of imported goods |
| Di | Domestic goods sold internally | PINDEX | Model price index |
| DIRTAX | Total direct taxes | Piq | Price of composite goods |
| DKi | Real sector investment per sector of destination of capital goods | Piv | Price of net value added |
| DST | Investment in stocks | Pix | Price of goods produced internally |
| Ei | Exports | Pwie | Price in dollars of exported goods |
| EXPSUB | Export Subsidies | pwim | Price in dollars of imported goods |
| Fil | Labor sectoral demand per type of labor | pwsei | Prices of goods produced abroad |
| Fl | Labor demand per type of labor | Qi | Composite product supply in the domestic market |
| FSAV | Balance of the capital account in the Balance of Payments | R | Exchange rate |
| FSl | Labor supply of each type of labor | RGDP | Real GDP |
| FXDINV | Investment in fixed capital | SAVING | Total savings |
| GDPVA | Value Added (in market prices) GDP | SOCBAL | Social security balance |
| GG | Total government consumption | TARIFF | Import tariffs |
| GOVSAV | Government savings | Ul | Unemployment rate per type of labor |
| GR | Central government revenues | VALADDi | Net value-added by sector |
| HHSAV | Household savings | WFDISTil | Wage differential per type of labor and sector |
| IDi | Investment per sector of origin of capital goods (producer of the goods) | WFl | Wage per type of labor |
| INDTAX | Total indirect taxes | WRl | Real wage per type of labor |
| INTi | Intermediate goods | Xi | Domestic production |
| INVEST | Total investment | YDFIRM | Large firms available income |
| Ki | Capital stock by sector | YDh | Household available income |
| KINCi | Capital income by sector | YDSMFIRM | Small firms available income |
| KINCSMi | Small capital income by sector | YFCTR | Gross labor income (over sector) by labor type |
| LDi | Aggregate sectoral labor by type of labor | YFIRM | Large firms gross income |
| MPS | Marginal propensity to save | YHh | Household income |
| Mi | Imports | Yl | Gross labor income (over sector) by labor type |
| Pid | Price of domestic goods sold Internally | YSMFIRM | Small firms gross income |

## Appendix B: The Models' Data Bases and Econometrics Estimates

### *B.1. CGE Database*

Almost all data used in the CGE model and simulations were derived from a Social Accounting Matrix (SAM–2003), which contains all the quantity and price information in 2003 (the model's base year). Besides, all the model's coefficients and parameters obtained by the model calibration process are calculated from this data matrix, whose description can be found in Cury *et al* (2006). It deserves mention that ithis SAM was not made based on new Brazilian National Accounts 2000 series released in March 2007 by the *Instituto Brasileiro de Geografia e Estatística* (IBGE, 2007). Table B.1 describes the 42 sectors of the CGE.

**Table B.1 – The 42 sectors in the CGE model**

| IBGE-NA Code | Sectors descriptions |
|---|---|
| 01 | Agriculture |
| 02 | Mining (except fuels) |
| 03 | Extraction of oil and natural gas, coal and other fuels |
| 04 | Manufacture of non-metallic mineral |
| 05 | Steel |
| 06 | Non-ferrous metallurgy |
| 07 | Manufacture of other metallurgic products |
| 08 | Manufacture and maintenance of machines and tractors |
| 10 | Manufacture of electrical material and equipment |
| 11 | Manufacture of electronic material and equipment |
| 12 | Manufacture of cars, trucks and buses |
| 13 | Manufacture of other vehicles, parts and accessories |
| 14 | Sawmills and manufacture of wood and furniture |
| 15 | Manufacture of paper and printing |
| 16 | Rubber industry |
| 17 | Manufacture of non-petrochemical chemical elements |
| 18 | Refining of petroleum and petrochemical industry |
| 19 | Manufacture of various chemicals |
| 20 | Manufacture of pharmaceuticals and perfumery |
| 21 | Processing industry of plastic |
| 22 | Textile industry |
| 23 | Manufacture of articles clothing and accessories |
| 24 | Manufacture of footwear and leather goods and furs |
| 25 | Coffee industry |
| 26 | Processing of products of vegetable origin, including tobacco |
| 27 | Slaughter and meat preparation |
| 28 | Cooling and preparation of milk and dairy |
| 29 | Sugar industry |
| 30 | Manufacture and refining of vegetable oils and fats for food |
| 31 | Other food and drink industries |
| 32 | Miscellaneous industry |
| 33 | Industrial services of public utility |
| 34 | Construction |
| 35 | Retail trade |
| 36 | Transports |
| 37 | Communications |
| 38 | Financial institutions |
| 39 | Services provided to families |
| 40 | Business services |
| 41 | Rental properties |
| 42 | Government |
| 43 | Private non-market services |

Source: Cury *et al* (2006).

### *B.2. Microsimulation Database*

The database for the microsimulation consists of the sample of almost 384,834 individuals distributed in 117,010 households in the 2003 PNAD. Each of the individuals in active age (over 10 years old) was classified according to the 11 types of factors derived from the CGE model. However, only individuals in active age belonging to the factors L1 to L5 were considered in the CGE-MS integration; that is, those individuals who have their wages paid in the private sector as their main income source.[51] Thus, the sample had 106,590 observations that represent 48,742,853 individuals that were classified as occupied and unoccupied, as shown in table B.2.

One of the main difficulties in making the CGE-MS integration work is convergence. For this convergence to be successful it was appropriate to make the two databases have the same values. Thus, the weights of individuals were multiplied by a factor (reweighting), so that the PNAD data base reflected the CGE model data. Table B.2 presents the results of this reweighting for employed and unemployed people.

**Table B.2: Employed and unemployed reweighing for L1 to L5 work factors**

| Factor | Description of the worker | PNAD occupational condition (in 1.000 persons) | | | Unem-ployed ratio | CGE model data (in 1.000 persons) | | | Unem-ployed ratio | Reweighing | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Emplo-yed | Unem-ployed | Total | | Emplo-yed | Unem-ployed | Total | | Emplo-yed | Unem-ployed |
| L1 | Unskilled informal | 12.890 | 1.567 | 14.457 | 10,8% | 11.714 | 1.418 | 13.132 | 10,8% | 0,9088 | 0,9052 |
| L2 | Skilled informal | 5.694 | 952 | 6.646 | 14,3% | 5.264 | 878 | 6.143 | 14,3% | 0,9245 | 0,9226 |
| L3 | Formal with low skill | 13.923 | 1.349 | 15.272 | 8,8% | 12.274 | 1.184 | 13.458 | 8,8% | 0,8815 | 0,8782 |
| L4 | Formal with average skill | 9.208 | 854 | 10.062 | 8,5% | 8.331 | 774 | 9.105 | 8,5% | 0,9048 | 0,9062 |
| L5 | Formal with high skill | 2.211 | 95 | 2.306 | 4,1% | 2.063 | 88 | 2.152 | 4,1% | 0,9334 | 0,9238 |
| **Totals** | | **43.926** | **4.817** | **48.743** | **9,9%** | **39.647** | **8.537** | **87.788** | **9,7%** | | |

Source: PNAD 2003, CGE model data base

### *B.3. Econometric Estimates*

The first part of the microsimulation process is the computation of the labor supply equation (3.2.1). The entire PNAD sample was considered for this phase. From the reweighed database, equations (3.2.1) and (3.2.2) were estimated using the two-stage method proposed by Heckman (1979) for three demographic groups: men, women head of household with children, and other women. Table B.3 contains the econometric estimates by the system equation, including the coefficients and their standard errors to 5 percent of significance, as well as the inverse of the Mills's ratio, $\hat{\lambda}(\mathbf{z})$. From these estimates were computed the potential hours of work necessary for completing step 2 of the microsimulation process.

The second part of the microsimulation process is the computation of the reservation wages and the new occupation ratio. For this phase, only the factors L1 to L5 were considered. From the reweighed data base, equations (3.2.3) and (3.2.4) were estimated using the two-stage method proposed by Heckman (1979). Table B.4 contains the econometric estimates by this system

[51] Individuals in active age who belong to the factors L6 and L7 (public sector) were not considered in the microsimulation, because their wages are not regulated by the market. Furthermore, the employment levels of the factors are rigid in accordance with Brazilian law (see Section 3.2).

equation and the benefits shocks, changing the log $B_i$ that corresponds to the *Bolsa Família* and *BPC* amounts of 2003, to log $B_i^*$ that corresponds to the benefits amounts of 2005.[52]

**Table B.3: Results of labor supply estimates**

| | Coefficients<br>Group: j = 1 (Men) | Coefficients<br>Group: j = 2 (Women w/ children) | Coefficients<br>Group: j = 3 (Women) |
|---|---|---|---|
| **Labor supply regression equation:** $h_i$ | | | |
| log w | -2,3275 ** | -4,4850 ** | -2,5876 ** |
| | (0,0567) | (0,1793) | (0,0873) |
| log B | -0,0893 | -1,5730 ** | -1,3203 ** |
| | (0,1011) | (0,1373) | (0,0778) |
| log Q | -0,2655 ** | -0,2435 ** | -0,1505 ** |
| | (0,0161) | (0,0518) | (0,0371) |
| Educ | 0,1386 ** | 0,6143 ** | 0,5238 ** |
| | (0,0129) | (0,0375) | (0,0199) |
| Age | 0,9658 ** | 1,0852 ** | 0,6261 ** |
| | (0,0241) | (0,0858) | (0,0367) |
| $age^2$ | -0,0112 ** | -0,0138 ** | -0,0089 ** |
| | (0,0003) | (0,0011) | (0,0005) |
| Famsize | -0,1423 ** | -0,1175 | -0,3811 ** |
| | (0,0285) | (0,1154) | (0,0463) |
| $D_a$ | -0,6749 ** | -5,6864 ** | -9,2074 ** |
| | (0,1275) | (0,5287) | (0,2064) |
| Constant | 34,4863 ** | 32,8253 ** | 41,7028 ** |
| | (0,4924) | (1,7713) | (0,7587) |
| **Selection equation:** $\Pr(S_i = 1 \mid \mathbf{z})$ | | | |
| log w | 2,6519 ** | 2,6359 ** | 2,7232 ** |
| | (0,0271) | (0,0454) | (0,0281) |
| log B | -0,0938 ** | 0,0870 ** | 0,0833 ** |
| | (0,0159) | (0,0140) | (0,0065) |
| log Q | -0,0728 ** | -0,0582 ** | -0,0259 ** |
| | (0,0044) | (0,0076) | (0,0048) |
| Educ | -0,0494 ** | -0,0424 ** | -0,0221 ** |
| | (0,0026) | (0,0048) | (0,0020) |
| Age | -0,0122 ** | 0,0429 ** | 0,0464 ** |
| | (0,0043) | (0,0089) | (0,0033) |
| $age^2$ | 0,0001 * | -0,0005 ** | -0,0005 ** |
| | (0,0001) | (0,0001) | (0,0000) |
| Famsize | 0,0660 ** | 0,0571 ** | 0,0181 ** |
| | (0,0055) | (0,0130) | (0,0043) |
| $D_a$ | 1,4757 ** | 0,9410 ** | 1,2707 ** |
| | (0,0248) | (0,0488) | (0,0160) |
| Constant | -1,8483 ** | -2,8367 ** | -3,2942 ** |
| | (0,0941) | (0,1818) | (0,0721) |
| $\hat{\lambda}(\mathbf{z})$ | -4,9936 ** | -5,2360 ** | -5,1552 ** |
| | (0,1117) | (0,2599) | (0,1205) |
| Number of obs. | 108.897 | 21.526 | 95.707 |
| Censored obs. | 20.292 | 8.454 | 44.616 |
| Log likelihood | -363.403,5 | -57.265,63 | -230.780,8 |

Note: Standard errors in brackets; ** significant at 1%; * significant at 5%. Source: Authors' estimates.

[52] The procedure to impute these values in the 2003 database is described in Appendix C.

**Table B.4: Results of reservation wages – L1 to L5 factors**

| | Benefits of 2003 | | Benefits shocks of 2005 | |
|---|---|---|---|---|
| | Coefficients | S.E. | Coefficients | S.E. |
| **Wage regression equation:** $\log \overline{w}_i$ | | | | |
| log B | -0,1176 ** | (0,0040) | -0,1133 ** | (0,0034) |
| log Q | -0,0029 * | (0,0009) | -0,0034 ** | (0,0009) |
| Educ | 0,1039 ** | (0,0006) | 0,1035 ** | (0,0006) |
| Age | 0,0876 ** | (0,0011) | 0,0871 ** | (0,0010) |
| $age^2$ | -0,0009 ** | (0,0000) | -0,0009 ** | (0,0000) |
| Constant | 3,4343 ** | (0,0198) | 3,4477 ** | (0,0197) |
| **Selection equation:** $\Pr(S_i = 1 \mid \mathbf{z})$ | | | | |
| log B | 0,0241 * | (0,0079) | 0,0150 * | (0,0068) |
| log Q | 0,0021 | (0,0020) | 0,0017 | (0,0021) |
| Educ | 0,0204 ** | (0,0013) | 0,0203 ** | (0,0013) |
| Age | 0,0346 ** | (0,0022) | 0,0349 ** | (0,0022) |
| $age^2$ | -0,0003 ** | (0,0000) | -0,0003 ** | (0,0000) |
| Famsize | -0,0365 ** | (0,0033) | -0,0348 ** | (0,0033) |
| $D_g$ = 2 (Women w/ children) | -0,5199 ** | (0,0102) | -0,5116 ** | (0,0103) |
| $D_g$ = 3 (Others women) | -0,3597 ** | (0,0089) | -0,2981 ** | (0,0029) |
| $D_a$ | 0,2561 ** | (0,0220) | 0,2556 ** | (0,0220) |
| Constant | 0,8714 ** | (0,0522) | 0,8531 ** | (0,0521) |
| $\hat{\lambda}(\mathbf{z})$ | -0,5581 ** | (0,0053) | -0,5549 ** | (0,0053) |
| Number of obs. | 103.289 | | 103.289 | |
| Censored obs. | 10.867 | | 10.867 | |
| Log likelihood | -128.537,9 | | -126.387,7 | |

Note: ** significant at 1%; * significant at 5%. Source: Authors' estimates.

### *B.4. Labor Supply Elasticities*

In this section we evaluate the relations between the conditional cash transfer programs and the individual work decision through the substitution and income effects. In table B.5 we present the marginal effects in respect to hours of work, implied by the estimates in table B.3 as presented in this Appendix.

The wage compensated elasticity of labor supply reflects the strength of the substitution effect from the perspective of labor income. The wage elasticities are the coefficients reported by the variable $\log w$ in equation (3.2.1). For women without children (*j* = 3) this elasticity is positive and higher than for women head of families (*j* = 2),which is to be expected and according to the results of many empirical studies. For men, the negative elasticity is not usual, but its result is non-significant.

The magnitude of the income effect is reflected in the income elasticity of labor supply. These income elasticities – described by the variables $\log B$ (public transfer benefits) and $\log Q$ (all other non labor income) in equation (3.2.1) – are all negative, as expected. The highest sensibility is related to the group formed by women head of households with children which is in line with the great majority of the empirical work on this subject. Also, the results are consistent with the standard theory and show that the cash benefits may have participation effects on the specific population groups.

**Table B.5: Elasticities - Marginal effects for grouping demographics**

| | j = 1 (Men) | | j = 2 (Women with children) | | j = 3 (Women) | |
|---|---|---|---|---|---|---|
| **Variable** | **Elasticity** | **S.E.** | **Elasticity** | **S.E.** | **Elasticity** | **S.E.** |
| Wage elasticity (log w) | -0,0230 | (0,0506) | 0,0328 ** | (0,0070) | 0,1168 ** | (0,0047) |
| Income elasticicity (log B) | -0,0009 | (0,0010) | -0,0128 ** | (0,0014) | -0,0082 ** | (0,0008) |
| Income elasticity (log Q) | -0,0026 ** | (0,0002) | -0,0041 ** | (0,0006) | -0,0028 ** | (0,0004) |

Note: ** significant at 1%; * significant at 5%. Source: Authors' estimates.

## Appendix C: The methodology to assign the 2005 benefits

Here, the methodology adopted to assign the 2005 *BF* and *BPC* benefits in the 2003 household survey is discussed, which were used in the simulations described at section 4. The simulated shocks represent the situation where the 2005 benefits (values and profiles) were applied to the 2003 economy to check their economic impacts, mainly on poverty and income distribution.

Two main problems arise from this assigned process. The first problem is the comparison between the benefits amount and values identified in the two household surveys database with government data. The benefits of the 2003 and 2005 PNAD data were firstly identified by Barros *et al* (2007) and they do not show the complete universe of beneficiaries of government's administrative data. Table C.1 compares the 2003/2005 benefits between the household surveys and the administrative data.

**Table C.1: Comparison between the transfer program data**

| Programs | 2003 | | | 2005 | | |
|---|---|---|---|---|---|---|
| | PNAD (1) | Registers (2) | Identification (1)/(2) in % | PNAD (1) | Registers (2) | Identification (1)/(2) in % |
| **Bolsa Família** | | | | | | |
| Amounts (in R$ millions) | 2.283,50 | 3.185,00 | 39,48% | 4.226,13 | 6.871,36 | 62,59% |
| Number of Beneficiated Families | 5.173.051 | 8.106.163 | 56,70% | 6.495.157 | 10.592.024 | 63,08% |
| **BPC** | | | | | | |
| Amounts (in R$ millions) | 804,97 | 5.132,93 | 537,66% | 4.201,55 | 7.838,64 | 86,57% |
| Number of Beneficiaries | 279.503 | 2.312.711 | 727,44% | 1.167.097 | 2.277.365 | 95,13% |

Source: PNAD 2003, 2005 (IBGE) e IPEA.

We can realize from the above table that the survey numbers (PNAD) are always smaller than the administrative data. The major discrepancies are in the year 2003, particularly for BCP. This fact suggests an identification problem in the 2003 survey.

The second main problem is the identification of new beneficiaries in the 2003 survey, which should be the equivalent to the 2005 beneficiaries. This question is amplified by the significant differences pointed out in the table which could lead to two other problems: the identification of the new beneficiaries who do not comply with program rules and the identification of a new number of benefits that would not represent the programs' real evolution between those years.

The solution adopted for these problems was to create two different assigned rules, one for *BF* and another for *BPC*, which are described separately bellow.

### *C.1. The Bolsa Família Benefits Allocation*

In table C.1, according to the government registers, the benefited families increased by 30.7 percent and the total expenditure by 115.7 percent, between 2003 and 2005. The higher increment in the amounts was also due to the changes in basic benefits. In this case, the solution for the benefits assignment was the implementation of a new number of beneficiaries which would follow the same programs evolution capture in the household surveys.

This task was facilitated by the fact that the PNAD 2003 surveys present a variable that allows a new set of potential *Bolsa Família* beneficiaries. With this information, it was possible to identify 1,619,507 new beneficiaries, totaling 6,792,558 families in 2005, representing a 31.3 percent growth in the number of beneficiaries. For comparison, the number of identifications in the PNAD 2005 was 6,495,157 families, resulting in a difference of just 5 percent between the imputation and the identification. In this case, the payment amounts increase by 90.6 percent. This percentage was inferior to the 115.7 percent of the administrative data between 2003 e 2005, but it is important to remember that our task at the household level is replicate the 2005 survey and not the registers.

### *C.2. The 2005 BPC Imputed Benefits*

As pointed out before, identification of *BPC* beneficiaries in PNAD 2003 was very precarious as compared with their identification in PNAD 2005. Analyzing the beneficiaries profile during that year suggests that the identification problem was mainly due to the spread of this benefit to not just one variable in the 2003 survey but to others i.e., the variables that identify the personal income related with social security benefits (retirements, pensions, etc). In this way, the benefits were captured in the survey but were not separately identified by Barros *et al* (2007).

One way to circumvent this problem is to rely on the data provided by government. According to table C.1, the growth in *BPC* beneficiaries was 33.9 percent, while the growth in the amount of benefits amount was 52.7 percent. On the other hand, table C.2 shows that this increase was mainly among the benefits for the elderly compared with benefits for the disabled (approximately 60% and 17%, respectively). In view of this, we adopted a strategy that could identify the possible candidates for the *BPC's* aged benefits, following the program's rules.

**Table C.2: Expenditure and number of *BPC* benefits (2003 – 2005)**

| Programs | 2003 | | 2005 | | Variation (%) | |
|---|---|---|---|---|---|---|
| | Year Amount (R$ mi) | Beneficiaries | Year Amount (R$ mi) | Beneficiaries | Year Amount (R$ mi) | Beneficiaries |
| BPC (aged) | 1.972,45 | 664.875 | 3.614,93 | 1.065.604 | 183,3% | 60,3% |
| BPC (disable) | 3.160,49 | 1.036.365 | 4.223,71 | 1.211.761 | 133,6% | 16,9% |
| Total | 5.132,93 | 1.701.240 | 7.838,64 | 2.277.365 | 152,7% | 33,9% |

Source: Government Administrative Registers

In order to minimize the identification error of *BPC*s, we opted for the following procedure:

*Step 1*: Identify all aged individuals (65 years or more) which did not have pensions or retirement benefits.

*Step 2*: Choose individuals from step 1 whose family per capita income is less than 1 minimum wage.

*Step 3*: Allocate one 1 minimum wage (2003) *BPC* benefit to all selected individuals in the former step.

This procedure resulted in identifying 570,314 individuals who could receive the *BPC*. In this way, the methodology reasonably captures the administrative programs situation showed in table C.2. Contrary to the imputation process of *BF*, the *BPC* process must be compared with the administrative increase due to the identification problems of these benefits in the base year 2003.

## Appendix D: Transfer Programs in Brazil

### *D.1. Bolsa Família*[53]

*D.1.1. Objective*

Integrates the program "Fome Zero" (Hunger Zero), which aims to assure the human right to adequate feeding, promoting the alimentary and nutritional security and contributing to the eradication of extreme poverty among the most vulnerable segments of the population.

*D.1.2. Program Rules*

*D.1.2.1. Conditions of access*

- Families with incomes of up to R$ 60.00 (USD 26.09) per person;
- Families with incomes of R$ 60.01 (USD 26.10) to R$ 120.00 (USD 52.17) per person, with children from 0 to 15 years.

*D.1.2.2. Concession of benefits*

Classified into two types according to family composition:

- Basic: the value of R$ 62.00 (USD 26.96), granted to families with monthly income of up to R$ 60.00 (USD 26.09) per person, regardless of family composition;
- Variable: the value of R$ 20.00 (USD 8.69) for each child or teenager up to 15 years or within the limit R$ 60.00 (USD 26.09), equivalent to three children per family.

The *Bolsa Família* program eligibility criteria are demonstrated in table D.1.

**Table D.1: *Bolsa Família* eligibility criteria**

| Eligibility Criteria | | Occurence of children / teenagers 0-15 years old, pregnant and breast-feeding | Quantity and Type of Benefits | Benefit Values (R$) |
|---|---|---|---|---|
| **Family Situation** | ***Per capita* Monthly Income** | | | |
| Poverty Situation | From R$ 60,01 to R$ 120,00 | 1 member | (1) Variable | 20,00 |
| | | 2 members | (2) Variable | 40,00 |
| | | 3 or more members | (3) Variable | 60,00 |
| Extreme Poverty Situation | Up to R$ 60,00 | No Occurence | basic | 62,00 |
| | | 1 Member | Basic + (1) Variable | 82,00 |
| | | 2 Members | Basic + (2) Variables | 102,00 |
| | | 3 or more members | Basic + (3) Variables | 122,00 |

[53] All program sources can be checked with the Ministry of Social Development and Hunger Combat, Brasilia-DF; IPEA (2004): *Bulletin of Social Policies - Monitoring and Analysis*, Nº 9, IPEA, Brasilia-DF; IPEA (2007): *Bulletin of Social Policies - Monitoring and Analysis*, special edition Nº 13; *Bulletin of Social Policies - Monitoring and Analysis* nºs. 14 and 15, IPEA, Brasilia-DF.

There is also the Variable Benefit of Extraordinary Character (VBEC) that is granted to the families of remaining programs ( these are Bolsa Escola, Bolsa Alimentação, Food Card and Gas Assistance Programs) whose migration to the BF program caused financial losses to the family. In these cases, the amount granted is calculated case by case and has a limitation period, beyond which it will no longer be paid under the Ordinance MDS / GM nº 737, of 15/12/2004.

*D.1.3. Recent Expansion*

Since March 17, 2008 the program has started to attend to teenagers from families who already received the benefit. Each family attended to by the program started receiving up to two benefits of R$ 30 (USD 13.04) for children between 15 and 17 years (maximum of R$ 60, or USD 26.09 per family; the current exchange rate is R$ 2.3 = 1 USD). The ministry estimates that 1.7 million teenagers in this age group should get the benefit. Only young people who commit to attend 75 percent of classes each month are entitled to this extension. The families then add this value to the resources already passed to them by the *Bolsa Família*; that is, this new benefit is cumulative to the previous one.

*D.1.4. Conditionalities*

*D.1.4.1. Health (Ordinance MS / MDS nº 2509 of November 18, 2004)*

For families with children up to 7 years:

- Take the kids to vaccination and stay up to date with the vaccination schedule;
- Take the kids to be weighed, measured, and examined according to the timetable of the Ministry of Health.
- For pregnant women and mothers who are breast-feeding:
- Participate of prenatal care;
- Continue the monitoring after the birth according to the timetable of the Ministry of Health and always caring the Pregnant's card with;
- Participate in educational activities developed by health teams on breastfeeding and healthy feeding.

*D.1.4.2. Education (Ordinance MEC / MDS nº 3789 of November 17, 2004):*

- Enroll children and teenagers aged 6 to 15 years in school;
- Ensure their attendance in at least 85 percent of the classes each month. The absences need to be notified with the school and the reasons need to be explained;

- Inform the local manager of the *Bolsa Família* program whenever a child moves to another school, so that the local public servant can continue to monitor the school attendance.

*D.1.5. Financing*

In January 2004, the Ministry of Social Development and Hunger Combat (MDS) was created to follow through on the national policies of social assistance, food security and income transfer. The MDS took under its responsibility the management of two funds within the federal budget, the National Fund of Combat and Eradication of Poverty (FCEP) and the National Fund of Social Welfare, which embraces, among others, the Manager Council of the *Bolsa Família* program. Currently, the FCEP provides almost all the financial sources to the *Bolsa Família* program.

Table D.2 shows the taxes that finance the program. We can see that 76 percent of the program was funded by the Provisory Contribution over Financial Movements (CPMF), which was the main source of FCEP's funds. The second largest source comes from the Ordinary Resources, which includes various taxes but is mainly comprised of the tax on corporations' income, taxes on labor income and capital gains retained at source, and the import tax. The rest of the funding is from the Contribution over Corporations' Net Profits (CSLL-PJ), the Contribution for Social Security Funding (COFINS), and a small part from the external credit operations.

**Table D.2: Program financing (1335) – income transfer with conditionalities, 2005**

| Code – Source | Value | Composition |
|---|---:|---:|
| 155 – Provisory Contribution Over Financial Movements (CPMF) | 5.021.407.702 | 76,13% |
| 300 - Ordinary Resources | 858.502.089 | 13,02% |
| 151 - Contribution over Corporations' Net Profits (CSLL) | 360.361.798 | 5,46% |
| 153 - Contribution for Social Security Funding (COFINS) | 340.056.460 | 5,16% |
| 148 - External credit operations - in currency | 15.100.000 | 0,23% |
| **Total** | **6.595.428.049** | **100,00%** |

Source: Federal Senate, Budget Council, own elaboration under solicitation of Senator Eduardo Suplicy's cabinet

*D.1.6. Evolution in the number of beneficiaries and in expenditures*

The *Bolsa Família* program was established in 2004, unifying the previous programs *Bolsa Escola*, *Bolsa Alimentação* and Food Card, which in 2003 was managed by the Active Community Program. Table D.3 shows that the program grew by 128 percent over a five-year period. From 2003 to 2006 the growth was 36 percent, reaching more than 11 million families. The table also shows that the other programs have decreased their number of beneficiaries, being only remnants of *Bolsa Família*.

**Table D.3: Number of *Bolsa Família* beneficiary families**

| Programs | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| Bolsa Escola | 4.794.405 | 5.106.509 | 3.771.199 | 3.042.794 | 1.783.874 | 36.481 |
| Bolsa Alimentação | 30.137 | 966.553 | 369.463 | 53.507 | 24.175 | 2.474 |
| Food Card | | | 349.905 | 107.907 | 83.524 | 32.136 |
| Bolsa Família | | | 3.615.596 | 6.571.842 | 8.700.451 | 10.965.810 |
| **Total** | **4.824.542** | **6.073.062** | **8.106.163** | **9.776.050** | **10.592.024** | **11.036.901** |

Source: IPEA - BPS nº 13 (2001-02); BPS nº15 (2003-06)

As for the expenditure, one can see a growth of $ 5,046,021,853 (158%) in three years, with the greatest growth occurring in the year of unification (2004) followed by a constant rate of growth of 16 percent in the succeeding years.

**Table D.4: *Bolsa Família* expenditure (in R$)**

| Program | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|
| Bolsa Família | 3.185.000.000* | 5.917.079.972 | 6.871.361.925 | 8.231.021.853 |

Source: IPEA - BPS nº13 (2001-04) (deflated by IPCA of 2005); BPS nº 14 (2005-06) (deflated by IPCA of 2006).

* Includes the programs Bolsa Escola, Healthy Feeding and Active Community; source: BPS nº9 (in prices of 2004, com deflator of 5,91%).

*D.1.7. Specific Legal and Administrative Information*

*D.1.7.1. Regulation*

Law 10836 of 09 January 2004 and Decree nº 5749 of April 11, 2006. The Law nº 10.836 establishing the *Bolsa Família* program can be viewed in full at:

http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/l10.836.htm.

*D.1.7.2. Documentation*

If the family fits the conditions defined by the program, it should coordinate with the person responsible for the *Bolsa Família* program in the city where the family resides. The potential beneficiary should be ready with its personal documents (such as a voter title or CPF) to register in the Unified Register of the Federal Government Social Programs.

*D.1.7.3. Operational Model*

The municipality is responsible for operating the program. However, registration in the program does not mean the immediate entry of these families or the receipt of the benefit. Each city has an estimated number of poor families regarded as the attending goal of the program in that specific territory. Based on the information entered into the Unified Register, the Ministry of Social Development and Hunger Combat (MDS) selects the families that will be included in the Program each month using automated processes.

*D.1.7.3.1. From the Federal Government*

The Federal Government through the Ministry of Social Development and Hunger Combat, manages the *Bolsa Família* program. The inclusion of families in the program is managed by the

National Office of Income and Citizenship (SENARC), which oversees the concession of the benefit. The responsibilities of SENARC are:

- Drawing up rules and regulations of the *BF*;
- Managing the Unified Register of Social Programs;
- Monitoring the local management of *BF*;
- Promoting improvements and encouraging the use of Benefits Management System by the municipal administrators, state coordinators, members of Boards of Social Control and members of the Network for Surveillance of the *Bolsa Família* program, aimed at the efficiency, effectiveness and transparency of benefits management actions;
- Promoting the exchange of good practices among municipal managers of the program and its dissemination at the national level;
- Carrying out activities for the administration of benefits;
- Building capacities among officials responsible for benefit management and members responsible social control, in partnership with other federal entities.

*D.1.7.3.2. Responsibilities of the Municipalities*

- Periodically check if the families of the *BF* and other programs meet the eligibility criteria, using statistical sampling techniques in order to match the financial benefits to the real conditions of families;
- Register officials from the city hall and members of the municipal instance of social control with SIBEC and empower these users;
- Meet the requirements for information and clarification from the Public Surveillance Network;
- Disclose information on the benefits of *BF* and other programs to other local public agencies and civil society organizations;
- Keep SENARC informed about cases of irregularities or deficiencies identified in the provision of services by responsible Operator Agents or its local registered network (banking correspondent, lottery agents etc.).

***D.2. Benefit of Continued Installment - BPC*[54]**

*D.2.1. General Information*

Continued installment consists of a monthly payment equivalent to one minimum wage for people 65 years of age or older and the disabled, both of whom work and live independently. In both cases the per capita family income must be less than ¼ of the minimum wage. The benefit is administered by the Ministry of Social Development and Hunger Combat (MDS), which includes its management, monitoring, and evaluation. In turn, its operation is under the responsibility of the National Social Security Institute (INSS). Resources for costing the *BPC* come from the National Fund of Social Welfare (FNAS).

The eligible person requests the benefit through social security. It is necessary to prove income of less than 1/4 of the minimum monthly wage per person in the family, to show the minimum age of 65 years in the case of elderly people, and to have the beneficiary's disabling condition certified by medical specialists of the INSS (in the case of people with disabilities). It is not necessary that the applicant has social security contributions.

The Lifelong Monthly Income (RMV) is a similar benefit established in 1974 but was replaced by the *BPC* in 1993 through the Organic Law of Social Welfare (LOAS). The RMV benefits are paid as a remaining benefit.

In these programs the gross monthly family income is defined as the sum of monthly gross income earned by family members including wages, profits, pensions, food, public and private welfare benefits, commissions, pro-labor, other income from non-rewarded work, income from the informal market or self-employment, earned income from property, Lifelong Monthly Income and Benefit of Continued Installment, except when it applies to the *BPC* granted to another elderly in the family, according to Article 34 of Law 10.741 of October 1, 2003 (also called the Statute of the Elderly).

*D.2.1.1. Legislation*

*BPC* was created by 1988 Constitution and is also supported by Law 10.741 of October 1 2003 that introduced the *Estatuto do Idoso*. The benefit is part of SUAS (*Sistema Único de Assistência Social*), which is a new decentralized system for managing social benefits and was created by the LOAS (*Lei Orgânica de Assistência Social*, nº 8.742, of December 7, 1993).

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[54] All program's sources can be checked in: Ministry of Social Development and Hunger Combat, Brasilia-DF; IPEA (2006): *Bulletin of Social Policies - Monitoring and Analysis*, nº 12, IPEA, Brasilia-DF; IPEA (2007): *Bulletin of Social Policies - Monitoring and Analysis*, special edition nº. 13 and *Bulletin of Social Policies - Monitoring and Analysis* nº 15, IPEA, Brasilia-DF.

*D.2.1.2. Beneficiaries and Expenditure Evolution*

Table D.5 shows that the number of *BPC* beneficiaries had grown by 916.635 individuals, an increase of 58.65 percent from 2002 to 2006. It is important to note that although the number of beneficiaries with disabilities is larger in absolute terms, the growth is due more to the growing number of elderly beneficiaries, reflecting the aging of the population during the period.

The Lifelong Monthly Income benefit decreases every year, since it is a benefit that is remaining in the process of replacement by the *BPC*.

**Table D.5: Number of *BPC* beneficiaries**

| Programs | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| BPC issued to elderly | 584.597 | 664.875 | 933.164 | 1.065.604 | 1.183.840 |
| BPC issued to disabled people | 976.257 | 1.036.365 | 1.127.849 | 1.211.761 | 1.293.645 |
| **sub-total BPC** | **1.562.856** | **1.703.243** | **2.063.017** | **2.279.370** | **2.479.491** |
| RMV issued to elderly | * | 208.297 | 181.014 | 157.860 | 135.603 |
| RMV issued to disabled people | * | 403.174 | 370.079 | 340.715 | 310.806 |
| **TOTAL** | **1.562.856** | **2.312.711** | **2.612.106** | **2.775.940** | **2.923.894** |

Source: IPEA - BPS nº 12 (2003-04); BPS nº 14 (2005-06).
* Data not available

Regarding the evolution of program spending, there is an increase of 175.43 percent from 2001 to 2006, representing approximately R$ 6.190.182.160. As the value of the benefit is pegged to the minimum wage, even the RMV (which dropped in attendance in the period) shows positive increments of spending in most years. Again, the biggest growth is due to the *BPC* issued to the elderly, which increased to R$ 3.399.377.329 (281.67%) in the period.

**Table D.6: *BPC* expenditure (in R$)**

| Programs | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|
| BPC issued to elderly | 1.206.868.227 | 1.672.606.907 | 1.972.447.737 | 2.595.763.442 | 3.614.931.846 | 4.606.245.556 |
| BPC issued to disabled people | 2.321.737.199 | 2.953.111.905 | 3.160.486.871 | 3.526.909.333 | 4.223.706.476 | 5.112.542.025 |
| **sub-total BPC** | **3.528.607.427** | **4.625.720.814** | **5.132.936.611** | **6.122.674.779** | **7.838.640.327** | **9.718.789.587** |
| RMV issued to elderly | * | * | * | 645.113.156 | 604.723.319 | 591.798.567 |
| RMV issued to disabled people | * | * | * | 1.327.892.680 | 1.271.076.861 | 1.316.567.069 |
| **TOTAL** | **3.528.605.426** | **4.625.718.812** | **5.132.934.608** | **8.095.678.611** | **9.714.438.502** | **11.627.153.217** |

Source: IPEA - BPS nº 13 (2001-04) (deflated by IPCA of 2005); BPS nº 14 (2005-06) (deflated by IPCA of 2006).
* Data not available

*D.2.1.3. Financing*

Tables D.7 and D.8 show the *BPC* funding during the 2005 fiscal year, with data for budgetary disbursement in Real (R$) related to the benefits granted to the disabled and to the elderly, and the composition of such funding. In both cases, the COFINS tax is the biggest source of program funding. In the *BPC* for the elderly however, Ordinary Resources represent more than it does in the case of the *BPC* to disabled people. As a secondary source of funding however, Ordinary Resources provide more for the *BPC* to the elderly than the disabled.

## Table D.7: Program financing (0065) for social protection to the disabled person, 2005

| Code – Source | Value | Composition |
|---|---|---|
| 153 - Contribution for Social Security Funding (COFINS) | 3.799.835.045 | 94,20% |
| 300 - Ordinary Resources | 233.833.395 | 5,80% |
| 151 - Contribution over Corporations' Net Profits (CSLL) | 13.249.867 | 0,33% |
| 155 - Provisory Contribution Over Financial Movements (CPMF) | 12.262.280 | 0,30% |
| **Total** | **4.033.668.439** | **100,00%** |

Source: Federal Senate, Budget Council, own elaboration upon solicitation from Senator Eduardo Suplicy's cabinet

## Table D.8: Program financing (1282) for social protection to the eldery, 2005

| Code – Source | Valor | Composição |
|---|---|---|
| 153 - Contribution for Social Security Funding (COFINS) | 3.036.672.326 | 87,24% |
| 300 - Ordinary Resources | 400.487.719 | 11,51% |
| 151 - Contribution over Corporations' Net Profits (CSLL) | 22.693.119 | 0,65% |
| 155 - Provisory Contribution Over Financial Movements (CPMF) | 21.001.672 | 0,60% |
| **Total** | **3.480.854.837** | **100,00%** |

Source: Federal Senate, Budget Council, own elaboration upon solicitation from Senator Eduardo Suplicy's cabinet