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

This research intends to assess the efficiency of the Governmental income transfer programs in achieving their purposes of alleviating poverty and reducing the inequality in income distribution in Brazil. After evaluating the impacts of the current programs, we also intend to simulate the effects of alternative designs for these programs in order to generate proposals that can be used as inputs that can help to improve the income transfer programs in achieving their purposes in a more strong and effective way.

1 Introduction

The Brazilian economy has presented one of the most concentrated income distributions in the world. It is also known that the inequality in income distribution is the main determinant of the high poverty level in the country, being the average income level a secondary determinant.

Due to the historical inequality in personal and household income distribution in Brazil and the enormous number of people still in poverty and extreme poverty condition, the Federal Government has been transferring income to these people as a way of a broad poverty alleviation strategy.

Recent studies show that the income distribution inequality in Brazil has declined in the last years and that the Governmental income transfer programs have played an important role in this process, once almost of one third of the decline in income distribution was due to the implementation of these programs, as will be shown in the section 3 of this proposal.

Therefore, the efficiency of poverty alleviation policies would be improved by the maintenance of the declining path of the income inequality. As mentioned before, given the importance of income transfer programs, this research begins with the idea that any strategy designed to reduce poverty and to induce additional falls of the inequality in income distribution and poverty in Brazil should consider the improvement of these transfer programs in a broader perspective.

Thus, this research proposal is organized in more 11 sections, besides this introduction. The next section presents the main research questions and the core research objectives. In the third section are presented the theoretical background and the scientific contributions of this research, also considering

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the main references and the gaps to be addressed. The policy relevance of this research project will be discussed in the section 4. The next two sections depict the methodology and the data source of this work. The seventh section presents the consultation and dissemination strategy of this study, while the eighth section introduces the researchers enrolled in this research and their training and experience in the issues and techniques involved. Given the conditionality of this research program in CGE modeling application, on the ninth section will be discussed the importance of this subject to the researchers and their institutions. The three last sections present the projects’ risks, a list of previous research projects related to this proposal and the final comments.

2 Main research questions and core research objectives

The first main research questions of this research are: what are the impacts of the current income transfer programs on poverty and income distribution in Brazil?

Some studies already presented answers to these questions. Barros et alii (2006b) estimated that one third of the fall of 4.05% of the Gini index from 2001 to 2004 was due to the Governmental income transfer programs, a result very similar to the one found by Hoffmann (2006b). Also, Barros et alii (2006a) estimated that the program called “Bolsa-Família” induced around 14% of this reduction, while other programs such as the “Benefício de Prestação Continuada (BPC)” and the public pensions and retirement payments would have caused around 16% of this fall.

However, the empirical evidences from the abovementioned studies were found by means of partial equilibrium approaches and, in this sense, they do not take in account some systemic (general equilibrium) effects induced by these programs as well as the feedback impacts from the economic system on the household income. When poor families receive a monetary transfer from the Government, their income increases inducing higher consumption expenditures, which tends to motivate firms to produce more and, in some extent, to employ more workers. When these people receive their payments, a new round of additional effects induced by their expenditures goes on. Then, the original amount of transfer generates a higher amount of money in the economy or, in other words, the poor families not only benefit from receiving transfers but also from the secondary effects induced by the expenses of the original transfers.

The demand effects described above can be enhanced when we take into account the differences in the expenditure pattern of Brazilian families differentiated by income level. In the average poor urban Brazilian households, the food expenditure was 40% of the total consumption. On the other side, on the Brazilian richest households the consumption pattern is totally different. The food expenditure was just 12 %, while health and education private services accounts for near 20 % [Cury; Coelho, Pedrozo, 2006].

Also, the relevance of the general equilibrium effects is justified by the size and evolution of the transfer programs between 2001 and 2005. The total amount of the central government (federal) transfer programs, including the social security benefits, was around 11 % of GDP in 2005. The participation of these programs, in GDP terms, increased practically 15 % in this period (it was 9,25%
of the GDP in 2001). In nominal values, using a roughly calculation, the increased amount was R$ 93 billions.\(^4\)

In the same period, the total expenditure in the main targeted transfer program, Bolsa Família (BF), increased 300%. According to the last Brazilian Central Government report ("Perfil das famílias beneficiárias do Bolsa Família"), in 2007, 11 millions families (around one in each five in the country) are program beneficiaries, reaching 45.8 million individuals (around one fourth of population).

On the other hand, we also expect that the 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 this period, some important changes were introduced in the fiscal system. For example, in the social security budget, the sharpest increase revenue came from PIS-COFINS taxes (increased 30% as ratio of GDP), which in 2003-2004 started to levy imports. Facts like this one changed the size and composition of the fiscal sources that are financing the programs and reinforce the general equilibrium impacts derived from the programs recent evolution.\(^5\)

By other side, when the income of poor families increases, it is possible that this additional income can induce some people to reduce their labor offer and reducing their working hours. If this happens, the abovementioned effects induced by expending the transfers would be less than expected. In the methodological section we will discuss this issue with more details.

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

Thus, the **first core research objective** is assessing the extent in which the Governmental income transfer programs are alleviating poverty and reducing the inequality in income distribution, when they are evaluated by a methodological approach that take in account the systemic economic integration between different markets, economic agents and institutions in a general equilibrium environment.

A **second core research objective** is comparing the results found in this research with those reported by the abovementioned studies. This comparison can give an indicator on the robustness of

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\(^4\) The information reported in this paragraph came from IPEA (2007) and it was collected in the implemented Federal Budget for each year. In the National Accounts, which collected data from the entire public sector, these amounts can be even higher. But this information has not yet been available for 2004 and 2005.

\(^5\) It is possible to identify 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 more 4 digits, called “subprogramas”. On the other hand, each “programa”/“subprograma” is earmarked with your own revenue source. In this case, it is a system of 2-digit identification code, called “fonte”. For example, the main revenue source of the transfer programs are “fonte”: 53 – “COFINS”, 54 – “Contribuição para Previdência Social”, 55 – “CPMF” and 79 – “Fundo de Combate a Pobreza” (a specific fund for poverty eradication policies).
the impacts of these transfer programs and can indicate in which extent other systemic and feedback effects are significant for the final impacts of the transfer programs.

There are many kinds of income transfer programs in Brazil as “Bolsa-Família”, “Benefício de Prestaçao Contínuada (BPC)”, retirement benefits, pensions, “Abono do Pis/Pasep” and “salário-família”. Therefore, the existence of various Governmental income transfer programs poses the following questions: each of them is accomplishing their aiming of poverty reduction? Would the Government prioritize any of them? These issues constitute the second main research questions.⁶

A third core research objective is presenting a comparison of the relative effectiveness of these programs in achieving these purposes.

We intend to pursue these objectives because we believe that the response to these questions can generate inputs that can contribute to the policy makers in the sense of pointing out which of the current programs are relatively more efficient concerning their objectives.

After evaluating the impacts of the current programs, we aim at answering the third main research questions of this research that are: which would be the impacts of the income transfer programs on poverty and income distribution if they had alternative designs? In other words, would the impacts of these programs be much different from the current ones if they were more focused on specific groups of the target population? Or if the programs be more efficient if it adopts a design based in the Negative Income Tax (NIT) or in the US Earned Income Tax Credit (EITC).

In this sense, as an example, we intend to simulate the following situation: suppose that the resources of some program start to reach firstly only to the poor families that live in rural areas instead of being distributed among poor families in general. After transferring resources to the poor families living in rural areas, the remaining amount of benefits would start to be transferred to the rest of eligible families. Another possibility could be: in which extent the effects of these programs on poverty and inequality change if the program starts to benefit more the poor families headed by females? By simulating alternative designs like these ones for the transfer programs we plan to find empirical evidence on whether it should prioritize some particular population groups.

Then, the fourth core research objective is generate proposals (recommendations), when appropriate, concerning changing characteristics of the current programs that could help them to improve the achievement of their purposes in a stronger and more effective way.

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⁶ Comparing such programs will be raising the issue of legal minimum wage that should influence two specific transfer programs, “Beneficio de Prestação Contínuada (BCP)” and the Social Security benefits. In the first program, m.w. works as the monthly fixed benefit and in the second, it is the minimum value. Thus, at least the benefit side and the expenditure side (budget constraint) of the problem must be addressed at the CGE level. Basically, in our CGE, we can handle the first issue through a specific vector of benefits, received by families. The second issue can be handle using a specific government institution, Public Social Security, which has your account of expenditures and revenues. Both modeling characteristics had been already implemented in the proposed CGE model (see Section 3 for the basic model specification).
3 Research scientific contributions: key references and knowledge gaps to be addressed

Key references

It is widely known that the Brazilian economy has historically presented one of the highest inequality degrees in income distribution in the world with a Gini index around 0.60. It is also known that the inequality in income distribution is the main determinant of the high poverty level in the country, being the average income level a secondary determinant, that is, the poverty level does not decline in significant way when the country grows because the income gains are very unequally distributed, being mostly appropriated by non-poor families. Thus, falls in the inequality in income distribution have more significant effects on poverty level than the economic growth.

In addition to a high inequality degree in income distribution, Brazil also presents significant levels of poverty and severe poverty. In 2005, around 32% (58 millions individuals) and 12% (22 millions) of Brazilian population are, respectively, poor and extremely poor (Barros et alii, 2006a). Due to the historically unequal income distribution in Brazil and the enormous number of people still in the poverty and extreme poverty condition, the Federal Government has been transferring income to these people by means of transfer programs as a way of a broad poverty alleviation strategy.

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.

**Temporal evolution of inequality in per head income distribution in Brazil – Gini index**

While in 2001 the Gini index was close to its average value in the last 30 years, in 2005 it achieved its lowest magnitude. According to Barros et alii (2006d), from 2001 to 2005, the Gini index value declined from 0.593 to 0.566, corresponding to a reduction of 4.6% in the inequality degree in income distribution. Once this inequality is the main determinant of poverty in Brazil, we should also expect that it has caused a significant reduction of the poverty level Barros et alii (2006a) reports that the reduction of the inequality in income distribution from 2001 to 2004 induced declines of the poverty and the extreme poverty levels of around 2 percentage points. In terms of extreme poverty this meant that more 5 millions people left this condition.

Investigating the determinants of the decline of 4.05% in inequality in income distribution, Barros et alii (2006b) estimated that one third of this fall was due to the Governmental income transfer programs. In this sense, other things being equal, without these programs, the inequality in income distribution in Brazil would have decreased only 2.67%.

Moreover the more immediate impacts of these programs on income distribution and poverty, they point towards to better perspectives, since 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.”

Considering the existing information on inequality in income distribution for 124 countries, almost 95% of them present an income distribution less concentrated than the Brazilian one (Barros et alii, 2006c; and Hoffmann, 2006a; UNDP, 2006). On the other hand, Barros et alii (2006d) shows that in 2005 that inequality in income distribution would still be declining but in less intense or slower way, which can be indicating that the effects of the poverty alleviation strategies could start to loose strength.

The efficiency of the poverty alleviation policies can be improved with the maintenance of the declining path of the income inequality. Concerning this subject, a report by UNDP states (UNDP, 2006, p. 272):

“Why does income distribution matter for poverty reduction? In a mechanical sense the rate of income poverty reduction in a country is a function of two things: the rate of economic growth and the share of any increment in growth captured by the poor. Other things being equal, the larger the share of income captured by the poor, the more efficient the country is in converting growth into poverty reduction.”

The above paragraph is particularly true for Brazil due to its income inequality degree. As mentioned before, the Governmental income transfer programs have performed an important role in reducing income inequality and poverty. Therefore, this research will begin with the idea that any strategy designed to reduce poverty and to induce additional falls of the inequality in income distribution should consider the improvement of these transfer programs.

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9 In the end of 2006, Ministério do Desenvolvimento Social informed that the number of beneficiary families reach 11,1 million.
There are many kinds of income transfer programs in Brazil that can be classified into two broad categories: (1) direct income transfer programs and (2) the social security benefits (related to the past individual contribution). In the first group are the programs that consist of direct income transfers to poor families, as “Bolsa-Família” and “Benefício de Prestação Continuada (BPC)”. In the second are the programs that, even not consisting of direct income transfers only to poor families, also benefit them, such as retirement benefits, pensions and “salário-família”. The existence of various Governmental income transfer programs poses questions presented as the second main research questions (section 2).

Many studies of partial equilibrium shed some light on this question. Among them, some recent studies deserve to be commented in order to show how this research proposal 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 that the more recent programs would be more efficient in reducing poverty once their value of transfers 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 that 31% of the decline in income distribution in Brazil from 2002 to 2004 was due to the mentioned programs. In Northeast region, these programs induced 87% of the estimated decline in income distribution for the same period.

Besides the before mentioned results, Barros et alii (2006a) estimated that the program called “Bolsa-Família” induced around 14% of the calculated reduction of income inequality from 2001 to 2004, while other programs as “Benefício de Prestação Continuada (BPC)” and the public pensions and retirements payments would have caused around 16% of this fall in inequality.

It deserves mention that according to Barros et alii (2006d) despite BPC was very important to reduce poverty, the benefits from this program should not be increased once the benefited families left the poverty condition, while the families that receive transfers through “Bolsa Família” remain poor even though the received benefits.

Although, the empirical evidences from the above mentioned studies were found by means of partial equilibrium approaches, and the consideration of all previous factors, indicates that the proposed research should start from the idea that any policy strategy designed to reduce poverty and induce additional improvements of income distribution in Brazil must consider the following

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10 In 2004, the “Bolsa Família” has unified several other national income transfer programs such as “Bolsa Escola, Bolsa Alimentação, Vale-Gás and PETI (Programa de Erradicação do Trabalho Infantil)”. On the other hand the benefits of the BCP are under the legal cover of the Social Law named LOAS (“Lei Orgânica de Assistência Social”).

11 In this sense, they do not take in account some systemic (general equilibrium) effects induced by the income transfer programs as well as the feedback impacts from the economic system on the households’ incomes which will be discussed in the section 5, Methodology.
directions: the optimization of the present programs, introduction of associate policies aiming to improve and support the income transfer programs and the expansion of these programs.

**Knowledge gaps to be addressed**

As we mentioned in section 2, it is relevant to address the effects of the income transfer programs on poverty and income inequality in an environment take in account the systemic effects induced by these programs as well as the feedback impacts from the economic system on the household incomes.

Therefore, by running this research we firstly intend to address the knowledge gap represented by the lack of evaluations concerning the impacts of the Brazilian income transfer programs on poverty and income inequality in a general equilibrium environment.

Another unexplored issue in the national literature concerns to issues like “should the programs be enlarged?”, “should any of the programs be preferred in relation to the others?” or “should the current programs designs be changed, i.e., focus more on specific groups of the target population?”.

Additionally, there is a set of other factors that could reinforce or not the intended beneficial effects of these income transfer programs. Among those factors that would deserve be investigated, in Brazilian case, would be:

- The sources of budget resources that finance the income transfer programs and their respective progressiveness degree;
- The effects of the programs design, specifically the effects of the benefits on the individual willingness to offer labor and the focalization degree of the programs.
- The impacts of these programs on main macroeconomic and sectoral variables in a medium run perspective.

By making the proposed research we secondly aim at covering the knowledge gaps represented by the lack of answers to issues like the abovementioned ones by assessing the impacts of the enlargement of the programs on poverty and income inequality, by providing evaluations and comparisons among the effects of different programs on poverty and inequality indicators and, finally, producing information on what would be the effects on these indicators whether the transfer programs started to be more focused on specific groups of the target population and/or funded by alternative ways.

At the same time, we share the idea that the implementation of these main directions should be understood as a long political and administrative process where the economic foundations must be clear and transparent in order to follow the correct economic path of changes.

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12 By optimization we mean better focusing the programs, i.e., prioritizing the benefits to poorer families.
13 See section 2, Main research questions and objectives, for a further discussion of this issue.
Research scientific contribution

The first research scientific contribution of this research will constitute in providing assessments on the impacts of the income transfer programs in Brazil on poverty and income inequality indicators in a general equilibrium environment, as presented in the section 2.

To provide these evaluations it will be necessary to extend and improve the CGE model and to construct the MS model with the relevant variables that permits to run the intended simulations. Besides this it will be necessary to develop a mechanism to integrate the CGE and the MS model.

After having integrated both models we will evaluate the transfer programs by running simulations in two ways, as explained in the section 5. Doing this we intend to produce results that could be compared to the ones found by partial equilibrium studies, which can throw some light on the robustness of the programs impacts to the methodology used to make the evaluations. Also, we intend to generate results that could useful about the differences of starting the simulations in the traditional way (from CGE to MS model) and the opposite way (from MS to CGE model).

4 Policy relevance

Recent researches have found empirical evidence about the negative effects of inequality on income distribution to economic growth (Persson and Tabellini, 1994; Bénabou, 1996; Knowles, 2001).14 According to Ravallion (2001), a high initial level of inequality can restrain prospects for pro-poor growth. Thus, these results indicate that the promotion of reduction of inequality in income distribution would be important to countries like Brazil to achieve not only higher growth rates but mainly higher pro-poor growth rates, once it is one of the most unequal countries in the world and where almost one third of the population is below the poverty line.15

As previously stated, the analysis is focused on the main Brazilian income transfer programs, being the most important ones: “Bolsa Família” and “BPC”. These programs have increased fastly in the last years. In the former case, 3,6 millions of families had benefited from it in 2003, while, in 2006, the number of benefited families reached 11,1 millions. Thus, only in four years, a population of approximately 26 millions individuals was incorporated to the program (a population larger than those of the majority of the countries in the world).

Therefore, an assessment of these programs is very relevant, especially considering the orientations of the re-elected government of the President Luís Inácio Lula da Silva, which relies on the income transfer programs as its main strategies for reducing poverty and inequality.

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14 Also, there empirical evidences that inequality asset distribution has adverse effects on economic growth, as for example Deininger and Olinto (2000) and Birdsall and Londono (1997).
15 According to UNDP (2006), in 2003, Brazil presented the tenth worst income distribution in the world, among 126 countries and territories.
5 Methodology

As we mention before, it is relevant to address the effects of the income transfer programs on poverty and income inequality in an environment that takes into account the systemic effects induced by these programs as well as the feedback impacts from the economic system on the household incomes. This is a largely unexplored issue in the national literature. In this sense, questions like “should the programs be magnified” or “should the programs focus more on a specific part of the target population, as families headed by females or rural families” are largely unexplored. The use of a model that integrates a Computable General Equilibrium (CGE) model with a Micro-Simulation (MS) model is suitable to evaluate the research questions, and can significantly contribute to the debate on this subject.

We intend to evaluate the income transfer programs with a computable general equilibrium (CGE) model of Brazil linked to a micro-simulation (MS) model. The CGE model that we intend to use here will be a development from the one presented by Cury & Coelho (2006), while the MS model will be based on the general structure proposed by Müller (2004). The approach to be pursued will be based in the strategy proposed by Savard (2003a and 2003b) to overcome the difficulties posed by traditional CGE models for poverty analysis: the use of a CGE model linked to a micro-simulation model, but with a bi-directional linkage between them to guarantee a convergence of solution for both models.

Savard (2003b) links the models by running them in a repeated sequence of CGE-MS model runs, first computing the CGE simulation, then the MS model simulation, in a looping way, until convergence occurs. We will first run the simulations in the opposite direction, that is, first computing the MS model simulation and, then, computing the CGE simulation, assuring the consistency between the results from both models. However, we also intend to run the simulations in Savard’s way for some designed simulations.

The CGE model

The CGE model that we intend to use here will be developed from the one presented by Cury & Coelho (2006) that resulted from a series of developments made in the model proposed by Devarajan et alii (1991), as can be seen in Cury (1998), Barros et alii (2000), Coelho et alii (2003) and Cury et alii (2005).

The CGE model will be adapted to incorporate the transfer programs characteristics and specified to simulate their impacts on poverty, income distribution and on selected economic variables in Brazil, with complex and systemic propagation methods. To capture the distributive impacts, the model adopts a design focused on the separation of production and institutional factors, as labor and households. The model current version has three main blocks: product and factor markets, and a block that handles with income transfers among institutions and economic agents (seven types of workers, eight kinds of families, forty-two sectors, the Government, the Social Security System and the external sector). The third block specifies the distribution of the value added among production factors and the redistribution of income among economic agents/institutions.
In the CGE model current version, the labor market specification incorporates a recent theoretical advance, the wage curve proposed by Blanchflower and Oswald (1990, 1994), that allows the determination of involuntary unemployment in the equilibrium. After linking this model with the proposed MS model this labor market specification will be substituted by the traditional equilibrium mechanism, the interaction between labor demand and labor supply. This point will be presented in the discussion on the CGE-MS models interaction.

Concerning free parameters of the CGE model, it deserves mention that we do no empirical estimates of Brazilian export elasticities using a CET structure for a highly disaggregated sectoral specification. Therefore, it was adopted the same procedure used in Cury (1998, pp. 112-113), which started with the elasticities estimated by Holand-Holst et alii (1994) to the American economy.

With relation to the Armington elasticities, the values were estimated by Tourinho et alii. (2002), specifically for Brazilian economy and for the same sectors considered in the model.  

The MS Model

According to the methodology applied in many micro-simulation studies based in household data, as in Bourguignon et al. (2003), Bourguignon et al. (2004) and Müller (2004), the labor supply can be specified from a discrete choice between doesn’t work and the several occupational states when the agent take part of the labor market.  

Under these assumptions, let $S_{ih}$ be a qualitative representing the occupational choice made for an individual $i$ in household $h$. This variable takes the following values:

$$
\begin{align*}
S_{ih} &= 0, \text{ if the individual works; } \\
S_{ih} &= 1, \text{ if the individual doesn’t take part of the labor market; } \\
S_{ih} &= 2, \text{ if the individual is an unemployment but searches for a job. }
\end{align*}
$$

When $S_{ih} = 0$, the person works full time and the model doesn’t consider the number of work hours. When $S_{ih} = 1$, the person doesn’t work outside the household and doesn’t search a job. When $S_{ih} = 2$, the person is outside of the labor market, but searches a new job. The occupational choice variable ($S_{i}$) can be modeled using the utility-maximizing interpretation of the multinomial logit framework. So that:

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16 As presented earlier, we will not use the wage curve in the labor market specification with the integration proposed. However, in the current version of the CGE model, the parameter values were taken from Reis (2002), who estimated then for the Brazilian case.

17 The first generation studies on labor supply, for instance, Leuthold (1968), Cain and Watts (1973), Heckman (1974 and 1979) and Hausman (1981), adopt general functional forms wherein income transfers can result in changes in the number of hours worked. The specification propose in this study (and in above-mentioned references) provides information on parameters governing labor supply but does not utilize any information on hours worked.
\[
\Pr(S_i = k) = \Pr[S^k_i(X_i, H_i; Y_{i-j} + y_i^k) + v_i^k > S^i_j(X_i, H_i; Y_{i-j} + y_i^j) + v_i^j], \quad j \neq k \text{ and } k = 0, 1, 2 \quad (1)
\]

where: \(S^k_i(\cdot)\) is a latent function reflecting the net utility of choosing alternative \(k\) (=0, 1 or 2); \(X_i\) is a vector of characteristics of the individual \(i\); \(H_i\) is a vector of the characteristics of the household that he belongs; \(Y_{i-j}\) is the net income of household members except the individual \(i\); \(y_i\) is the total contribution of the individuals towards the income of the household, depending on her occupational choice \(k\) (=0, 1 or 2); \(v_i\) is a random normal variable that stands for the unobserved heterogeneity due to the occupational status choice.

Performing all exogenous variables, except income variable, in a single vector \(Z_i\), the linearization of expression (1) can lead to the utility function as:

\[
U_i(j) = S_j(X_i, H_i; Y_{i-j} + y_{ij}) + v_{ij} = Z_i\gamma_j + Y_i\alpha_j + v_{ij} \quad (2)
\]

where: \(\gamma_j\) and \(\alpha_j\) are, respectively, the parameters associated with the characteristics and household income vectors. The household income variable can be represented by the sum:

\[
Y_h = Y_{i-h} + y_{ih}
\]

To collect the effects in \(U_i(j)\) due to an increase in income transfer amounts is important to segregate the other individual income components. After that, the disposable net income to the family \((Y_h)\) can be defined, following Müller (2004), by:

\[
Y_h = [1 - \tau^k_i(y_{ih})]y_{ih}^k, \quad y_{ih}^k = (1 - \tau_s)(w_i) + m_i + b_i \quad (3)
\]

where \(\tau^k_i\) is the average tax-benefit function applying to individual \(i\) in state \(k\); \(\tau_s\) is the rate at which social security contributions are levied; \(m_i\) is the capital income; \(b_i\) is the transfer income; and \(w_i\) is the working wage.

The wage earnings gained in the labor market are turn to account the reservation wage for individuals that don’t work or report work revenue equal to zero. Assuming that these are determined in accordance with the standard human capital model, so we define that:

\[
\log w_i = X_i\beta + u_i \quad (4)
\]

where \(X_i\) is the set of individual characteristics and \(u_i\) is a random term that stands for unobserved earnings. From the equation (4) we can determinate the potential earnings of all individuals inside and outside the labor market.\textsuperscript{18}

\textsuperscript{18} In this case, it is necessary a proceeding to correct the estimation of the earning function for a potential sample selection bias. The initial proposal in this study will make use of the two stage procedure for selection bias correction offered by Heckman (1979).
Let the \( v_j \) from equation (2) be \( i.i.d. \) among the sample observations according to a Weibull distribution, the model can be estimated as a multinomial logit for the different states \( j = 0,1,2 \):

\[
\Pr(S_{ih} = 1 \mid \mathbf{z}) = \Lambda(\mathbf{z}) = \Lambda(Z, \gamma_k + Y_h \alpha_k + w_i \beta_k + b_j \delta_k + m_i \theta_k + v_{ih})
\]

where \( \Lambda(\cdot) \equiv \Lambda(\mathbf{z}) \equiv \frac{\exp(z_k)}{\sum_j \exp(z_j)} \) is the multinomial logit. The vector \( \mathbf{z} \) represents all social and income characteristics that affect the labor supply. The parameter \( \alpha_k \) allows evaluate the income-effect on labor supply. The parameters \( \beta_k, \delta_k \) and \( \theta_k \) make possible evaluate the substitution-effect on labor supply with respect the labor and non-labor incomes.

In other words, the equation (2) stands that a person takes part to the labor market if the rule associated to her activity \( (j = 0) \) is higher than the rule associated to the inactivity \( (j = 1,2) \), so that:

\[
\Pr(S_{ih} = j) = \Pr[S_{ih}^j(\Lambda^j(\cdot)) > S_{ih}^k(\Lambda^k(\cdot))], \text{ para } j \neq k \text{ e } j = 0,1,2
\]

Replace (5) in (2), the expected utility takes a form of:

\[
U_j(j) = S_j(Z_{ih}, Y_h; w_i, b_j; m_i) + v_{ij} = Z_{ih} \gamma_j + Y_h \alpha_j + w_i \beta_j + b_j \delta_j + m_i \theta_j + v_{ij}
\]

The partial-equilibrium micro-simulation takes into account the assumption that wages \( (w_i) \) and capital income \( (m_i) \) are exogenous. An exogenous change in \( \tau_i \), for other hand, cause changes in individuals and families disposable income. In this case, if have a chock in income transfers, for example, from \( b_i \) to \( b^*_i \) \( (b^*_i > b_i) \), will make a new disposable net income \( Y^*_h \), which implies a new utility function and a new set of parameters that satisfy this condition:

\[
U_i^*(j) = S_j^* (Z_{ih}^*, Y^*_h; w_i^*, b_i^*; m_i^*) + v_{ij}^* = Z_{ih}^* \gamma_j + Y^*_h \alpha_j + w_i^* \beta_j + b_i^* \delta_j + m_i^* \theta_j + v_{ij}^*
\]

Under the hypothesis above-mentioned, the equation (7) implies the complete model in a reduced form after the transfers increase. If are known all parameters \( \alpha^*, \beta^*, \delta^*, \theta^* \text{ e } \gamma^* \), the earnings inside and outside the labor market \( (w_i, m_i, \text{ e } b_i^*) \) and the residuals \( (v_{ij}^*) \), so each individual \( i \) reconsider the decision about labor supply and choose the optimum occupational status \( j^* \) according to:

\[
j^* = \arg \max_k [U_i^*(j)]
\]

Therefore, the labor supply decisions by an individual, before and after an increase in income transfers, correspond to the optimum status \( j^* \) that produces the maximum utility.

\[\text{[19]}\] O multinomial logit model was introduced by McFadden (1974), in sense of get outcomes for an individual that choose maximize her utility among several choices.
**Interaction CGE-MS**

As stated in the beginning of this section, we intend to evaluate the income transfer programs with a CGE model and a MS model with a bi-directional linkage between them to guarantee a convergence of solution for both models. This integration of models permits enlarge the representation of the economic environment of individuals and families by linking the CGE model with representative agents with the MS that presents very detailed information for a much larger number of families. In this integration process, the main challenge is to implement a simultaneous and interactive solution for both models instead of only using “top-down” decomposition procedures, as in Bourguignon *et al.* (2003).

The reference framework that we are taking for implementing the CGE and MS models integration is presented in the chart below, following Müller (2004):

![Diagram of CGE-MS Interaction](chart.png)


In the framework we intend to implement, the Tax-Benefit (TB) module will present the specification of the tax schemes that levy the household income. It will determine the families’ available income and the aggregate amounts of income tax and social security contributions. As presented in the section on **MS model** earlier, these households’ disposable income will be transmitted to the MS model in order to determine the individual willingness to supply labor.
The MS model contains data about thousands of households and is based on an econometrically estimated model of labor supply. In conjunction with the tax-benefit module, it allows to simulate the impact of the transfer programs on households’ labor supply and the changes in their income.

In general, the communication between the CGE and the MS models will occur by means of the labor supply, the tax/transfer and the households’ available income amounts.

The TB module will generate the aggregate amounts of income tax and social security contributions that will communicated to the CGE model, specifically to the Government and to the Social Security System, respectively.

The variables amounts of available income and transfers and labor supply for disaggregated individuals/families in the MS model will be aggregated to the kinds of families in the CGE model, and then transmitted to it. The labor supply amounts will be aggregated to the labor categories in the CGE models, generating labor supplies by labor type. These amounts will replace, in the CGE, the variables related to households by the related aggregated values calculated by the MS model.

Making the total amounts of workers equal between the CGE and MS models, the starting unemployment rates will be the same. Changes in the labor supply choices and, by consequence, in unemployment rates will be transmitted to the CGE model.

In a broad sense, given the changes implemented in the simulation, the new integrated equilibrium is achieved when the common aggregated values achieve similar values in both models.

We also stated before that we intend to run some simulations in the way proposed by Savard (2003b) – from the CGE to the MS model – and also in the opposite direction – from the MS to the CGE model.

In the first way, when a scenario is simulated the algorithm runs in the following way. Changes in the aggregated transfer amounts to the families in the CGE model will induce it to a new equilibrium, with new values for wages specific by labor category. These new wages values will be transmitted to TB module that will calculate the aggregate fiscal indicators for income tax and social security contributions, besides calculating the new amounts of households’ available income. Then, the MS model calculates labor supply by labor type, considering the new amounts of transfers. The aggregate fiscal indicators and the labor supply schemes will be fed back to the CGE model, which will achieve a new equilibrium with new factor prices, and the procedure starts again. This iterative process will finish when the changes in wage rates from one iteration to the next becomes very small.

In the second way, when a change in transfer program is simulated, the interactive procedure will go as follows. The MS model will calculate labor supply by labor type, considering the new values for transfers, which will be transmitted to the CGE model. Then this model will achieve a temporary equilibrium with new factor prices that will communicated to the TB model, which will generate the aggregate fiscal indicators for income tax and social security contributions, besides calculating the new amounts of households’ available income. Then, the MS model will calculate new labor supply amounts by labor type, and the procedure will occur in a repeated way until the convergence of solution for both models is achieved.
Motivation for starting micro-macro sequence with MS model

These two interactive processes present similarities but differ in their starting points. We believe that for some simulations such as testing alternative benefit schemes, the adoption of the second method is more appropriate because it permits better identification of the target families than it would be in a CGE model. For example, the implementation of different schemes of NIT would better simulated starting with in a MS model than in a CGE model because it would be possible to identify the individualized household incomes instead of the representative-households average income.

As said before, we believe that starting the micro-macro sequence with the MS model can capture some effects that could not be equally considered by starting with the CGE model, once it presents representative households. This is not a point concerning which we are making an affirmative. Actually, we intend to compare both sequential procedures in order to investigate this point further.

Besides linking the CGE model to a MS model, we intend to modify some of its characteristics in order to be able to simulate some alternative designs for the income transfer programs, as incorporating new classification for families in order to distinguish the effects on urban and rural families, as well as on households headed by women, men and retired person. Also, we intend to evaluate the results sensitiveness to some model structure characteristics as the modeling of the labor market, especially the effects of the income transfers on labor supply willingness and external closure.

6 Data requirements and sources

There are two main sources of household data that has been produced by IBGE (Instituto Brasileiro de Geografia e Estatística) and can be used in the micro-simulation model: the recent available versions of the Pesquisa Nacional por Amostragem de Domicílios (PNAD, a national sample household survey) and the Pesquisa de Orçamentos Familiares (POF, a household budget and expenditure survey) that, respectively, presents information for 2003.

The main information extracted from PNAD is wage by industry and labor type, as well as other personal characteristics such as years of schooling, gender, age, position in the family, labor contract status, urbanization level and other socio-economic characteristics. The POF, on the other hand, is a budget and expenditure survey that, in 2003, covered all the Brazilian states and present information for the urban and the rural areas. The main information extracted from POF is related to consumption expenditures and income by household type. Actually, in our case, these data from POF were used to disaggregate the original one column consumption vector in the National Accounts to the eight columns consumption in the social accounting matrix (once there are eight types of families in the model current version). Also, the data on families’ income were used to quantify the income transfer flows from productive sectors to families and among institutions (families, Government, firms and Social Security system).
By matching information from the last available version of these surveys and of the Brazilian National Accounts we made a Social Account Matrix (SAM2003) that contains all the price and quantity information used for the CGE model parameter calibration (Cury et alii, 2006). This SAM was already implemented in the CGE proposed model.

Finally, using the SAM build process, we will be able to address an important issue about data Microsimulation data sets. For example, some researches claim that the income information in the database used in these studies, the household survey called Pesquisa Nacional por Amostra de Domicílios (PNAD), does not capture good information on income from assets. In this sense, as this kind of income is mainly received by richer families, the measures of income inequality would be underestimated, that is, the richer families are richer than the data from PNAD indicates and, consequently, also is the inequality in income distribution.

To solve problems like this one, at MS data level, we intend to “correct” the surveys mentioned before using “multiplied factors” originated in the National Accounts and in our SAM 2003. These factors for different income sources were already calculated for 2003 by Barros, Cury and Ulyssea (2007). Also, we intend to use the applied procedure, at the specific household individual level, described by Fofana and Cockburn (2003), which reconcile MS-SAM data for Nepal. At the end of this process, at the household survey level, the amounts by income source and economic agents should match the SAM 2003 values which reflect the same amounts of National Accounts.

7 Consultation and dissemination strategy

The transfer programs has been the focal point of the debate about the Brazilian social policy,, involving from the policy makers to the mass media (national newspapers and open TV channels), oriented to the general population.

Dissemination Strategy.

To fulfill the above expectations we plan to divide the dissemination of the research in 3 levels: academic community, policy makers and the public in general.

• Academic Community: we intend to present and discuss the results in policy seminars on the subject especially at Fundação Getulio Vargas- São Paulo (Economic and Business School) to attend the local researchers. Also, we intend to apply for at least the following conferences:

1) ANPEC (National Association of Graduate in Economics), the most important conference of economic academic researchers in Brazil; and
2) the International Conference on Policy Modeling organized by the ECOMOD (Economic Modeling Network) and/or the annual GTAP conference which congregates the researchers of the CGE field.

20 In the last presidential election (September-October 2006) , the transfer program “Bolsa Familia” was the most debatable economic program by both the main candidates and the press.
• **Policy Makers:** for these group, our strategy include at least one seminar at IPEA (Applied Economic Research Institute located in the Planning Ministry of Brazil), which is the most important think tank of poverty issues at Federal Government. Also, in the executive branch, it is important to address the “Ministério do Desenvolvimento Social” which is responsible for the “Bolsa Família” and “BPC”.

On the other hand, in the Brazilian Congress, we plan to send our report for some “key” non partisans representatives specialized in the social policy issues. To achieve this goal we are going to rely in the previous experience one of the team members as former employee at Brazilian Senate (see section 8).

• **General Public:** we also intend to disseminate the results from this research through publications in the main Brazilian economic newspapers in order to present our evaluations to the public in general and some NGO organizations. Although, this is a difficult task, we believe that our research can provide information that can be converted in attractive “news” for the press media. Alternatively, we can rely in signed newspaper articles, where we can show the main research findings.

**Consultation Strategy.**

The chosen ways to disseminate the research by means of presentations and reports will generate debate on the simulations and results. We believe these exchanges of ideas would be very fruitful as they can generate useful suggestions to the design of new simulations and to improve the research.

8 **Team members: prior training and experience in the issues and techniques involved**

Samir Cury (male, 43 years old) is professor at the Department of Economics, Escola de Administração de Empresas of Fundação Getulio Vargas, São Paulo, Brazil (FGV–SP). His main research activity is multisectoral models, especially CGE applied to income distribution, poverty and trade issues.

His experience on poverty issues started as former advisor of the Brazilian Senate Economics Committee, from 1991 to 1995, where he worked with several federal budget issues and specially in supporting the entire process of the first Brazilian transfer program law, including the program elaboration and all the phases of the project approval by the Senate. In 1993, he obtained his Master degree in Economics, whose subject was based on Input-Output and SAM based model applied to income distribution issues.

As part of his PhD, he was trained in CGE modeling as Fulbright Visiting Scholar at the Department of Agriculture and Development Economics, UC at Berkeley. During this period, his advisor was Professor Irma Adelman (from 1996 to 1997), and he worked in several modeling environment including a combination of GAMS and SAS. Since his PhD Thesis in Economics with subject in CGE modeling and income distribution analysis (1998), he has been publishing in the area.
In Brazil, several of his research projects and activities were carried out at IPEA (see section 11), the leading poverty research institute in the country. Recently, in his research activities at FGV he has been working with GEMPACK environment applied to GTAP model. Recently, he has been invited by IPEA to work in a special group established to study the recent decline of inequality in Brazil (BARROS et alii, 2006a).

Alexandro Mori Coelho (male, 35 years old) has been working as part time researcher in specific research projects at the Fundação Getulio Vargas (FGV–SP) and is professor of Economics at the Faculdades Oswaldo Cruz and Universidade Cruzeiro do Sul, São Paulo, Brazil. His teaching activities include undergraduate level courses in Microeconomics, Monetary Economics, International Economics, Economic Growth, Financial Economics, Mathematics Applied to Economics, Mathematical Statistics, Statistics for Economists, and Econometrics.

His field of research is the economic policies impact analyses using CGE models. His interest in this field started in the Master program and in his dissertation he developed a CGE model to evaluate the impacts of alternative strategies of trade liberalization and integration in Brazil at national and state levels. He also took CGE modeling courses offered by researchers from the Centre of Policy Studies (CoPS at Monash University, Australia). In the last years, he integrated research teams that evaluated the impacts of trade and taxation policies using this methodology at IPEA and Fundação Getulio Vargas. Currently participating of researches under supervision of Prof. Samir Cury and on prepare to doctoral program admission examination.

Euclides Pedrozo (male, 35 years old) is researcher at the Fundação Getulio Vargas (FGV–SP) and professor at Universidade Paulista (UNIP) and Instituto Brasileiro de Mercado de Capitais (IBMEC), São Paulo, Brazil. His teaching activities include courses in Microeconomics, Development Economics, Econometrics and Financial Economics. He has participated in several research projects in the following fields: Income distribution, poverty and social welfare, education and child labor; family consumption, antitrust and regulation and evaluation of public policies. He has abilities with econometric packages (SPSS and Stata) and experience with IBGE data sources like Census, PNAD and POF. With the assistance of Prof. Samir Cury, he developed the databases for the SAM2003, from PNAD and POF data sources. Currently studies for Doctoral in Economics and prepares thesis with subject in intra-household consumption allocation, making use of a detailed cross-sectional micro-simulation model of individuals and families.

9 Expected capacity building

The main capabilities that this research can provide are divided in two main issues: i) the construction of the micro-simulation (MS) model and ii) the integration between the CGE and the MS models.

The first issue includes activities such as the manipulation of the data base (household and expenditure surveys) and the estimation-calibration process. Although the team members have some experience in the manipulation of the data base, the MS model building process is a set of new
techniques that must be absorbed by researches. The same applies for the integration of these models, where the interface between them must be designed, programmed and executed through the GAMS software used for CGE modeling.

However, it is important to stress that the present research project does not look for learning generalist skills in AGE modeling nor in MS modeling. Our purpose is to consider the modeling aspects that are directly related to the main characteristics found in the simulation of the transfer programs, such as:

- The problem of price homogeneity and the monetary benefits (in nominal and real terms);
- The reaction of economic agents to these programs (willingness to supply labor and child education);
- The treatment of the temporal evolution of these programs and the incorporation of these features by means of modeling tools;
- Discuss in a deeper way the conciliation between different sources of data. For example, there is significant differences in income data from household surveys and from national accounts have. These questions are important because the data disparity affects the modeling accuracy. Also, measuring income in accurate way has important consequences to better estimation of the poverty level which will affect the design of transfer programs.

Among the team members, the previous tasks will be allocated in the following form:

- Samir Cury: project coordinator, CGE and MS models specification and simulations designs;
- Allexandro Mori Coelho: CGE and MS models specification and implementation of the models integration process;
- Euclides Pedrozo: construction of the databases and implementation of the MS model;

The participation in this project represents a really important opportunity for both Allexandro Mori Coelho and Euclides Pedrozo. The former is applying for a graduate program in Economics where he plans to continue studying the questions posed by this research. By this turn, Euclides Pedrozo is currently enrolled in the PhD program, at Fundação Getulio Vargas, where he is studying the consumption side of the models. For both, this research project represents a really important opportunity for future researches in the field of studies on poverty and income inequality issues.

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21 For example, recent calculation estimates that the aggregate income of poor families is underestimated by 30% when the income calculation is made with data from PNAD and National Accounts (BARROS, Cury and ULYSSEA, 2006).
Concerning the institutional capacity building we believe that this project, given its purpose of treating a very often discussed question, will attract the attention of more researchers at Fundação Getulio Vargas to study the issues related to poverty and income inequality using quantitative techniques based on economic theory and systemic and consistent methods, which will enhance the important role played by Fundação Getulio Vargas (FGV) in the economic debate in Brazil. Besides, the present project will reinforce the initiatives to develop joint researches with the other institutes, such as IPEA.

Finally, once applied general equilibrium modeling is still in development stages in Brazil, with few researchers actively working in the field, this research project will contribute to the consolidation of the CGE modeling team at Fundação Getulio Vargas, representing an important step in capacity building for the analysis of poverty alleviation and income inequality reduction policies.

10 Ethical, social, gender or environmental issues or risks involved.

The project does not involve any of these issues or risks as well as it will not use any confidential data.

11 List of previous research projects related to this proposal

This proposal is a natural extension of the research line initiated in 1988 by Prof. Samir Cury in the PhD program. From 1988 on, the main projects related so far are:

   • Description: Issues and Design of Brazilian Transfer Programs.
   • Participants: Samir Cury (Coordinator); Nada Eissa (UC at Berkeley).
   • Funded by the IPEA (Planning Ministry of Brazil).

   • Description: Development of a CGE Model for analyzing the welfare impacts of the Brazilian trade liberalization process.
   • Participants: Samir Cury (Coordinator); Allexandro Mori Coelho; Carlos Henrique Corseuil; Ricardo Paes de Barros.
   • Funded by the IPEA (Planning Ministry of Brazil).

   • Description: Economic Impacts of the PIS-COFINS Taxation Reform using a CGE model.
   • Participants: Samir Cury (Team Leader); Allexandro Mori Coelho; Euclides Pedrozo.
- Description: Simulations of the impacts of the Doha Round negotiations on NAMA goods on Brazilian economy; simulations with the GTAP model and several combinations of Swiss formulas applied to MAcMap data.
- Participants: Samir Cury; Allexandro Mori Coelho; Maria Lucia Padua Lima; Sergio Goldbaum.
- Funded by GV Pesquisa - EAESP/FGV.

- Description: Impacts of the accession of Venezuela as a full member to Mercosur using the GTAP model for simulation the new sets of tariffs between Venezuela and the former members (Brazil, Argentina, Paraguay and Uruguay).
- Participants: Samir Cury; Allexandro Mori Coelho; Maria Lucia Padua Lima; Sergio Goldbaum.
- Funded by “Escola de Economia de São Paulo – EESP/FGV”.

12 Final comments

Our purpose in this research Project is the development of a robust analytical tool which will permit to evaluate and analyze, in a systemic environment, the income transfer programs in Brazil, the main Brazilian policies to reduce poverty and enhance income distribution.

To achieve this objective, the authors expect to take advantage from their previous experience in analyzing income direct transfer programs as well as with general equilibrium modeling applied to distributive questions. The experience accumulated from previous research activities demonstrate that the specific and practical knowledge about experimental problems is an important condition to achieve the proposed objectives, once they permit that researchers concentrate their efforts in the value-aggregating stages of the research project.

This research proposal seeks to achieve a considerable improvement in the analytical capacity for understanding the policy impacts on poverty and income distribution through applied general equilibrium modeling. The integration of the CGE model with a MS model with feedback between them and the inclusion of a more detailed description of the entire income formation process flows will be an important development. We understand this process as ways of improving the analytical and modeling skills to treat in suitable manner a problem too complex to be approached without a
consistent and integrated tool. In this sense, the present research project represents an important and almost natural way of improving the research line emphasized in this proposal.

It deserves to be emphasized that, no other sources of funds have been or will be sought for this research project.

13 References


