The role of Income Transfer Program in the Fall of Income Inequality in Brazil: a CGE Micro-Simulation Approach [a]

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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% combined with a significant poverty reduction. We used a CGE model specified to capture particular features of the social security and taxation systems and calculated the incidence of benefits and welfare indicators through an integration with a micro-simulation model to assess the role (contribution) of income transfer programs implemented in Brazil to the mentioned fall of the Gini index. The results of this analysis have confirmed the important role of these policies to the income inequality reduction during 2003-2005.

Key words: fiscal policy, computable general equilibrium, welfare.

1. Introduction

The Brazilian economy has historically presented one of the highest inequality in income distribution in the world with a Gini index around 0.60. 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, 2007; and Hoffmann, 2006a; UNDP, 2006).

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.[1] 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. Around 32% (58 millions individuals) and 12% (22 millions) of Brazilian population are, respectively, in poverty and extreme poverty conditions (Barros et alii, 2007a). Due to the historically unequal income distribution in Brazil and the

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[1] Barros et alii (2001).

enormous number of people still in these conditions, 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 of income inequality in Brazil, recent studies show empirical evidences that this inequality has declined in an expressive, accelerated and continuous way from 2001 to 2005, as shown in the chart below.

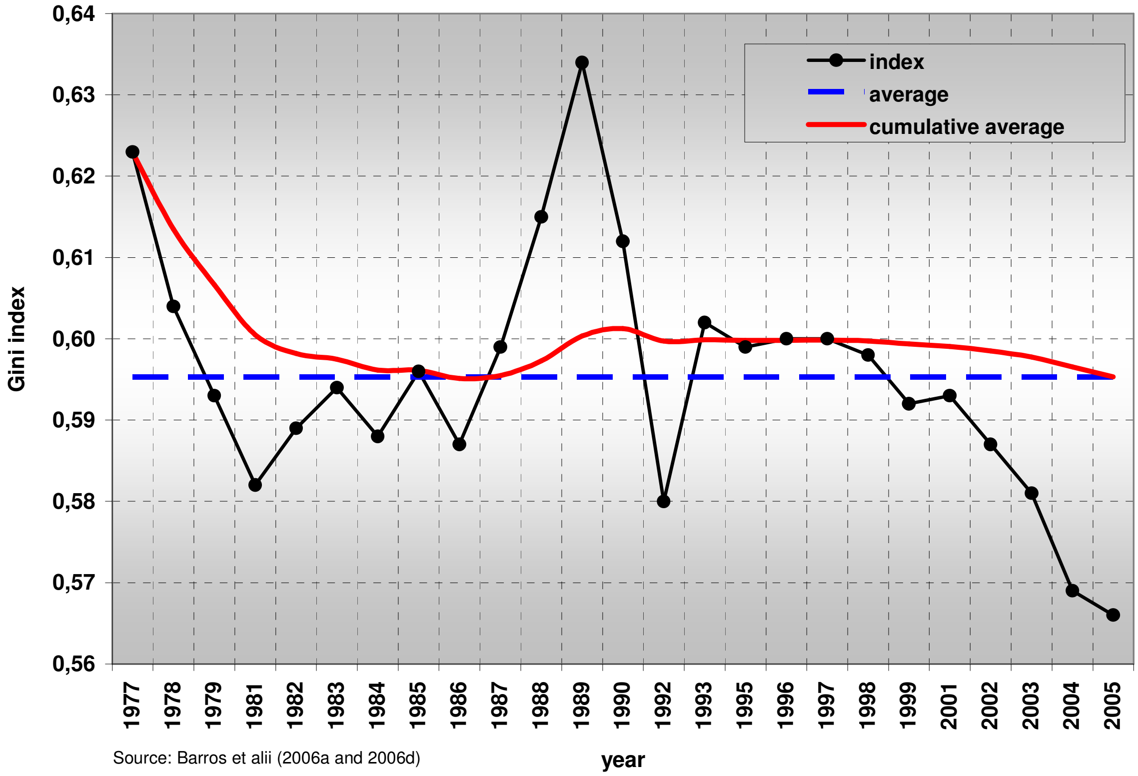

Figure 1 – Temporal evolution of inequality in per head income distribution in Brazil – Gini index

While in 2001 the Gini index was close to its average value in the last 30 years, in 2005 it achieved its lowest magnitude in this period. According to Barros et alii (2007a), 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.

Some studies show that the Governmental income transfer programs were important determinants of this fall in income inequality. Barros et alii (2007) estimated that one third of this fall was due to these programs, and, in this sense, other things being equal, without them, the inequality in income distribution 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." [2]

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)".[3] 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".

Many studies of partial equilibrium shed some light on this question. Among them, Rocha (2005) simulated the impacts that some income transfer programs would have whether they were applied to their entire target population, considering the rules for each program, and pointed 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) evaluated 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.

Although, the empirical evidences from the above mentioned studies were found by means of partial equilibrium approaches. 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 household incomes. When poor families receive monetary transfer from the Government, their income increase and induce higher consumption expenditures, which tends to motivate firms to produce more and 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.

It is not possible to say in advance if these general equilibrium effects reinforce or reduce the changes in income inequality induced by the income transfer programs, once these effects depend on the way these programs are financed.

Thus, this study intends to assess the impacts of two income transfer programs called "Bolsa-Família" and "Benefício de Prestação Continuada (BPC)" on income inequality considering the general equilibrium effects on household incomes and specific ways of financing them. In this

[2] In the end of 2006, Ministério do Desenvolvimento Social informed that the number of beneficiary families reach 11,1 million.

[3] As from 2004, the Bolsa Familia 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).

sense, these programs' evaluation will be made with a computable general equilibrium (CGE) model integrated with a micro-simulation (MS) model

This paper is organized in more six sections, besides this introduction. The next section presents the computable general equilibrium (CGE) model. The third describes the micro-simulation (MS) model and the integration between both models. The models databases are presented in section 4. The fifth section describes the simulations and the model closure. The simulation results are reported in section six. Finally, the final remarks are presented in section seven.

2. The CGE Model – main features

The CGE model used here is the one presented in Cury and Coelho (2006) and consists of the follow framework.[4]

2.1. The Product Market

2.1.1. Product Supply

Foreign product supply is modeled as being totally elastic,[5] while sectoral domestic supply is represented by a three steps nested production function with three types of inputs: labor, capital and intermediate inputs.[6]

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:[7]

$$Ld_i = \prod_l F_{il}^{\beta_{il}} \tag{1}$$

where β_{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).[8].

Second, in each sector i, aggregated labor (Ld_i) and capital (K_i)[9] are associated by a constant elasticity of substitution (CES) function to obtain the production level (X_i):

$$X_i = a_i^D \left[\alpha_i Ld_i^{\rho_{it}} + (1-\alpha_i) K_i^{\rho_{it}}\right]^{1/\rho_{it}} \tag{2}$$

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

[4] This model results 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* (2000a), Coelho *et alii* (2003) and Cury *et alii* (2005).
[5] Thus, Brazilian demands for imported goods are fully satisfied without facing external supply constraints.
[6] The model represents the 42 sectors of activities listed in the 2003 Brazilian National Accounts.
[7] This means that an identical increase of every type of worker results in an identical increase of the aggregate worker.
[8] Also, there are more 2 types of employers that are treated as labor and enter in the Cobb-Douglas aggregation.
[9] The model closure adopted in the simulations determines that the sectoral levels of capital are fixed.

Finally, in the third step the various intermediate inputs levels (INT_i) are obtained by a Leontief production function (e.g., fixed proportion to sector *j* total product, X_j):[10]

$$INT_i = \sum_j a_{ij} * X_j \quad (3)$$

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

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 in products sold to these markets:

$$X_i = a_i^T * \left[\gamma_i * E_i^{(\rho_{it}+1)/\rho_{it}} + (1-\gamma_i) * D_i^{(\rho_{it}+1)/\rho_{it}}\right]^{(\rho_{it}+1)/\rho_{it}} \quad (4)$$

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 γ_i are model's parameters and ρ_{it} is the elasticity of transformation.[11]

2.2. Demand for products

2.2.1. 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 average income (f5), rural families with average 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,[12] according to a Cobb-Douglas functional form (similar to the production function presented earlier).

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:

$$Q_i = a_i * c\left[\delta_i * M_i^{(\rho_{ic}-1)/\rho_{ic}} + (1-\delta_i) * D_i^{(\rho_{ic}-1)/\rho_{ic}}\right]^{1/\rho_{ic}} \quad (5)$$

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 δ_i are parameters, while ρ_{ic} is the Armington elasticity of substitution between D_i and M_i.[13] Finally, Q_i indicates the utility derived from the consumption of good *i*.[14].

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[10] It is worth mentioning that Devarajan *et alii* (1991) makes use only the first and third steps, by combining capital with labor and value added with intermediate inputs, in this order.

[11] There are 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 departed from the elasticities estimated by Holand-Holst *et alii* (1994) to the American economy.

[12] 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.

[13] These elasticities values were estimated by Tourinho *et alii.* (2002) for the same sectors considered in the model.

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.

2.2.2. 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 important for product demand. Similarly to consumption, the investment is characterized as the purchases of certain goods and can be considered as a final consumption undertaken by firms. The savings represent this amount of resources and it is assumed that 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) and the matrix of sectoral composition of capital (goods by sector of destination and 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.

2.2.3. 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.

2.3. The Labor Market

Labor is a production factor used by firms and is classified into 7 types, according to contract status and schooling.[15] It is admitted that firms aim at maximizing profits under technological constraints conditions imposed by production function, in an environment where prices of inputs, production factors (labor and capital) and output are beyond their control. . Therefore, as a result

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

[15] The labor treatment that follows is applied for the 5 types of private workers. The 2 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 is no public companies. In the sectors where public and private firms coexist, the changes in the public-private composition of labor are related to the changes in the public-private composition of the sectoral representative firm.

of this maximization, for each type of workers, a specific demand curve is defined by the condition that their marginal productivities equalize their wages:[16]

$$P_i * \partial X_{il} / \partial F_{il} = W_{il} \tag{6}$$

The labor market equilibrium (employment and wage) is determined by E', the intersection point between the demand curve (L^d) and the wage curve (S). The wage level defined by E' does not correspond to the labor supply (L^o), and the difference $L^o - L$ is the excess of labor supply that corresponds to the involuntary unemployment level (U) in the economy.[17]

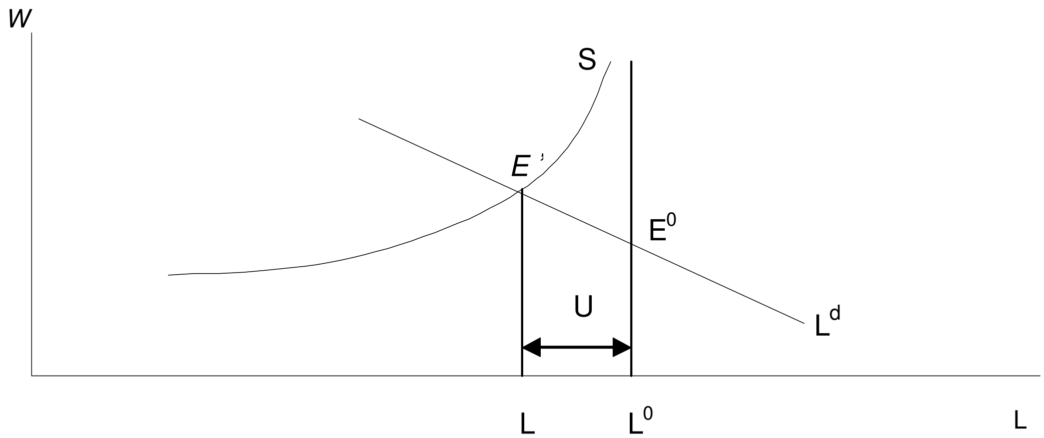

Figure 2 - Equilibrium in the labor market for a given type of labor

The wage curves adopted here represent the negative relation between the unemployment rate (U_l) and the wage level (W_l) for private worker l in Brazil: [18]

$$\ln W_l = \alpha_i - \beta_l * \ln U_l \tag{7}$$

where β_l reflects the firm's bargaining power in offering lower wages according to unemployment rate. [19]

After defining the aggregate levels of employment, wages (w_l) and unemployment, for each type of workers, their sectoral wages (w_{li}) are found by means of the sectoral relative wage differentials. Using a sector and worker specific demand curve (equation 6), the sectoral employment level of each type of labor (F_{il}) is determined and, then, aggregated by a Cobb-Douglas function (equation 1) defining the sector i's composite labor.

2.4. The Income Transfer Mechanisms

Here it will be presented the formation process of income flows received by families and firms. The remuneration of capital is paid to firms[20] and the labor earnings to workers. In each sector,

[16] The derivative of the profit function with relation to the factor demand must be equal to the factors' price (first order condition).
[17] E^o would be the full employment level given by the interaction between labor supply and labor demand.
[18] A brief description of wage curves can be found in Cury, Coelho and Corseuil (2005). Broader explanation about them can be found in Blanchflower and Oswald (1990 and 1994).
[19] These parameter values were taken from Reis (2002), who estimated then for the Brazilian case.

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 initial shares (ε_{hl}) of these workers in these families, which also receive the remuneration of capital transferred by firms (YK) according to the family h's share in these income flows (ε_{hk}). 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)[21] and as other transfers (essentially domestic debt interest)that are allocated to the families according to the initial shares (θ_{ht}). Therefore, the family *h's* income is:

$$Y_h = \varepsilon_{hl} * W_l + \varepsilon_{hk} * YK + (pindex) * \theta_{hk} * TG + R * RE_h \tag{8}$$

2.5. 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 determination of 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 (θ_k). Finally, it also transfers resources to abroad (GE) and its total expenditure is:

$$GG = \sum_i CG_i + pindex * (\theta_{ht} + \theta_k) * TG + R * GE \tag{9}$$

To face all expenditures, the Government relies on three types of collections: (1) direct taxes levied on firms' and families' income (ϕ_h and ϕ_k, respectively), and (2) indirect taxes on domestic and 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, there is the balance of the social security system ($SOCBAL$).[22] Thus, the Government total revenue is:

$$\begin{aligned} RG = & \sum_h \phi_h * Y_h + \sum \phi_k * YK + \sum_i (\eta_i * X_i) + \sum_i (\xi_i * D_i) + \sum_i (\pi_i + \sigma_i) * VA_i \\ & + \sum_i (\mu_i + \kappa_i + \gamma_i) * M_i + R * gfbor + SOCBAL \end{aligned} \tag{10}$$

where η_i are the tax rates on production, ξ_i and π_i are, respectively, the sector i's PIS-COFINS rates on domestic sales value (cumulative regime) and on value-added (non-cumulative regime),

[20] Small (self-employed people) and large (other firms).

[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.

σ_i and κ_i are, respectively, the ICMS-IPI tax rates on value-added and imports, μ_i is the tariff on imports, while γ_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 implementation of the PIS-COFINS reform changed the way by which the Government collects indirect taxes that levy domestic and imported commodities. Thus, the indirect tax revenue (INDTAX) from domestically produced goods is given by:

$$INDTAX = \sum_i (\eta_i * (PX_i * X_i)) + \sum_i (\xi_i * (PD_i * D_i)) + \sum_i ((\pi_i + \sigma_i) * (VA_i)) \qquad (11)$$

where $PX_i * X_i$ is the production value, $PD_i * D_i$ is the gross revenue value from domestic sales and VA_i , η_j , ξ_i , σ_i and π_i were presented in equation 10.

This equation is very important to understand the way the implementation of the fiscal reform will be simulated. According to PIS-COFINS tax revenue data from "Receita Federal", all sectors are being levied in both cumulative and non-cumulative regimes. Then, the domestic part of the simulation will consist in applying the ξ_i and π_i tax rates that were verified in 2004 at sectoral level.

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

$$TARIFF = \sum_i (pwm_i * R).(\mu_i + \kappa_i + \gamma_i) * M_i \qquad (12)$$

where pwm_i is the external price of imports (in US$), μ_i is the tariff on imports, κ_i is ICMS-IPI rates on Imports and γ_i are the PIS-COFINS rates on imports.

Again, this equation is important to understand the way that the fiscal reform will be simulated, once another feature of this reform was that the imports started being levied by PIS and COFINS taxes. Thus, the implementation of this part of the reform will consist in applying γ_i tax rates that were collected from import flows of commodity type *i* in 2004.

3. The Micro-Simulation (MS) Model

The effects of the public transfers programs on the Brazilian income distribution could be simulated by applying the rules to a representative sample of households, as for instance the National Household Survey (Pesquisa Nacional por Amostra de Domicílios, or PNAD). This section describes the specification of the household income model used for micro-simulation and the way consistency between the results of the CGE model and the MS model are achieved. The household income model's structure used here follows the one proposed by Bourguignon *et alii* (2003), where further details can be found.

The distribution of individual earnings and equivalent household incomes, as mentioned by Bourguignon et alii (2005), may come from three sources: (i) the population or endowment effect, (ii) the participation or occupation effect, and (iii) the price effect.

The determination of the population or endowment effect, in other words, the sociodemographic characteristics of the households and individuals, could be represented in accordance with the standard Becker-Mincer human capital model. The logarithm of the monthly earnings w_{ih} of household *h* and working age household members $i = 1, \ldots, k_h$ assumed to depend on the personal observable sociodemographic characteristics, *X*, and its unobservable earnings characteristics (*u*):

$$\log w_{ih} = \alpha_{ih} + \beta_{ih} X_{ih} + u_{ih}, \qquad i = 1, \ldots, k_h \tag{13}$$

The vector X_{ih} is a set of individual characteristics and is defined as follows:

$$X_{ih} = educ, educ^2, age, age^2, D_g, D_a \tag{14}$$

where *educ* denotes completed effective years of schooling; *age* is a proxy for labor experience; D_g is a gender dummy variable, which takes the value of 0 for females and 1 for males; and D_a is a geographic area dummy variable, which takes the value 0 for Metropolitan area, 1 for Urban non metropolitan area, and 2 for Rural areas. The error term u_{ih} captures any other determinant of earnings, including any unobserved individual characteristics, such as innate talent.

The participation or occupation effect represents the characteristics of the occupational choices made for an individual *i*. This choice changes the population of earners within and across economic sectors. Under these assumptions, let S_{ih} be a qualitative variable representing the person's occupational status. This variable takes the value 0 if the person does not occupy and 1 if he or she worked outside the household. This occupational (discrete) choice variable S_{ih} will be modeled using the standard logistic or logit function defined as:

$$\Pr(S_{ih} = 1 \mid \mathbf{z}) = \Lambda(\mathbf{z}) = \Lambda(a_{ih} + b_{ih} Z_{ih} + v_{ih}) \tag{15}$$

where $\Lambda(\cdot) \equiv \Lambda(\mathbf{z}) \equiv \dfrac{\exp(\mathbf{z})}{1 + \exp(\mathbf{z})}$ is the logit model. In other words, equation (15) states that an individual will prefer wage work if the value of the criterion associated with that activity (j = 1) is higher than that associated with inactivity (j = 0), that is:

$$\Pr(S_{ih} = j) = \Pr\left[S_{ih}^{j}\left(\Lambda^{j}(\cdot)\right) > S_{ih}^{k}\left(\Lambda^{k}(\cdot)\right)\right], \text{ for } j \neq k \text{ and } j = 0,1 \tag{16}$$

The vector **z** represents the model covariates, where Z_{ih} is the characteristic vector of person *i* in the household *h* that may affect the labor supply of that individual. This vector can be described as follows:

$$Z_{ih} = educ, age, age^2, D_g, D_r, D_a, educ\_max, age\_max \tag{17}$$

where *educ*, *age*, D_g and D_a have the same meaning above; D_r is a race dummy variable, which takes the value 0 for black and 1 for white; *educ_max* and *age_max* represents the person relatives' maximum education and experience in the household respectively. The term v_{ih} is a random normal variable that stands for the self-selection bias or unobserved heterogeneity of observed inactive/wage-worker behavior.

The price effect is the change in the individual income due to a remuneration rates or prices in the labor and output markets have changed. Therefore, the total income is then deflated by a household specific consumer price index, P_h, which is derived from the observed budget shares, s_{hk}, of household *h* and the price, p_k, of the various consumption goods, *k*, in the model, that is:

$$P_h = \sum_{k=1}^{K} s_{hk} p_k \tag{18}$$

The basic form of the income-generating for a household member observed consists of the system formed by equations (13), (15) and (18) plus another equation that defines the total household real income. This accounting identity sums actual earnings over all household members, Y_h^1, and adds (exogenous) non-labor income, Y_h^0, to obtain total household income, Y_h. It then follows that:

$$Y_h = \frac{1}{P_h}\left(Y_h^1 + Y_h^0\right) = \frac{1}{P_h}\left(\sum_{i=1}^{k_h} w_{ih} \cdot \Pr\left(S_{ih} = 1\right) + Y_h^0\right) \tag{19}$$

The model defines the total real income of a household as a non-linear function of the observed characteristics of household members, X_{ih} and Z_{ih}, its budget shares (s_h), and unobserved characteristics of the household members, u_{ih} and v_{ih}. This function depends on two sets of parameters the various demographic groups and the vector of prices: (i) α_{ih} and β_{ih}, from the earning function; and (ii), a_{ih} and b_{ih} from the occupational choice model.

In order to calculate the effects on income inequality with micro-simulations made with the household income model it is necessary estimate an initial set of coefficients – α_{ih}, a_{ih}, β_{ih} e b_{ih} – as well as an estimate of the unobserved characteristics, or fixed effects, that enter the earning functions, or the utility of the various occupational alternatives, through the residual terms – u_{ih} and v_{ih}.

The link between the MS model and the CGE model is made by associating macro-economic shocks and changes in policies simulated in the CGE model to changes in the set of coefficients of the household income generation model. With a new set of coefficients and the observed and unobserved individual characteristics, these equations permit computing the occupational status of all household members, their earnings, and total real income of the household.

This association is done in a consistent way with the equilibrium of aggregate markets in the CGE model, which requires that: (1) changes in average earnings with respect to the benchmark in the micro-simulation must be equal to changes in wage rates obtained in the CGE model for each segment of the wage labor market; (2) changes in the number of wage workers by labor-market segment in the micro-simulation model must match those same changes in the CGE model, and (3) changes in the consumption price vector, *p*, must be consistent with the CGE model.

4. The Model Data Base

CGE data base. Almost all data used in the CGE model and simulations were derived from a Social Account Matrix (MSC–2003) that was specifically made to be used in this research and contains all the quantities and prices information in 2003 (the model's base year). Besides, all the model's coefficients and parameters obtained by means of a model calibration process are calculated from this data matrix. The description of this matrix can be found at Cury *et alii* (2006).[23] It deserves mention that it was made based on information from the latest officially published Brazilian National Accounts by the Instituto Brasileiro de Geografia e Estatística (IBGE). Another set of data used to calculate the economic shocks that will be simulated and evaluated will be presented in the next section.

Microsimulation data base. The data base for micro-simulation consists of the sample of 117,000 households surveyed in the 2003 PNAD household survey. The main difficulty of modeling household incomes arises from the fact that the wage may be obtained from different activities or occupational choice. In light of these difficulties, we consider that all persons can only earn income as wage workers in an activity. Let G be an index function that indicates the labor market segment or activity to which member i in household h belongs, then the micro-simulation system becomes:

$$\begin{cases} \log w_{ih}^{G} = \alpha_{ih}^{G} + \beta_{ih}^{G} X_{ih} + u_{ih}^{G} \\ \Pr\left(S_{ih}^{G} = 1 \mid \mathbf{z}\right) = \Lambda(\mathbf{z}) = \Lambda\left(a_{ih}^{G} + b_{ih}^{G} Z_{ih} + v_{ih}^{G}\right) \\ Y_h = \dfrac{1}{P_h}\left(Y_h^1 + Y_h^0\right) = \dfrac{1}{P_h}\left(\sum_{i=1}^{k_h} w_{ih} \cdot \Pr\left(S_{ih} = 1\right) + Y_h^0\right) \end{cases} \tag{20}$$

We organized these groups [$G(L,A)$] into 7 activities sectors (A) and 11 labor characteristics (L). These groups can be observed in Appendix A. The labor characteristics aggregation was made according to the education and contract agreement (formal or informal) and including only employees and employers (the two public and self-employment labor types don't have wage and occupational status variations). This pooled sample yields 49 equations of earnings (7 activities

[23] Although the matrix will not be described here, further information on it can be requested with authors.

and 7 labors) and the corresponding residual are obtained by OLS estimation. For individuals at working age (i.e. 15 years and older) who are not observed as wage earners in the survey, predict values of w_{ih}^{G} was applied. In Appendix B shows the results of the OLS estimation of the earnings function.

Parameters of the occupational choice model were obtained through the (conditional) maximum likelihood estimation of a logit model, thus assuming that the residual term, v_{ih}, are distributed according to the i.i.d. model. The estimation was conducted only for employees (the employers don't have occupational status variations). This pooled sample then yields 35 equations of occupational choice (7 activities and 5 labors).[24]

5. Simulations and closure

5.1. Simulations – modeling issue

This study intends to assess the impacts of income transfer programs on income inequality with a computable general equilibrium (CGE) model integrated with a Microsimulation (MS) Model. More specifically, we run simulations concerning the two most important income transfer programs called "Bolsa-Família (BF)" and "Benefício de Prestação Continuada (BPC)".[25] As we mention before, the simulation was done in two parts: (i) the simulation at the CGE model and (ii) the integration of the CGE simulation results at the Microsimulation Model.

5.1.1 CGE Simulation – modeling issue

At the CGE level, we just run one simulation. Its main aiming is the evaluation of the effects of changing the values and focalization of these two programs, BF and BPC, from the ones they presented in 2003 to the ones presented in 2005. To do so, we proceed in the following way.

Transfer Programs. We imputed both differences concerning the total amount and the focalization, between 2003 and 2005. To address the focalization we used the same adapted household survey, at micro data level, utilized by Barros, Carvalho, Franco and Mendonça (2007), which were provided by the authors. From the former study, we just used the benefits share for the 8 model families. The total amount for both came from the administrative Federal Budget and is shown in the Table 1 bellow.[26]

[24] The results from the estimation of the logit for occupational choice are available from the authors on request.

[25] "Bolsa Família (BF)" is a federal government transfer program targeted in poor families with per capita income bellow R$ 100 per month. Benefício de Prestação Continuada (BPC) is a benefit, for poor individuals with disabilities or with age more than 65 which are excluded from the social security system.

[26] The entire compatibility between the survey data and the model data base (SAM 2003) is fully described in Cury and Silva Leme (2007).

Table 1 – Total Amount of Benefits for Model Family type, 2003 and 2005 (R$ million)

	2003		2005	
	Bolsa Família	**BPCs**	**Bolsa Família**	**BPCs**
F1	965,73	224,39	1.823,80	293,17
F2	0,00	183,59	0,00	239,87
F3	735,44	196,64	1.342,22	237,20
F4	920,93	1.462,90	1.677,69	2.245,95
F5	225,91	1.079,85	354,55	2.043,56
F6	392,67	592,69	745,80	1.099,69
F7	386,43	713,50	402,55	1.084,27
F8	235,90	79,43	190,39	279,30
Total	**3.863,00**	**4.533,00**	**6.537,00**	**7.523,00**

Source: Federal Government Budget Values

As we can see above, the introduction of 2005 benefits characteristics in the 2003 model base year will increase the total amount for the 2 programs (approximately 70% for "BF" and 66% for "BCP"). Also, specially for the "Bolsa Família", there is an improving in targeting the benefits, which goes from 70% (2003) to 80% (2005), for the 50% poorest families in the model (f1,f2,f3 and part of f4 and f6). For the other hand, we realize that BPC had a focalization worse than the BF (45 % for the 50% poorest families in 2005).

Program Finance. The increase expenditure of "BF" and "BPC", reported in the above table, was fully financed by the increase of 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. In this way, we simulated a type of cost-benefit analysis.

In the choice of which tax we are going to increase in the model, we decided to reproduce the composition of real federal taxes evolution for the same simulation period (2003-2005). The Table 2 shows the amount of the three main federal taxes for that period.

Table 2: Main Fed taxes in Brazil (R$ millions – nominal values)

Year	***IR***	***PIS-COFINS***	***SSC***
2003	100,053	74,902	80,730
2004	109,622	97,010	93,765
2005	132,287	108,244	108,434

Source: Federal Tax Collection Secretary (2002 and 2006).

From the Table 2 above, we collected the share of each tax in financing the total programs expenditure, calculated in R$ 5,664 billions. Thus, doing this, the taxes are increased in the following way:

- increasing in 2% the direct income taxes for all types of families (IR);
- increasing in 2% the direct income taxes for all for model firms (IR);
- increasing in 2% the social security taxes paid by employers (companies) for all 42 model sectors and activities (SSC);

- allocating 35% of the PIS-COFINS tax reform, which was implemented in the same period and is fully described in a paper by Cury and Coelho (2006) about this specific tax reform.

5.1.2 MicroSimulation – integration issue

The second part of the simulation is relating to the method we adopted to make the consistency between the models. We decided to use two approaches, from which we derived two sets of inequality indicators from the CGE simulation. Therefore, from the CGE simulation, we are going to have two simulations results, that we call **SIMU 1** and **SIMU 2**.
As mentioned in the section 3, we do not have a feed back solution between the models (CGE and MS), but we adopt linking procedures in two different ways. Both, SIMU 1 and SIMU 2, have a common procedure for the non-labor income described in the Table 3 bellow.

Table 3 – Integration CGE-Microsimulation Model for non labor Income (base year 2003)

Household Income Source	Procedure in the Microsimulation (PNAD 2003)
Transfer Programs: Bolsa Família, BCP	Household Survey Vectors 2005 imputed in 2003: shares from Barros et all (2007), amount from federal budget values.
Self Employed Income	CGE results variations from the 7 grouped sectors are applied to the microsim. model vectors.
House Rent	The same vector value of the microsim. base year model
Interest, Dividends and Others	CGE results variation from these income flows, individualized by the 8 model families types.
Retiree and Pension Public Benefits	The same vector value of the microsim. base year model
Retiree and Pension Private Benefits	The same vector value of the microsim. base year model
Donation received	The same vector value of the microsim. base year model
The above sources are deflated by the CGE model price index (after simulation) for each family type (weighed by the consumption model vector)	

Differences in the Simulations. Table 4 bellow presents the summary of labor income procedure adopted for **SIMU** 1 and **SIMU** 2. In the first simulation (**SIMU** 1), we are using the estimated MS model equations described at section 3. In this case, the consistency between the CGE and MS model were done through wage and employment variations from the CGE model. Then, we re-estimated the new individual employees and their wages, using the estimated regressions of the MS model. In this way, we are allowing the intra group effect that the CGE does not take account.

In the second simulation, we didn’t use the regression equations. We just apply the variation of wage amounts, for each CGE labor type sub-group, into the wage vector of the household survey.

Thus, in the **SIMU** 2, the MS model reduces to the household survey fixed for the variation of income sources come from the CGE model. Therefore, in this simulation, there is no relative variation inside de sub-groups and employment is fixed[27].

Table 4 – Integration CGE-MS Model for labor Income (base year 2003)

Simulation	Household Income Source	Procedure in the Microsimulation (PNAD 2003)
SIMU 1	Employment (35 sub-group from CGE 5 labor types and 7 grouped sectors)	CGE results variations for the 35 sub-groups are applied in LOGIT probability model to select the new individuals (un)employed in the MS model.
	Wages (35 sub-group from CGE 5 labor types, 2 employer types and 7 grouped sectors)	CGE results variations for the 49 sub-groups are applied in the multivariate wage regression model to determine the new individuals wage in the MS model.
SIMU 2	WAGE amounts (35 sub-group from CGE 5 labor types, 2 employer types and 7 grouped sectors)	CGE results variations for the 49 sub-groups are applied in the wage vector model of the MS model without employment variation of the MS Model in the base year.
The above sources are deflated by the CGE model price index (after simulation) for each family type (weighed by the consumption model vector)		

5.2. Model Closure

As previously mentioned, the model closure is closer to a medium-run type, since it is being assumed that: (1) sectoral capital stocks are constant, (2) prices are flexible, (3) involuntary unemployment exists in equilibrium and (4) trade balance is exogenous. The constancy of capital stocks is due to the fact that, in the model, the investment goods are being produced but not considered as increments of capital stock. The existence of involuntary unemployment in equilibrium is a consequence of the labor market modeling (section 2.3).

By admitting trade balance as exogenous, the exports adjust not only due to the price responsiveness of external demand but also to adjust the changes in imports.

[27] In some way, the account of employment variation were done trough the replication of wage amount (not just wage) variation from the CGE model.

6. Results

6.1. Inequality and Welfare results

The Table 5 bellow shows the 2 inequality indicators, GINI and THEIL–T, for the SIMU 1 and SIMU 2 described before. The variations of THEIL–T index are higher than the GINI due to theirs sensibility differences and the characteristics of the simulations, a very well targeted income transfer program. Also the general direction's results confirm the important role of transfer programs in the Brazilian recent inequality fall[28].

Table 5 – Inequality Indicators from household per capita Income (base year 2003)

	GINI	% Var.	THEIL-T	% Var.
Original	0,601		0,742	
SIMU 1	0,556	- 7,56 %	0,606	- 18,26%
SIMU 2	0,593	- 1,35 %	0,722	- 2,67 %

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

If we choose the GINI index as reference, the 7.56% reduction of SIMU 1 are higher than the previous analyses, such as Barros *et alli* (2007b), which used partial equilibrium analysis and Cury and Silva Leme (2007) using the same CGE model of this paper, but with a simpler calculation of the inequality indicators[29] and without MS model. On the other hand, the SIMU 2 results are more aligned with the previous analyses.

Despite the previous comments and the methodological differences, we cannot directly compare these analyses mainly because the differences in the simulations design. In our analysis, we try to fully finance the "Bolsa Familia" and "BPC" programs according to the evolution of Federal taxes in that period. Also, we imputed the federal budget values of BF and BCP into MS model, which enhance the programs welfare indicators[30].

This fact can be noted in the table 6 bellow, that shows the gross family income after running the MS model. At both simulations, the positive strong effects in the three poorest families are primarily due to increase of the transfer amounts for them. Again, the higher effect that we can

[28] There are several chapters aligned with this view in

[29] Cury and Silva Leme (2007) analysis don't use a separated MS Model. The household survey is just utilized to generate inequality indicators after correcting the base year per capita income for the family income CGE results. Besides that, their analysis take the full advantage the several income sources of the CGE model

[30] The household survey, PNAD 2003 and 2005, don't have a variable(s) that identify the Transfer Program benefits. Barros *et alli* (2007) and Soares *et alli* (2006) adopt a special procedure in order to identify the received benefits. But in both cases, they are lower than the budget values with stronger differences in the BPC case.

notice in the SIMU 1 was only due to the labor income since for the others income sources they adopt the same procedure described in the section 5 above.

The full implementation of MS model in the SIMU 1 allows free mobility of individuals inside their respective sub group providing robust changes at the employment status among individuals. Also it looks like that new individuals wages, calculated after the CGE simulation, are less unequal than before.

Table 6 – change in household income from the base-year (%)

	F1	F2	F3	F4	F5	F6	F7	F8
SIMU 1	65.1	21.1	47.4	20.3	10,3	14,6	– 0.96	– 19.7
SIMU 2	19.1	12.3	13.0	1.40	- 0.04	- 0.17	0,40	- 0.60

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 average income; **F6** – rural families with average income; **F7** – families with high average income; **F8** – families with high income.

On the other hand, the negative effects of the highest income families (f7 and f8) came from the general equilibrium effects of the CGE model. We notice the same effect at Cury and Silva Leme (2007) reinforcing the primary effects of the income transfers.

6.3. Macroeconomic impacts

Table 7 - Macroeconomic Indicators (percentage change) *

	CGE SIMU
GDP	– 0.65
Consumption	– 0.81
Investment	– 0.68
Public sector revenue	0.08
Public sector deficit	– 0.75
Exports	– 1.20
Imports	– 1.54
Employment	– 1.70
Price Index	2.51

Note: (*) Real percentage change from the CGE base year.

The table 7 presents the macro results that formed the background for SIMU 1 and SIMU 2. Overall the impacts were adverse since it induced a real GDP fall of 0.65 %, an aggregate employment decrease of 1.70% and generated real inflation of 2.51%. These adverse effects can be mainly attributed to the partial PIS-COFINS tax reform accounted in the simulation. The former analysis of this issue done by Cury and Coelho (2006) provided similar results[31].

[31] This paper provides an intensive analysis for the PIS COFINS tax reform explaining the negative effects reasons.

Particularly, the consumption fall is due to the decrease the overall family income despite the rise of the poorest ones.

Exports fell due to the price-responsiveness behavior of external agents and the model external closure characteristics. First, the simulation induced an increase in domestically produced commodities prices, which, by turn, caused a decrease in external demand by Brazilian commodities. Second, the rise of import prices and the reduction of internal absorption (activity) induced a fall in demands for imported commodities, and in order to not affect the trade balance equilibrium, exports decreased.

Finally, the government deficit decreases for only R$ 250 million (-0,75 %) showing that the simulated tax increased were enough to finance the total simulation costs.

7. Final remarks

The aiming of this paper was the investigation of the role of the two most important Brazilian transfer program in reducing inequality. Utilizing a CGE-MS integrated approach, for the 2003-2005 period, the analysis confirms the importance of these programs for recent improvement of Brazilian income distribution.

Also the paper addressed some methodological issues, such as the differences in MS integration and its results impacts. Despite this, some data issues are very important to perform the simulations, specially the inconsistence between income components of the household survey (base for MS model) and National Accounts (base for the CGE model).

Finally, we would like to emphasize that this paper is part of a research project aiming to develop a better analytical approach to study the impacts of income distribution policies. We think, that these first results show that we are taking the right direction.

References

BARROS, R. P. de; CORSEUIL, C. H.; CURY, S. Abertura comercial e liberalização do fluxo de capitais no Brasil: impactos sobre a pobreza e a desigualdade. In HENRIQUES, R. (Org.). **Desigualdade e pobreza no Brasil.** Rio de Janeiro: Ipea, 2000. p. 271-298.

BARROS, R. P. de; CORSEUIL, C. H.; CURY, S. Salário mínimo e pobreza: uma abordagem de equilíbrio geral. **Pesquisa e Planejamento Econômico,** Rio de Janeiro: Ipea, v. 30, n. 2, p. 157-182, 2000a.

BARROS, R. P. de *et alii* (2006a). Sobre a recente queda da desigualdade no Brasil. Rio de Janeiro: IPEA, Nota técnica, Agosto de 2006, 68p.

BARROS, R. P. de; CARVALHO, M.; FRANCO, S; MENDONÇA, R. Determinantes Imediatos da queda da desigualdade de renda no Brasil. In Barros, R. P.; FOGUEL, M. N.; Ulyssea, G. (org) **Desigualdade de Renda no Brasil: uma análise da queda recente**. Brasilia: Ipea, 2007. Vol. 1.

BARROS, R. P. de; CARVALHO, M.; FRANCO, S; MENDONÇA, R. A queda recente da desigualdade de renda no Brasil. In Barros, R. P.; FOGUEL, M. N.; Ulyssea, G. (org) **Desigualdade de Renda no Brasil: uma análise da queda recente.** Brasilia: Ipea, 2007A. Vol. 1.

BLANCHFLOWER, D. G.; OSWALD, A. J. The wage curve. **Scandinavian Journal of Economics,** v. 92, 1990, p. 215-235.

BLANCHFLOWER, D. G.; OSWALD, A. J. **The wage curve.** Cambridge, Massachussetts: MIT Press, 1994, 493 p.

BOSCHETTI, I.; TEIXEIRA, S.; DIAS, A. **Programas de transferência de renda:** a "nova" face da política de assistência social no governo Lula. Ano I, nº 1, nov. 2004. Nota Técnica do Grupo de Estudos e Pesquisas em Seguridade Social e Trabalho, Departamento de Serviço Social – UNB.

BRASIL. Ministério da Fazenda - Secretaria Executiva. **Impactos da mudança do regime de tributação da Cofins.** Brasília, 2004. available at: htpp://www.fazenda.gov.br/portugues/releases/notapisappy04-12.pdf).

BRASIL. Ministério da Fazenda - Secretaria de Política Econômica. **Gasto social do governo central:** 2001 e 2002. Brasília, nov. 2003.

BRASIL. Ministério da Fazenda - Secretaria de Política Econômica. **Gasto social do governo**: 2001-2004. Brasília, abr. 2005.

BRASIL. Receita Federal. **Análise da arrecadação das receitas federais**. Relatório mensal, Brasília: Receita Federal – Coordenação Geral de Política Tributária, dez. 2004.

BRASIL. Receita Federal. **Carga tributária no Brasil 2002.** Estudos Tributários 11, Brasília: Receita Federal – Coordenação Geral de Política Tributária, abr. 2003.

BRASIL. Receita Federal. **Carga tributária no Brasil 2005.** Estudos Tributários 15, Brasília: Receita Federal – Coordenação Geral de Política Tributária, ago. 2006.

BOURGUIGNON, F.; SILVA , L. P. da (Eds). *The Impact of Economic Policies on Poverty and Income Distribution"*. Oxford University Press, 2003

BOURGUIGNON, F.; ROBILLIARD, A.S. e ROBINSON, S. (2003): "Representative vesus Real Households in the Macroeconomic Modeling of Inequality." Working Paper, nº. 2003-05, DELTA/ENS, Paris.

BOURGUIGNON, F.; FOURNIER, M. e GURGAND, M. (2005): "Distribution, Development, and Education in Taiwan, China, 1979-94." In: BOURGUIGNON, F.; FERREIRA, F.H.G.; e LUSTIG, N (eds.): The Microeconomics *of Income Distribution Dynamics in East Asia and Latin America.* Washington, DC: The World Bank.

COELHO, A. M.; CORSEUIL, C. H.; CURY, S.; BARROS, R. P. de. Um modelo de equilíbrio geral computável para analisar aspectos distributivos no Brasil. In: CORSEUIL, C.H; KUME, H. (Org.). **A abertura comercial brasileira nos anos 1990:** impactos sobre empregos e salários. Rio de Janeiro: MTE / IPEA, 2003 p. 170-197.

CURY, S. **Modelo de equilíbrio geral para simulação de políticas de distribuição de renda e crescimento no Brasil.** 1998, 176 p.. Originalmente apresentada como dissertação de doutorado, Departamento de Economia, São Paulo: Fundação Getúlio Vargas, 1998.

CURY, S.; COELHO, A. M.; CORSEUIL, C. H. A computable general equilibrium model to analyze distributive aspects in brazil with a trade policy illustration, **Estudos Econômicos,** v. 35, n. 4, São Paulo, 2005.

CURY, S; COELHO, A.M. **From revenue to value added taxes**: welfare and fiscal efficiency effects in Brasil. Paper presented at International Conference on Policy Modeling (ECOMOD 2006), Hong Kong, June, 2006.

CURY, S.; COELHO, A.M.; PEDROSO, E. **Matriz de contabilidade social** – Brasil 2003. Relatório de Pesquisa 461/04 (Anexo 1), GV Pesquisa, São Paulo: EAESP-FGV, fev. 2006. Mimeo.

CURY, S.; SILVA LEME, M.C. **Redução das Desigualdades e os Programas de Transferência de Renda: Uma Análise de Equilíbrio Geral**. In Barros, R. P.; FOGUEL, M. N.; Ulyssea, G. (org) Desigualdade de Renda no Brasil: uma análise da queda recente. Brasilia: Ipea, 2007. Vol. 2 (t2o be published).

DEVARAJAN, S.; LEWIS, J.; ROBINSON, S. **From stylized to applied models:** building multisector CGE models for models for policy analysis. USA: University of California at Berkeley, Department of Agriculture and Resources Economics. Working Paper 616, 1991.

DEVARAJAN, S.; HOSSAIN, S. I. The combined incidence of taxes and public expenditure in the philippines. **World Development,** v. 26, n. 6, 1998.

HOFFMANN, R. (2006a). Brasil, 2004: Menos pobres e menos ricos. In: **Parcerias Estratégicas - Edição especial: Análise sobre a Pesquisa Nacional por Amostra de Domicílios (Pnad 2004).** Brasília: Centro de Gestão e Estudos Estratégicos, n 22, 2006, p. 77 – 88.

HOFFMANN, R. (2006b). Transferências de renda e a redução da desigualdade no Brasil e cinco regiões entre 1997 e 2004. **Econômica.** Rio de Janeiro, 8(1): 55-81, jun. 2006..

HOLAND-HOLST, D. W.; REINERT, K.A.; SHIELLS, C.R. A general equilibrium analysis of North American economic integration. In: **Modeling Trade Policy:** applied general equilibrium assessments of North American free trade. New York: Cambridge University Press, p. 47-82.

IBGE (Instituto Brasileiro de Geografia e Estatística). Sistema de Contas Nacionais – Brasil 2003, Contas Nacionais n. 12, Rio de Janeiro, 2004.

KUME, H. (Orgs.). **A abertura comercial brasileira nos anos 90 –** impactos sobre emprego e salário. Rio de Janeiro: Ipea, 2003, p. 171-197.

REIS, M. **Mudanças na estrutura da demanda por trabalho qualificado e na composição da oferta e seus impactos sobre desemprego.** Rio de Janeiro: PUC-Rio, 2002. Mimeo.

ROBINSON, S.; EL SAID, M. Poverty and inequality analysis in a general equilibrium framework. In: **The impact of economic policies on poverty and income distribution.** In BOURGUIGNON, F.; da SILVA, L. P.; (eds). Oxford University Press, 2003.

ROCHA, S. (2005). Impacto sobre a Pobreza dos Novos Programas Federais de Transferência de Renda. **Revista Economia Contemporânea**. Rio de Janeiro, 9(1): 153-185, jan./abr. 2005.

SOARES, F.; SOARES, S.; MEDEIROS, M.; OSÓRIO, R. **Programas de transferência de renda no Brasil:** impactos sobre a desigualdade. Brasília: Ipea, 2006. (Texto para discussão n. 1.228).

TOURINHO, O.; KUME, H.; PEDROSO, A. C. **Elasticidades de Armington para o Brasil:** 1986–2001. Rio de Janeiro: Ipea, 2002. (Texto para discussão n. 901).

UNDP – United Nations Development Programme (2006). **Human Development Report 2006 Beyond scarcity: power, poverty and the global water crisis**. New York, 2006, 440 p.

Appendix A: Structure of the Social Account Matrix

Activities

A1 – Farm and Livestock
A2 – Manufacturing Industry, Mining and Petroleum Extractives
A3 – Non-durable good consumption industry
A4 – Public utility services and public administration
A5 – Construction Sector
A6 – Wholesale and Transports
A7 – Banking and Insurance, Personal Households and Other Services

Labor

L1 – Informal Unskilled Labor
L2 – Informal Skilled Labor
L3 – Formal Unskilled Labor
L4 – Formal Medium Skilled Labor
L5 – Formal Skilled Labor
L6 – Public Unskilled Labor
L7 – Public Skilled Labor
L8 – Small Employer Labor
L9 – Medium and Big Employer Labor
L10 – Self-employment Unskilled Labor
L11 – Self-employment Skilled Labor

Appendix B: Log earning regression (49 groups reporting earnings)

Groups(L,A)	Intercept	Std	educ	Std	educ2	Std	age	Std	age2	Std	Dg = 1	Std	Da = 1	Std	Da = 2	Std
G(1,1)	3,523	0,079	0,054	0,010	0,000	0,000	0,059	0,059	-0,001	-0,001	0,487	0,487	-0,002	-0,002	-0,150	-0,150
G(2,1)	7,232	1,726	-0,633	0,312	0,033	0,033	0,057	0,057	-0,001	-0,001	0,106	0,106	0,399	0,399	0,015	0,015
G(3,1)	4,692	0,092	0,079	0,009	-0,004	-0,004	0,027	0,027	0,000	0,000	0,246	0,246	0,131	0,131	0,123	0,123
G(4,1)	28,181	8,703	-4,822	1,744	0,244	0,244	0,046	0,046	0,000	0,000	0,291	0,291	0,114	0,114	0,176	0,176
G(5,1)	38,743	36,844	-4,629	5,564	0,181	0,181	-0,110	-0,110	0,002	0,002	-0,369	-0,369	-2,025	-2,025	-0,567	-0,567
G(1,2)	3,088	0,159	0,053	0,028	0,002	0,002	0,090	0,090	-0,001	-0,001	0,642	0,642	-0,308	-0,308	-0,270	-0,270
G(2,2)	2,238	1,093	0,193	0,187	0,001	0,001	0,075	0,075	-0,001	-0,001	0,325	0,325	-0,159	-0,159	-0,279	-0,279
G(3,2)	4,437	0,096	-0,007	0,012	0,006	0,006	0,060	0,060	-0,001	-0,001	0,346	0,346	-0,030	-0,030	-0,127	-0,127
G(4,2)	11,190	3,663	-1,456	0,730	0,080	0,080	0,062	0,062	0,000	0,000	0,275	0,275	-0,021	-0,021	-0,079	-0,079
G(5,2)	12,375	4,544	-1,348	0,670	0,057	0,057	0,113	0,113	-0,001	-0,001	0,419	0,419	-0,135	-0,135	-0,346	-0,346
G(1,3)	2,828	0,136	0,076	0,024	-0,002	-0,002	0,109	0,109	-0,001	-0,001	0,516	0,516	-0,067	-0,067	-0,189	-0,189
G(2,3)	5,690	1,108	-0,364	0,194	0,024	0,024	0,052	0,052	0,000	0,000	0,315	0,315	-0,065	-0,065	-0,145	-0,145
G(3,3)	4,835	0,070	0,035	0,009	-0,001	-0,001	0,038	0,038	0,000	0,000	0,279	0,279	-0,045	-0,045	-0,028	-0,028
G(4,3)	14,445	3,136	-2,021	0,624	0,104	0,104	0,056	0,056	0,000	0,000	0,302	0,302	-0,020	-0,020	-0,065	-0,065
G(5,3)	4,287	8,952	-0,128	1,327	0,014	0,014	0,073	0,073	-0,001	-0,001	0,465	0,465	-0,093	-0,093	-0,244	-0,244
G(1,4)	3,864	0,099	0,021	0,017	0,003	0,003	0,067	0,067	-0,001	-0,001	0,332	0,332	-0,039	-0,039	-0,268	-0,268
G(2,4)	3,490	0,517	0,014	0,085	0,006	0,006	0,071	0,071	-0,001	-0,001	0,323	0,323	-0,079	-0,079	-0,303	-0,303
G(3,4)	4,668	0,078	0,023	0,009	0,002	0,002	0,040	0,040	0,000	0,000	0,353	0,353	-0,046	-0,046	-0,157	-0,157
G(4,4)	9,809	3,245	-1,147	0,646	0,065	0,065	0,058	0,058	-0,001	-0,001	0,237	0,237	-0,072	-0,072	-0,233	-0,233
G(5,4)	12,267	2,739	-1,268	0,405	0,053	0,053	0,089	0,089	-0,001	-0,001	0,401	0,401	-0,197	-0,197	-0,458	-0,458
G(1,5)	4,641	0,166	0,059	0,016	-0,003	-0,003	0,047	0,047	0,000	0,000	-0,128	-0,128	-0,048	-0,048	-0,201	-0,201

G(2,5)	9,025	1,181	-0,964	0,202	0,048	0,009	0,084	0,018	-0,001	0,000	0,023	0,114	-0,073	0,074	-0,195	0,067
G(3,5)	4,477	0,142	0,047	0,013	0,000	0,002	0,048	0,005	0,000	0,000	0,327	0,088	-0,065	0,026	-0,059	0,024
G(4,5)	2,239	7,767	0,537	1,549	-0,020	0,077	0,009	0,018	0,000	0,000	0,164	0,091	-0,045	0,062	-0,149	0,062
G(5,5)	20,850	11,812	-2,466	1,748	0,095	0,064	0,080	0,026	-0,001	0,000	0,309	0,112	-0,108	0,112	-0,358	0,159
G(1,6)	3,032	0,068	0,038	0,013	0,003	0,001	0,108	0,003	-0,001	0,000	0,396	0,023	-0,151	0,025	-0,322	0,022
G(2,6)	3,588	0,528	-0,009	0,093	0,007	0,004	0,069	0,006	-0,001	0,000	0,287	0,025	-0,025	0,031	-0,245	0,028
G(3,6)	4,568	0,053	0,029	0,008	0,001	0,001	0,050	0,003	0,000	0,000	0,329	0,013	-0,031	0,013	-0,058	0,013
G(4,6)	6,436	1,926	-0,414	0,383	0,024	0,019	0,062	0,003	-0,001	0,000	0,238	0,011	-0,049	0,013	-0,127	0,014
G(5,6)	8,049	3,622	-0,610	0,537	0,028	0,020	0,083	0,012	-0,001	0,000	0,413	0,035	-0,138	0,040	-0,398	0,045
G(1,7)	3,679	0,051	0,057	0,009	-0,001	0,001	0,067	0,002	-0,001	0,000	0,445	0,022	-0,177	0,018	-0,445	0,016
G(2,7)	5,378	0,479	-0,316	0,082	0,022	0,003	0,052	0,006	0,000	0,000	0,423	0,028	-0,156	0,029	-0,422	0,027
G(3,7)	5,110	0,064	0,024	0,008	0,001	0,001	0,022	0,003	0,000	0,000	0,256	0,015	-0,081	0,014	-0,197	0,014
G(4,7)	16,010	3,307	-2,310	0,658	0,123	0,033	0,030	0,005	0,000	0,000	0,300	0,021	-0,161	0,021	-0,269	0,021
G(5,7)	17,144	3,945	-1,994	0,580	0,081	0,021	0,071	0,009	-0,001	0,000	0,391	0,036	-0,182	0,037	-0,412	0,043
G(8,1)	5,559	0,595	0,078	0,035	-0,002	0,002	0,015	0,019	0,000	0,000	0,432	0,162	0,244	0,266	0,055	0,231
G(9,1)	2,744	0,762	0,255	0,043	-0,006	0,003	0,074	0,023	-0,001	0,000	1,095	0,203	0,317	0,448	-0,447	0,420
G(8,2)	5,047	0,416	0,054	0,034	0,001	0,002	0,059	0,017	-0,001	0,000	0,134	0,090	-0,141	0,091	-0,219	0,078
G(9,2)	6,550	1,021	-0,119	0,102	0,009	0,005	0,044	0,033	0,000	0,000	0,674	0,170	-0,136	0,143	-0,142	0,134
G(8,3)	5,402	0,425	0,011	0,039	0,003	0,002	0,048	0,018	0,000	0,000	0,101	0,073	-0,092	0,095	-0,245	0,083
G(9,3)	6,551	1,053	-0,083	0,086	0,008	0,005	0,024	0,042	0,000	0,000	0,574	0,158	0,328	0,185	-0,257	0,175
G(8,4)	6,144	0,417	-0,092	0,055	0,006	0,002	0,048	0,014	-0,001	0,000	0,235	0,064	-0,053	0,069	-0,032	0,073
G(9,4)	6,703	0,662	0,153	0,064	-0,005	0,003	0,008	0,024	0,000	0,000	0,160	0,108	-0,035	0,088	-0,282	0,105
G(8,5)	5,201	0,503	0,071	0,029	0,001	0,002	0,023	0,019	0,000	0,000	0,320	0,269	-0,105	0,085	-0,095	0,076
G(9,5)	5,157	1,015	0,041	0,103	0,001	0,005	0,062	0,045	-0,001	0,000	0,726	0,356	-0,079	0,183	-0,302	0,239
G(8,6)	5,341	0,165	0,052	0,014	0,000	0,001	0,039	0,007	0,000	0,000	0,277	0,030	-0,042	0,036	-0,151	0,032
G(9,6)	6,810	0,393	0,089	0,037	-0,003	0,002	0,022	0,015	0,000	0,000	0,279	0,074	-0,014	0,073	-0,102	0,076
G(8,7)	4,906	0,442	-0,110	0,046	0,009	0,002	0,080	0,018	-0,001	0,000	0,229	0,066	-0,002	0,078	-0,100	0,080
G(9,7)	5,469	1,620	0,069	0,236	0,001	0,010	0,072	0,042	-0,001	0,000	0,282	0,113	0,027	0,121	-0,193	0,165