

# From Revenue to Value Added Taxes: Welfare and Fiscal Efficiency Effects in Brazil\*

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**Contents:** 1. Introduction; 2. The CGE Model – Main Features; 3. The Model Data Base; 4. Simulations and Closure; 5. Fiscal Reform Impacts; 6. Conclusion.

**Keywords:** Taxation reform, Fiscal policy, PIS/PASEP and COFINS, Computable general equilibrium, Welfare.

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This paper presents an evaluation of the economic impacts from the taxation reform of PIS/PASEP and COFINS that started to be collected by two regimes (cumulative and non-cumulative) associated to domestic flows and to levy imports. The evaluation made with a computable general equilibrium model adapted to new fiscal system characteristics indicates that the effects of this reform would have deteriorated macroeconomic, labor market and welfare indicators.

*Este artigo apresenta uma avaliação dos impactos econômicos da reforma tributária do PIS/PASEP e da COFINS, que passaram a ser arrecadados por dois regimes (cumulativo e não-cumulativo) associados aos fluxos domésticos e a onerar as importações. A avaliação feita com um modelo de equilíbrio geral computável adaptado para as novas características do sistema tributário indica que esta reforma teria deteriorado indicadores macroeconômicos, do mercado de trabalho e de bem-estar.*

## 1. INTRODUCTION

Since the promulgation of the 1988 Constitution several initiatives took place in the scope of the Union aiming at changing the Brazilian tributary system. Among the implemented changes, the most significant ones were:

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- (1) the introduction of the “Contribuição Provisória sobre Movimentação Financeira” (CPMF)<sup>1</sup> in 1993, and
- (2) the taxation reform that affected the “Contribuição do Programa de Integração Social e de Formação do Patrimônio do Servidor Público” (PIS/PASEP) and the “Contribuição para a Seguridade Social” (COFINS) started in 2003 and completed in 2004.<sup>2</sup>

Prior to this reform, PIS and COFINS were cumulative taxes that charged firms' gross revenue and did not levy imports. The initial proposal of the reform was the complete conversion of these cumulative (on gross revenue) taxes in non-cumulative (on value-added) ones in order to induce economic efficiency gains by reducing the incentives to excessive vertical integration of firms. Also, the reform intended to improve the national firms' competitiveness by applying them on imports of goods and services and maintaining the exemptions to exports. By means of this reform, in 2003 the incidence of PIS on firms' gross revenue was partially changed to firms' value-added, that is, this cumulative tax was partially converted to a non-cumulative one. In 2004, the COFINS was subject to a similar change and both taxes started levying imports of goods and services.

Table 1 presents the recent evolution of some amounts of tax collections: Total, Union (broad Federal Government) and PIS-COFINS. Once the later ones are federal taxes, their joint collection is compared to the Union values.

Table 1: Tax collection and PIS-COFINS participation (R\$ millions – Nominal values)

Year	Total	Union (1)	PIS-COFINS (2)	(2) / (1)
1998	271,856	186,561	24,786	13.3%
1999	309,420	215,915	40,366	18.7%
2000	357,646	247,420	48,025	19.4%
2001	407,668	281,300	56,674	20.1%
2002	479,368	335,441	62,410	18.9%
2003	543,344	377,285	74,902	19.9%
2004	633,810	441,594	97,010	22.0%
2005	724,113	507,172	108,244	21.3%

Source: Receita Federal (2003, 2006).

It is observed an increase in the participation of PIS-COFINS collections in the Brazilian Federal public sector (Union) fiscal revenue and that from 1998 to 1999 and from 2003 to 2004 this share increased in a more significant way. In the first period: (1) COFINS rate applied on firm's total gross revenue was raised from 2.0% to 3.0%, and (2) PIS and COFINS started levying Financial Institutions (Law 9718/98). In 2004, the year in which the reform was completed, this participation achieved 22%.

Table 2 shows the four main tax groups in Brazil:

- (1) the total state level value-added taxes (ICMS),<sup>3</sup>
- (2) all forms of Income Tax (IR),<sup>4</sup>

<sup>1</sup>Financial transactions tax that has not been applied since December 2007 when the Brazilian Senate extinguished its validity.

<sup>2</sup>Henceforth, these taxes will be respectively referred as PIS and COFINS.

<sup>3</sup>ICMS (Imposto sobre Circulação de Mercadorias e Serviços).

<sup>4</sup>Income Tax: on Individuals (IRPF), on Firms (IRPJ) and withheld at source (IRRF).

(3) PIS-COFINS, and

(4) the Social Security Contributions (SSC – from employees and employers).

Table 2: Main taxes in Brazil (R\$ millions – Nominal values)

Year	ICMS (1)	IR (2)	PIS-COFINS (3)	SSC (4)	(3) / (1)	(3) / (2)	(3) / (4)
1998	60,886	47,724	24,786	46,641	40.7%	51.9%	53.1%
1999	67,885	55,215	40,366	47,425	59.5%	73.1%	85.1%
2000	82,279	59,840	48,025	55,715	58.4%	80.3%	86.2%
2001	94,267	70,126	56,674	61,060	60.1%	80.8%	92.8%
2002	105,386	90,673	62,410	71,028	59.2%	68.8%	87.9%
2003	120,233	100,053	74,902	80,730	62.3%	74.9%	92.8%
2004	138,275	109,622	97,010	93,765	70.2%	88.5%	103.5%
2005	154,810	132,287	108,244	108,434	69.9%	81.8%	99.8%

Source: Receita Federal (2003, 2006).

It is observed that, in 1998, the PIS-COFINS amount as equivalent to 52% of the Income taxes collection and 53% of the Social Security collection. Henceforth, its amount grew faster than the other amounts, presenting, between 1998 and 2004, a growth rate of 291%, followed by IR with 130%. Following this path, in 2004 the PIS-COFINS exceeded all revenues from Social Security Contributions, becoming the third bigger tax group, surpassed only by ICMS and all forms of Income Tax. Again, as in Table 1, it deserves mention the significant increase in the ratios presented in the last three columns, in Table 2, from 2003 to 2004.<sup>5</sup>

The data presented in previous tables show that the PIS-COFINS evolution changed in 2003 and 2004, when their taxation regimes were modified by:

- (i) the introduction of a non-cumulative form of incidence for both taxes and
- (ii) their incidence on imports of goods and services.

Despite the analysis will focus on economic variables, some aspects of the related legislation deserves be emphasized to justify some methodological issues. In order to better understand this taxation reform the Table 3 identifies the main federal laws that had accomplished these changes, with a summary of their content and beginning date.

The Law 10637/2002 (December 2002) introduced the non-cumulative regime for PIS. The main modification was the change of its rate and incidence base from 0.65% on firm's gross revenue to 1.65% on firm's value added, following a credit and debit system similar to the one adopted by the ICMS. Despite the Federal Government would intend generalize these changes, exceptions and exemptions were established for: firms that have chosen the income tax bill estimation form based on "Lucro Presumido" (a type of profit estimation based on a fixed percentage of revenues), firms that were under the "SIMPLES" taxation system, firms located in the "Zona Franca de Manaus", Financial Institutions and the sectors whose collection system is called "antecipação monofásica" (a single-phase anticipation process). Finally, the exports exemptions from PIS were maintained.<sup>6</sup>

<sup>5</sup>These ratios also significantly increased in 1999.

<sup>6</sup>The exports were exempted from PIS/PASEP and COFINS by the Provisional Remedy 2158-35/2001.



Table 3: Main Federal Laws related to PIS-COFINS reform

Legal Instrument	Changes	Starting date
Law 10637/2002	Establishment of non-cumulative regime for PIS on domestic flows.	January 2003
Law 10833/2003	Establishment of non-cumulative regime for COFINS on domestic flows.	February 2004
Law 10865/2004	PIS and COFINS start levying imports of goods and services. Several tax exemptions were established.	May 2004
Law 10925/2004	Reduction of PIS and COFINS rates on agricultural inputs public concession, postal services and tourism package selling firms PIS and COFINS rates on crops and cattle products were reduced to zero and a forecasted credit system ("crédito presumido") is created to agribusiness activities.	November 2004
Law 11033/2004	PIS and COFINS rates on printed media were exempted.	January 2005
Law 11051/2004	The time period for using the PIS-COFINS credit to investment goods goods was reduced. Outsource in transport operations and software services software services were exempted extended. It the exemption or reduced rate to benefit all manufactured food.	January 2005

By means of the Law 10833/2003 (December 2003), one year after the beginning of the non-cumulative regime for PIS, a similar regime was also established for COFINS with tax rate of 7.6% on value-added to do not change the COFINS collection level (SE-MFaz, 2004, p. 2). Beyond allowing the exceptions and exemptions mentioned in the previous paragraph, the option to stay in the old cumulative regime was given to many kinds of activities,<sup>7</sup> among them: health insurance firms, values monitoring and transport services, cooperative societies, telecommunications services and media companies, public multi-modal transportation services, health services provide by hospital or similar units and all kinds of educational services. Finally, the exports exemptions from COFINS were maintained.

The taxation reform was completed by means of the Law 10865/2004 (March 2004) by which PIS and COFINS started levying imports of goods and services. The basic percentage tax rates were the same for domestic flows, 1.65% and 7.60%, summing up to 9.25%, but levying a different base from that one that is considered for Import Tariff (CIF value) collection. In the PIS-COFINS case, beyond the imports CIF value, must be added the Import Tariff (IT), a tax on manufactured products (IPI),<sup>8</sup> the ICMS (mentioned before), and the own PIS-COFINS. Thus, the final effect of this extended base is a multiplier that magnifies the original (nominal) legally established tax rates.

Here again, some exemptions were introduced, for example, all imports under drawback regime and all imported equipments and input goods to the "Zona Franca de Manaus" were totally exempted from these taxes. Besides, some specific goods were also exempted, such as: press paper, intermediate inputs for aircraft and boats (maintenance and construction), equipment for the audiovisual industry, petrochemical nafta and natural gas.

<sup>7</sup>Exemptions were established by means of 17 paragraphs in the law.

<sup>8</sup>IPI (Imposto sobre Produtos Industrializados).

The large number of exceptions, mainly exemptions or suspensions, common to the previously mentioned laws, created a subsequent pressure for the extensions of these benefits that were the main aspect of the Laws 10925, 11033 and 11051. As example of this process, the Law 10637 that created the non-cumulative regime for PIS, was later modified by the Laws 10684, 10833, 10925 and 10996, within only two years from its original edition. Specifically for this work, this “mutant” characteristic caused a significant difficulty to simulate the economic effects of changes in the PIS-COFINS taxation regimes in the context of a dynamic quantitative analysis.

Considering all the previous information, the PIS-COFINS complete reform presented two parts: (1) the “domestic” and (2) the “external”. The first part of the PIS-COFINS reform was basically characterized by the introduction of their: (1) incidence on firms’ value-added (non-cumulative regime) and (2) new rates (1.65% for PIS and 7.60% for COFINS) on value-added. The “external” side of the PIS-COFINS reform presented the introduction of their: (1) incidence on imports of goods and services and (2) new rates (1.65% for PIS and 7.60% for COFINS) on imports. Also, after the PIS-COFINS taxation reform these taxes started being collected by two regimes: (1) the (previous) cumulative and (2) the (new) non-cumulative. As pointed in Table 1 and 2, the PIS-COFINS collections presented significant increase in 2004 and due to their relative importance it seems reasonable to expect that the effects of this reform on Brazilian economy were not negligible and deserves to be addressed.

Given these characteristics, the implementation of PIS-COFINS reform basically induced relative prices changes in the Brazilian economy and, consequently, the economic agents rethought their resource allocation decisions, which characterize a general equilibrium phenomenon. From the individuals’ and families’ point of view, modifications in the relative prices structure can significantly alter their welfare, by means of the changes in the structure of the real incomes and the expenditure of these agents. Besides, the taxation system together with the social public expenditure has been considered very ineffective in changing income distribution in Brazil.<sup>9</sup> Therefore, it seems very appropriate to assess the economic impacts from the PIS-COFINS taxation reform by means of a computable general equilibrium (CGE) model.

Despite the importance of this reform, the literature on its economic impacts is relatively scarce. Thus, it is convenient to present some details on these studies to show how our paper can contribute to address this subject.

Kume (2004) employed a multisectoral fixed prices model, based on IBGE<sup>10</sup> input-output matrix and resources and uses tables, to estimate the change of the domestic protection due to the proposed PIS-COFINS legislation. Although the simulation results from models with price rigidities must be carefully interpreted, among the main results, we can mention that the average domestic protection would have almost doubled, from 7.50% to 14.40% on imports CIF value. However, concerning the results, it is not clear if the simulations have applied the proposed or the approved laws, which has differences for sectors and the way the taxes are calculated. More important, policy analysis in an environment of fixed prices must be interpreted with restrictions, mainly for not allowing agents reaction to relative prices change, which essentially is the initial economic impact induced by the PIS-COFINS reform.

SE-MFaz (2004) reports the results of two studies aimed at estimating the permanent (long-run) impacts of only the “domestic” part of the COFINS reform. According to the first study, this change would have reduced the COFINS tax burden on domestic production, as a proportion of the firms’ gross revenue or value added, at aggregate level and in many sectors with few exceptions.

The second study reports the impacts of the changes in the COFINS taxation regime on its legal and effective tax rates at national and sectoral levels, calculated with an input-output matrix. The results indicate reduction of 7.9% of the tax burden on national production and that almost all the economic

<sup>9</sup>Robinson and El Said (2003) discussed the relationship between CGE Analysis and Income Distribution/Poverty issues. For some aspects of Brazilian fiscal system and inequality see SPE-MFaz (2003, 2005).

<sup>10</sup>Instituto Brasileiro de Geografia e Estatística.



sectors would be benefited by falls in their legal tax rates and mainly in their effective rates. However, the same remarks pointed to Kume (2004) apply to the results from this study.

Although these studies have contributed to shed some light on the impacts of the “domestic” part of the COFINS reform on domestic production, they did not evaluate the “external” part of this taxation reform, which, in our opinion have induced significant changes in the relative price system and in the general price level in Brazil.

Using a recursive and dynamic general equilibrium model Paes and Bugarin (2006) evaluated the macroeconomic and distributive impacts from alternative proposals to a broader taxation reform that would encompass other changes besides the reform of PIS and COFINS. In this sense, despite their contribution to address the effects from a broader reform, the results reported did not present the isolated effects from PIS-COFINS reform that is the objective of our research.

Even though Kume (2004) and SE-MFaz (2004) have contributed to address some impacts of PIS-COFINS reform, they did not evaluate its effects on the price system and the resource allocation in the Brazilian economy. The evaluation of these effects using CGE models was made only by Silva et al. (2004)<sup>11</sup> that present a descriptive section for a “broader tax reform” proposed by the Brazilian government, characterizing the participation of the main indirect taxes, before the PIS-COFINS tax reform. They simulated the implementation of this reform and also tested a possible incidence change for the social contribution of employers.

Although the taxation characteristics in Brazil are very well modeled and they provided useful results to evaluate the potential impacts of the referred reform, some characteristics and assumptions in their study deserves to be commented. First, the model’s database (Social Account Matrix) is for 1998 and the use of more recent data would more accurately express the features presented by the Brazilian economy in the period in which the reform was implemented.

Second, the sectoral effective rates of COFINS on value-added used in the simulation were calculated by extrapolation procedure based on the changes presented in the PIS collection in 2003. Defining the efficiency of a tax on a determined taxation base in a given year as the ratio of its effective rate by its legal rate and the relative efficiency between COFINS and PIS on a determined taxation base in a given year as the ratio of their efficiencies (COFINS by PIS), the COFINS effective rates were calculated assuming that the relative efficiency between these taxes on value-added in 2003 was the same as in 2001, when both taxes were charging the gross revenues only. In other words, it is assumed that the sectoral levels of tax evasion and exemption were the same in the non-cumulative and in the cumulative regimes for each tax.

By this procedure they verified that some sectors would present an effective rate higher than legal rate and, thus, in the simulation, it was assumed that these sectors remained just under the cumulative regime with rate as in 2001.<sup>12</sup> Due to other reasons, this assumption was also applied to other sectors.<sup>13</sup> However, data from Secretaria da Receita Federal<sup>14</sup> show that PIS and COFINS were being collected by means of both taxation regimes in all the sectors present in the used classification. Therefore, the simulated taxation reform presented some characteristics that conflict with empirical data available after this paper.

Concerning the tax rates that would charge imports of goods and services, it was assumed that for each import flow the relation between the PIS and COFINS legal and effective rates would be the same as those presented between the import tariff rates. In this sense, PIS and COFINS legal rates would be subject to a system of exemptions that would make them differ from the effective rates in the same degree verified for the tariff on imports rates, whose differences are due to trade agreements, preference

<sup>11</sup>The model employed in this study was developed from Devarajan et al. (1991).

<sup>12</sup>As Mining, Electronic Equipment and Other chemical products, for example.

<sup>13</sup>As Dwellings and Public Administration, Automobile industry, Pharmaceutical and perfumes, for example.

<sup>14</sup>The Brazilian Tax Collection Bureau.

systems, exemptions and exceptions. It deserves comment that it is possible that this assumption can be conflictive with the empirical data available after this paper.

Third, the model closure admitted full employment of labor and constant capital stocks, which nullify the impacts on GDP by assumption (GDP-neutral effects). Fourth, it is assumed in the simulations that the nominal exchange rate is endogenous while the general price index (GDP deflator) is fixed, which induce price-neutral effects by assumption (no changes in the aggregate price index). Considering the facts that the new PIS and COFINS rates were much higher than the previous ones, even though the changes in the incidence base, and that they started levying imports, it is reasonable to expect price increase and product decrease.

Finally, their focus was the impacts on macroeconomic and the sectoral indicators due to the reform, while we intend to extend the analysis towards individuals' and families' welfare effects, taking the advantage of a specific institutional modeling for these issues. Once there are some points that can be advanced, another evaluation that can contribute to the analysis on the effects of the PIS-COFINS reform on Brazilian economy is justified.

## 2. THE CGE MODEL – MAIN FEATURES

The CGE model used here is an extension from the one presented by Cury et al. (2005)<sup>15</sup> where further details can be found.

### 2.1. The Product Market

#### 2.1.1. Product supply

Foreign product supply is modeled as being totally elastic,<sup>16</sup> while sectoral domestic supply is represented by a three steps nested production function with three types of inputs: labor, capital and intermediate inputs.<sup>17</sup>

First, amounts of types of labor ( $F_1$ ), 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:<sup>18</sup>

$$Ld_i = \prod_l F_{il}^{\beta_{il}} \quad (1)$$

where  $\beta_{il}$  is the share of each type of labor: unskilled informal (l1), skilled informal (l2), formal with low skill (l3), formal with average skill (l4), formal with high skill (l5), public servant with low skill (l6) and public servant with high skill (l7).<sup>19</sup>

Second, in each sector  $i$ , aggregated labor ( $Ld_i$ ) and capital ( $K_i$ )<sup>20</sup> are associated by a constant elasticity of substitution (CES) function to obtain the production level ( $X_i$ ):

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

<sup>15</sup>This model results from a series of developments made in the model proposed by Devarajan et al. (1991), as can be seen in Cury (1998), Barros et al. (2000) and Coelho et al. (2003).

<sup>16</sup>Thus, Brazilian demands for imported goods are fully satisfied without facing external supply constraints.

<sup>17</sup>The model represents the 42 sectors of activities listed in the 2003 Brazilian National Accounts.

<sup>18</sup>This means that an identical increase of every type of worker results in an identical increase of the aggregate worker.

<sup>19</sup>Also, there are more 2 types of employers that are treated as labor and enter in the Cobb-Douglas aggregation.

<sup>20</sup>The model closure adopted in the simulations determines that the sectoral levels of capital are fixed.



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

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,  $X_j$ ):<sup>21</sup>

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

where  $a_{ij}$  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  $\gamma_i$  are model's parameters and  $\rho_{it}$  is the elasticity of transformation.<sup>22</sup>

## 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,<sup>23</sup> 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 the families 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  $\delta$  are parameters, while  $\rho_{ic}$  is the Armington elasticity of substitution between  $D_i$  and  $M_i$ .<sup>24</sup> Finally,  $Q_i$  indicates the utility derived from the consumption of good  $i$ .<sup>25</sup>

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.

<sup>21</sup>It is worth mentioning that Devarajan et al. (1991) makes use of only the first and third steps, by combining capital with labor and value added with intermediate inputs, in this order.

<sup>22</sup>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 al. (1994) to the American economy.

<sup>23</sup>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.

<sup>24</sup>These elasticities values were estimated by Tourinho et al. (2002) for the same sectors considered in the model.

<sup>25</sup>It can be interpreted as the quantity of a hypothetical composite good that would be demanded by consumers.



### 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.<sup>26</sup> 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 of this maximization, for each type of workers, a specific demand curve is defined by the condition that their marginal productivities equalize their wages:<sup>27</sup>

$$P_i * \partial X_{il} / \partial F_{il} = W_{il} \quad (6)$$

The labor market equilibrium (employment and wage) is determined by  $E^l$ , the intersection point between the demand curve ( $L^d$ ) and the wage curve ( $S$ ). The wage level defined by  $E^l$  does not correspond to the labor supply ( $L^0$ ), and the difference  $L^0 - L$  is the excess of labor supply that corresponds to the involuntary unemployment level ( $U$ ) in the economy.<sup>28</sup>

The wage curves adopted here represent the negative relation between the unemployment rate ( $U_l$ ) and the wage ( $W_l$ ) for private worker  $l$  in Brazil.<sup>29</sup>

$$\ln W_l = \alpha_i - \beta_l * \ln U_l \quad (7)$$

<sup>26</sup>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.

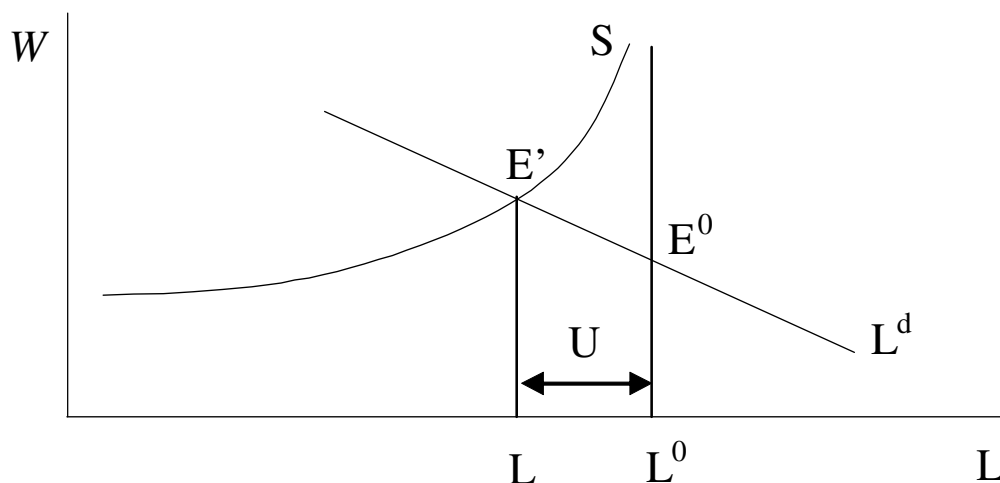
<sup>27</sup>The derivative of the profit function with relation to the factor demand must be equal to the factors' price (first order condition).

<sup>28</sup> $E^0$  would be the full employment level given by the interaction between labor supply and labor demand.

<sup>29</sup>A brief description of wage curves can be found in Cury et al. (2005). Broader explanation about them can be found in Blanchflower and Oswald (1990, 1994).



Figure 1: Equilibrium in the labor market for a given type of labor



where  $\beta_l$  reflects the firm's bargaining power in offering lower wages according to unemployment rate.<sup>30</sup>

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<sup>31</sup> and the labor earnings to workers. In each sector, the payments to capital are distributed to the firms according to their initial share in the total earnings of capital.

The eight types ( $h$ ) of families receive earnings from the seven types ( $l$ ) of labor according to the initial shares ( $\epsilon_{hl}$ ) 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 ( $\epsilon_{hk}$ ). Finally, the families also receive net remittances from abroad ( $RE_h$ ), adjusted by the exchange rate ( $R$ ) and trans-

<sup>30</sup>These parameter values were taken from Reis (2002), who estimated them for the Brazilian case.

<sup>31</sup>Small (self-employed people) and large (other firms).

fers from the Government ( $TG$ ), in the form of payment of benefits (direct income transfers)<sup>32</sup> and as other transfers (essentially domestic debt interest) that are allocated to the families according to the initial shares ( $\theta_{ht}$ ). Therefore, the family ( $h$ )'s income is:

$$Y_h = \epsilon_{hl} * W_l + \epsilon_{hk} * YK + (pinde x) * \theta_{ht} * TG + R * RE_h \quad (8)$$

## 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. Similarly to the families, the sharing of government transfers to the types of firms follows the proportions observed in the base year ( $\theta_k$ ). Finally, it also transfers resources to abroad ( $GE$ ) and its total expenditure is:

$$GG = \sum_i CG_i + pinde x * (\theta_{ht} + \theta_k) * TG + R * GE \quad (9)$$

To face its all expenditures, the Government relies on three types of collections: (1) direct taxes levied on firms' and families' income ( $\phi_h$  and  $\phi_k$ , respectively), and (2) indirect taxes on domestic and 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 ( $SOCBAL$ ).<sup>33</sup> Thus, the Government total revenue is:

$$RG = \sum_h (\phi_h * Y_h) + \sum_k (\phi_k * YK) + \sum_i (\eta_i * X_i) + \sum_i (\xi_i * D_i) + \sum_i ((\pi_i + \sigma_i) * VA_i) \\ + \sum_i ((\mu_i + \kappa_i + \gamma_i) * M_i) + R * gfbor + SOCBAL \quad (10)$$

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

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

The 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:

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

where  $PX_i * X_i$  is the production value,  $PD_i * D_i$  is the gross revenue value from domestic sales and  $VA_i$ ,  $\eta_j$ ,  $\xi$ ,  $\sigma_i$  and  $\pi_i$  were presented in equation 10.

<sup>32</sup>These transfers include the social security benefits as well as other programs such as unemployment benefits, income transfer social programs and other cash benefits.

<sup>33</sup>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 value added of labor.



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  $\xi_i$  and  $\pi_i$  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:

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

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

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  $\gamma_i$  tax rates that were collected from import flows of commodity type  $i$  in 2004.

### 3. THE MODEL DATA BASE

Almost all data used in the 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 al. (2006).<sup>34</sup> 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.

### 4. SIMULATIONS AND CLOSURE

#### 4.1. Simulations – Modeling issue

Pursuing to reduce the cumulativeness of the PIS and the COFINS, the taxation reform has changed part of these taxes incidence from the firms' gross revenue from domestic sales to their value-added and also established a legal (nominal) rate on the later magnitude. Even though a tax on value-added is non-cumulative, the effective tax rate differs from the legal rate because it is established, by law, that to calculate the former rates that must be applied on the value-added amounts, it is necessary to consider the incidence of these taxes on the ICMS rates, which is sector specific. Besides, the legal and the applied rates can be different due to fiscal exemptions.

By the PIS-COFINS *implemented* reform all sectors in the classification used here started to be levied by a taxation regime that is a mix of the cumulative (previous) and the non-cumulative (new) regimes. Thus, as exposed earlier, the domestic part of the simulation will consist in applying the tax rates on domestic sales (production less exports) and value-added amounts, calculated based on 2004 flows, at sectoral level.

More specifically, tax rates changes were calculated based on data of PIS and COFINS collections by taxation base (firms' gross revenue, value-added and imports) obtained from the Secretaria da Receita Federal (SRF). Once these data are classified according to sectoral classification CNAE that differs from the IBGE codification used in the MCS-2003, the sectors in both codes were matched assuring that the aggregated amounts of collections were equal.

<sup>34</sup> Although the matrix will not be described here, further information on it can be requested with the authors.

The taxation reform has also established that, in general, the imports should be levied by a PIS rate of 1.65% and by a COFINS rate of 7.60%. The reform has also admitted different rates to PIS and COFINS on imports to the following sectors: machines and tractors (2.00% and 9.60%); automobiles, trucks and buses (2.00% and 9.60%); oil refinery (2.34% and 10.74%); pharmaceutical and perfumes (2.10% and 10.00%) and other food and beverages products (1.97% and 9.21%).

It is important to mention that the legal compound PIS-COFINS rates are not directly imposed on imports once the legislation establishes that the applied rate is calculated with a specific formula by which these rates must interact with the ICMS and tariff rates on imports, besides themselves.

Also, the existence of special taxation regimes benefiting some import flows by exempting them from tariffs and/or indirect taxes, as for example the imports under the drawback regime, can make the applied rates differ from the legal ones. Then, given these possible differences, the implementation of the incidence of PIS and COFINS on imports will consist in applying the tax rates that were verified from these flows in 2004.

Therefore, the impacts of the PIS-COFINS taxation reform will be simulated by implementing a mixed taxation regime, which consists of the following features:

- (1) the taxes levy sector's revenue from domestic sales and value added,
- (2) application of the new tax rates on domestic flows verified in 2004,
- (3) the taxes start levying imports and
- (4) application of the new tax rates on import flows verified in 2004.

Therefore, we expect that the impacts calculated here will differ from those presented by Silva et al. (2004) because while we will simulate the impacts of the changes in these taxes rates calculated based on the verified collections they simulated the effects of estimated changes in these taxes rates (see the first section).

The taxation reform will be simulated in two steps. First it will be implemented the mixed taxation regime (features (1) and (2)). Then, the PIS-COFINS rates on imports will be also implemented (features (3) and (4)), taking as database the resulting scenario from the first step. Thus, the results from the second step capture all the impacts of the taxation reform. Henceforth, these simulations will be referred as PCVA (domestic reform) and PCVAM (complete reform).

## 4.2. Model closure

As previously mentioned, the model closure is closer to a medium-run type, since it is 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 (subsection 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.



## 5. FISCAL REFORM IMPACTS

### 5.1. Macroeconomic impacts

Once one of the main purposes of the simulation is to evaluate the potential distributive impacts of the PIS-COFINS fiscal reform, the analysis will focus on the impacts on employment, wages and household income. However, the impacts on selected aggregated variables will be presented in order to show the magnitude of the macroeconomic effects.

The simulated macroeconomic impacts of the PIS-COFINS reform are reported in the first column (PCVAM) in Table 4. The effects of just the domestic part of this reform are also reported in the second column (PCVA), even they are not the focus of analysis.

Table 4: Macroeconomic Indicators (percentage change)\*

	PCVAM	PCVA
GDP	-0.70	-0.52
Consumption	-1.13	-0.68
Investment	0.28	-0.51
Public sector revenue	0.54	-0.34
Public sector deficit	-10.30	1.40
Exports	-2.33	-0.33
Imports	-3.00	-0.42
Employment	-1.60	-1.01
Price Index	2.51	-0.16

Note: (\*)real percentage change from base year.

The overall impacts from fiscal reform were adverse since it induced a real GDP fall of 0.70%, an aggregate employment decrease of 1.60% and generated inflation of 2.51%. The effect on real GDP reflects the fact that the reduction of the cumulativeness of these taxes had significantly divergent effects on output at sectoral level.

The taxation of value-added (VA) induced an increase in its price, which was equivalent to a rise in marginal costs. To achieve the equilibrium, in perfect competition, the representative firm need earn higher marginal revenue or reduce marginal costs, which could be done by reducing the VA components usage. Considering the way that the labor market operates and the model's closure features, this implies in a lower labor demand, inducing a decrease in wages, and so, reducing the available income and, consequently, consumption expenditure.

Also, by taxing imports, that is, increasing their prices in domestic market (+6.80%), the reform induced another adverse effect on aggregate consumption. Once domestically produced and imported commodities are not perfect substitutes, even changing the relative prices in favor of the domestic ones,<sup>35</sup> this price increase raised the composite commodities prices in internal market (+2.51%), which induced the households to consume less, but substituting imported commodities by larger amounts of domestic ones. In a similar way, the firms have substituted imported inputs by domestic ones in some extent. However, this positive effect was not strong enough to offset the negative effect on consumption induced by the taxation of imports, and so, there was a second adverse impact on consumption demand.

<sup>35</sup>The prices of the domestically produced commodities sold in the internal market increased by 2.20%.

The macroeconomic closure considers that the investment is determined by the savings behavior and that the Government consumption is fixed. This implies that the changes in the tax revenue affected the Government savings and, therefore, the public deficit and investment. Thus, the investment increased by 0.28% due to the rise of 0.54% in the public sector revenue, which induced a decrease of 10.30% in the public sector deficit.

Exports fell due to the price-responsiveness behavior of external agents and the model external closure characteristics. First, the reform 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.

The fall in aggregate consumption and exports more than offset the increase in investment and the fall of imports. Thus, the PIS-COFINS reform caused a decrease in the national real GDP (−0.70%) and in employment (−1.60%).

Although the implementation of the mixed taxation regimes only (column PCVA) is a more stylized scenario, its effects can reveal some interesting results when compared to the effects from the complete reform (column PCVAM). Although weaker than before, the effect on GDP would still be negative (−0.52%) but, in an opposite way, the total government revenue would fall (−0.34%), inducing decrease of public savings and, therefore, also in investment. This would be the opposite result from the complete reform that shows the importance of PIS-COFINS taxation on imports.

The differences to the results reported by Silva et al. (2004) are due to differences in the simulated impacts and in the models' closures, since they assumed full employment of labor and constant capital stocks, which induces GDP-neutral effects by assumption, and that the nominal exchange rate is endogenous while the general price index (GDP deflator) is fixed, which induces aggregate price-neutral effects by assumption. As expected, the reform induced price increase and product decrease, mainly due to the incidence of PIS and COFINS on import prices.

To better understand the relationship between public sector fiscal revenue and PIS-COFINS taxes according to their three different sources, the amounts for the model base year (2003) and the two simulations scenarios are shown in Table 5.

Table 5: PIS-COFINS values, before and after taxation reform (2003 R\$ millions)\*

	Base (2003) <sup>36</sup>	PCVAM	PCVA
PIS-COFINS other than value added	62,868	32,462	31,836
PIS-COFINS on value added	11,157	45,938	45,030
PIS-COFINS on Imports	—	13,616	—
Total PIS-COFINS	74,025	92,016	76,866

Note: (\*) real values deflated by model price index.

From the data, we can verify that the total value collected in the partial reform (column PCVA) is very similar to the base value with an increase of just 3.84%. These results confirm the hypothesis that only changing the taxation regime would not significantly alter the total PIS-COFINS collection. However, when the taxation on imports are also simulated, the total revenue significantly increases by R\$ 17,991 millions (+24.30%) with PIS-COFINS collection on imports (R\$ 13,616 millions) representing

<sup>36</sup>The base year total value of this table has a small difference from the data reported in Table 1 and Table 2 above because the later has some deductions due to total taxes GDP participation methodology adopted by "Receita Federal".



almost 80% of that growth.<sup>37</sup> This means that the imposition of PIS and COFINS on imports were the major determinants of fiscal revenue rise.

## 5.2. Sectoral impacts

In this section we will analyze the impacts at sectoral level, once each sector performance can vary in a significant way comparing to others. The analysis will be based on a combination of prices and quantities indicators represented by real gross revenues in the table below.

Table 6: Five less and most benefited sectors (real gross revenue in PCVAM\*)

More damaged sectors	Change	More benefited sectors	Change
Leather and shoes	- 5.40%	Chemical elements	3.94%
Steel industry (siderurgy)	- 2.86%	Non-iron metallurgy	1.47%
Retail and wholesale trade	- 2.86%	Rubber industry	0.75%
Coffee industry	- 2.43%	Plastic industry	0.70%
Sugar industry	- 2.14%	Services provided to firms	0.57%

Note: (\*) sectoral nominal gross revenue percentage changes from base year deflated by model price index.

The least benefited sector was Leather and shoes and its performance can be explained by the fall of quantity produced, basically due to decline in exports and consumption. The effects on Coffee and Sugar industries are understood by a similar explanation. The effects on Steel industry and Retail/Wholesale trade are explained in a different way. These two sectors were benefited in the taxation reform by paying lower indirect taxes amounts that reduced their production prices. Besides this price decrease, the Steel industry also presented fall of output due to the reduction of its domestic sales and exports. In the case of the Retail/Wholesale trade the increase in output was not strong enough to offset the effects on prices.

On the other hand, the fifth most benefited sector was the Services provided to firms that benefited from a price effect due to a difficulty in finding substitution for its products. The two most favored sectors, Chemical elements and Non-iron metallurgy shared the property of increases in production prices and quantities. These combinations of effects were possible in the context of a strong sectoral import substitution in the market of intermediate inputs. The increase in the real gross revenue of the Rubber and the Plastic industries were due to increase in their prices, above the general price index, that offset the fall in their output levels.

## 5.3. Impacts on employment and wages

The taxation reform has reduced the aggregate employment by 1.60% (see Table 4). Now it will be presented the fiscal reform impacts on employment by labor type.

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

Among workers in the private sector, the effects were more pronounced among the less skilled ones, regardless their labor contract status (L1 and L3). The second higher impacts were on employment of

<sup>37</sup> Despite not being a good method for comparison, the total value showed in Table 4 agree with the amount verified in 2004, when it is deflated, R\$ 91,140 millions (see Receita Federal (2006)), since it is just 0.96% higher than this value.



Table 7: Change in employment from the base-year (%)

	L1	L2	L3	L4	L5	L6	L7
PCVAM	- 3.04	- 0.96	- 1.84	- 0.65	- 0.88	0.00	0.00
PCVA	- 2.14	- 0.50	- 1.10	- 0.25	- 0.48	0.00	0.00

Note: L1-unskilled informal; L2-skilled informal; L3-formal with low skill; L4-formal with average skill;

L5- formal with high skill; L6-low skilled public servant; L7-highly skilled public servant.

more skilled workers, also regardless contract status (L2 and L5). The less affected category would be the formal with average skill worker (L4).

In our interpretation, with lower imports there was a pressure to overvalue the exchange rate that has tended to make exports more expensive, which was reinforced by an increase in input prices used to produce exported goods. The sectors in which exports are more sensible to price changes are the most traditional ones. Thus, by exporting less, there was a tendency for these sectors to produce less and, therefore, to employ less workers, especially the less skilled ones.

The decreases in employment of more skilled workers were due to the fall in the output of sectors that produce goods with higher technological content and demand this kind of worker in a more intensive way (automobiles, auto parts, electronic equipments, pharmaceutical, financial services and services provided to firms, for example).

Now, it will be presented the effects on wages by labor type. It is worth remembering that, it is assumed that the sectoral wage differentials are rigid. Thus, the wage structure can only react to the type of labor. As a consequence, we report, in Table 8 the changes in real wages for each type of worker without any sector desegregation.

Table 8: Change in the average real wage from the base-year(%)

	L1	L2	L3	L4	L5	L6	L7
PCVAM	- 1.27	- 0.92	- 1.10	- 1.20	- 1.56	- 1.87	- 1.84
PCVA	- 0.93	- 0.50	- 0.70	- 0.46	- 0.90	- 1.71	- 1.13

Note: L1-unskilled informal; L2-skilled informal; L3-formal with low skill; L4-formal with average skill;

L5- formal with high skill; L6-low skilled public servant; L7- highly skilled public servant.

Note that the general effect was a real wage fall. The real wage of informal workers (L1 and L2) fell relatively less comparing to the other categories. Among private sector workers, the decreases in wages were lower among the less skilled workers (L3 and L4) and the fall strength was proportional to the increase in qualification. The higher reductions of public servants' earnings were due to the assumption that the equilibrium in their labor market is almost exclusively achieved by means of adjustments in wages.

In general terms, it does not seem that there was a labor category that had benefited more or less from the reform in a very significant way. Classifying the workers from the most to the less benefited worker group, according to the impacts on employment, we would have this ordering: public servants, formal with average skill, highly skilled and low skilled. However, according to the impacts on average



real wage, we would have almost the opposite ordering. The classification of workers into informal, formal private and formal public categories also does not show any pattern.

#### 5.4. Impacts on household income

The effects of the fiscal reform on household income are presented in Table 9.

Table 9: Change in household income from the base-year (%)

	L1	L2	L3	L4	L5	L6	L7	L8
PCVAM	-1.28	-0.16	-1.20	-1.24	-1.18	-0.96	-1.21	-1.27
PCVA	-0.84	-0.10	-0.78	-0.81	-0.76	-0.62	-0.77	-0.83

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.

The results show that all types of households had their real incomes negatively affected by the fiscal reform. It is notorious that only the poor urban families headed by non-active individuals (F2) presented a much lower decrease in their real income ( $-0.16\%$ ) comparing to the fall experienced by the other types of families (stronger than  $-0.96\%$ ). This happens because the total income of family F2 presents the lowest dependency on labor earnings.

In Brazil, the labor income has large weight in the total household income. Nevertheless, income transfers have an important participation, mainly for the poor households by means of the social security retirement pensions and benefits, besides the direct transfers from social programs (as “Bolsa Família”).

Considering the distribution of impacts on families’ real income, it is not clear that the reform had affected the inequality in income distribution in Brazil. However, the reform had almost linearly reduced the average real income and induced a decrease in employment and consumption, then, it is possible to interpret the general impact from the reform as a welfare reducing one.

Table 10 reinforces the argument that the taxation reform would not have affected the inequality in income distribution.

Table 10: Income inequality indicators

	Base year	PCVAM
Poor income / total income	5.86%	5.86%
20% poorest / 30% richest	9.02%	9.03%
20% poorest / 5% richest	23.18%	23.22%

Note: Poor or the 20% poorest (F1 + F2 + F3), 30% richest (F7 + F8), 5% richest (F8).

Therefore, taking in account the income levels, the main losers of PIS-COFINS tax reform would be the poorest households. Even it is not so clear to infer that the reform would unequivocally worse the

income inequality, it is reasonable to expect that it increased the poverty gap, once the poor families' real income levels have fallen, and had reduced more their, already low, consumption levels.

## 6. CONCLUSION

In this paper, we have investigated the effects of a change in the Brazilian Fiscal System on some economic indicators, also trying to infer the impacts on social welfare. More precisely, together with macroeconomic indicators we have estimated how wages and employment structures, as well as the household income distribution would react to the tax reform characterized by the introduction of a mixed (cumulative and non-cumulative) taxation system for PIS/PASEP and COFINS, and by their incidence on imports of goods and services.

Despite the increase of Government fiscal revenues and the reduction in the public deficit, that induces increase in investment, the results show that the reform caused adverse effects on macroeconomic aggregates, as real GDP, general price level, employment, consumption and external trade flows (exports and imports). Also, the strength of changes induced by the reform would depend on the taxation level of PIS-COFINS on imports. As imports are taxed, the public sector indicators became better but the negative effects on other macroeconomic variables were enhanced, except for investment.

For the labor market, we can notice a clear general deterioration, but the effects differ among categories of workers. The negative impacts on employment structure were concentrated among less skilled workers in the private sector (L1 and L3), regardless their labor contract status. The second higher impacts would be on employment of more skilled workers (L2 and L5), also regardless contract status. These effects are due to the decrease in exports of sectors that represent large shares in these workers distribution along productive activities. Again, the intensity of results was magnified with taxation of imports.

There was a general welfare loss for all families. Only the poor urban families headed by non-active individuals would present a relatively lower fall in income due to their lower dependency on labor earnings. All the other families presented real income decreases very close to the others. Therefore, according to the simulation results, considering the real income level the main losers of PIS-COFINS tax reform were the poorest households. Even it is not so clear to infer that the reform would unequivocally worsen the income inequality, it is reasonable to expect that the reform had increased the poverty gap, once the poor families' real income levels would fall, reducing more their relatively lower consumption levels.

Finally, it deserves be emphasized that the imposition of PIS and COFINS taxes on imports induced a stronger and much more relevant impacts than the effects related to the domestic flows, which consisted in partially changing the tax base from firms' 'gross revenue to firms' value-added, especially because of the induced increase in the general prices level, whose control was and still is very important for the macroeconomic policy management in Brazil.

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