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Assessing the impact of the 2007 tax reform on poverty and inequality in Uruguay

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Abstract

In the context of a sharp rise in the incidence of poverty and increasing inequality since the end of the last decade, a major tax reform was put into place in mid-2007 with the explicit goals of promoting both greater efficiency and equity in the Uruguayan tax system. Overall, the reform substantially increased direct taxes on personal income by increasing marginal rates, lowered indirect taxes and direct taxes on firms, harmonized employer contributions to social security across sectors and eliminated some highly distortionary taxes.

The joint effects of these changes on the macroeconomic equilibrium, labour markets, and poverty and inequality are assessed using a top-down static CGE, a microsimulation approach. It is shown that full implementation of the tax reform has substantial general equilibrium effects which generally strengthen the reduction of poverty incidences, poverty gaps and the severity of poverty exclusively due to the introduction of the personal income tax (without behavioural responses). Regarding poverty, the general equilibrium effects are significantly greater than the direct effects. Overall, we estimate a one-point reduction of the Gini index due to the reform.

JEL classification: C15, D58, H20, I38

Keywords: Tax reform, CGE models, Microsimulations, Poverty, Inequality

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1. Introduction

Uruguay has historically had lower poverty and inequality than the rest of the Latin-American region, but trends in this regard have not been encouraging in recent years. The incidence of poverty declined significantly in the first half of the 1990s compared to the previous decade. Unfortunately, this trend shifted into reverse in 1995, when the incidence of poverty began to climb, especially during the economic recession that began in 1999 and climaxed in 2002 with a severe financial crisis. Wages lost more than 20% of their purchasing power during this period and the unemployment rate reached its historical maximum.

Table 1: Poverty, labour market indicators and GDP in Uruguay, 1990-2007

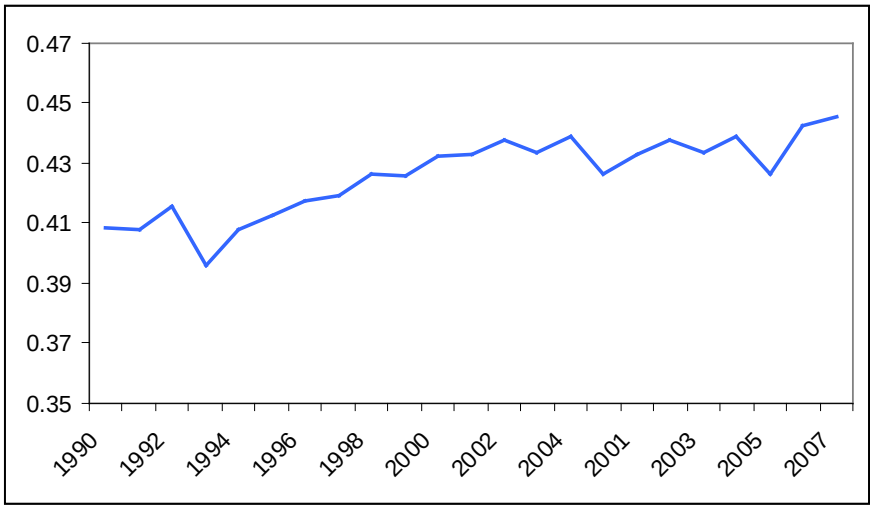
Year	Extreme poverty (%) 1/	Moderate poverty (%) 1/	Poverty gap (%) 1/	Unemployment rate (%) 1/	Annual growth rate of real wage (%)	Annual growth rate of GDP (%)
1990	3	29.7	30	8.5	-7.7	0.3
1991	2.1	23.4	30	8.9	4.3	3.5
1992	1.8	19.9	30	9.0	2.2	7.9
1993	1.2	17.1	30	8.3	4.8	2.7
1994	1.2	15.3	30	9.2	0.9	7.3
1995	1.6	17.4	30	10.3	-2.6	-1.5
1996	1.7	17.2	29	11.9	0.6	5.6
1997	1.2	17.2	28	11.4	0.2	5.1
1998	1.6	16.7	30	10.1	1.8	4.5
1999	1.2	15.3	29	11.3	1.6	-2.8
2000	1.5	17.8	30	13.6	-1.3	-1.4
2001	1.3	18.8	30	15.3	-0.3	-3.4
2002	2.0	24.3	31	17.0	-10.7	-11.0
2003	3.0	31.3	33	16.9	-12.4	2.2
2004	3.9	31.9	34	13.1	-0.1	11.8
2005	3.4	29.8	34	12.2	4.6	6.6
2006	2.1	26.8	32	11.4	4.4	7.0
2007	2.1	25.5	32	9.6	4.8	7.4

Source: National Institute of Statistics (INE), Central Bank of Uruguay (BCU).
1/ Refers to urban population. Official estimates, using INE-2002 methodology.
Extreme poverty line: the cost of the basket of basic food deemed necessary for an individual. Moderate poverty line: the cost of the basket of goods deemed necessary to live at the socially accepted minimum.
Poverty gap: the distance of the poor below the poverty line, as a proportion of the line.

In spite of strong post-crisis economic growth and reduced unemployment, the incidence of poverty is still high compared to the mid-nineties. In 2007, 25.5% of the urban population[1] was below the national poverty line, a higher percentage than in 1991. Post-crisis poverty reduction did not lower the Gini inequality index. Indeed, the economic crisis favoured a concentration of income as shown in Figure 1.

[1] The rural population in Uruguay is only 6.3% of total population.

Figure 1: Gini index



Source: Developed from the National Household Survey, National Institute of Statistics (INE).

It was in this context that the government that took office in March 2005 sent a tax reform bill to congress. The bill was passed in January 2007 and came into force by mid-2007.[2] It was the first structural tax reform in 30 years and the government expected it to play an important role in income redistribution.

Some studies have focused on analyzing the effects of the pre-reform tax scheme on the distribution of income (Grau and Lagomarsino, 2002; Perazzo, Robino and Vigna, 2002). The focus of other studies was to propose and evaluate tax reforms (Barreix and Roca, 2003 and 2006; Grau, Lorenzo and Oddone, 2004).

Recently, Amarante, Arim and Salas (2007) analyzed the poverty and inequality impacts that the 2007 tax reform had on disposable household incomes (via changes in value added taxes and direct income taxes) by applying an arithmetical microsimulation approach. Their analysis of the tax change finds redistributive effects: the pre-reform tax system was practically neutral when viewed in terms of inequality, while the new tax system is progressive and has a small and positive impact on inequality. This is because the reduced value added tax is less regressive and direct taxes are now more progressive. They also find that the changes in value added and direct income taxation have a somewhat positive impact on the incidence of poverty. This impact is largely explained by price reductions resulting from the change in the value added tax, a change that these researchers assumed to have been entirely translated into consumer prices.

[2] Uruguayan Law Nº 18 083, known as the Tax System Reform.

Although these studies indicate substantial progress in understanding of Uruguayan tax policy and the impacts of such policy, they are all based on partial equilibrium analysis and are mainly arithmetical microsimulations. However, a policy shock such as the tax reforms of 2007 could lead to changes in the behaviour of agents, induce reallocation of resources and generate feedback effects on household income, consumption and savings. This study aims to assess the impact of the four main changes introduced by this tax reform by using a methodology that accounts for general equilibrium effects. These changes are: a) introduction of a new income tax on households; b) changes in the tax base and value added tax rates along with elimination of two other indirect taxes on goods; c) modification of labour taxes by harmonizing employers' contribution rate to social security across sectors; and d) a reduction in direct taxes on firms by introducing the FDIRTAX[3] (which mainly replaces the PROFTAX[4]).

With the goal of evaluating the effects of these four main components of the reforms, a static computable general equilibrium model (CGE) was built and then linked to a microsimulation model to capture the macro-micro links. The effects of the main tax changes on (aggregate and sectoral) output and employment on the fiscal balance, poverty and inequality are then assessed.

2. Brief description of the Uruguayan tax system and main features of the tax reform

2.1 The pre-reform tax structure

Before the 2007 tax reform, the Uruguayan tax system included a large variety of taxes, a few of which formed the bulk of tax revenues. The most important of these were the value added tax (VAT), an excise tax[5] and a tax on profits. Nearly 70% of fiscal revenues (excluding social security taxes) originated from the VAT and the excise tax, while the tax on profits accounted for a further 13% of these revenues. The pre-reform direct income tax on labour and pensions[6] amounted to 5% of total fiscal revenues.

Before the reform, Uruguay had one of the highest value added tax rates in Latin America (Perazzo Robino and Vigna 2002). The effective tax rate differed among goods,

[3] Impuesto a la Renta de las Actividades Económicas (*Tax on Profits of Economic Activities).*
[4] Impuesto a la Renta de la Industria y el Comercio (*Tax on Profits of Industry and Commerce).*
[5] Impuesto Específico Interno (*Specific Domestic Tax),*an excise tax on certain goods (tobacco, fuel, beverages, sugar, vehicles, and cosmetics).
[6] Impuesto a las Retribuciones Personales (*Tax on Salaries and Pensions).*

with three different VAT rates: the basic rate that most goods are taxed at (23%), the minimum rate (14%) and a third set of goods that were exempted from the VAT. Despite these high tax rates, exempted goods were a large share of total consumption (nearly 40%, according to Amarante, Arim and Vigorito, 2007).

A large number of sales taxes only contributed a small share of fiscal revenues, most of which were eliminated under the current reform. Two of these eliminated taxes are particularly worth mentioning: an intermediate consumption tax[7] and health tax[8]. The 3% intermediate consumption tax was meant to finance the increasing social security deficit and thus worked as a tax on economic activities that increased the cost of intermediate consumption, possibly increasing prices. The health tax was a 5% specific tax on health services which were exempt from the VAT, which implied that health services could not deduct value added taxes paid on intermediate inputs. The effect was higher costs for these services.

At the international level, tax rates in Uruguay were low for income and profits and were high for goods and services. According to Perazzo, Robino and Vigna *(*2002) only 28% of Uruguayan tax revenues in the late nineties were collected from direct income taxes, while the share was much higher in developed countries (for example, 89% for the USA and 63% for Germany). Indeed, the Uruguayan share of revenues from direct taxes was much lower than in other South American countries (such as 42% for Argentina and 53% for Brazil. The incidence of the direct income tax (was much lower than in other countries, and it was only applied on wages and pensions as opposed to revenues from financial and real-estate capital, which were not taxed. As such, the system did not respect the criterion of horizontal equity (Barreix and Roca, 2003).

In terms of its distributive impact, preceding studies pointed out the regressive nature of the pre-reform tax structure (Grau and Lagomarsino, 2002; Barreix and Roca, 2003). Firstly, the personal tax was a progressive tax on wages and pensions, reflected by an average tax rate that increased with the tax base. It was not, however, a progressive tax on household income as a whole because capital income is a higher share of income in wealthier households, but was not taxed. Secondly, the effective VAT rate by decile of

[7] Contribución al Financiamiento de la Seguridad Social (*Contribution to the Financing of Social Security*).
[8] Impuesto Específico a los Servicios de Salud *(Specific Tax on Health Services).*

household income clearly shows that this tax is regressive due to the relatively high share of consumption in total household income in the lower deciles.

Finally, social security charges include contributions from both employers and employees, each of whom faces different pension and health insurance tax rates. The employer contribution (which was modified under the 2007 reform) consisted of a pension tax and a health insurance tax, respectively equal to 12.5% and 5% of payroll, for an overall employer contribution to social security (ECSS) of 17.5% of gross wages. This contribution was sector-specific as some sectors were exempted and others were taxed at considerably higher rates than those of the general regime.[9]

In sum, preceding studies pointed out that the pre-reform tax structure was complex, regressive and specific to sector of activity and source of income. A high share of fiscal revenues came from consumption taxes, taxes which depend on source of income, and numerous taxes that were a small portion of the public tax take. In terms of the distributive effects of tax policy, preceding studies showed that there was scope to use the tax structure as an instrument for redistribution.

2.2 Main features of the 2007 tax reform

The explicit goals of the 2007 tax reform are: i) to promote greater equity in the tax structure by linking the tax burden to each agent's taxpaying capacity, ii) to promote greater efficiency of the tax scheme and iii) to stimulate investment and employment.

To these ends, the main reforms involved: a) introduction of a direct personal income tax[10] to replace the previous wages and pensions tax; b) changes in the tax base and rates of the VAT along with elimination of the intermediate consumption tax and the health tax; c) modified labour taxes, through a harmonized employer contribution rate to social security (payroll taxes) across sectors; and d) introduction of the direct tax on firms which largely replaced the industry and trade tax. Also, in order to simplify the tax structure, twelve taxes totalling approximately 20% of total fiscal revenues were eliminated.[11] The direct personal

[9] Manufacturing and passenger transportation were exempted from the pension contribution; electricity and the public petroleum refiner paid 6.5%; the rate for public sector activities and for public enterprises were respectively 19.5% and 24.5%. Construction was taxed at a fixed rate of 76% that included both personal and employer contributions plus financing of other benefits received by workers. Finally, a special regime was in place for rural activities, with the tax applied on productive land and not on labour.

[10] Impuesto a la Renta de las Personas Físicas, (IRPF in Spanish).

[11] The other eliminated taxes are: Tax on Banks Assets (IMABA), Tax on Financial System Control (ICOSIFI), the health tax on small enterprises (IPEQUE), Tax on Commissions (ICOM), Tax on

income tax is a dual tax which treats capital and labour income differently. Capital revenues are taxed at 3-12% (depending on source of income). Taxes on labour income are nonlinear, with minimum non-taxable income and marginal tax rates ranging from 10-25% according to tax bases defined in terms of the BPC (*Basis for Contributive Benefits*).[12] The direct income tax allows medical costs to be deducted for both children under the age of 18 and pensioners and it also allows social security payments to be deducted.[13] These items can be deducted to determine taxes on labour income and pensions but cannot be used as deductions against capital income. Table 2 presents the bases and rates of direct income tax on labour and pensions together with the previous wages and pensions tax and table 3 shows the new rates on capital income.

Table 2: Bases and rates of direct personal income tax and the wage and income tax

Direct personal income tax on labour income			Wages and pension tax		
Monthly income*	**Tax rate**	**Income**	**Monthly income**	**Tax rate**	**Income**
Up to 5 BPC	Exempt	Wages Pensions Non wage remunerations	Up to 3 BPC	Exempt	Wages
More than 5 and up to 10 BPC	10%		More than 3 and up to 6 BPC	2%	
More than 10 and up to 15 BPC	15%		More than 6 BPC	6%	
More than 15 and up to 50 BPC	20%		Up to 6 BPC	Exempt	Pensions
More than 50 and up to 100 BPC	22%		More than 6 BPC	2%	
More than 100 BPC	25%				

* Although the personal income tax is an annual tax, it is expressed on a monthly basis to make it comparable to the wages and pensions tax.
Source: Authors' elaboration based on data from the Ministry of Economics and Finance

Telecommunications (ITEL), Tax on Credit Cards (ITC), Tax on Forced Sales (IVF), Tax on Agricultural and Farming Activities (IRA), Tax on Sportsmen, Tax on Auction Sales, Tax on Contests and Competitions (ICSC). The reforms also anticipate gradual elimination of the Tax on the Purchase of Foreign Currency (ICOME) and other minor taxes.

[12] The BPC is a unit of account that is adjusted according to average wage growth. The nominal value of the BPC was 1636 Uruguayan pesos (approx. 74 dollars) in January 2007.

[13] In the first case, the contributor is able to deduct 6.5 annual BPC for each child. In the case of pensioners, the allowed deductions for medical care are 12 annual BPC.

Table 3: Bases and rates of personal income taxes on capital

Concept	Tax rate	Income
Interest on deposits over one year in financial institution	3%	Pure revenues from capital
Interest on deposits, under a year in financial institutions	5%	
Interest on bonds and other debt securities, longer than three-year maturity	3%	
Distributed profits	7%	
Other rents	12%	

Source: Authors' elaboration based on data from the Ministry of Economics and Finance

The changes in the VAT consisted in reducing the base rate from 23% to 22% and the minimum rate from 14% to 10%. Also, some goods that were exempted before the reform are taxed at the minimum rate or at the base rate in the post-reform situation.[14] The sales tax on health services and the tax on intermediate consumption of goods were also eliminated.

On the other hand, the reform established a uniform employer pension contribution rate of 7.5% for industrial, commercial and services sectors, as well as for public enterprises. The health insurance rate is still sits at 5%, for an overall ECSS rate of 12.5% in the post-reform situation as opposed to the pre-reform rate of 17.5%. The 19.5% tax rate for public sector activities remains the same, as does the exemption for passenger transportation. Pre-reform and post-reform ECSS rates by sector and value added tax rates by commodity (defined as any category of goods and services subject to the VAT) are presented in table 4.

Finally, the previous tax on profits was relatively high at 30% of profits. The actual level of this tax was sector-specific: some activities were exempt and others paid the full tax rate. The reform studied in this paper aimed for a more neutral system by reducing the tax rate to 25% and standardizing it across all sectors. Dividends distributed to households are charged an additional 7% in the form of a direct personal income tax on capital, which effectively means that the reform stimulates re-investment of profits by firms.

[14] E.g. health services and passengers transportation are taxed at the minimum rate while tobacco is taxed at the basic rate.

Table 4: Employer contribution to social security and value added tax rates: pre- and post-reform

Sectors	Employer contribution to social security		Value added tax	
	Pre reform	Reform	Pre reform	Reform
Primary except livestock	-----	-----	9.8%	15.4%
Livestock	-----	-----	0.0%	0.0%
Meat, fruit & veg.	5.0%	12.5%	23.0%	22.0%
Mills, sugar & vegetable oils	5.0%	12.5%	14.0%	10.0%
Dairy	5.0%	12.5%	8.6%	12.4%
Other food industry	5.0%	12.5%	21.5%	20.0%
Press	5.0%	12.5%	0.0%	0.0%
Petroleum refining	6.5%	7.5%	5.9%	4.2%
Pharmaceutical industry	5.0%	12.5%	14.0%	10.0%
Metal products and machinery	5.0%	12.5%	22.3%	21.4%
Other manufacturing	5.0%	12.5%	23.0%	22.0%
Electricity and gas	6.5%	7.5%	`	22.0%
Water	24.5%	7.5%	0.0%	0.0%
Construction	32.6%	23.3%	0.0%	0.0%
Commerce	17.5%	12.5%	16.0%	15.8%
Hotels	17.5%	12.5%	14.0%	10.0%
Passenger transport	0.0%	0.0%	14.0%	10.0%
Communications	24.5%	7.5%	23.0%	22.0%
Financial services	17.5%	12.5%	0.0%	0.0%
Public administration	19.5%	19.5%	0.0%	0.0%
Private education	0.0%	0.0%	0.0%	0.0%
Hospitals	17.5%	12.5%	0.0%	10.0%
Other health services	17.5%	12.5%	0.0%	22.0%
Other services	17.5%	12.5%	23.0%	22.0%

Source: Authors' elaboration based on data from the Social Security Bank and the Ministry of Economics and Finance

2.3 Expected effects

Implementation of the direct personal income tax directly affects the household budget constraint. Households in the first eight deciles of the income distribution have more disposable income following the reform whereas households in the two richest deciles have less disposable income. This is particularly the case for the wealthiest. The progressivity of the personal income tax is more pronounced than the previous tax on wages and pensions, not only because of the different rates applied to labour income, but also due to the fact that gross labour income of the self-employed and capital income are both taxed through the personal income tax in the post-reform situation.[15]

[15] Although income from self-employment and professional income were taxed by the tax on wages and pensions, the rates applied were at a fixed, and generally very low, base.

The main expected household behavioural responses to variations in their budget constraint include changes in consumption and labour supply.[16] Following the shock of the new tax rates, optimal consumption demand and labour supply change for each household type. If labour supply and consumption effects arising from implementation of the new income tax are sufficiently large, we may expect to see changes in price and wage structures. Household consumption demand for goods and services is likely to change across household deciles, both because of the different sign of the variation of disposable income (richer households experienced a reduction of disposable income and poorer households saw income increase) and because income elasticities of demand differ among households for different goods. Also, after the shock, net wages for households in the first eight deciles are expected to be higher. This increases the opportunity cost of leisure, which induces an increase in labour supply, so long as the substitution effect is larger than the income effect. This can be contrasted with an expected reduction of labour supply from wealthier households. The size of this latter effect depends strongly on the wage elasticity of labour supply.

The expected general equilibrium effects are captured through variations in relative prices of goods. Also, as sectors of activity face changing demand for their goods or services, factor demand from each sector is likely to change, affecting wage rates and employment.

The CGE model captures the price effect of a change in the value added tax: a modified VAT rate results in new market clearing prices and quantities via consumer and producer optimization, likely leading to a change in the sectoral structure of the economy. This is also expected because the size and sign of the shock are different across types of goods, so the income effects of the change in the VAT will differ by household type. In principle, we can expect poorer households to enjoy a greater positive effect because the minimum rate declines by more than the basic rate under the reforms.

The employer contribution to social security is a part of labour costs in each sector. A decrease (increase) in the cost of hiring workers should push up (down) labour demand. The magnitude of these variations will depend on the elasticities of substitution between production factors and the share of labour in total costs for each sector of activity. Regarding

[16] In the long run, non-linear tax rates on income may also induce negative effects on human capital accumulation by lowering the wage premium for the more educated. This effect is not considered, as the analysis is developed in a static framework.

the shock, lower labour costs can be expected to increase labour demand in the commerce- and service-oriented sectors and also in construction, while the opposite holds in manufacturing sectors. The increase in labour demand in the first three types of sectors could push up wages. If the fall in labour demand in the manufacturing sector is outweighed by the increase in labour demand in the other sectors, an increase in overall wages or a decrease in unemployment can also be expected.

Finally, the reduction of the tax rate for non-distributed profits associated with implementation of the direct tax on firms should affect returns to capital. This would affect relative factor prices as well as the level and allocation of new investment.

It is worth mentioning that, due to the static nature of the model used here, the effects that the direct tax has on firms' capital accumulation are not assessed even though the main objective of modifying this tax has to do with capital accumulation. A full account of the effects of the direct tax on firms would require a dynamic model, a possible extension of the current work. In this study, the final effects of the introducing the direct tax on firms as part of the full reform (i.e., the combination of all the taxes included in the reforms) are considered, but an exhaustive analysis of its own impact is not attempted.

3. Methodology and data

The adopted methodology has two main components: a static computable general equilibrium model (CGE) and a microsimulation procedure to evaluate the effects on poverty and inequality by accounting for the distribution of income.

3.1 The data

For the purpose of this study, a new 2006 benchmark Social Accounting Matrix (SAM) was built using the most recent Supply and Use Tables published by the Central Bank (with 1997 data), 2006 National Accounts data, 2006 Household Survey data (which includes information on both urban and rural households) and complementary data about fiscal revenues. To calibrate the model, the SAM was disaggregated by: *a) household type*, to capture different consumption profiles, different sources of income and variations in the way households are affected by the new structure of personal income taxes; *b) sector of activity*, to capture variations in how sectors are affected by changes in the VAT and ECSS; and *c) labour*, to capture how the effects of the direct personal income tax vary with skill level. The data was disaggregated to model the taxes in detail.

The final SAM includes 24 sectors of economic activity (and 24 goods) aggregated according to VAT and ECSS rates. Three types of labour are considered: those with less than completed secondary education (unskilled); those with less than completed post-secondary education (semi-skilled) and those who have completed a level of post-secondary education (skilled). There is only one type of capital factor, which includes land. The composition of value added in Uruguay is shown in table 5.

Table 5: Share of value added by sector

Sectors	Skilled labour	Semiskilled labour	Unskilled labour	Capital
Primary except livestock	1.0%	1.5%	4.4%	1.1%
Livestock	3.4%	3.6%	9.2%	7.5%
Meat, fruit & veg.	0.5%	1.2%	2.5%	2.4%
Mills, sugar & vegetable oils	0.1%	0.3%	0.5%	0.3%
Dairy	0.2%	0.7%	0.8%	0.9%
Other food industry	0.6%	1.0%	2.6%	2.2%
Press	0.8%	1.0%	0.7%	0.4%
Petroleum refining	0.7%	0.7%	0.2%	8.4%
Pharmaceutical industry	1.5%	1.2%	0.5%	0.1%
Metal products and machinery	0.9%	1.7%	2.0%	2.1%
Other manufacturing	2.5%	4.4%	6.2%	6.0%
Electricity and gas	1.8%	1.5%	1.0%	3.6%
Water	0.4%	0.4%	1.1%	0.2%
Construction	1.5%	2.1%	7.8%	7.1%
Commerce	6.5%	18.5%	18.3%	8.9%
Hotels	0.4%	0.6%	0.7%	2.3%
Passenger transport	0.3%	2.2%	3.5%	0.5%
Communications	1.7%	2.0%	1.2%	3.7%
Financial services	6.4%	8.7%	2.3%	11.9%
Public administration	26.7%	18.8%	13.8%	0.0%
Private education	4.2%	3.2%	0.6%	1.1%
Hospitals	11.1%	4.5%	2.3%	1.8%
Other health services	5.0%	1.5%	0.7%	0.5%
Other services	21.9%	18.7%	17.2%	27.0%
Total	100%	100%	100%	100%

Source: SAM 2006

There are 13 tax accounts, one for each of the taxes that were specifically considered, including those paid by institutions on the sales of commodities and in relation to economic activities and factors. Table 6 shows the different taxes included and their share of total fiscal revenues in the pre-reform situation.

Table 6: Taxes included in the CGE model (%)

Taxes	% Tax revenue	% GDP
Labour income tax [(1)]	4.1%	1.0%
Capital income tax	0.0%	0.0%
Pensions tax	0.4%	0.1%
Employer contribution to social security	14.9%	3.7%
Factor tax	9.0%	2.3%
Direct tax on firms	11.5%	2.6%
Taxes on products	10.8%	2.5%
Tariffs	4.3%	1.1%
Activity Taxes	2.9%	0.7%
Value added tax	39.2%	10.0%
Tax on intermediate consumption of goods	2.8%	0.7%
Total	100%	24.7%

Source: SAM 2006
(1) Includes taxes on the three types of labour

Households are disaggregated by decile of household income. The institutional accounts also include a representative firm, the government and the rest of the world. The SAM includes a savings and investment account.

The decision to disaggregate households by decile of household income was made to minimize heterogeneity of effective income tax rates within each household group and to maximize it between groups. Disaggregating households by income is the best way to achieve this goal because effective income tax rates (on labour and pensions) vary with income. Similarly, disaggregating labour by skill level allows us to further disaggregate effective tax rates *within* household types since labour endowments clearly vary across households in terms of skill levels. This specification is relevant because, despite the fact that tax rates are not defined by skill, there is obviously a high correlation between skill and income.

In order to calibrate the model and to specify the simulated shock on labour and pension income taxes, an arithmetical microsimulation was carried out. Based on (observed) market incomes and socio-demographic household characteristics, this analysis arithmetically derives net household tax payments and thus the effective tax rates under the post-reform tax system. Effective tax rates on labour, pension and capital were obtained for each household type by dividing total tax payments by total income for each household type. Effective rates thus account for tax evasion (or informality). It is assumed that tax evasion does not change following the reform, so evasion is held at its initial level in the model. A detailed description of the arithmetical microsimulation is presented in the technical appendix.

In addition to the SAM, the database includes various elasticities for production, consumption, trade and labour supply, along with the wage-unemployment elasticity (see table A.1 in the annex for their respective values). Data on labour stocks were drawn from the 2006 National Household Survey (NHS), disaggregated by skill level, sector of activity and the initial unemployment rate for each skill level. The average unemployment rate was nearly 11% in 2006, while unemployment decreased with workers' skill level. Calibration of parameters in the labour supply equation follows the process used by Annabi (2003).

3.2 The general equilibrium model

The CGE model is based on the standard model used by Löfgren, Harris and Robinson (2002). A number of modifications were made to the standard model to account for the main effects of the tax reform. Those modifications pertain to: a) treatment of the VAT; b) modelling of the specific tax on intermediate consumption of goods; c) modelling of income taxes; d) modelling of employer contributions to social security; e) the choice of the production function; and f) modelling of the labour market. The main components of the model are described in the present section, as are these modifications. A detailed description of all the equations is included in a technical appendix that is available from the authors upon request.

3.2.1 Main features of the CGE model

The model has the following general characteristics:

1. A Leontief specification is used to combine value added and intermediate consumption. Value added is in turn modelled with a nested CES (constant elasticity of substitution) function that considers a combined labour and capital production factor.
2. Domestic and imported goods are imperfect substitutes in the domestic market so an Armington specification is used.
3. Domestic producers choose to export or to sell in the domestic market according to a CET (constant elasticity of transformation) function. The small open economy assumption is adopted, so the economy is a price-taker in foreign markets.
4. Household consumption expenditures are distributed between goods and leisure according to a Stone-Geary utility function.

5. Firms receive capital payments, pay taxes and transfer most of the net benefits to households, and only keep non distributed profits.
6. The government collects taxes and tariffs, purchases goods, makes transfers to households (mostly relating to social security), and makes interest payments on loans received from the rest of the world or for bonds traded either on domestic markets or abroad.
7. The labour market is segmented into three categories of workers: skilled, semiskilled and unskilled. Endogenous labour supply and a wage curve are introduced.
8. The consumer price index is the numeraire.

3.2.2 Treatment of the value added tax (VAT) and tax on intermediate consumption of goods

We modified the standard model by Lögfren *et al*. (2002) by specifying a value added tax on commodities with rebates for intermediate inputs as per Go *et al.* (2005), which means that the VAT does not have cascading effects. It is assumed that commodities *(c)* are taxed at the corresponding (basic or minimum) rate regardless of whether they are final or intermediate transactions. Rebates are then introduced, so producers can deduct taxes paid on intermediate consumption. Sales of imports are taxed and do not receive rebates, while exports are not subject to the VAT. Total public revenues from the value added tax is then:

$$\sum_c VAT_c PQS_c (1 + tq_c) QQ_c - \sum_a REBATE_a$$

where:

VAT_c is the effective value-added tax rate on commodity *c*
PQS_c is the supply price of composite commodity *c*
tq_c is the excise tax rate on commodity *c*
QQ_c is the quantity of composite goods supplied of commodity *c*
$REBATE_a$ is the value added rebate for intermediate consumption of activity *a*, where:

$$REBATE_a = \sum_c PQS_c (1 + tq_c) QINT_{c,a} VAT_c$$

where:

$QINT_{c,a}$ is the quantity of intermediate demand for *c* from activity *a*.

The demand price of commodity *c* includes the value added tax and the corresponding tax on commodities (the excise or health tax):

$PQD_c = PQS_c(1+tq_c)(1+VAT_c)$

where:

PQD_c is the demand price of composite commodity *c*

Finally, the price of aggregate intermediate inputs includes the per unit rebate for the aggregate intermediate input and the tax on intermediate goods as given by:

$$PINTA_a = (\sum_{cgood} PQD_{cgood}\ ica_{cgood,a})(1+\frac{tsstax_a}{1+TVA_{cgood}}) + \sum_{cngood} PQD_{cngood} ica_{cngood,a} - \frac{REBATE_a}{QINTA_a}$$

where:

$PINTA_a$ is the aggregate intermediate consumption price for activity *a*
$ica_{cgood,a}$ is intermediate consumption of goods *cgood* per unit of aggregate intermediate consumption by sector of economic activity *a*
$ica_{cngood,a}$ is the intermediate consumption of services *cngood* per unit of aggregate intermediate consumption by activity *a*
tsstax is the tax rate on intermediate consumption of goods
$QINTA_a$ is the quantity of aggregate intermediate consumption by activity *a*

The tax on intermediate inputs collected by government is:

$$\sum_{Cgood,a} PQD_{cgood}\ QINT_{cgood,a} tsstax$$

In order to calibrate the model, it is initially assumed that the legal VAT rate following the reform is actually paid on the sale value of each commodity. The rebate on intermediate consumption for each production activity is calculated using input-output data. These values are then adjusted by a scaling factor to ensure that total VAT revenues match tax revenues as reported by the Ministry of Economy and Finance (MEF). This procedure yields effective VAT rates which accounts for tax evasion, which is presumed to be proportional across all sectors.

In order to carry out the simulations, the effective VAT rates were specified as the product of the new legal rates and a fixed factor (representing tax evasion), as follows:

$VAT_c = VATADJ_c\ vat_c$

where:

$VATADJ_c$ is the value added tax-scaling factor for commodity *c*
vat_c is the legal value added tax rate on commodity *c*

So, in the corresponding simulations, $\overline{vat_c}$ is changed and the scaling factor remains fixed. This means that the level of tax evasion is held at its initial level which implies that tax evasion does not change as a result of the reform.

3.2.3 Specification of household income taxes

The standard model by Lofgren, Harris and Robinson (2002) provides a single direct tax on domestic institutions' total income. In our case, the direct tax on households was calculated according to income source and labour type, via five types of tax: a) a direct tax on household income derived from skilled labour; b) a direct tax on household income from semi-skilled labour; c) a direct tax on household income from unskilled labour; d) a direct tax on household capital income; and e) a direct tax on household pension income.[17]

3.2.4 Specification of production functions and employer contribution**s** to social security

Employer contributions to social security differ across sectors in the baseline situation. The reform scenario introduces the ECSS as a sector-specific tax paid on labour costs.

On the production side, value added is modelled using a nested CES technology. The three labour factors are combined into a composite labour factor, which is in turn combined with capital. Employer contributions to social security are introduced in the CES equation that combines composite labour and capital (note that the rate does not differ by labour type). Factor remuneration may differ across activities due to a fixed distortion factor calibrated from the SAM and labour stock data.

The ECSS and VAT rates are treated similarly. The effective rates are specified as the product of the legal rate and a fixed scaling factor representing tax evasion:

$$TS_{fact,a} = TSADJ_{fact,a}\ \overline{ts}_{fact,a}$$

where

$TS_{fact,a}$	is the effective ECSS rate on the factor *(fact)* used in activity *a*
$TSADJ_{fact,a}$	is an adjustment parameter for the tax on *fact* used in activity *a*
$\overline{ts}_{fact,a}$	is the legal ECSS rate on *fact* used in activity *a*

[17] Income must be distinguished by source because the new direct personal income tax treats income from labour, capital and pensions differently. Distinguishing between the tax rates for different labour types allows us to proxy for tax rates that vary with income level.

In this case, tax evasion is a function of the number of informal workers and wages in each sector as obtained from the 2006 NHS. An estimate of total tax evasion is calculated as the difference between theoretical revenues (if the legal rates were actually applied) and actual revenues reported by the Social Security Bank (BPS).

3.2.5 Labour market specification

Modelling the labour market is a crucial aspect of this study because the labour market is the main way that the results of the CGE can influence the microsimulations. Labour supply was endogenized by allowing changes in disposable income to affect labour supply. Unemployment was also introduced by adding a wage curve.

As mentioned earlier, unemployment rates are relatively high in the Uruguayan labour market and also differ by labour type. This necessitates consideration of unemployment when modelling the labour market. Equilibrium on the labour market thus differs from a strict micro-theoretic definition. Nevertheless, the solution provided by the model guarantees that the resulting unemployment rate is consistent with the wage rate prevailing in each market via a wage curve (Blanchflower and Oswald, 1995). This wage curve is specified as:

$$\frac{WF_f}{CPI} = \left(awc_f \, UN_f\right)^{-welasf}$$

where

WF_f	is the wage for labour factor *f*
awc_f	is a scaling parameter
UN_f	is the unemployment rate for factor *f*
$welas_f$	is the elasticity of wages to unemployment
CPI	is the consumer price index

The concept of the wage curve typically indicates a negatively sloped relationship between the unemployment rate and the real wage rate, and is associated with non-competitive labour market behaviour. This non-competitive behaviour may be explained by the existence of efficiency wages or union bargaining. The efficiency wage theory argues that firms motivate workers by offering higher wages to promote effort or to reduce turnover rates. If unemployment increases, the wage premium required to improve worker efficiency declines. The wage curve in the Uruguayan economy is also consistent with union bargaining models. These models show that union power increases when unemployment is low, a situation that tends to increase wages.

The presence of a negative wage elasticity with respect to unemployment is incorporated by introducing a wage curve for each segment of the labour market. Elasticities are taken from Bucheli and Gonzalez (2007), who provided empirical estimates for Uruguay. Their estimates indicate that unemployment does not significantly affect wages for skilled workers (the estimated elasticity is -0.034 and is not significantly different from zero). This relationship is more notable for both unskilled and semiskilled workers, however. The estimated elasticity with respect to unemployment is -0.145 for unskilled workers, somewhat greater than the elasticity of -0.139 estimated for semiskilled workers.

Introducing endogenous labour supply to the CGE model is accomplished by including leisure in the set of consumption goods. Following Annabi (2003), it is assumed that leisure is a normal good with an opportunity cost equal to the wage rate. An increase in wages raises the opportunity cost of leisure and induces consumers to work more (the substitution effect). On the other hand, the increase in the wage rate raises real income, increasing the consumption of normal goods including leisure (the income effect). The total effect on labour supply takes the form of a backward-bending curve: the substitution effect is greater than the income effect at lower wages, whereas the income effect is stronger at higher wage rates.

Each representative household in this study is endowed with the three types of labour. This means that not only are we faced with the problem of how to model the labour-leisure decision, but we must also deal with the question of which type of labour will vary. This is done by assuming that each household is endowed with three budgets (one for each type of labour) to allocate between work and leisure, as per Decaluwé, Lemelin and Bahan (2006).

Each household is treated as though it were composed of a maximum of three members (one per type of labour), where each member maximizes their own utility regardless of other members' decisions. Minimum levels of leisure and consumption are both assumed in the utility function.

The following equation refers to supply of each labour type from household *h*, derived from the Stone-Geary utility maximization problem:

$$QFACINS_{h,lab} = MAXHOUR_{h,lab} - \frac{zeta_{lab,h}}{\left(1-\sum_{lab} zeta_{lab,h}\right)(1-THLAB_{lab,h})(1-UN_{lab})WF_{lab}}\left(EH_h - \sum_c \gamma_{ch} PQD_c\right)$$

where:

QFACINS $_{h,lab}$	is the quantity of labour type *lab* supplied by household *h*
MAXHOUR $_{hflab}$	is the total available time of labour type *lab* in household *h*
Zeta $_{lab,h}$	is the share of leisure in the utility function of labour type *lab* for household *h*
γ_{ch}	is the minimum consumption level of commodity *c* in household *h*
UN_{lab}	is the unemployment rate of labour type *lab*
THLAB $_{lab,h}$	is the direct tax rate on income of labour type *lab* of household *h*
WF_{fab}	is the economy-wide average wage for labour type *lab*

Notice that the net wage rate is replaced by the "expected" wage rate, corrected by unemployment rate. It is thus assumed that the representative agents adjust for the probability of finding employment when maximizing their utility. Calibration was done following Annabi (2003).

3.3 The microsimulation model

The simulation with the CGE model illustrates the effects of the tax reform at the macro level. To go from the counterfactual effects simulated with the CGE model to the distribution of poverty and income at the household level, we adopt the methodology presented in Ganuza, Paes de Barros and Vos (2002), itself an adaptation of the methodology proposed by Almeida dos Reis and Paes de Barros (1991).[18] It consists of simulating, at the micro level, the labour market and income structure obtained from the CGE macro simulations. To this end, micro data from the 2006 NHS was used to obtain poverty and inequality indicators which are consistent with the simulated structure. The approach can thus be described as "top-down" because the policy shock leads to changes in factor prices, the structure of unemployment and employment, the extent of poverty and inequality, and it is assumed that there are no additional feedback effects.

[18] The origins of this type of counterfactual microsimulation can be found in Orcutt (1957), Oaxaca (1973) and Blinder (1973). In the case of Uruguay, this methodology has been used in Laens and Perera (2004), Terra *et al*. (2006) and Laens and Llambí (2008).

The counterfactual microsimulation methodology follows a non parametric technique. It does not specify income and labour-choice models as proposed in Bourguignon, Fournier and Gurgand (2001) or in Bourguignon, Ferreira and Lustig (2001). Instead, it assumes that occupational shifts may be approximated by a random selection procedure within a segmented labour market structure**.** A Monte Carlo procedure can then be used to obtain confidence intervals for the outcomes of the simulations (poverty and inequality coefficients). The important assumption made is that, on average, the effects of the random changes within segments correctly reflect the impact of the actual changes in the labour market.

Individuals are defined according to skill to form the three labour categories in the CGE, while the 24 sectors of activity in the CGE model were aggregated into 7 sectors. These aggregated sectors are: a) primary; b) manufacturing; c) construction; d) commerce; e) electricity, gas, water and public administration;[19] f) transport, communications and services; and g) private education and health services.

The microsimulations involve the following sequence of steps: i) labour supply adjustment; ii) unemployment rate adjustment; iii) sectoral employment change; iv) relative wage changes between types of labour; v) average wage changes; and vi) capital income changes, equal to the simulated variation of the price of capital in the CGE model. Capital income is simulated at the household level rather than at the individual level. The sequence of the microsimulation method is similar to the one followed by Ganuza, Paes de Barros and Vos (2002), except they did not account for changes in capital income. Although the results obtained from this methodology are path dependent in principle, some sensitivity analysis suggests that the results are robust to the selected sequence of changes.[20]

It is important to note that after-tax incomes are observed in the NHS, so pre-tax incomes must be estimated in the first stage of the microsimulation. The new after-tax incomes of individuals (and thereby disposable household income) are then estimated by accounting for the new direct tax system. The initial picture of a change in direct income taxes on households can be seen by comparing after-tax household income for the pre-reform and simulated situations. This can be viewed as the “next day” effect of the reform to the direct income tax because agents’ behaviours have not yet changed. This initial effect will be referred to as the arithmetical microsimulation.

[19] Note that electricity and water are produced by public enterprises.
[20] Results are available from the authors.

In order to introduce the general equilibrium effects from the CGE model to the microsimulation, one labour market parameter is changed in each step of the sequence described above. It is important to note that the simulated changes in remuneration to labour refer to the gross or pre-tax income. To obtain information on net or disposable income (after direct taxes), an arithmetical microsimulation has to be carried out (again) on the new results. This procedure allows us to compute effective income tax rates by incorporating "second round" effects (labour market and factor price changes) by accounting for exogenous individual and household variables which affect tax payments but are not present in the CGE (e.g. deductions for the number of children in households).

An important issue is imputing the status of newly employed workers with respect to informal and formal employment.[21] This is addressed by randomly assigning a job to unemployed individuals when the unemployment rate decreases in a specific population segment. The informal or formal nature of this new job is crucial, since it determines whether labour income is taxed. To deal with this, the observed incidence of informality by sector and type of worker in the NHS was estimated and then the informal/formal status was randomly assigned on the basis of these observations.

Finally, income tax rates on labour vary with income; they are actually endogenous, although the macro CGE model treats them as exogenous. When the "final" effective tax rates on labour income resulting from the microsimulations are compared with the initial shock on the CGE, by accounting for changes in the tax bases due to changes in average nominal wages, only slight differences were found.[22]

4. Simulations and CGE model closures

Several simulations were carried out with the CGE model. In each simulation, a shock for some (or all) of the specific tax rates involved in the reform was introduced. To start with, the full reform was simulated including the introduction of the direct personal income tax, changes in VAT rates, elimination of the intermediate consumption tax and the health tax, changes in the ECSS rate and introduction of the direct tax on firms to replace the industry and trade tax. Each of these components of the reform was then simulated separately in order to assess the relative importance of their effects. The list of simulations carried out is then:

[21] Also note that the CGE model does not endogenize this aspect of the labour market.
[22] Results are available from the authors.

a) REFORM – Simulation of the full reform
b) VAT – Simulation of the modified VAT plus the elimination of intermediate consumption tax and health tax
c) INCTAX – Simulation of the new personal income tax that replaced the previous personal income tax
d) ECSS – Simulation of the changes to employers' contribution to social security
e) FDIRTAX – Simulation of the direct personal income tax as a replacement for the industry and trade tax

A savings-driven closure was adopted by maintaining a constant marginal propensity to save among all domestic non-government institutions. The trade balance is exogenous and the real exchange rate is the equilibrating variable. When analyzing tax reforms, it is generally assumed that government revenue does not change (Go *et al*., 2005). Nevertheless, three different government closures were tested. In the first two, government income was allowed to vary endogenously. The reason for this is that we primarily intended to assess the impact of the actual reform, including the effects of various assumptions about government adjustments resulting from the reform. The first two government closures adopted were thus guided by the desire to understand the effects of the reform under two extreme government behaviours: a) variation in government income due to the reform is completely absorbed by government expenditures, with constant government savings and b) government consumption is fixed and changes in income alter government savings. While neither of these closures is completely realistic, they do illustrate some aspects of the impacts of the actual reform in the absence of compensating mechanisms, either by assigning the change in government income to additional consumption or to additional savings, with no intermediate setting.

The budget-neutral closures usually compensate for the simulated changes in direct taxes with a change in indirect taxes or vice versa. This type of compensation is not easy to interpret when simulating the full reform because changes in all major direct and indirect taxes are part of the reform. It is nevertheless rather interesting to assess the trade-off between a higher (lower) VAT and lower (higher) personal income taxes by maintaining fixed government savings and real government consumption. In fact, the reduction in indirect taxes to compensate for the introduction of direct personal income taxes has been one of the main features of the reform.

Therefore, the full reform was simulated by holding real government consumption and government savings unchanged, while the VAT compensates for: introduction of the new structure of personal income taxes, changes in employers' contributions to social security, changes in the direct tax on firms, and all components of the reform considered together. In the first three cases, a proportional adjustment of the VAT rate was permitted to compensate for revenue gains or losses. In the full reform case, the actual change in the VAT rate was simulated (together with the rest of the tax changes) and an additional proportional adjustment in VAT rates was permitted to compensate for variations in government revenues. So, this simulation allows us to estimate the number of additional points by which VAT rates could be reduced (or increased) if the full reform were set up to be revenue-neutral. Table 7 summarizes the simulations carried out and the closures used.

As for the labour market, it is assumed that capital and labour are perfectly mobile across sectors but that the labour market is segmented by skill level. The supply of capital is fixed and is fully employed, so the average capital return is the equilibrating variable. Labour supply is endogenous and there is unemployment in every segment of the labour market. Both labour employment and wages can vary after a shock, but wage differentials are fixed at their initial level.

Table 7: Simulations and macro closures

Simulations	Gov. closure	Foreign closure	S–I closure
REFORM_gcons INCTAX_gcons VAT_gcons ECSS_gcons FDIRTAX_gcons	Fixed government savings and flexible government consumption	Fixed foreign savings	Fixed marginal propensity to save
REFORM_gsav INCTAX_gsav VAT_gsav ECSS_gsav FDIRTAX_gsav	Flexible government. savings and fixed government consumption	Fixed foreign savings	Fixed marginal propensity to save
REFORM_vat INCTAX_vat ECSS_vat FDIRTAX_vat	Flexible VAT rates, fixed gov. savings and fixed gov. consumption	Fixed foreign savings	Fixed marginal propensity to save

Note**:** lower case letters in the name of each simulation indicate the variable that is flexible in relation to government accounts: government savings (gsav), government consumption (gcons) and the value added tax rate (VAT).

5. Results of the CGE simulations

5.1 Government accounts

Table 8 shows the results for the main macroeconomic aggregates, government accounts and labour market variables in each of the simulations carried out.

The first two groups of simulations show the results of the actual reform for two alternative uses of the additional revenue. Government income as a share of GDP increases by 0.6 percentage points when the full reform is simulated regardless of how additional revenue is allocated. The new personal income tax generates a nearly 3 percentage point increase in government income as a share of GDP, but this is partly countered by reduced receipts from indirect taxes, employers' social security contributions and taxes on profits. Changes in the VAT and other indirect taxes (intermediate consumption and health taxes) lead to the main compensating reductions in government income.

A significant change in the composition of tax revenue (excluding tariffs and contributions to social security) results from these opposing effects. Direct taxes as a share of total tax revenues rise from 22.3% in the baseline scenario to 33.4% when the full reform is simulated, while the relative importance of indirect taxes declines by 11 percentage points.

Table 8 also shows the different outcomes obtained according to the allocation of the additional revenue. In the first group of simulations (flexible government savings), the share of government savings in GDP rises by 0.5 percentage points. Similarly, if the additional government income were used to increase government consumption, the latter would rise by 0.5 percentage points as a share of GDP (see REFORM_gcons). As will be shown later on, these situations generate different macro results. The last columns of table 8 show the results of the compensated simulations where budget neutrality is assumed. In the case that the reform is compensated by changes in VAT rates, the share of direct taxes reaches its highest value (34.5% of GDP).

Table 8: Simulation results

		Base	Simulations with flexible government savings					Simulations with flexible real government consumption					Simulations with budget neutral assumption			
	Units	scenario	REFORM_ gsav	VAT_ gsav	INCTAX_ gsav	ECSS_ gsav	FDIRTAX_ gsav	REFORM_ gcons	VAT_ gcons	INCTAX_ gcons	ECSS_ gcons	FDIRTAX_ gcons	REFORM_ vat	INCTAX_ vat	ECSS_ vat	FDIRTAX_ vat
Government financing																
Government Income	% GDP	25.0	25.6	23.9	27.9	24.3	24.5	25.6	23.9	27.8	24.3	24.5	25.2	25.1	25.0	25.0
Government consumption	% GDP	11.4	11.4	11.4	11.4	11.4	11.4	11.9	10.3	14.1	10.7	10.9	11.5	11.5	11.4	11.4
Government savings	% GDP	1.6	2.1	0.4	4.5	0.8	1.0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Direct taxes	% tot. revenue*	22.3	33.4	24.2	32.5	22.4	20.1	33.4	24.1	32.7	22.4	20.1	34.5	39.2	21.3	19.4
Indirect taxes	% tot. revenue*	77.7	66.6	75.8	67.5	77.6	79.9	66.6	75.9	67.3	77.6	79.9	65.5	60.8	78.7	80.6
Main macroeconomic aggregates																
Absorption	% change	--	0.9	0.3	0.1	0.5	0.0	1.1	0.0	0.9	0.3	-0.2	1.1	1.0	0.3	-0.2
Private consumption	% change	--	0.3	1.7	-3.4	1.6	0.5	0.6	1.2	-2.0	1.2	0.3	1.1	0.9	0.5	-0.3
Investment	% change	--	4.5	-5.6	16.2	-4.1	-2.5	1.2	1.4	-1.3	0.3	0.6	1.8	2.0	-0.4	0.1
Government consumption	% change	--	0.0	0.0	0.0	0.0	0.0	4.1	-9.5	22.4	-5.9	-4.2	0.0	0.0	0.0	0.0
Exports	% change	--	1.8	-0.3	2.7	-0.3	-0.4	1.1	1.1	-0.8	0.6	0.2	1.5	1.6	0.0	-0.2
Imports	% change	--	1.8	-0.3	2.8	-0.3	-0.4	1.2	1.2	-0.9	0.6	0.2	1.6	1.6	0.0	-0.2
GDP mp	% change	--	0.9	0.3	0.1	0.5	0.0	1.1	0.0	0.9	0.3	-0.2	1.1	1.0	0.3	-0.2
Net indirect taxes	% change	--	1.1	0.4	0.2	0.5	0.0	0.9	0.9	-0.9	0.8	0.2	1.1	1.3	0.2	-0.2
GDP fc	% change	--	0.9	0.3	0.1	0.5	0.0	1.1	-0.2	1.2	0.2	-0.3	1.3	0.9	0.3	-0.2
Household disp. income	% change	--	0.1	1.7	-3.6	1.6	0.5	0.3	1.2	-2.2	1.2	0.3	0.9	0.8	0.4	-0.3
Employment by labor type																
Skilled	% change	--	1.7	0.9	-0.5	1.2	0.1	2.5	-1.3	3.9	-0.1	-0.9	2.1	1.8	0.7	-0.4
Semiskilled	% change	--	1.6	0.7	-0.1	1.0	0.0	1.9	-0.1	1.9	0.5	-0.4	1.9	1.7	0.5	-0.3
Unskilled	% change	--	2.0	0.6	0.6	0.9	-0.1	2.0	0.5	0.7	0.9	-0.1	2.2	2.0	0.6	-0.4
Total	% change	--	1.9	0.7	0.3	1.0	0.0	2.0	0.2	1.3	0.7	-0.3	2.1	1.9	0.6	-0.4
Unemployment rate by labor type																
Skilled	% of labour force	4.4	2.9	3.4	5.4	3.1	4.3	2.2	5.4	1.3	4.3	5.2	2.5	2.8	3.8	4.7
Semiskilled	% of labour force	10.1	8.7	9.4	10.4	9.2	10.0	8.4	10.1	8.6	9.6	10.4	8.4	8.6	9.6	10.4
Unskilled	% of labour force	12.0	10.2	11.4	11.6	11.1	12.0	10.2	11.5	11.4	11.2	12.1	9.9	10.1	11.5	12.3
Participation rate by labor type																
Skilled	% of pop.in age	81.6	81.8	81.5	82.0	81.6	81.6	81.8	81.4	82.2	81.5	81.5	81.7	81.7	81.6	81.6
Semiskilled	% of pop.in age	74.8	74.9	74.8	75.1	74.8	74.8	74.9	74.8	75.1	74.8	74.8	74.8	74.8	74.8	74.9
Unskilled	% of pop.in age	58.2	58.1	58.1	58.2	58.1	58.2	58.1	58.2	58.2	58.2	58.2	58.1	58.1	58.2	58.2
Factor payments																
Skilled	% change	--	1.4	0.9	-0.7	1.2	0.1	2.4	-0.7	4.2	0.1	-0.5	1.9	1.6	0.5	-0.2
Semiskilled	% change	--	2.1	1.1	-0.4	1.4	0.1	2.6	0.0	2.2	0.7	-0.4	2.6	2.3	0.7	-0.4
Unskilled	% change	--	2.4	0.7	0.5	1.1	-0.1	2.4	0.6	0.8	1.0	-0.1	2.8	2.5	0.6	-0.4
Capital	% change	--	3.2	2.1	0.3	1.0	-0.1	2.8	2.9	-1.9	1.5	0.3	4.3	6.2	-0.5	-1.1

* Total revenue excluding social security contributions and tariffs

A relevant result is the “cost” of each component of the reform in terms of VAT. In particular, if the INCTAX were introduced and compensated for by reducing VAT rates, the initial legal rates of 23% and 14% could be lowered to 15% for the base rate and 9% for the minimum rate. In the case of the full reform (which includes changes in other taxes and a reduction of VAT rates to 22% and 10%), choosing the VAT as the compensating mechanism allows the VAT rates to be lowered by an additional percentage point (to 21% for the basic rate and 9% for the minimum rate).

5.2. Macro results

A first result to point out is that every simulation of the full reform has a similar positive effect on GDP, regardless of which of the three government closures is adopted. It is important to note that assumptions with respect to the government’s use of additional revenue from the reforms are nevertheless very relevant. For example, the final results for investment absorption and public-private shares of investment differ substantially according to the choice of closure, a fact that has implications in a dynamic setting (not considered in the current study).

When government savings are held fixed (simulations ending in *gcons*), the positive effect on GDP is mainly explained by implementation of the direct personal income tax (which increases fiscal revenues) and to a lesser extent by the effect of the ECSS shock. The increase in government income enables a 4.1% increase in real government consumption, which implies an increase of government consumption as a share of GDP. Under this assumption, investments and exports increase because changes in VAT rates and elimination of the intermediate consumption tax cause their prices to fall. Meanwhile, increasing government revenues tend to crowd out private consumption, which increases by just 0.6%.

When government consumption is held fixed and government savings are allowed to vary endogenously (simulations ending in *gsav*), GDP also increases, but somewhat less so than in the previous closure. Every component of the reform positively affects aggregate activity with the exception of the macro-neutral shock on taxes on profits. Increased government savings due to the revenue-increasing personal income tax allows investment to increase by 16.2%. In this case, there is a moderate crowding out effect on investment (as private savings decrease).

The first two closures, where the government either spends or saves the additional revenues, can be compared for their effects on aggregate household income. We find that the effects are slightly more favourable when current government consumption is allowed to increase. This is because value added is a high share of output in public education and health services. Since remuneration to labour comprises all of value added for these public services, households receive nearly all of the additional spending, after intermediate consumption is accounted for. In the simulations with flexible government savings (ending in *_gsav*) the variation in disposable income is lower than in the flexible government consumption closure (ending in *_gcons*). Investment rises, leading to higher demand for construction and some tradable goods (particularly primary goods and machinery), so part of the increase in demand is absorbed by imports and is not captured by domestic institutions.[23]

The most interesting result is the budget-neutral simulation which allows changes in the tax structure to be compensated by the VAT. Changes in government accounts are not permitted in this case, so any variations are due to changes in the tax structure. There is also an increase in GDP in this case and the increase is similar to the two previous simulations.

The budget-neutral scenario has the most favourable effects on disposable household income. In this case, the additional reduction in VAT rates is partly captured by households through lower prices. Increased disposable income leads to higher aggregate demand, mainly due to the combined changes involving the personal income tax and the VAT. This demand is met by increased imports and domestic production, with a related increase in factor demand. Total capital supply is fixed in this model, so increased demand for capital implies higher returns. In the case of labour, increased demand is partially satisfied via reduced unemployment.

The analysis of each separate effect illustrates part of the mechanisms behind these results. As shown in the last columns of table 8, most of the positive effect comes from replacing indirect taxes (VAT) with direct taxes on household income (see INCTAX_vat simulation). The other positive effect arises from lower distortions on relative factor prices by reducing the ECSS rate and harmonizing it across sectors of activity.

[23] Again, note that investment is only considered as a demand factor, as the model is static and therefore does not capture investment's dynamic effect on growth.

Replacing VAT revenues with a direct personal income tax increases disposable income for all household groups except the richest decile, which amounts to a positive demand shock for domestic economic activity (see table 9). Furthermore, the elimination, reduction or uniformization of some indirect taxes (such as the intermediate consumption tax, the health tax or ECSS) together with the shift towards direct taxation, tends to reduce price distortions on markets for good and factors.[24] As factors are assumed to be (perfectly) mobile across sectors, this change induces a better reallocation of resources and stimulates economic activity.

Table 9: Household disposable income (% change)

Decile of HH income	REFORM_ vat	INCTAX_ vat	ECSS_ vat	FDIRTAX_ vat
1	3.9	3.8	0.6	-0.5
2	4.7	4.6	0.7	-0.5
3	4.9	4.8	0.6	-0.5
4	4.6	4.5	0.6	-0.5
5	4.6	4.5	0.6	-0.4
6	4.2	4.1	0.5	-0.4
7	3.6	3.6	0.4	-0.3
8	2.5	2.4	0.3	-0.3
9	1.2	1.2	0.2	-0.2
10	-2.8	-2.7	0.0	-0.1

Source: author's CGE simulation results

Direct taxation on household income could also have undesirable long-run effects for at least two reasons. First, we have an efficiency loss due to substitution effects between labour (used to purchase commodities) and leisure, although this is later shown to be insignificant in the present context. Secondly, and more importantly for the present case, progressive tax rates on household income could have negative impacts on private savings, with negative implications for dynamic capital accumulation. Again, this aspect is not considered, as the present analysis is not dynamic.

5.3 Labour market results

The expected effects of the reform on the labour market are ambiguous because the shocks derived from its different components are not uniform across sectors or households. In sectors where the VAT and other indirect taxes were cut, the expected initial decline in prices leads to higher demand for goods and services, with a corresponding increase in

[24] This result is highly dependent on the assumption of perfect competition. For the case of Uruguay, a small open economy, this assumption is reasonable for the tradable sectors (especially manufacturing and primary activities). However, imperfect competition would probably be a more realistic assumption for some non-tradable sectors. In these cases, the reduction in VAT rates could be entirely (or mostly) captured by firms and thus not lead to efficiency gains.

factor demand. However, the negative effect on factor demand in sectors where the VAT increases could counter the positive effect in the first group of sectors. There is a similar situation with respect to the decline in demand for goods and services from high income households due to the new personal income tax, in that it could outweigh the positive effect on demand from lower income households. Finally, changes in ECSS also have different effects across sectors. Table 10 shows the results of all these shocks on each factor market for each of the three government closures.

The full reform has practically no effect on labour supply. We find that a negative income effect of the personal income tax (which more than counteracts the substitution effect) only leads to a very limited increase in the supply of labour.[25]

The full reform's impact on employment and unemployment are substantial for each of the three government closures, however, due to the positive effect on overall economic activity. There is also a substitution effect that results from a general reduction of the ECSS which reduces labour costs and stimulates labour demand in every sector except for manufacturing (whose tax rate increased). In fact, table 10 shows that when the ECSS shock is considered alone, the decline in labour demand in the manufacturing sector ranges from 3.2% to 1.7% depending on the government closure adopted, while labour demand grows in nearly every other sector of activity.[26] The change in ECSS also causes overall employment to increase by between 0.6% and 1%.

The reduction of the VAT rate and the elimination of the tax on intermediate consumption of goods also positively affect overall employment regardless of the closure adopted. As indicated above, elimination and/or reduction of these highly distortionary taxes (particularly the intermediate consumption tax) induces a better allocation of resources, stimulating activity growth. When government savings is the adjustment variable, the effects of the tax change on the labour market are similar to those seen for the ECSS shock, albeit for different reasons: all private sectors except for construction and primary activities increase their demand for labour. When government consumption is allowed to adjust, all

[25] Note that the direct tax rate is not endogenous in this model. Further variations in the marginal tax rate due to changes in labour income are therefore not captured, a fact that could affect these results. Nevertheless, as stated above, the differences in the "final" effective tax rates on labour income arising from the various microsimulations with the initial shock on the CGE were found to be quite small.

[26] When government consumption is allowed to decrease, employment also decreases in the public sector in response to revenue losses caused by the ECSS shock. When government savings is the adjustment variable, employment in the construction sector is also affected.

sectors increase their labour demand except for the public sector. In this case, it is worth noting that the manufacturing and construction sectors benefit most: the share of intermediate consumption of goods is relatively high in both sectors, so they are both favoured by elimination of the intermediate consumption tax (see table 10).

This stands in contrast with the effect of the INCTAX-only simulation on employment. The effect is negative in the private sector due to a substantial increase on the overall tax burden on households which reduces private consumption and savings. The adjustment via government accounts (by either allowing consumption or savings to increase) compensates for this negative effect, with a final result of an increase in aggregate activity and employment. However, neither closure is reasonable in this case because personal income tax receipts are quite high and it is not realistic to consider such an increase in the tax burden without compensation. It is thus more interesting to consider the budget-neutral closure by compensating for the new personal income tax with a uniform reduction of VAT rates. The direct negative shock on the aggregate household budget is then compensated by the positive effect of new (lower) prices, stimulating aggregate private consumption and investment and increasing labour demand.

Although the final result of the full reform is a 1.9-2.1% increase in overall employment, the choice of assumptions for government closure affects the change in labour demand by skill level. Full implementation of the reform together with an increase in public services is a skill-biased scenario because skilled labour is relatively intensively used in public services. When the full reform is accompanied by an increase in government savings, however, the bias is in favour of unskilled workers due to increased demand in the construction sector. Finally, the budget-neutral scenario shows a more uniform increase in labour demand by skill level (see table 10).

Employment growth with a stable labour supply leads to a substantial 2 percentage point reduction in overall unemployment in the full reform scenario under each alternative closure. The largest reduction in unemployment is achieved in the budget-neutral scenario, with unemployment among unskilled workers falling by the most.

Increased demand in the full reform scenario also leads to higher wages for all types of labour and under all three closures. In the budget-neutral scenario, increased private demand also raises demand for capital, leading to an increase in capital returns. Although the ECSS shock negatively impacts capital demand via a substitution effect, this slight effect is more than compensated for by the positive impact of the increase in aggregate demand.

Table 10: Labour demand by aggregated sector of activity (percentage change with respect to base (%))

	Simulations with flexible government consumption					Simulations with flexible government savings					Simulations with budget neutral assumption			
	REFORM_gsav	INCTAX _gsav	ECSS _gsav	TVA _gsav	FDIRTAX _gsav	REFORM _gcons	INCTAX _gcons	ECSS _gcons	TVA _gcons	FDIRTAX _gcons	REFORM _tva	INCTAX _tva	ECSS _tva	FDIRTAX _tva
Primary sectors	3.1	2.1	1.4	-0.3	-0.3	2.4	-1.4	2.4	1.1	0.3	3.3	3.3	1.2	-0.5
Manufacturing	1.6	4.6	-3.2	0.9	-0.7	0.5	-1.5	-1.7	3.4	0.4	1.2	2.5	-2.6	-0.3
Construction	5.9	12.4	-1.4	-3.8	-1.9	3.1	-2.2	2.4	2.1	0.7	4.1	3.2	1.1	-0.3
Pub. administration & pub. services	0.1	-0.2	0.1	0.1	0.0	4.0	21.2	-5.5	-8.9	-4.0	0.1	0.1	0.0	0.0
Commerce	2.1	-1.6	2.3	1.2	0.3	2.0	-2.1	2.5	1.4	0.3	2.8	1.9	1.4	-0.4
Private education and health	1.9	-2.8	2.0	2.4	0.5	2.1	-1.6	1.7	1.9	0.3	2.6	1.2	0.9	-0.3
Other services	1.4	-2.6	2.5	1.3	0.4	1.4	-2.4	2.4	1.2	0.3	2.2	2.0	1.3	-0.5
Total	1.9	0.3	1.0	0.7	0.0	2.0	1.3	0.7	0.2	-0.3	2.1	1.9	0.6	-0.4

Source: author's CGE model results

5.4 Sensitivity analysis of key parameters

Robustness of the key results was tested by a sensitivity analysis of key parameters in the CGE model. For the main simulation of the full reform with the budget-neutrality assumption, the elasticities of substitution between labour and capital were allowed to vary between half and 1.5 times their range of values. Similarly, elasticities of substitution between labour types varied between half and twice their range of values and wage elasticity of labour supply varied between twice and three times their range of values. Finally, income elasticity of commodity demand varied between 0.8 and 1.2 times its range of values (see tables A.1 to A.3 for initial elasticity values).

The analysis shows that the main results are indeed robust to variations in these key parameters. The full reform's positive impact on GDP is maintained in the sensitivity analysis. Other key macro aggregates such as private consumption growth or government revenue are almost unchanged across a range of values for elasticities of substitution between labour factors, income elasticities or wage elasticities of labour supply. Only variations in the elasticity of substitution between capital and labour generate some variations in the main macroeconomic aggregates, but the sign of the overall results remain unchanged (see table 11).

The overall beneficial effects on employment and unemployment are also maintained in the sensitivity analysis. Minor variations can be observed when a lower elasticity of substitution between capital and labour is assumed. In this case, the labour demand effect resulting from reduced ECSS is smaller. Wage and employment growth is lower as a result, but remains positive.

Finally, the wage elasticity of labour supply does not seem to be a strong determinant of our main results.

6. Microsimulation results

Table 12 shows the results of the tax reform microsimulations according to the outcomes obtained from the CGE model for each of the three closures mentioned above. The results are obtained from the sequence of steps described in section 3.3 and report the change in each indicator in each phase compared to the previous one. Table 13 shows the microsimulation results of the reforms' effects on per capita household income by decile that result from the "next day" effects (arithmetical microsimulation) and due to changes in labour market indicators and factor prices provided by the CGE model ("general equilibrium" effects).

The first step was to carry out the arithmetical microsimulation, which amounts to re-estimating disposable income under the new direct income tax structure. The new direct income tax leads to a 1.2% reduction in mean per capita household income and a 1.5% decrease in average labour income. Extreme poverty is reduced by 0.01 percentage points (hereafter pp) and moderate poverty by 0.33 pp. The poverty gap ratio and the severity of poverty also decline, respectively by 0.10 pp and 0.04 pp, as reported in table 12.

Table 11: Main results from sensitivity analysis

	Units	Base scenario	Main results	Elasticities of substitution bet. capital and composite labour (sigma_kl)		Elasticities of substitution bet. types of labour (sigma_ll)		Income elasticity of commodity demand (leselas)		Labour supply elasticity to income (lelas)	
				O.5* sigma_kl	1.5* sigma_kl	O.5* sigma_ll	2* sigma_ll	O.8* leselas	1.2* leselas	2* lelas	3* lelas
Government financing											
Government income	% GDP	25.0	25.2	25.1	25.2	25.2	25.2	25.2	25.2	25.2	25.2
Government consumption	% GDP	11.4	11.5	11.4	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Direct taxes	% tot. rev*	22.3	34.5	35.0	34.7	34.8	34.8	34.8	34.8	34.8	34.8
Indirect taxes	% tot. rev*	77.7	65.5	65.0	65.3	65.2	65.2	65.2	65.2	65.2	65.2
Main macroeconomic aggregates											
Absorption	% ch	--	1.1	0.8	1.2	1.1	1.1	1.1	1.1	1.1	1.0
Private consumption	% ch	--	1.1	0.6	1.3	1.1	1.1	1.1	1.1	1.1	1.0
Investment	% ch	--	1.8	2.1	1.7	1.8	1.9	1.8	1.8	1.8	1.9
Government consumption	% ch	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exports	% ch	--	1.5	1.3	1.7	1.5	1.5	1.5	1.5	1.5	1.5
Imports	% ch	--	1.6	1.4	1.7	1.6	1.6	1.6	1.6	1.6	1.6
GDP mp	% ch	--	1.1	0.8	1.2	1.1	1.1	1.1	1.1	1.0	1.0
Net indirect taxes	% ch	--	1.1	1.0	1.5	1.3	1.3	1.3	1.3	1.3	1.3
GDP fc	% ch	--	1.3	0.7	1.2	1.0	1.0	1.0	1.0	1.0	1.0
Household disp. income	% ch	--	0.9	0.4	1.1	0.9	0.9	0.9	0.9	0.9	0.9
Employment by labour type											
Skilled	% ch	--	2.1	1.5	2.4	2.0	2.2	2.1	2.1	2.1	2.1
Semiskilled	% ch	--	1.9	1.3	2.2	1.9	1.8	1.9	1.9	1.9	1.9
Unskilled	% ch	--	2.2	1.6	2.6	2.3	2.1	2.2	2.2	2.1	2.1
Total	% ch	--	2.1	1.6	2.5	2.2	2.1	2.1	2.1	2.1	2.1
Unemployment rate by labour type											
Skilled	% of lab	4.4	2.5	3.0	2.2	2.6	2.4	2.5	2.5	2.6	2.6
Semiskilled	% of lab	10.1	8.4	8.9	8.1	8.4	8.4	8.4	8.4	8.4	8.4
Unskilled	% of lab	12.0	9.9	10.5	9.6	9.9	10.0	9.9	9.9	9.9	9.9
Participation rate by labour type											
Skilled	% pop	81.6	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.8	81.8
Semiskilled	% pop	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8
Unskilled	% pop	58.2	58.1	58.1	58.1	58.1	58.1	58.1	58.1	58.1	58.1
Factor payments											
Skilled	% ch	--	1.9	1.3	2.4	1.8	2.1	1.9	1.9	1.9	1.9
Semiskilled	% ch	--	2.6	1.8	3.1	2.7	2.6	2.6	2.6	2.6	2.6
Unskilled	% ch	--	2.8	2.0	3.2	2.9	2.7	2.8	2.8	2.8	2.8
Capital	% ch	--	4.3	4.9	3.8	4.3	4.2	4.3	4.3	4.2	4.2

* Total revenue excluding social security contributions and tariffs
Source: author's CGE model results

The arithmetical microsimulation finds a decrease in income inequality. The Gini index of per capita household income falls by approximately 0.010 points and the Gini index of per capita labour income falls by 0.013 points. Average per capita household income increases moderately in the first eight deciles[27] (table 13) and decreases in the two richest deciles (-0.7% and -4.2% respectively). These results are clearly driven by the greater progressiveness of the new direct income tax. Per capita household income grows by an average of 0.2% in the 1st decile and 0.6% in the 2nd decile. The new income tax structure is thus shown to have smaller effects on the poorest decile, a result that can be explained by the fact that there was already a minimum taxable income on labour.[28]

[27] Initial incomes brackets based on pre-reform rankings.
[28] Moreover, informal labour is more common in the poorest decile and changes in this due to the reform are not modeled.

Table 12: Microsimulation results of the full reform under different macroeconomic closures of the model on the government: effects on income, poverty and inequality

	Mean of PCHI (after direct taxes)	Mean of LI (after direct taxes)	Extreme Poverty (incidence)	Moderate Poverty: FGT(a) indicators			Inequality	
				Incidence: FGT(0)	Poverty Gap Ratio: FGT(1)	Severity of Poverty: FGT(2)	Gini of PCHI	GINI of LI
Base Indicators	***6,425***	***8,148***	***2.29***	***27.88***	***9.34***	***4.31***	***0.453***	***0.498***
(a) **Arithmetical Microsimulation**	**-1.2%**	**-1.5%**	**-0.01**	**-0.33**	**-0.10**	**-0.04**	**-0.009**	**-0.013**
Simulations with flexible government savings								
(b) **Labour Market Changes (Gen. Eq. Effects)**	**1.5%**	**1.8%**	**-0.16**	**-0.65**	**-0.32**	**-0.18**	**-0.001**	**0.001**
i) Participation Rate Change	0.0%	0.0%	0.00	0.00	0.00	0.00	0.000	0.000
ii) Unemployment Rate Change	0.4%	0.0%	-0.10	-0.29	-0.14	-0.09	-0.001	0.002
iii) Employment Structure Change	0.0%	-0.1%	0.01	0.03	0.01	0.01	0.000	0.000
iv) Wage Structure Change	0.0%	0.0%	0.00	-0.04	-0.02	-0.01	0.000	-0.001
v) Wage Rate Change	0.9%	1.8%	-0.07	-0.35	-0.17	-0.09	0.000	-0.001
vi) Capital Price Change	0.1%	0.0%	0.00	0.00	0.00	0.00	0.000	0.000
(c) **Total Microsimulation Effects** = (a)+(b)	**0.3%**	**0.3%**	**-0.16**	**-0.98**	**-0.43**	**-0.22**	**-0.010**	**-0.012**
Final Counterfactual Indicators	***6,441***	***8,169***	***2.12***	***26.90***	***8.91***	***4.09***	***0.443***	***0.486***
Simulations with flexible real government consumption								
(b) **Labour Market Changes (Gen. Equilib. Effects)**	**1.8%**	**2.2%**	**-0.18**	**-0.82**	**-0.38**	**-0.20**	**-0.001**	**0.000**
i) Participation Rate Change	0.0%	0.0%	0.00	0.00	0.00	0.00	0.000	0.000
ii) Unemployment Rate Change	0.5%	0.0%	-0.10	-0.32	-0.15	-0.09	-0.001	0.002
iii) Employment Structure Change	0.0%	0.0%	0.00	-0.04	-0.02	-0.01	0.000	-0.001
iv) Wage Structure Change	0.0%	0.0%	0.00	0.01	0.00	0.00	0.000	0.000
v) Wage Rate Change	1.2%	2.2%	-0.07	-0.46	-0.22	-0.11	0.000	-0.001
vi) Capital Price Change	0.1%	0.0%	0.00	0.00	0.00	0.00	0.000	0.000
(c) **Total Microsimulation Effects** = (a)+(b)	**0.6%**	**0.8%**	**-0.18**	**-1.14**	**-0.48**	**-0.25**	**-0.009**	**-0.013**
Final Counterfactual Indicators	***6,463***	***8,208***	***2.11***	***26.73***	***8.85***	***4.06***	***0.443***	***0.485***
Simulations with budget neutral assumption								
(b) **Labour Market Changes (Gen. Eq. Effects)**	**1.8%**	**2.1%**	**-0.17**	**-0.80**	**-0.37**	**-0.20**	**-0.001**	**0.001**
i) Participation Rate Change	0.0%	0.0%	0.00	0.00	0.00	0.00	0.000	0.000
ii) Unemployment Rate Change	0.5%	0.0%	-0.11	-0.33	-0.16	-0.10	-0.001	0.002
iii) Employment Structure Change	0.0%	-0.1%	0.01	0.04	0.02	0.01	0.000	0.000
iv) Wage Structure Change	0.0%	0.0%	0.00	-0.03	-0.01	-0.01	0.000	-0.001
v) Wage Rate Change	1.2%	2.2%	-0.06	-0.48	-0.21	-0.11	0.000	-0.001
vi) Capital Price Change	0.1%	0.0%	0.00	0.00	0.00	0.00	0.000	0.000
(c) **Total Microsimulation Effects** = (a)+(b)	**0.6%**	**0.7%**	**-0.18**	**-1.13**	**-0.48**	**-0.24**	**-0.009**	**-0.012**
Final Counterfactual Indicators	***6,461***	***8,201***	***2.11***	***26.75***	***8.86***	***4.06***	***0.443***	***0.486***

Table 13: Counterfactual changes in mean per capita household income by decile, due to reforms, by different government closures

Decile of HH income	Base Scenario	Arithmetical Microsim	% Arith./Base	Simulations with flexible government savings			Simulations with flexible real government consumption			Simulations with budget neutral assumption		
				Cumulative Changes (Arith. + GE effects)	% Cum./Arith.	Total Variation (%)	Cumulative Changes (Arith. + GE effects)	% Cum./Arith.	Total Variation (%)	Cumulative Changes (Arith. + GE effects)	% Cum./Arith.	Total Variation (%)
1	1,448	1,452	**0.2%**	1,484	**2.2%**	**2.5%**	1,49	**2.6%**	**2.9%**	1,488	**2.5%**	**2.7%**
2	2,386	2,401	**0.6%**	2,453	**2.1%**	**2.8%**	2,458	**2.4%**	**3.0%**	2,458	**2.4%**	**3.0%**
3	3,216	3,241	**0.8%**	3,301	**1.9%**	**2.7%**	3,311	**2.2%**	**2.9%**	3,311	**2.2%**	**3.0%**
4	4,064	4,095	**0.8%**	4,167	**1.7%**	**2.5%**	4,179	**2.0%**	**2.8%**	4,178	**2.0%**	**2.8%**
5	4,996	5,029	**0.7%**	5,107	**1.5%**	**2.2%**	5,124	**1.9%**	**2.6%**	5,119	**1.8%**	**2.5%**
6	6,091	6,125	**0.6%**	6,21	**1.4%**	**1.9%**	6,231	**1.7%**	**2.3%**	6,228	**1.7%**	**2.2%**
7	7,48	7,51	**0.4%**	7,604	**1.3%**	**1.7%**	7,629	**1.6%**	**2.0%**	7,627	**1.6%**	**2.0%**
8	9,455	9,46	**0.1%**	9,578	**1.3%**	**1.3%**	9,607	**1.5%**	**1.6%**	9,604	**1.5%**	**1.6%**
9	12,883	12,792	**-0.7%**	12,933	**1.1%**	**0.4%**	12,974	**1.4%**	**0.7%**	12,965	**1.4%**	**0.6%**
10	26,441	25,32	**-4.2%**	25,589	**1.1%**	**-3.2%**	25,667	**1.4%**	**-2.9%**	25,647	**1.3%**	**-3.0%**

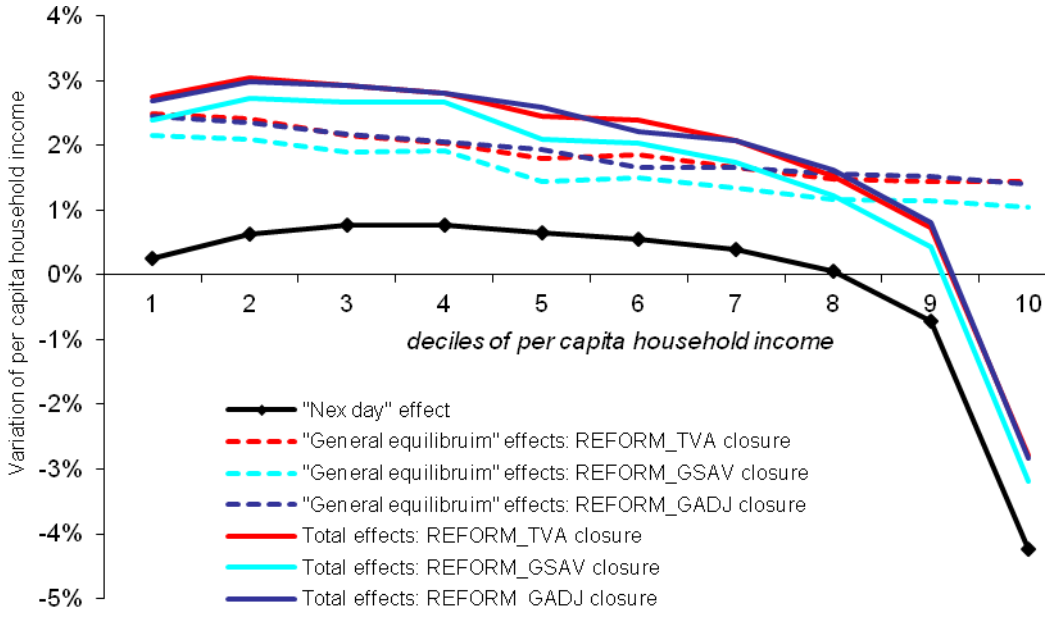
The counterfactual changes in wages, unemployment, labour supply and employment by sector of activity as derived from the CGE model result from changes in agents' behaviour that affect household income. These effects are in addition to the "next day" effect. The microsimulation results of these counterfactual changes thus represent pure "general equilibrium effects".

The general equilibrium effects show an increase in mean per capita household income and mean labour income. These effects compensate for the "next day" reduction in income found in the arithmetical microsimulation. The most important counterfactual changes driving these results are reduced unemployment and growth in mean wages and capital income indicated by every CGE simulation. Moreover, general equilibrium effects strengthen the observed "next day" reduction of the incidence of poverty, the poverty gap and the severity of poverty. The size of these effects is much greater than the "next day" effect. The average increase in the wage rate and the reduction of unemployment are the most important labour market changes underlying this poverty reduction. As for inequality indicators, general equilibrium effects lead to a minor additional reduction of the Gini index for total household income (in the same direction of the arithmetical simulation) and do not affect the Gini index for labour income.

The simulated change in household income across the income distribution shows an interesting trend. The "next day" effects of the tax reform are progressive, with a significant reduction in the richest decile's after-tax income. The "general equilibrium" effects with respect to per capita household income move in the opposite direction: every decile sees income increase regardless of the CGE closure used (see figure 2).

As mentioned above, the most important change behind this result is the approximately 2 pp reduction in the unemployment rate, with particularly notable effects for the unskilled workers that are predominant in lower income households. The other main counterfactual change that explains this result is average real wage growth of about 2%. The counterfactual indicators of these key labour market parameters are very similar in each of the three government closures used in the CGE model, so the full reform's general equilibrium effects on poverty and inequality are very similar in each simulation. In sum, substantial general equilibrium effects are robust to the type of government closure assumed in the CGE model and reinforce the observed poverty and inequality reduction obtained from the "next day" simulation.

Figure 2. After-tax per capita household income by decile and type of microsimulation. Full reform (variation w.r.t base)



Source: Author's CGE microsimulation results

7. Concluding Remarks

First, it is important to remark that full implementation of the 2007 Uruguayan tax reform has significant general equilibrium effects. Taken together, they tend to reinforce the progressive nature of the "next day" effects of implementing its main policy, i.e. the introduction of a direct personal income tax to replace the previous wage and pensions tax. Although this is an expected result, it reinforces the importance of evaluating these types of macro reforms using methodologies that account for potential reallocation of resources due to changes in prices of goods and factors due to the policy.

Second, the main results relating to the effects of full implementation of the reforms on aggregate economic activity, employment, poverty and inequality are robust to the alternative assumptions about government closure, although there are clear differences regarding investment absorption structure and public-private shares of investment in addition to possible dynamic effects that are not captured in this study. The results are also robust to variation of key parameters.

An important result is that the full reform increases GDP and employment even though it actually increases the tax burden. In other words, when government revenues

increase due to the tax reform (by allowing an increase in either government provision of public services or government savings), the reform also results in employment and wage growth and reduced unemployment, generating positive general equilibrium effects on average household income and poverty. This obviously does not mean that the government's use of additional revenue is irrelevant. The simulations that alter either government consumption or savings accounts tend to crowd out private consumption or savings, with probable future negative effects on private capital accumulation. When the government budget is held fixed and additional reductions of the VAT rate are allowed, the reform generates the most positive effects in relation to economic activity, poverty and inequality.

This result is linked to the fact that the reform generally reduces or eliminates taxes on some goods and factors and harmonizes tax rates across categories for others. This is done though the intermediate consumption tax, the health tax, the VAT and ECSS, with any revenue losses being compensated for with an increase in direct taxation. Reduction, elimination or harmonization of these taxes tends to reduce price distortions of goods and factors. In a context of (perfect) factor mobility across economic activities this leads to a better reallocation of resources, stimulating an expansion of economic activity.

Although direct taxation on household income could also be distortionary because of the efficiency loss associated with substitution between labour (used to purchase commodities) and leisure, the simulated models suggest that the shift towards direct taxation in Uruguay is desirable from the efficiency perspective. Despite an elastic labour supply in the model (i.e., there is some substitution between labour and leisure), the final simulated changes in participation rates were insignificant. It should be noted that this may result from the nature of labour supply in the macro model, which is defined in terms of representative individuals and not in terms of working hours. A future analysis could improve on this weakness by adjusting an econometric model of labour supply to the NHS microdata and then link it to the CGE (see for example Robilliard, Bourguignon and Robinson (2001)).

We also find that the joint effect of the new personal income tax and a compensatory change in VAT rates leads to a significant increase in disposable income for all household groups except for the richest decile. This has positive effects on aggregate consumption (and levels of economic activity) and reduces both the incidence of poverty and the Gini index by about one percent. The general equilibrium effects of the full reform include an increase in aggregate disposable household income that compensates for the reduction

obtained by the application of the personal income tax ignoring other components of the reform and economic agents' responses to the reform.

Moreover, the general equilibrium effects strengthen the reduction of the incidence of poverty, the poverty gap and the severity of poverty exclusively due to the new personal income tax, without behavioural responses. The magnitude of the general equilibrium effects is significantly greater than the "next day" effects.

The 1-point reduction of the Gini inequality coefficient is entirely due to the progressive nature of the direct income tax: households in the richest decile are the clear "losers" from the reform. However, the general equilibrium effects of the full reform do not play a significant role in this regard.

The main redistributive effects of the reform come from the direct impact of the new (progressive) personal income tax. Nevertheless, given that individuals in the lower half of the income distribution currently face a very low effective tax rate, further changes to the minimum taxable income threshold would have a limited role in terms of redistribution.

Finally, the results also indicate that VAT rates could be lowered further to make the reform budget neutral. When the full reform is compensated by changes in VAT rates, the VAT rates could be lowered by an additional percentage point, to 21% for the basic rate and 9% for the minimum rate. A main result is that, under an assumption of budget-neutrality, and when additional reductions in the VAT rate are permitted, the reform generates a larger positive effect on aggregate economic activity and leads to the best results in terms of poverty and inequality. This suggests that further reductions in VAT rates are desirable both with respect to efficiency and equity.

8. References

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Annex – Parameters used in the CGE Model

Table A.1: Trade and production elasticities

	Armington 1/	CET 2/	Elasticities of substitution: capital and composite labour 3/	Elasticities of substitution: types of labour 4/
Primary except livestock	0.9	1.2	0.5	0.7
Livestock	0.9	1.2	0.5	0.7
Meat, fruit & veg ind., beverages	1.53	2.5	0.5	0.9
Mills, sugar and vegetable oils	0.48	2.5	0.5	0.9
Dairy	0.76	2.5	0.5	0.9
Other food industry	0.97	2.5	0.5	0.9
Other manufacturing	2.05	2.5	0.5	0.9
Press	2.05	2.5	0.5	0.7
Petroleum refining	0.75	2.5	0.5	0.6
Pharmacy	1.52	2.5	0.5	0.7
Metal products & machinery	2.05	2.5	0.5	0.9
Electricity and gas	0.9	1.2	0.5	0.9
Water	0.9	1.2	0.5	0.9
Construction	0.9	1.2	0.7	0.9
Commerce	0.9	1.2	0.6	0.9
Hotels	0.9	1.2	0.6	0.9
Services	0.9	1.2	0.6	0.9
Passenger transport	0.9	1.2	0.7	0.9
Communications	0.9	1.2	0.6	0.9
Financial services	0.9	1.2	0.6	0.9
Public administration	0.9	1.2	0.6	0.9
Private education	0.9	1.2	0.6	0.9
Health – hospitals	0.9	1.2	0.6	0.9
Other health services	0.9	1.2	0.6	0.9

Source**:** [1]Based on Flores and Cassoni (2010); [2]Laens and Llambi (2008); [3,4]Based on authors' own estimations for manufacturing, construction and services

Table A.2: Labour elasticities

	Wage elasticity of labour supply	Elasticity of wages to unemployment
Skilled	0.120	0.034
Semiskilled	0.101	0.139
Unskilled	0.080	0.145

Source**:** Based on Bucheli and Gonzalez (2007)

Table A.3: Income elasticities of commodity demand

	Deciles of household income									
Commodity	**Poorest**	**HH-2**	**HH-3**	**HH-4**	**HH-5**	**HH-6**	**HH-7**	**HH-8**	**HH-9**	**Wealthiest**
Primary exc. livestock	1.00	1.00	1.00	0.90	0.89	0.88	0.87	0.85	0.84	0.84
Meat, fr.&veg ind.,bev.	1.00	1.00	1.00	0.90	0.89	0.88	0.87	0.85	0.84	0.84
Mills, sugar, veg. oils	1.00	1.00	1.00	0.90	0.89	0.88	0.87	0.85	0.84	0.84
Dairy	1.00	1.00	1.00	0.90	0.89	0.88	0.87	0.85	0.84	0.84
Other food industry	1.00	1.00	1.00	0.90	0.89	0.88	0.87	0.85	0.84	0.84
Other manufacturing	1.03	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00
Press	1.03	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01
Petroleum refining	1.01	1.01	1.00	0.98	0.98	0.97	0.97	0.87	0.84	0.84
Pharmacy	1.04	1.04	1.02	1.03	1.02	1.00	1.00	1.00	0.99	0.99
Metal prod, machinery	1.07	1.05	1.04	1.03	1.03	1.02	1.02	1.02	1.01	1.01
Electricity and gas	1.01	1.01	1.00	0.98	0.98	0.97	0.97	0.87	0.84	0.84
Water	1.01	1.01	1.00	0.98	0.98	0.97	0.97	0.87	0.84	0.84
Construction	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Commerce	1.02	1.02	1.01	0.99	0.98	0.98	0.97	0.95	0.94	0.94
Hotels	1.05	1.03	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00
Services	1.05	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.01
Passenger transport	1.03	1.01	1.01	1.01	1.00	1.00	0.99	0.99	0.99	0.99
Communications	1.01	1.01	1.00	0.98	0.98	0.97	0.97	0.87	0.84	0.84
Financial services	1.05	1.03	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00
Private education	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.02	1.02	1.02
Health – hospitals	1.04	1.04	1.02	1.03	1.02	1.00	1.00	1.00	0.99	0.99
Other health services	1.04	1.04	1.02	1.03	1.02	1.00	1.00	1.00	0.99	0.99

Source**:** Based on González (2003)