TAX INCIDENCE IN COLOMBIA: A GENERAL EQUILIBRIUM ANALYSIS

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Final Version

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1. Introduction

The conventional approach to tax incidence rests heavily on arbitrary assumptions as to how taxes are shifted forward or backwards. Some of the major shortcomings of this approach are now widely recognized. First, these assumptions have no empirical basis and may not reflect the functioning of economies, especially the underdeveloped ones. Second, this approach does not take into account the indirect effects of taxes on production and consumption patterns, which in turn affect relative prices and incomes. Third, it does not consider the deadweight loss of taxes, sometimes largely underestimating their incidence (Musgrave, 1987; Shah and Whalley, 1991; Clarete and Whalley, 1990).

Computable general equilibrium models (CGEs) have therefore been applied to tax incidence analysis. However, conventional CGEs may also be inadequate as they generally assume fully flexible prices and perfect mobility of factors between sectors, thus ruling out some of the so-called rigidities that determine relative prices and incomes in developing countries. Hence, although taking into account the indirect effects of taxes, conventional CGEs may also implicitly adopt shifting assumptions that may be valid for some developed economies but certainly not for developing ones.

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The purpose of this paper is to analyze tax incidence in Colombia with a CGE model that allows for the inclusion of different degrees of factor mobility between sectors, as well as for various economic rigidities, such as wage and price stickiness and supply constraints in specific sectors. Incidence analysis is focused on factor incomes, socioeconomic groups and deciles of income distribution in the urban and the rural sectors.

Taxes studied include the value added tax (VAT), import tariffs, a capital tax, and corporate and income taxes. Taxes are modeled incorporating some of the most prominent features in Colombia. For instance, a number of goods and services are excluded from the VAT system in Colombia, which implies that taxes paid on their inputs can not be deducted. This feature of the system is explicitly taken into account and the results are compared with those derived from a hypothetical flat VAT. In the same way, a flat tax on capital is compared with a realistic one where corporate income and earnings accruing to the two urban top deciles are taxed. The model is also used to assess the effects of the tax reforms of 1990-1992, which were introduced as part of the structural reforms implemented by César Gaviria's Administration (1990-1994). Finally, incidence of the tax system is analyzed for 1992.

The paper is organized as follows. Section 2 describes the structure of the basic model, while section 3 refers to the sources of data and parameters. Section 4 explains the set of simulations to be performed for each tax. The following three sections analyze the incidence of the VAT, tariffs and income taxes, respectively. Sections 8 and 9 discuss how the recent tax reforms modify the overall incidence of the tax system in Colombia. In the last section some general conclusions are summarized.

2. Model Structure

The model is a static CGE model disaggregated into 21 sectors, 5 factors of production and 20 households. The list of sectors (see Table 1) is based on a rearrangement of the two-digit level SITC. Sectoral disaggregation captures major factor intensity differentials and/or demand composition differentials among production branches.

The 5 factors considered comprise two types of capital, rural and urban, and 3 types of labour, rural, skilled urban and unskilled urban. Rural labour includes wage earner workers in the agricultural activities. The remaining rural incomes are considered capital incomes. Skilled urban labour comprises

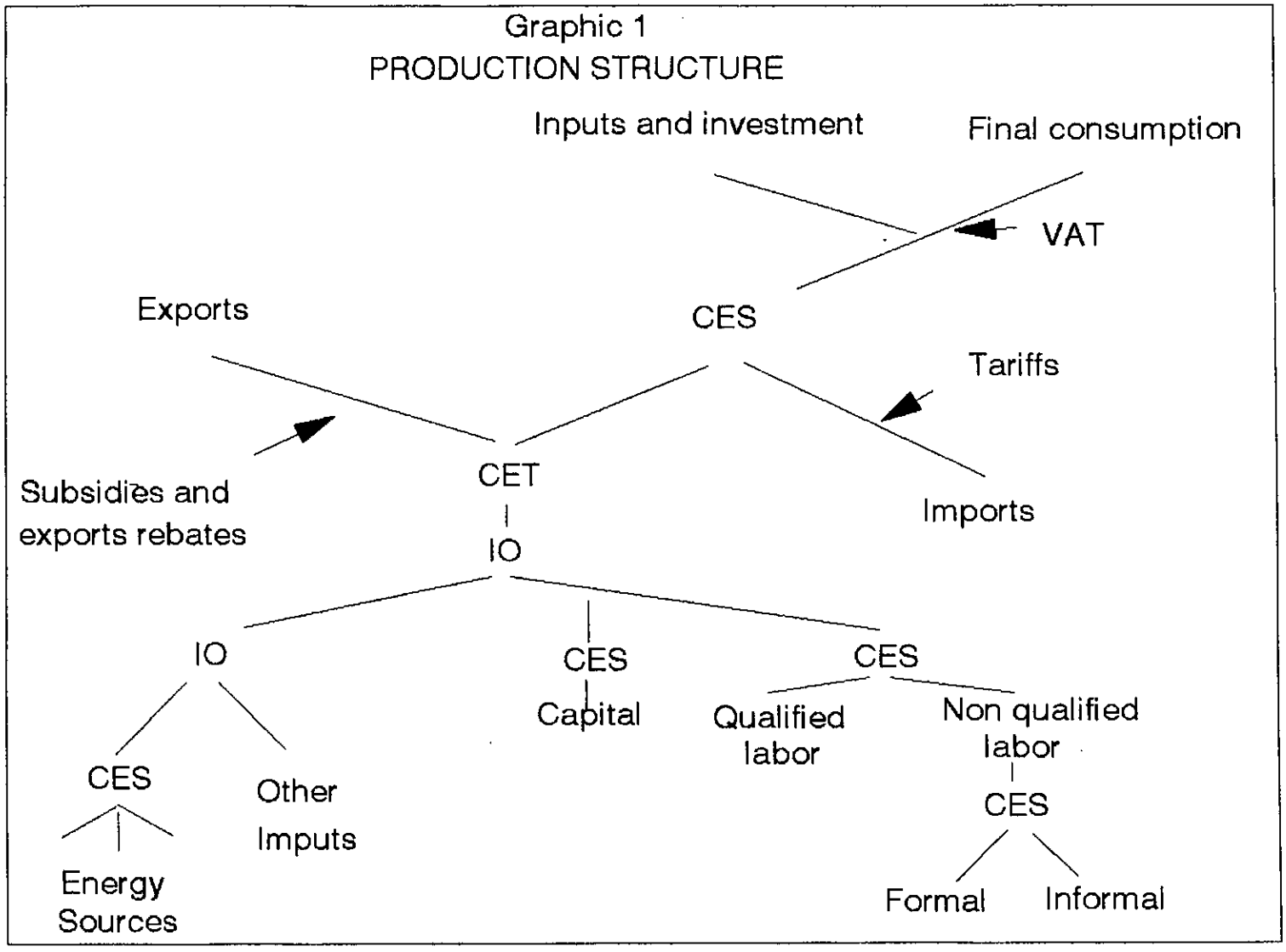
Table 1
SECTORIAL STRUCTURE OF DEMAND AND FACTOR USE
(As percent of GDP)

	Consumption		Investment		Inventories Accumulation	Exports	Imports	Value Added	Labour Income				Capital income	
	Households	Government	Private	Public					Rural	Unskilled Informal	Unskilled formal	Skilled	Rural	Urban
Agriculture food products	3.80	-	0.00	-	0.09	0.01	0.35	4.57	1.05	-	-	-	3.41	-
Modern agriculture	2.64	-	0.23	0.02	1.31	1.57	0.24	10.05	4.06	-	-	-	5.97	-
Raw coffe	-	-	-	-	-	-	-	3.21	1.50	-	-	-	1.71	-
Oil	-	-	-	-	-0.14	3.66	-	5.40	-	0.01	0.09	0.17	-	4.86
Coal	-	-	-	-	-0.01	1.31	-	1.37	-	0.01	0.05	0.11	-	1.18
Natural gas	0.10	-	-	-	-	-	0.01	0.24	-	0.00	0.00	0.00	-	0.22
Refined oil products	0.94	-	-	-	0.03	1.21	1.16	1.53	-	0.01	0.11	0.20	-	0.24
Rest of mining	0.01	-	-	-	0.22	1.72	0.13	2.00	-	0.19	0.02	0.03	-	1.69
Processed coffee	0.64	-	-	-	0.04	3.78	-	0.20	-	0.07	0.10	0.24	-	-1.08
Other processed foodstuffs	11.27	-	-	-	-0.04	0.94	0.33	4.87	-	0.25	0.47	0.32	-	3.78
Other non durable manufactured	7.72	-	0.08	0.02	0.14	2.29	0.61	7.10	-	1.08	1.05	0.62	-	2.54
Intermediate manufactured goods	7.16	-	-	-	0.31	1.22	3.72	6.19	-	0.35	1.13	0.78	-	3.43
Durable manufactured goods	2.63	-	7.87	0.37	0.16	0.49	6.87	4.61	-	0.41	0.74	0.65	-	2.04
Consturction	0.00	-	5.16	2.90	-	-	-	5.49	-	1.16	0.35	0.40	-	3.30
Commerce	0.00	-	-	-	-	0.02	0.03	0.15	-	0.01	0.01	0.01	-	0.11
Transportation	8.65	-	-	-	-	1.60	0.87	7.65	-	1.58	0.76	0.44	-	4.71
Rest of modern services	3.42	-	-	-	-	0.74	0.48	11.57	-	0.43	1.61	3.03	-	6.18
Personal services	11.40	-	-	-	-	-	0.03	8.60	-	2.85	0.67	0.18	-	4.69
Domestic services	0.22	-	-	-	-	-	-	0.22	-	0.22	-	-	-	-
Housing	4.70	-	-	-	-	-	-	4.31	-	-	-	-	-	3.99
Government services	0.22	10.27	-	-	-	-	-	7.80	-	0.30	2.96	4.61	-	-
Tariffs	-	-	-	-	-	-	-	3.06	-	-	-	-	-	-
Total	65.45	10.27	13.32	3.32	2.10	20.67	14.82	100.00	6.61	8.92	10.01	11.70	11.08	41.89

Source: DANE and author's calculations.

Graphic 1

PRODUCTION STRUCTURE



workers with 12 or more years of education, with the remaining workers classified as unskilled. Unskilled labour in the urban areas, in turn, is disaggregated between formal and informal depending on whether the worker is entailed in the social security system or not.

Households are classified into rural and urban, ordered by deciles in each case. Concentration as measured by a Gini coefficient reaches 0.482 among urban households and 0.464 among rural households (see Table 2). Apart from households, the model considers as institutions the urban corporate sector, the government and the social security system.

Production

In each of the sectors production is specified by nested production functions (see Graphic 1). Inputs and value added by sector are combined in fixed coefficients (IO). Inputs used in each sector are, in turn, the result of combining energy and the rest of the inputs in fixed coefficients; energy used in each sector is determined by constant elasticity of substitution (CES) funtions that combine the different sources of energy. Labour use in each of the urban sectors is modelled through two-stage CES functions. In the first stage the two types of labour are combined; in the second, skilled labour is combined with total unskilled labour. Table 1 presents the employment patterns of each type of labour in the various sectors. In the rural sector only rural labour is used. As long as there are no quantity rigidities or mark-up pricing in the corresponding sectors, capital is combined with labour through a CES function. However, when quantity rigidities or pricing rules occur, capital does not enter the production function of the corresponding sectors, as it is not paid according to its marginal productivity (see below).

Supply of goods

Sectoral productions are split between exports and domestic uses. Constant elasticity of transformation (CET) functions are used for this purpose except in those versions of the model where mark-up pricing occurs in some sectors; in such sectors fixed technical coefficients are applied. Goods supplied to the domestic market are a CES composite of domestic and imported goods according to the Armington specification. The supply of imported goods is infinitely elastic at given external prices. Goods supplied domestically are used for intermediate consumption, investment and final consumption.

Factor markets

Each of the two types of capital are split by sector through a constant elasticity of transformation function (CET). The value of the elasticity parameter, which varies according with the simulation determines the degree of mobility. Perfect mobility between sectors is assumed for each type of labour. Mobility also occurs within segments of the labour market, according to migration functions of the form

$$A/B = c*(EWA/EWB)^m$$

where A and B are the supplies of labour in the segments of the labour market, EWA and EWB are the relative expected wages, c is a calibration parameter and m is the elasticity of migration. The higher the costs of migrating, the lower this elasticity. Three of these migration functions are introduced to deal, respectively, with rural-urban migration, unskilled-skilled migration and formal-informal migration. Expected wages take into account relative earnings and, in the first function, the differential probability of the rural immigrant finding a job in the formal vis-a-vis the informal urban segment of the labour market [2].

Income distribution

Each type of capital and labour income is assigned to household deciles in the rural and urban areas in proportion to their original factor endowments (see Table 2), after deducting corporate income taxes and social security taxes (in the cases of skilled and formal unskilled urban workers). Urban households receive transfers from abroad and from the government in fixed amounts. Apart from these, in each simulation households receive compensatory transfers proportional to their disposable income, as a means to transfer back to consumers the net additional tax receipts accruing to the government. By doing so, we adopt the "differential incidence" approach to assess tax incidence. Disposable income of each household group is finally obtained by deducting direct taxes (paid only by the two upper urban income deciles).

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[2] This type of modelling is based on the classical work by Todaro (1969) and Harris and Todaro (1970). However, by assuming that migration is costly, wage equalization between any pair of segments of the labour market is ruled out.

Table 2

INCOME DISTRIBUTION BY FACTOR 1990

(As percent of GDP)

URBAN						RURAL			
	Labour Income						Inco		
Urban Deciles	Unskilled Informal	Unskilled Formal	Skilled	Non-labour Income	Porcentual Distribution	Rural Deciles	Labour Income	Non-Labour Income	Porcentual Distribution
1	84.818	47.050	4.076	107.901	2.15	1	19.144	28.307	1.31
2	127.551	90.093	9.286	164.856	3.45	2	56.408	78.808	3.72
3	157.833	121.369	13.246	220.224	4.51	3	78.867	117.429	5.41
4	182.314	152.780	30.147	285.577	5.73	4	93.803	139.536	6.43
5	190.687	177.531	57.948	332.160	6.68	5	111.650	164.264	7.6
6	204.170	188.744	91.152	443.027	8.16	6	131.500	192.761	8.93
7	203.409	212.751	159.808	544.620	9.87	7	153.288	233.719	10.66
8	205.118	235.933	261.845	692.563	12.29	8	194.240	297.320	13.54
9	218.280	230.739	437.598	1020.822	16.80	9	192.857	332.349	14.47
10	223.797	267.831	952.300	1997.633	30.36	10	327.646	686.841	27.94
Gini coef. a/					0.482				0.464

a/ Calculation based on post-tax incomes.

Includes factors incomes and goverment and social security transfers.

Source: author's calculations based on DANE data.

Consumption

In each household consumption is modelled as a Cobb-Douglas utility function. Savings are included in the utility functions to prevent saving squeezing (for instance, through large income redistributions from the urban to the rural sector) from turning into a welfare improvment. The price of investment goods is assumed as the savings deflator. Due to lack of information, the same consumption pattern is assumed for the 10 rural households.

External sector

Imports are modelled under the small country assumption of infinite elasticity of supply. Perfectly elastic demand curves are also assumed for all types of exports. However, the "law of one price" is ruled out by the referred treatment of export supplies and import demands. The current account is equivalent to net exports of goods and services plus net transfers to families and government, which are given in dollar terms. The exchange rate is assumed fixed in nominal terms and is used as the numeraire for the model. External balance (i.e. a current account surplus fixed in dollar terms) is achieved by relative price changes with respect to the numeraire.

Government

The government collects direct and indirect taxes, obtains earnings from its production of government services and receives transfers from abroad. The proceeds are used to consume, save, invest and pay transfers to the corporate sector and households. All transfers are fixed in nominal terms; the exception is compensatory transfers received by households. Government consumption and investment in goods and services are fixed in real terms and do not enter the households' utility functions.

Indirect taxes and subsidies comprise the VAT, import tariffs, export subsidies and export rebates. Some minor indirect taxes by sector of production are also included in the model, but their incidence is not analyzed in this paper. Treatment of each tax in the model is discussed in connection with the simulations (Sections 5 to 7).

Private investment and model closure

Private investment consists of fixed investment and inventory accumulation, both assumed fixed in real terms. Since government investment is also fixed in real terms, total savings must accomodate to close the model. The sources of savings include the current account, corporate sector, households and government. Currents account savings are fixed, while corporate sector and

household savings are endogenous given the average propensity to save. Hence, the saving-investment balance requires government savings to be residual. This is achieved by accommodating the amount of compensatory transfers to households. This closure rule assures that the burden of any tax change is reflected entirely on the utility of consumers, not on government expenditures (which do not enter consumers' utility), nor on the level of investment or the net income of the rest of the world.

3. Sources of Data and Parameters[3]

Aggregate accounts are consistent with the official 1990 national accounts by DANE. Production accounts are taken from the 1990 Input-Output Matrix elaborated by DANE. However, production accounts for the mining sectors are taken from Lora, Perry, et. al. (1992). Disaggregation of the aggriculture sector is based on the cost structure and the supply-demand equilibriums by product, presented in Lora and Ramírez (1990) and Gómez (1990).

The major macroeconomic variables for the base case are presented in Table 3.

Value added by capital and labour within each sector comes from the 1990 Input-Output Matrix. The proportions in which the different types of urban labour are combined in each sector are obtained from the September 1992 National Households Survey.

Distribution of factor incomes to households by deciles is also based on the 1992 Household Survey. Urban households consumption by deciles is calculated maintaining the same consumption pattern observed in the 1985 Incomes and Expenditures Survey (the last one available). Since this survey did not include rural areas, rural consumption is obtained residually, ensuring that overall household consumption matches the private consumption of national accounts[4]. The rest of the data for final demand by type of good is taken from national accounts.

Regarding the parameters required by the model, elasticities of substitution between labour and capital come from Whalley (1985), and between sources of energy from Lora, Perry, et.al. (1992). Substitution elasticities between imports and domestic

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[3] The social accounting matrix of this model is the same as the one used by the World Bank (1994).

[4] Due to the residual treatment of rural consumption, some adjustments were necessary in order to avoid some implausible results.

Table 3

MAJOR MACROECONOMIC VARIABLES IN THE BASE CASE, 1990

	Billions of pesos	% of GDP
I. Value Added	20,228,097	100.00%
Wages and Salaries	7,555,360	37.35%
Return to capital and other factors	10,682,055	52.81%
Indirect Taxes	2,048,402	10.13%
Less: Subsidies	57,720	0.29%
II.Gross Domestic Product	20,228,164	100.00%
Private Consumption	13,238,466	65.45%
Goverment Consumption	2,076,459	10.29%
Private Investment	2,693,439	13.32%
Goverment Investment	671,062	3.32%
Inventory Accummulation	387,156	1.91%
Exports	4,159,955	20.57%
Imports	2,998,373	14.82%
III. Goverment accounts		
A: Expendifure	2,747,521	13.58%
Consumption	2,076,459	10.27%
Investment	671,062	3.32%
B: Revenue (Net of Subsidies)	2,842,480	14.05%
1.Income Taxes	885,216	4.38%
2.Indirect Taxes	2,048,402	10.13%
Taxes on production	1,042,490	5.15%
Value Added Tax	470,537	2.33%
Import Taxes	468,419	2.32%
Export Taxes	65,504	0.32%
-Coffe	63,615	0.31%
-Coal	1,889	0.01%
Other Taxes	1,452	0.01%
3.Capital Income	(33,418)	-0.17%
4.Less: Subsidies	57,720	0.29%
C: Surplus/Deficit	94,959	0.47%

Memo: 502.26 Col.$=1 US$

Table 4
EFFECTIVE TAX RATES IN THE BASE CASE
(Percentages)

	1990						1992					
	Income & Corporate	Tax on gross production value 1/	VAT	Tariffs	Export subsidies	Rents (a)	Income & corporate	Tax on production value 1/	VAT	Tariffs	Export subsidies	Rents (a)
A. Sectors												
Agriculture food products	-	0.20	-	10.80	-1.60	-	-	0.20	-	4.70	-1.60	-
Modern agriculture	-	0.30	-	10.80	-1.70	-	-	0.30	-	4.20	-1.70	-
Oil	-	-	-	-	-	4.50	-	-	-	-	-	-10.60
Coal	-	0.40	-	-	-	0.70	-	0.40	-	-	0.30	-17.80
Natural gas	-	1.20	-	23.50	-	-	-	1.20	-	23.50	-	-
Refined oil products	-	26.00	3.20	5.80	-0.02	-	-	16.30	3.80	5.80	-0.01	-
Rest of mining	-	3.00	-	12.00	-0.00	-	-	3.00	-	12.00	-	-
Processed coffee	-	9.30	-	-	-	9.10	-	9.00	-	-	-	-8.30
Other processed food products	-	0.60	0.01	29.80	-4.60	-	-	0.50	0.01	11.50	-4.60	-
Other non durable manufactured goods	-	14.80	2.40	15.40	-5.50	-	-	14.90	3.00	6.10	-5.50	-
Intermediate manufactured goods	-	0.60	6.30	20.70	-4.50	-	-	0.60	7.60	7.70	-4.50	-
Durable manufactured goods	-	1.00	33.00	17.30	-4.30	-	-	1.10	40.60	6.10	-4.30	-
Construction	-	3.30	-	-	-	-	-	3.30	-	-	-	-
Commerce	-	7.50	-	21.50	-0.40	-	-	7.50	-	4.40	-0.40	-
Transportation	-	1.20	0.10	1.10	0.50	-	-	1.20	0.10	1.10	-	0.50
Rest of modern services	-	0.90	4.10	0.30	-	-	-	0.90	6.80	0.06	-	-
Personal services	-	0.80	0.10	-	-	-	-	8.00	0.10	-	-	-
Housing	-	7.40	-	-	-	-	-	7.40	-	-	-	-
Goverment services	-	1.00	-	-	-	-	-	1.20	-	-	-	-
B. Income groups												
Enterprises	9.50	-	-	-	-	-	11.10	-	-	-	-	-
Urban households								-	-	-	-	-
Decil 9	0.90	-	-	-	-	-	1.00	-	-	-	-	-
Decil 10	5.30	-	-	-	-	-	6.10	-	-	-	-	-

1/: Mainly excises and local taxes on production

Source:

1990: Dane

1992: Authors calculations as in World Bank (1994)

production, and transformation elasticities between goods for domestic and external markets have been adopted from Botero and López (1989). For exports of manufactured goods, transformation elasticities are assumed to be equal to the price elasticities of supply estimated by Botero and Meisel (1988). The elasticities of migration between labour segments are based on the previous work of Lora and Ramírez (1990 and 1991).

4. List of Simulations

For each of the taxes considered in Sections 5 through 9 the same set of simulations is performed. The simulations evaluate the impact of changing a tax in order to increase its yield by 10% of the value of private consumption (or 6.5% of GDP). The exception is the tax reforms of 1990-1992 the additional yield is determined endogenously by the model.

Two elements are analyzed in the simulations. First, different degrees of factor mobility are considered. In the labour market, this is done by changing the values of the migration parameters. When migration is assumed "perfect", the elasticities of migration are set equal to 10. Otherwise, the following values are assigned: 0.02 to rural-urban migration, 0.1 to skilled-unskilled migration and 0.2 to formal-informal migration. In the capital market, the degree of mobility depends on the elasticities of transformation of the CET functions that assign the total supply of capital in both areas. When mobility is perfect these elasticities are infinite, otherwise they take the value of 0.5.

The second factor considered in the simulations are wage, quantity and price rigidities. One of the possible rigidities is the real wage of formal unskilled workers [5]. In the absense of migration possibilities, changes in the demand for this type of labour is reflected entirely on the number of urban workers unemployed. With migration, some of the urban unemployed may resort to informal jobs or migrate to the country, depending on the relative expected wages. The relative expected wage depends on the probability of being unemployed if one stays in the formal segment.

Quantity rigidities considered are those most relevant for the Colombian economy in the short to medium run. These rigidities include oil extraction (limited by the pipeline

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[5] For this purpose, the deflator used is the price index of the consumption basket of the 5th urban decile, which roughly corresponds to the usual definition of the CPI in Colombia.

network), coffee exports (limited in practice by the Marketing Coffee Board), and exports of coal and other mining products (limited by the extraction infrastructure).

Prices that may be assumed rigid (in real terms [6]) are the final price of gasoline and other fuels, and the producers price of coffee, which are determined by the government. As a different type of price rigidity, a mark-up pricing system in the manufacturing sectors may be introduced. Mark-up pricing can be seen as a crude way of modelling oligopolistic practices.

Price and quantity rigidities imply that some factors are not paid according to their marginal productivities. Hence, we assume that capital in the relevant sectors become immobile and receive either a rent or a markup [7].

5. Incidence of the VAT

Two sets of simulations are conducted to evaluate the effects of the VAT. These include a hypothetical flat VAT and a non-flat VAT.

Hypothetical Flat VAT

Initially, a hypothetical flat VAT is levied on all goods and services consumed by households. If no distortions occur, total neutrality would prevail, as the additional tax receipts are transferred back to the consumers according to their initial consumption levels. This is not the case, however, since the model incorporates distortions (i.e. several taxes).

When no rigidities occur but differente assumptions are places on factor mobility (simulations 1 to 3, Table 5) imposing a flat VAT yielding 6.5% of GDP increases welfare slightly; welfare, as measured by the sum of Hicksian equivalent variations for the 20 households, increases by 0.03 to 0.04% of GDP. Socio-

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[6] With respect to a basket of consumption goods, see the previous footnote.

[7] Note, however, that rents in the mining and oil-refining sectors accrue to the government, as major (and sometimes unique) shareholder of those firms. In the case of coffee, export rents also accrue to the government (through the National Coffee Fund), but producers rents resulting from the rigidity of the domestic price accrue to the coffee growers, and hence to rural households.

Table 5
SIMULATION RESULTS - HYPOTHETICAL FLAT VAT

Simulation Number	1	2	3	4	5	6	7
I. Migration							
Labour	infinite	low	low	low	low	low	low
Capital	infinite	infinite	low	low	low	low	low
II. Rigidities							
Wages	no	no	no	no	yes	yes	yes
Quantities	no	no	no	yes	no	yes	yes
Prices	no	no	no	no	no	no	yes
Mark-ups	no	no	no	no	no	no	yes
III. Tax tariff (% points)	11.4	11.4	11.5	11.5	13.2	13.2	13.4
IV. Welfare (EV as % of GDP)							
Total	0.03	0.04	0.03	0.03	-2.41	-2.35	-3.24
Rural	-0.01	-0.01	-0.04	-0.07	-1.35	-1.58	-1.70
Urban	0.04	0.05	0.07	0.10	-1.06	-0.77	-1.54
V. Distribution (Gini % change)							
Rural	-0.00	-0.00	-0.00	-0.00	-0.02	0.00	0.03
Urban	0.01	0.01	0.02	0.01	0.40	0.39	0.49
VI. Real Incomes (% change)							
A. Labour							
Rural	-9.98	-9.98	-10.17	-10.38	-14.91	-16.55	-20.75
Unskilled informal	-10.05	-10.02	-9.97	-9.94	-8.92	-8.59	-9.87
Unskilled formal	-9.90	-9.92	-9.84	-9.81	-12.82	-12.41	-13.89
Skilled	-9.87	-9.87	-9.77	-9.75	-8.37	-8.16	-9.48
B. Capital							
Rural	-10.07	-10.06	-10.23	-10.39	-15.25	-16.51	-20.22
Urban	-9.99	-9.98	-9.90	-9.90	-11.86	-11.40	-14.00
(Memo: Exporters)	-9.91	-9.90	-9.67	-19.86	0.49	-9.18	-12.69

economic groups are affected evenly, with real income reductions close to 10% (before compensating transfers) [8].

Since the distortionary effect of the flat VAT is almost negligible, it comes to no suprise that the imposition of quantity rigidities does not significantly alter the results (simulation 4). However, when a wage rigidity is introduced, substantial changes occur (simulations 5, 6 and 7). Such a rigidity prevents an even distribution of the burden of the tax among factors and thus distorts their allocation. Welfare costs are now over 2.3% of GDP, representing over a third of the additional tax yield (6.5% of GDP). The welfare cost is even larger (3.2% of GDP) when the wage rigidity is combined with price rigidities and a mark-up in the manufacturing sectors, as this hinders relative price changes and causes larger production reductions in the urban activities [9].

If real wages are rigid, unskilled formal workers bear the burden of the VAT; real incomes of this group suffer a reduction of 12.4%-13.9% of GDP. The urban unemployment rate increases from 8.8% up to 16% (not presented in tables). As expected, the demand for unskilled informal workers expands, but only marginally since the substitution effects are offset by the reduction in production in the urban sector. Wage rigidities do not increase the burden of other urban labour groups. Those affected are, instead, rural workers and capitalists, whose real incomes fall between 14.9% and 20.8%, and to a lesser extent urban capitalists, whose real income falls between 11.9 and 14%. Mark up pricing enhances urban capitalists' losses due to its adverse effect on urban productions.

Income distribution (as measured by the Gini coefficient of household post-tax income [10]) within the urban and the rural regions are not substantially altered by the VAT; the

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[8] In order to calculate factor incomes in real terms, the implicit price index of the consumption basket of the 5th urban decile is used as the deflator for each type of urban income. In the case or rural factors the deflator used is the implicit price index of the consumption basket of rural households (which is the same for all deciles).

[9] Mark-up pricing and price rigidities by themselves have a small effect on the welfare cost and the distribution of the burden of the VAT.

[10] Note that Gini calculations are invariant to the inclusion of compensating transfers, since these are proportional to after-tax incomes.

distribution of income significantly worsens because of the increase in the number of unskilled workers unemployed.

Non-flat VAT

So far, it has been assumed that the VAT is levied on all consumption goods and services. A more realistic VAT can now be analyzed. Goods and services within the Colombian VAT system are classified into three groups: (a) excluded, (b) included with zero tax, and (c) included with other taxes (mostly 14%). This classification applies both to imported and domestic goods, which are treated exactly the same in the VAT system.

Goods excluded comprise agricultural and mining goods, processed foodstuffs, construction, transportation, housing, personal, domestic and government services. All exports are excluded from the VAT system, regardless of the type of good. Exclusion implies no refund of taxes levied on the inputs of the corresponding good.

Inclusion at zero rate implies no tax paid either directly or indirectly. Goods taxed at zero rate comprise gasoline and other fuels, manufactured inputs, machinery and equipment for the agricultural sector, a few trading activities and modern services. Investment in machinery and equipment is subject to a special regime, since the corresponding VAT is deductible from the corporate tax. In the model, this type of investment is included in the list of goods taxed at zero rate.

The rest of the goods and services are taxed 14% explicitly, except for automobiles, with rates up to 40%. These goods and services include other oil derivatives, industrial goods, commerce and the rest of modern services. The tax is levied on the private consumption of these goods or on the intermediate consumption in the production of the goods excluded. In the following simulations, we assume a flat rate for this group, in order to get the required yield. The resulting flat rate fluctuates between 16.9% and 19.2%.

Compared with the previous case, the distortions originated by the VAT are now generally larger, with welfare losses ranging from -0.08% of GDP to -3.77% of GDP. The main difference, however, is how the burden is distributed. It now falls more heavily on the urban factors. Rural families may even be favoured, mainly as a result of the exclusion of agricultural goods from the base of the VAT.

When factors are perfectly mobile and there are no rigidities (simulation 1), a non-flat VAT results in a loss of 0.15% of GDP and a reduction of total welfare equivalent to 0.28%

Table 6
SIMULATION RESULTS - NON-FLAT VAT

Simulation Number	1	2	3	4	5	6	7
I. Migration							
Labour	infinite	low	low	low	low	low	low
Capital	infinite	infinite	low	low	low	low	low
II. Rigidities							
Wages	no	no	no	no	yes	yes	yes
Quantities	no	no	no	yes	no	yes	yes
Prices	no	no	no	no	no	no	yes
Mark-ups	no	no	no	no	no	no	yes
III. Tax tariff (% points)	17.0	17.0	16.9	16.9	19.0	19.1	19.2
IV. Welfare rates (EV as % of GDP)							
Total	-0.28	-0.24	-0.12	-0.06	-2.59	-2.65	-3.77
Rural	0.18	0.19	1.10	1.72	-0.16	0.13	-0.37
Urban	-0.46	-0.43	-1.22	-1.81	-2.43	-2.78	-3.40
V. Distribution (Gini % change)							
Rural	0.07	0.07	0.04	0.01	0.03	0.01	0.03
Urban	0.03	0.04	-0.10	-0.06	0.23	0.28	0.34
VI. Real Incomes (% change)							
A.Labour							
Rural	-7.50	-7.56	-2.42	1.74	-6.74	-4.49	-9.10
Unskilled informal	-9.10	-9.25	-10.35	-11.16	-8.74	-9.12	-10.24
Unskilled formal	-10.20	-10.09	-11.41	-12.15	-14.45	-14.96	-16.15
Skilled	-10.20	-10.30	-11.87	-12.44	-10.12	-10.35	-11.48
B.Capital							
Rural	-5.79	-5.80	-1.35	1.92	-5.91	-4.21	-8.51
Urban	-8.53	-8.48	-10.04	-10.73	-11.79	-12.04	-13.96
(Memo: Exporters)	-4.09	-3.96	-8.55	-17.55	-5.08	-13.02	-14.31

of GDP. This burden is borne entirely by the urban sector, whose welfare loss amounts to 0.46% of GDP, while the rural sector benefits by 0.18% of GDP. This result can be explained by the fact that agriculture productions are excluded from the VAT and a large proportion of their inputs are zero-taxed [11]. Thpositive welfare impact in the rural sector is magnified since foodstuffs absorb a larger proportion of rural households income. For analogous reasons, the negative welfare effect is magnified in the urban sector.

When examining the factors of production, the non-flat VAT produces relatively even effects, although affecting labour slightly more severely than capital. Labour income decreases between 7.5% and 10.2%, while capital earnings decrease 5.8% in the rural sector and 8.5% in the urban sector.

The effect of factor mobility can be seen in simulations 2 and 3. In simulation 2, limited migration between the rural and urban regions and within the urban segments of the labour market leaves all results virtually unchanged (compare simulations 1 and 2). Capital mobility between sectors has more substantial effects [12]. According to simulation 3, limiting capital mobility raises welfare gains in the rural areas to 1.1% of GDP and increases welfare losses in the urban areas to 1.2% of GDP, somehow compensating each other in the aggregate.

Supply rigidities in the primary exporting sectors accentuate the differential effect of the non-flat VAT between the rural and urban areas (simulation 4). Since all agricultural productions have the same treatment in the VAT system, when rural-urban migration of factors is limited, so is the reallocation of rural resources caused by the VAT. Hence, the introduction of a supply rigidity in an agricultural subsector (coffee) does not force any new reallocation. In the urban sectors, by contrast, the VAT causes a reallocation of resources

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[11] Using the exchange rate as the numeraire, prices of agricultural foodstuffs fall -2.1%, of other agricultural products -1.9% and of manufactured food -0.3%. In contrast, other manufactured non-durables increase 2.3%, durables 2.3% and modern services 4.4%.

[12] It should be stressed that the only difference between capital and labour introduced so far is the type of mobility; capital may or may not be assumed mobile between sectors within each area (rural, urban), while labour is always assumed to be perfectly mobile between sectors. Opposedly, it is assumed that capital can not move across areas (rural, urban), while labour may or may not be assumed to move across areas.

from the taxed sectors to the non or less taxed sectors, such as mining. Hence, if the supply of the latter is rigid, factors employed in its production become relatively more abundant, which causes a reduction of their real return. As a result, mining and manufacturing prices fall relative to agricultural ones, which produces the increase in welfare in the rural areas at the expense of the urban ones [13].

As in the previous set of simulations with the flat VAT, the presence of a wage rigidity alters the results substantially (simulations 5 to 7). Total welfare losses increase in similar magnitudes, to 2.59%-3.77% of GDP (in comparison to 2.35-3.24% in the previous set). However, the distribution of these losses differ. When the only rigidity is the wage rate, the effect of the non-flat VAT on the rural sector is a loss of 0.16% of GDP (instead of 1.35% of GDP). For the urban families the loss is now 2.43% of GDP (instead of 1.06% of GDP). Thus, the non-flat VAT prevents the wage rigidity from imposing a much larger burden on the rural sector.

However, when quantity rigidities are combined with the inflexibility of wages, rural losses improve but urban losses increase. Finally, when mark ups occur on top of the previous rigidities, rural losses worsen and urban costs increase again.

In summary, the non-flat VAT is always beneficial for the rural areas in comparison to the flat rate VAT, however the non-flat VAT is substantially detrimental for the urban sector. The various factors tend to be affected in a similar way within the urban and the rural areas, respectively.

6. Incidence of Tariffs

To evaluate the effects of tariffs, two sets of simulations are considered. The first set assume a flat tariff imposed on all imports. The complete set of flat tariff simulations are repeated, assuming a system of rebates applying only to the direct import content of the exported goods.

Flat tariff

Let us assume that a flat tariff is imposed on all imports so as to collect extra revenue equivalent to 6.5% of GDP. With no other

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[13] This also explains the substantial reduction of exporters capital incomes in simulation 4. Note that this result holds also with the flat VAT (Table 5), because exports are excluded of the VAT.

Table 7
SIMULATION RESULTS - FLAT TARIFF

Simulation Number	1	2	3	4	5	6	7
I. Migration							
Labour	infinite	low	low	low	low	low	low
Capital	infinite	infinite	low	low	low	low	low
II. Rigidities							
Wages	no	no	no	yes	no	yes	yes
Quantities	no	no	no	no	yes	yes	yes
Prices	no	no	no	no	no	no	yes
Mark-ups	no	no	no	no	no	no	yes
III. Tax tariff (% points)	65.0	65.1	60.4	93.7	72.4	88.9	90.1
IV. Welfare (EV as % of GDP)							
Total	0.40	-0.69	0.22	-1.17	-1.96	-1.47	-2.29
Rural	0.91	-0.96	-0.80	-1.60	-1.56	-1.84	-1.95
Urban	1.31	0.28	1.02	0.42	-0.42	0.37	-0.34
V. Distribution (Gini % change)							
Rural	0.14	0.10	0.11	0.04	0.12	0.04	0.06
Urban	-0.17	-0.15	0.03	1.39	0.52	1.32	1.33
VI. Real Incomes (% change)							
A. Labour							
Rural	-13.25	-12.27	-13.69	-10.82	-18.05	-12.37	-15.90
Unskilled informal	-2.85	-3.49	-3.72	-4.26	-3.50	-3.12	-4.16
Unskilled formal	-3.79	-3.15	-3.33	-4.07	-4.55	-4.31	-5.74
Skilled	-4.76	-3.36	-3.23	-3.07	-2.85	-1.80	-3.06
B. Capital							
Rural	-10.00	-9.98	-11.22	-9.96	-15.41	-11.53	-14.59
Urban	-6.00	-7.44	-7.40	-4.14	-9.04	-4.01	-4.94
(Memo:Exports)	-35.67	-39.88	-45.75	-50.43	-77.55	-74.42	-76.35

distortions, aggregate production and welfare should fall as a result. In simulation 1 this result does not occur for two main reasons. First, the original situation is affected by the presence of other taxes, whose distortionary effect may be partially corrected by the flat tariff. This is especially so with the initial tariff and indirect tax structures, which are highly uneven (see Table 4). Second, the productivity of unskilled labour is higher in the urban than the rural areas [14]. Since tariff protection favours import competing and non-tradable sectors, such as manufacturing and services, and punishes the exportable sectors, especially agriculture, there is a migratory flow from rural to urban areas (6% of the rural working force move to the cities in simulation 1 --not presented in the Table). Given the higher productivity of workers in the urban areas, this labour reallocation increases aggregate production. The benefit of these two effects are reaped by the cities: urban welfare increases to 1.3% of GDP, while rural welfare falls 0.9% of GDP.

Also opposite to conventional wisdom is the effect of tariff protection on some factor incomes. In the rural areas, labour incomes fall more than capital earnings (13.2% and 10%, respectively), but in the urban areas capital returns decrease more than labour earnings (6% vs 2.9-4.8%). This is due to the fact that some the import competing and non-tradable sectors are more labour intensive than exporting sectors (see Table 1). Furthermore, import tariffs amount to export taxes, thus heavily reducing capital earnings from exports.

The unconventional increase in welfare holds only in some rather restrictive circumstances. It requires the degree of mobility of labour and capital to be similar (see simulations 1 and 3). If labour is less mobile than capital, the distortionary effects prevail. The same occurs if, with similar degrees of mobility of both factors, other rigidities are present.

The case where capital is highly mobile but labour is not (simulation 2) produces a total welfare loss of 0.7% of GDP, due almost entirely to the smaller gain in the cities. If limited amounts of additional labour are available for the protected activities, fewer workers receive roughly the same incomes of the previous case but produce less and less efficiently. Not surprinsingly, capitalists incomes go down by an additional 1.4%. The case where both capital and labour have a low mobility (simulation 3) produces a gain of welfare equivalent to 0.22% of

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[14] According to the data base of the model, the wage rate for the unskilled workers in the urban areas is 2.5 times higher than in the rural areas.

GDP. When mobility is curtailed for all factors inefficiecy losses in production are smaller thus benefiting the cities.

Other things equal, the efficiency losses in production are higher when the supply of the most important primary exporting sectors is fixed. Since this further limit the mobility of factors, production by sectors change much less than in the previous cases. Not only does this prevents productive sectors from taking advantage of the efficiency gains in production that arises in a fully mobile setting (simulation 1), bur it also increases welfare losses due to the induced change in consumption patterns. As a result, total welfare losses are now 1.2% of GDP. Note that, due to the loss of efficiency in consumption, rural welfare significantly decreases in spite of the less severe fall of rural real incomes by factor. In the urban areas, the welfare gain is 0.4% of GDP which is much smaller than the 1% gain in the previous case. Furthermore, the Gini coefficient increases by 1.4% indicating greater income concentration. This is due to the fact that labour earnings fall more while capital returns improve.

As was the case with the VAT, wage stubborness is the single most distortionary rigidity. It increases the deadweight loss of tariffs to roughly 2% of GDP, nearly a third of its extra yield of 6.5% of GDP (simulation 5). The wage rigidity not only increases the welfare loss in the rural areas to -1.5% of GDP but also increases the loss in the cities to -0.4% of GDP. The rigidity of wages produces only two rather major changes in real incomes by economic groups. Comparing with simulation 3, real income of the unskilled formal workers, whose remunerations are directly determined by the rigid wages, fall 1.1% more, as a result of the reduction of this type of employment, which is reflected in an increase in the overall rate of urban unemployment (from 8.8% to 11.2% --not presented in tables). Also affected by the wage rigidity are urban capital owners, whose real earnings fall 1.6% more.

When the inflexibility of wages is combined with supply rigidities in some of the primary exporting sectors, major resource reallocations are prevented and welfare changes basically reflect the effects of income redistribution between areas. With respect to the previous case, the only noticeable changes in real incomes occur in the cities. Skilled workers and urban capitalists experience improvements in their real incomes of 1% and 5%, respectively. Urban welfare increases to 0.37% of GDP (compared to -0.42% in the previous case) and there is a higher income concentration in the cities as a result of the income improvements.

When price rigidities and mark-up pricing practices are placed on top of the previous rigidities, the final effect on urban capital income is an additional reduction of 0.9%. All other incomes are also reduced, due to the fall in productions. Most severely affected are rural workers and capitalists, with additional income reductions of over 3%. Due to the rigidity of wages, employment of the unskilled formal workers fall 1.4% more than in the previous case, which rises the urban unemployment rate from 8.8% to 11.8% (not presented in tables) [15].

Flat tariff with rebates

As stated in conventional theory, import tariffs amount to taxing exports, giving origin to severe efficiency losses. Table 7 shows that exporters income experiences reductions between 35.7% and 77.6% as a result of tariffs [16]

Rebates of duties levied on inputs of exports have been devised in a number of developing countries in order to counteract the effects of tariffs on efficiency and export profitability. Rebates are hardly perfect, however, since it is difficult in practice to compensate the exporter for all the duties paid by the whole chain of his suppliers. Furthermore rebates can not compesate the exporter for the appreciation of the exchange rate due to the restricted demand for imports. In practice, rebates refund the exporter just for the duties levied on the direct import content of the goods exported. This has been the case in Colombia since the creation of the drawback system (so-called "Plan Vallejo") in the late fifties [17]. Since the mid eighties, there is ready access to this basic system. In addition, a number of schemes have been recently introduced in order to allow the exporter to rebate the duties paid by his direct and indirect suppliers of inputs. These more complex schemes, however, have been restricted in practice to just a few large exporters.

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[15] Note, however, that in the absence of other price or quantity rigidities, mark-up pricing would have little effect on welfare (in a case comparable with simulation 3, the change in welfare would be +0.14% of GDP).

[16] Exports quantum fall between 11.6% and 18.6% (not shown in the Table).

[17] In practice, the system operates as a revolving fund, through which payment of duties is permanently postponed, provided exports are maintained (or increased) in dollar terms on an annual basis.

In order to evaluate the importance of rebates, keeping in mind their practical limitations, the complete set of tariff simulations was repeated, assuming a system of rebates applying only to the direct import content of the exported goods [18]. The assumption of equal extra yield for tariffs is maintained in gross terms (i.e. without subtracting the value of rebates). Although tables are not included, the results show that rebates have a correcting effect on product and welfare losses, but in negligible amounts; GDP in product or welfare never increases more than 0.2%. Furthermore, incidence results do not experience any important change. This applies to exporters' capital income, which remains almost unchanged.

Summarizing, regardless the various rigidities considered, and in sharp contrast with the non-flat VAT, tariffs are more detrimental for the rural families than for the urban ones. Not always do tariffs benefit the urban sector, however. When a wage rigidity is the only distortion, or when all rigidities are in effect, tariffs also reduce urban welfare. These two cases also produce the largest welfare costs [19]. Similar to the VAT, tariffs tend to concentrate urban income when there are some rigidities in the economy.

7. Incidence of Capital Taxes

A capital tax applicable to all sorts of capital income could appear attractive for redistributional purposes. If the total supply of capital were fixed, as it is assumed in our model, no important distortions could take place. This is, in fact, the result that we obtain (not presented in tables); a tax of 14.2% on all capital income causes a welfare loss of nearly 0.45% of GDP, regardless of the introduction of price or quantity rigidities [20]. However, the distributional effect of such tax is probably undesirable. The rural Gini does not change and the

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[18] The corresponding coefficients range from 0.5% in the production of coffee for export to 13.8% in durable manufactured goods.

[19] A similar result was obtained for the VAT, but in that case the combination of wage and quantity rigidities was slightly more distorting than the rigidity of wages by itself.

[20] We are assuming, or course, that capital taxes are not shifted to the consumers in the cases where the producers have some control over market prices (grossly modelled with our mark-ups).

urban one falls a bare 1% but the reduction of welfare takes place almost entirely in the rural areas (0.40-0.43% of GDP), implying an income redistribution towards the urban areas.

Rather than taxing all capital income, the Colombian tax system concentrates on the corporate sector and the large urban income makers. To analyze this taxing method, we assume that only corporate income and earnings accruing to the two top urban deciles can be effectively taxed. The resulting tax rate to produce a yield equivalent to 6.5% of GDP is close to 10%.

When capital and labour mobility is perfect, the deadweight loss of the tax is 0.36% of GDP, less than in the flat capital tax. Between areas, the changes are more substantial, however. Rural households experience a welfare improvement that amounts to 1% of GDP, while urban families suffer a loss of 1.3% of GDP. In the urban areas, real capital earnings barely change while labour incomes fall between 0.2% and 0.9%. The reason is to be found in the factor composition of the goods that weigh relatively more in the basket of consumption of the taxed income groups [21]. This also explains why real wages of the unskilled informal workers are the most reduced (0.9%). The tax also reduces income concentration in the urban sector (the Gini falls 5.1%), as it is levied only on corporate and upper class incomes.

When capital mobility is limited (simulation 3), urban factors are hit, while rural factors are favored, as was the case with the VAT. The result is a further improvement in rural welfare to 1.3% of GDP at the expense of urban families whose welfare loss increases to 1.6%; total welfare remains almost unchanged.

Quantity rigidities slightly reinforce the beneficial effect of direct taxes on rural households and their detrimental impact on urban ones, with only a minor change in total welfare. The opposite result occurs with the inflexibility of wages (simulation 5). The gains in rural welfare decrease and urban losses slightly diminishes, keeping total welfare loss virtually unchanged. This result contrasts with that obtained for other taxes, where the introduction of wage rigidities substantially increased those losses. In the present case, when the wage rigidity is introduced, factor earnings change slightly and unemployment increases only marginally (compare simulations 3 and 5).

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[21] In particular, personal services, which are highly intensive in unskilled informal labour, weigh much more heavily in the consumption of the top urban decile (28.6%), than in the middle (10.7%), low (5.6%) or rural ones (6.8%).

Table 8
SIMULATION RESULTS - INCOME AND CORPORATE TAXES

Simulation Number	1	2	3	4	5	6	7
I. Migration							
Labour	infinite	low	low	low	low	low	low
Capital	infinite	infinite	low	low	low	low	low
II. Rigidities							
Wages	no	no	no	no	yes	yes	yes
Quantities	no	no	no	yes	no	yes	yes
Prices	no	no	no	no	no	no	yes
Mark-ups	no	no	no	no	no	no	yes
III. Tax tariff (% points)	9.9	9.9	10.0	10.0	10.0	10.0	10.0
IV. Welfare (EV as % of GDP)							
Total	-0.36	-0.26	-0.30	-0.26	-0.44	-0.48	-0.44
Rural	0.96	0.96	1.29	1.53	1.22	1.39	1.33
Urban	-1.33	-1.23	-1.59	-1.79	-1.66	-1.87	-1.77
V. Distribution (Gini % change)							
Rural	0.02	0.02	0.01	-0.00	0.01	-0.00	-0.01
Urban	-5.12	-5.12	-5.19	-5.21	-5.18	-5.22	-5.21
VI. Real Incomes (% change)							
A. Labour							
Rural	-0.01	-0.07	1.89	3.30	1.60	2.75	2.94
Unskilled informal	-0.94	-0.78	-1.45	-1.77	-1.24	-1.47	-1.42
Unskilled formal	-0.20	-0.37	-0.94	-1.22	-1.11	-1.40	-1.34
Skilled	-0.25	-0.34	-0.89	-1.13	-0.56	-0.81	-0.79
B. Capital							
Rural	0.52	0.54	2.16	3.29	1.84	2.75	2.82
Urban	-0.02	0.11	-0.61	-1.05	-0.67	-1.06	-1.40
(Memo: Exporters)	1.33	1.63	0.13	-0.69	-0.64	-1.03	-0.51

A comparison between the case where the economy is plagued with rigidities with the undistorted case (simulations 7 and 1) shows minor changes in terms of welfare. In both cases, total welfare losses are small, approximately 0.4% of GDP but there are important welfare improvements in the rural areas at the expense of urban areas. In the rural sector, welfare gains of 1% of GDP in the undistorted case increase to 1.3% of GDP when the economy faces rigidities. Urban welfare losses of 1.3% of GDP in the undistorted case increase to 1.8% of GDP in the presence of rigidities.

The presence of rigidities reinforces the distributional impact of the tax from urban to rural areas and changes factor incidence. Without rigidities, the tax reduces urban labour incomes and increases rural capital income. With rigidities, all rural earnings do substantially better, while urban earnings significantly decrease. Thus, rigidities render the distinction between rural and urban areas largely significant. However, regardless of the distortions considered, corporate and upper-class income taxes reduce household income concentration in the city, while leaving rural income concentration virtually unchanged.

8. The Tax Reforms of 1990-1992

César Gaviria Administration (1990-1994) pursued a broad range of structural reforms in order to promote competitiveness and restrain state intervention in the economy. The centerpiece of the reforms was the liberalization of imports through the elimination of quantitative restrictions and the reduction of tariffs. Other reforms comprised the liberalization of foreign exchange operations and foreign investment, a profound reorganization of the financial system and a simplification of the labour regime.

The first major tax reform, aimed at strengthening fiscal revenue, was passed by Congress in late 1990. The reform enacted the following measures: (i) granted amnesty to capitals held abroad before the implementation of the reform, subject to the payment of a 3% tax or to the purchase of public bonds; (ii) increased the VAT from 10% to 12%; (iii) extended the VAT to communications and personal services; and (iv) granted tax exemptions to capital gains originated in the sale of shares in the stock market. The corresponding increase in tax revenues was expected to compensate for the reduction of the import surcharge from 18% in 1989 to 10% in 1991. During 1991 the government also imposed a 5% "war surtax" on the income of large taxpayers and a "special contribution" to be paid by oil companies as an excise tax on oil production.

Although originally scheduled to take place between 1990 and 1994, the reduction of import tariffs was accelerated in September 1991 and completed in March 1992. In the initial tariff structure, there were 14 different tariff levels plus an across-the-board surcharge of 18%, for an import-weighted average tariff rate of 43.7%. In the final structure, after incorporating the surcharge, five basic levels remained. These levels ranged from 0% for intermediate and capital goods not produced in Colombia to 20% for final consumption goods. Two additional levels of 35% and 40% were applied to automobiles only. The resulting average nominal protection for tariffs was 11.7%. With respect to export subsidies (granted through the Tax Reimbursement Certificate, CERT), the number of rates were reduced from six to three and its average rate reduced.

The acceleration of tariff reductions forced the government to submit a second tax reform to Congress. The main components of the reform approved in July 1992 were: (i) the broadening of the VAT base; (ii) an increase from 12% to 14% in the VAT basic rate; (iii) the creation of a surcharge of 7.5% on the income tax, which substituted the "war surtax" and increased the income tax to 37.5% (from 30% at the beginning of the Administration); and (iv) an increase in the ad-valorem gasoline tax and the "special contribution" on hydrocarbons.

The effects of these reforms are evaluated in Table 9. Tax changes comprised in the simulations are: (i) import tariff reductions; (ii) change export subsidies; (iii) VAT base broadening and rate changes; (iv) income tax increases; and (v) changes in the ad-valorem gasoline tax and the "special contribution" on hydrocarbons. To compare the results with those of previous sections one must keep in mind that the extra revenue produced by the reforms was a bare 0.02-0.03% of GDP, while all other experiments are based on an extra yield of 6.5% of GDP.

Depending on the type of rigidities and factor mobility assumptions considered, the reform causes welfare to slightly improve or deteriorate. In the worst case, with no rigidities and perfect mobility of labour and capital, the cost is 0.4% of GDP. In the best case, with only quantity rigidities the improvement amounts to 0.2% of GDP. These results mainly reflect the combined effect of tariff reduction and the VAT increase. Without rigidities both changes are welfare reducing. However, imposes rigidities causes the changes to offset each other.

In all cases, the rural sector is the beneficiary of the reform, with welfare improvements around 0.5% of GDP, while the urban sector appears adversely affected, with losses ranging from 0.27% to 0.97% of GDP. Given the sharp deterioration of relative rural incomes in Colombia between 1990 and 1992 (World Bank,

Table 9
SIMULATION RESULTS - 1990-92 TAX REFORMS

Simulation Number	1	2	3	4	5	6	7
I. Migration							
Labour	infinite	low	low	low	low	low	low
Capital	infinite	infinite	low	low	low	low	low
II. Rigidities							
Wages	no	no	no	yes	no	yes	yes
Quantities	no	no	no	no	yes	yes	yes
Prices	no	no	no	no	no	no	yes
Mark-ups	no	no	no	no	no	no	yes
III. Tax revenue (% of GDP)	0.02	0.02	0.02	0.03	0.02	0.03	0.03
IV. Welfare (EV as % of GDP)							
Total	-0.41	-0.13	-0.10	0.22	0.05	0.07	0.12
Rural	0.56	0.51	0.44	0.54	0.54	0.44	0.39
Urban	-0.97	-0.65	-0.54	-0.32	-0.49	-0.37	-0.27
V. Distribution (Gini % change)							
Rural	-0.03	-0.02	-0.01	0.00	-0.01	-0.00	-0.01
Urban	-0.42	-0.43	-0.47	-0.64	-0.53	-0.59	-0.59
VI. Real Incomes (% change)							
A. Labour							
Rural	3.89	3.28	2.93	2.01	2.94	1.93	2.10
Unskilled informal	-0.64	-0.37	-0.07	-0.03	-0.07	0.02	0.23
Unskilled formal	-0.43	-0.32	-0.18	-0.08	-0.25	-0.07	0.30
Skilled	0.28	0.00	-0.14	-0.14	-0.14	-0.11	0.15
B. Capital							
Rural	3.05	2.76	2.55	1.93	2.56	1.86	1.97
Urban	-0.51	-0.05	0.26	-0.05	0.23	-0.03	0.33
(Memo:Exports)	4.20	5.59	6.12	3.80	10.66	8.14	8.56

1994), this is an important result, as it shows that the tax reforms actually ameliorated the impact of other shocks. The combination of lower tariffs, higher VAT rates and higher corporate and income taxes all contributed to the improvement of relative rural incomes.

The reform also has a positive though mild effect on income distribution in the urban areas, largely due to the increase of corporate and income taxes (the Gini coefficient falls 0.4-0.6%).

When examining the real income by economic groups, it is clear that exporters, rural workers and rural capitalists benefit from the tax reforms. The income of rural workers and capitalists increases between 1.9% and 3.9%. Exporters increases real income increases between 4% and 10.7%; the gain can be explained by the reduction of tariffs, which not only imply reductions in cost but also a devaluation of the exchange rate in order to keep external savings constant [22]. Some factors, however, are slightly hit; in those simulations which do not take into account rigidities, unskilled workers and urban capitalists suffer income reductions up to 0.6%.

In summary, the reform did not modify government revenues significantly, nor did it introduce major changes in efficiency. However, it did benefit two important economic groups: the rural sector and the exporters. It should be noted, however, that the reform may have eased fiscal administration since it simplified the tariff system, extended the base of the VAT and made other provisions to facilitate tax collection. None of these administrative advantanges werer considered in the simulations.

9. Incidence of the Tax System in 1992

The last set of simulations is devoted to assess the overall tax system after the reforms of 1990-1992. The tax structure of these two years can be seen in Table 4. Simulations are performed on an equal yield basis in order to make them comparable to those discussed in Sections 5, 6 and 7. However, the base year is calibrated for 1992, taking into account not only the tax changes

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[22] As it is well known, however, this did not actually occur in Colombia, due to other factors, such as the increased inflow of foreign capitals, the expansion of public expenditure and the expected oil boom. In other words, given all these other shocks, the tariffs and tax reforms actually prevented a major appreciation of the exchange rate and a further decline if exporters' incomes.

Table 10
SIMULATION RESULTS - 1990 TAX STRUCTURE 1/

Simulation Number	1	2	3	4	5	6	7
I. Migration							
Labour	infinite	low	low	low	low	low	low
Capital	infinite	infinite	low	low	low	low	low
II. Rigidities							
Wages	no	no	no	yes	no	yes	yes
Quantities	no	no	no	no	yes	yes	yes
Prices	no	no	no	no	no	no	yes
Mark-ups	no	no	no	no	no	no	yes
III. Tax tariff (% points)							
VAT	72.17	72.17	71.18	73.89	74.88	75.37	75.37
Tariffs	73.77	73.77	72.13	75.41	75.41	77.05	77.06
Income and corporate	82.88	83.78	80.18	86.49	90.99	90.99	90.99
IV. Welfare (EV as % of GDP)							
Total	0.01	-0.17	-0.19	-0.47	-1.06	-1.15	-1.49
Rural	0.48	0.48	0.67	0.85	0.37	0.52	0.40
Urban	-0.47	-0.65	-0.87	-1.32	-1.42	-1.68	-1.89
V. Distribution (Gini % change)							
Rural	0.07	0.06	0.04	0.01	0.04	0.01	0.01
Urban	-2.42	-2.41	-2.33	-2.39	-2.49	-2.41	-2.41
VI. Real Incomes (% change)							
A. Labour							
Rural	-3.78	-3.65	-2.26	0.20	-3.55	-1.48	-2.92
Unskilled informal	-2.10	-2.30	-3.04	-3.46	-2.43	-2.63	-3.00
Unskilled formal	-2.89	-2.71	-3.55	-3.92	-4.26	-4.52	-4.96
Skilled	-3.29	-3.10	-3.94	-4.13	-3.20	-3.19	-3.57
B. Capital							
Rural	-2.00	-2.06	-1.18	0.40	-2.52	-1.25	-2.59
Urban	-2.47	-2.69	-3.30	-3.09	-3.78	-3.38	-4.02
(Memo: Exporters)	-7.03	-7.57	-9.29	-11.35	-10.97	-12.63	-13.01

1/ VAT, tariffs, income and corporte taxes.

introduced during 1990-1992 but also all other changes experienced by the economy[23].

The changes required in the tax rates, in order to raise extra revenue equivalent to 6.5% of GDP, range between 72% and 91%. Changes are made endogenous in order to get the same proportional revenue increases in each of the three types of taxes considered: the VAT, tariffs, and corporate and income taxes.

The results can be seen in Table 10. Total welfare changes appear to be relatively important only when quantity and, especially, wage rigidities are introduced. When price price rigidities and mark-up pricing are also considered, the welfare cost reaches a maximum of 1.5% of GDP [24]

The tax system is beneficial for the rural sector; welfare gains range between 0.4% and 0.8% of GDP. Meanwhile, welfare losses in the urban sector range from 0.5% to 1.9% of GDP.

The tax system does not have significant impact on rural income distribution. This is due to the similar distribution of labour and capital earnings by income groups in the rural areas and the de-facto exclusion of rural families and bussinesses from income and corporate taxes. In the urban areas, the tax system plays a moderate redistributive role (a reduction of 2.4% in the Gini coefficient), due entirely to the income and corporate tax[25]
.

The tax system affects all factors rather homogeneously. The largest differences occur when the only rigidity in place is the inflexibility of supply in the primary exporting sectors. In this case, rural factors escape the burden of the tax system, while other factor incomes fall 3-4%. However, capital revenues from export activities are severely affected. Income losses range from 7% to 13% in spite of the correcting effect of the 1990-1992 tax reforms. This is almost entirely due to tariffs on imports.

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[23] The calibration procedure and parameter changes are presented in World Bank (1994), Appendix.

[24] In this case tax rates are increased between 75.4% and 91%. Therefore, the welfare cost of the complete tax system may rise to nearly 2% of GDP.

[25] Recall that the VAT and tariffs are slighty regressive, especially in presence of wage and quantity rigidities.

10. Conclusions

Conventional tax incidence analysis rests heavily on arbitrary shifting assumptions that do not reflect the functioning of underdeveloped economies and do not take into account the indirect effects of taxes throughout the economic structure. The purpose of this paper has been to assess the welfare and incidence effects of the tax system in Colombia using a computable general equilibrium model that overcomes these shortcomings.

Three taxes have been considered: the VAT, tariffs, and the corporate and income tax. The simulations evaluate the impact of changing each of these taxes in order to increase its yield by 6.5% of GDP or 10% of the value of private consumption. The experiments are performed with various degrees of factor mobility and quantity, wage and price rigidities. The same set of experiments are performed to evaluate the tax reforms of 1990-1992 and the complete tax structure of 1992.

The results obtained largely depend on the assumptions made. In the simplest case, where factors are highly mobile and no rigidities occur, tariffs are slightly welfare improving, and both the VAT and the corporate and income tax are slightly welfare reducing. When factor mobility is limited and the economy is plagued with rigidities, the welfare cost of the VAT reaches 3.8% of GDP and that of tariffs 2.3% of GDP. Only the welfare cost of the corporate and income tax remains at low levels, nearly 0.4% of GDP.

These burdens do not fall equally on the rural and urban sectors. Given the practical and political limitations to tax all consumption goods on an equal footing, the burden of the non-flat VAT tends to lean heavily on the urban families, and may even be beneficial to the rural ones in some circumstances. The opposite result occurs with tariffs; they are always detrimental to rural families, and even more so if the economy is plagued with rigidities. For urban families tariffs may have either positive or slightly negative effects. Corporate and income taxes, which are assumed to apply only to formal businesses and high income urban families, always improve rural welfare at the expense of urban households, especially those in the upper deciles.

The burden of the VAT and the tariff system is spread much more evenly across the different factors of production within the urban and the rural areas than between the rural and the urban areas. Added to the fact that the distribution of the different factor incomes is relatively similar, neither the VAT nor the tariff system substantially affect urban or rural income

distributions. Only income and corporate taxes can substantially alter urban income distribution.

As part of an ambitious package of structural reforms, President Gaviria (1990-1994) introduced major changes to the tax system. The reform left government revenues unchanged and did not induce any major changes in efficiency. However, it did benefit the rural sector and the exporters.

The present combination of the VAT, the tariff system and income and corporate taxes causes a welfare cost equivalent to a fourth of its revenue, largely due to its interaction with rigidities. The tax system affects all major factor incomes rather homogeneously, but generates income changes in favour of the rural areas and the urban lower income groups.

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