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ABSTRACT

Efficiency and Equity Effects of Taxing the Financial Sector: Lessons from a CGE Model for Belgium*

This paper assesses the effects of applying VAT or a sales tax on (intermediate or final) sales of the financial sector. It uses a CGE Model calibrated for a small open economy. It highlights the differentiated sectoral and redistributional effects of these taxes and shows the importance of the financial openness of the economy on these results.

JEL Classification: H20, H25, H30 and H87
Keywords: belgium, financial sector, modeling, sales tax, taxation and vat

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1. Introduction

The economic and financial crisis that started in 2007 has led to a severe deteroriation of public finances all over the world. Part of the hight fiscal cost can also be attributed to the large public support to the financial sector early in the crisis. In the United States, the deficit reached over 10% of GDP in 2009 and 2010, the highest level in nearly 65 years, and public debt jumped from 62% of GDP in 2000 to a forecast 102% GDP in 2012. In the European Union, public deficits increased from close-to-equilibrium in 2007 to an average of over 6% of GDP by 2012 and the average public debt increased from less than 60% to over 80% of GDP in the same period.[2] It was thus no surprise when the need for additional revenue for consolidation led to policy discussions on possible additional taxes on the financial sector as revenue-raisers and corrective (in the Pigouvian sense) devices[3].

The financial sector is a target of choice because of the general perception that it bears large responsibilities in the occurrence, the extent and the cost of the financial crisis, because it received financial support which created borrowing costs for public authorities, and also because it is perceived as being undertaxed, at least in the European Union, due to its exemption from value-added taxation. The exemption of the financial sector, including insurances and investment funds, is provided for by article 135(1) of the VAT directive. Originally, the rationale for the exemption comes from the difficulties to implement an invoice-credit system on margin-based transactions.[4] One important empirical question is how the exemption affects VAT revenues. Article 168 of the Directive foresees that input VAT (i.e. VAT paid on inputs) is deductible insofar as the input is used for a taxed transaction of a taxable person, meaning that a taxable person usually cannot deduct the

[2] Ameco database. http://ec.europa.eu/economy_finance/ameco/user/serie/ResultSerie.cfm

[3] The policy debate in the G20 and in the EU has focused on two possible alternative taxes. The first candidate is the Financial Activity Tax (FAT), which is a tax on the sum of profit and remuneration of the sector. The FAT can essentially be designed as a cash-flow tax, which possesses the feature of mimicking ex-post the value-added generated by the sector. The second candidate, which was eventually proposed by the European Commission (2011), is the Financial Transaction Tax (FTT) which is a tax on each transaction of financial products. It thus aims at targeting specifically financial transactions. The merits and de-merits of the two taxes have been widely discussed in the literature (e.g. Hemmelgarn and Nicodeme, 2012; IMF, 2010a, 2010b; European Commission, 2010, 2011; Shaviro, 2012).

[4] See Kerrigan (2010).

part of input VAT used for exempt transactions.[5] The share of input VAT that cannot be recovered is the irrecovery rate.

In spite of the complexity raised, the decision of many European countries to tax the financial sector has enjoyed an extensive coverage in the media. The academic coverage has however been relatively modest in comparison and rather focused on the revenue effects and to a much lesser extent on the efficiency effects. None, to our knowledge, has addressed the distributional effects of taxes on the financial sector. Moreover, it is only recently that researchers have considered the importance of the general equilibrium effects of such taxes, and in that case, usually ignoring international capital flows effects.

This paper complements the literature by assessing jointly the revenue, efficiency and equity consequences of the introduction of two alternative taxes specific to the financial sector in a simple computable general equilibrium model of Belgium. This allows us, for instance, to track both direct and indirect effects of the tax across sectors as users of financial services, as employers and as sources of income for the population. The model is based on a social accounting matrix for 2007 to work with a picture of the economy just before the 2008 crisis and for Belgium to investigate the effects in a small open economy. The economy is unbundled into 16 sectors. There is indeed no reason to assume that interactions with the financial sector have the same importance for each subsector. The population is divided in two groups: the rich and the poor. Considering that with the crisis, in a country like Belgium a growing share of the population is living around the poverty line, the decision to dichotomize the population will allow us to give a sense of this increasingly important issue. Morever, the model reflects that the capital is largely owned by the rich and that very little of the income of the"poor" comes from capital sources.[6]

We consider two possible tax instruments: (1) the application of a 15% VAT to the Financial Sector, which is the minimum standard rate set by the VAT Directive and (2) a tax on sales (intermediate) of Financial Sector to other production sectors and on final sales to households at a rate of 10%. Both taxes apply to the total output of the sector. We use the

[5] Art 169a for instance allow financial institutions to recover input VAT on exempt services supplied within the EU in certain circumstances. Input VAT in respect of goods and services used for exempt financial services to non-EU customers is also deductible under Article 169(c) of the Directive

[6] Arguably, only direct ownership is considered here and ownership through pension funds is not taken into account.

model to compare the effects of various designs of the tax and highlight some trade-offs between the efficiency, equity and revenue effects resulting from alternative designs. Of specific interest in the context of the policy debates surrounding the taxes on the financial sector, we show how sensitive the results are to various degrees of openness of the economy. A key result of our simulations is the illustration of the importance of international capital mobility, (i.e. the possibility of using financial intermediaries of the rest of the world), in any assessment of the consequences of the tax which has tended to be overlooked by many of the models often quoted in the policy discussions.

The paper is organized as follows. Section 2 summarizes the literature on the effects of indirect taxes on the financial sector. Section 3 presents the social accounting matrix (SAM) we have constructed for 2007. Section 4 describes the model. Section 5 discusses the results of the simulations. Section 6 concludes.

2. A brief overview of the literature on the effects of applying VAT to the financial sector

For the last 15 years, much of the literature has tended to focus on the effects of the failure to tax the financial sector resulting from the VAT exemption. Most of this literature has tended to focus on the revenue effects of this VAT exemption. Using input-output matrices, Genser and Winker (1997) for Germany, Huizinga (2002) and the European Commission (2011) all show that the benefits of the exemption are relatively substantial. According to European Commission (2011), they amount to about 0.15% of GDP or EUR 18 billion in non-collected VAT. These studies rely however on exogenous assumptions on the VAT irrecovery rate of the sector. In addition, some Member States have also attempted to estimate the VAT revenue losses from exempting the financial sector. The UK treasury puts it at GBP 4.5 billion (or about 0.3% of GDP) in 2008 and Denmark sees it at DKK 2.5 billion in 2006 (or about 0.15% GDP).[7] More recently, Buettner and Erbe (2012) use a General Equilibrium Model under perfect competition to compute the effects of repealing the VAT exemption Germany. They find a more conservative revenue impact of 0.07%

[7] See respectively http://www.hm-treasury.gov.uk/d/pbr08_taxreadyreckoner_287.pdf (page 18) and http://www.rigsrevisionen.dk/media(461,1033)/Transparency_of_Tax_Expenditures.pdf (page 29).

GDP in 2007, showing that underestimating the general equilibrium effects may lead to overoptimism on potential revenue.

None of this previous literature however explicitly addresses the overall macroeconomic impact of taxes on the financial sector. In particular, it is striking that this literature is mostly silent on the macroeconomic effects of applying VAT to the financial sector, other than the revenue effects. [8] There is one exception however. Buettner and Erbe (2012), mentioned above, find that repealing the VAT exemption in Germany would lead to a modest welfare loss of about EUR 0.362 billion or about 0.015% GDP when revenue is redistributed in a lump-sum way. Alternatively, there is a welfare gain of EUR 1 billion (about 0.04% GDP) when this is used to lower labor taxes.

None of the models used for the macroeconomic impacts address explicitly three important policy considerations. First, they ignore the effects of the mobility of economic factors. Second, they do not assess the potential differentiation of the effects across sectors. Third, they do not assess the economic incidence of the tax and its possibly differentiated effects on various categories of income earners.[9] The following model takes on each of these concerns.

3. A social Accounting Matrix (SAM) for Belgium

Since the SAM is essentially the organization and synthesis of a wide range of data, it may be useful to provide some details on the kind of data and the level of details it builds on. It focuses on the drivers of total Demand and Supply in an economy. Total demand (DA) essentially reflects the value of all goods and services demanded and is the sum of private consumption (*C)*, gross investment *(I)*, public consumption *(G)* and exports *(X)):*

$$DA = C + I + G + X$$

Total supply (OA) is the value of all goods and services produced by the various sectors of the economy, Gross domestic product *(GDP)* as well as imports *(M).* Since the

[8] The European Commission (2011) and Lendvai, Raciborski and Vogel (2012) respectively assess the general equilibrium effects of the Financial Activity Tax and the Financial Transactions Tax. Our model does not spell out an explicit market for financial instruments and our taxes apply to all output of the financial sector, including for example loans, so that it cannot assess the effects of financial transaction taxes.

[9] European Commission (2011) addresses these equity aspects of the taxes on the financial sector by using Household Budget Surveys of private households consumption expenditure of insurance and financial services by income quintiles and finds that the FTT could be progressive.

data on demand usually is reported at Market Price, we include indirect taxes net of subsidies, (VAT, any production tax or any tax on goods) to get:[10]

$$OA = GDP_{pm} + M$$

In national accounts, these two measures are in equilibrium

$$OA = DA$$

In practice, all the data is easily available from the National Bank of Belgium (NBB). Table 1 summarizes the main information for 2007. This year was chosen to avoid the distortions of the normal picture of the economy resulting by the global crisis of 2008.

Table 1: Total Demand and Supply Belgium, 2007.

(in millions EUR)	2007
GDP at market price	335,085
Imports	266,532
Total supply	**601,617**
Private consumption (including VAT)	170,965
Public consumption	74,813
Gross domestic investment	76,402
Exports	279,437
Total demand	**601,617**

Source: NBB (2007)

3.1. The Supply side

3.1.1. How disaggregated are the sectors in the matrix?

We work with a disaggregation into 16 production sectors (7 produce goods and 9 produce services), 2 families (rich and poor), a public sector and an external sector. Table 2 provides an overview of the definition of each one of the sectors we work with. These are the actors of our synthetic view of the economy we represent in our SAM.

[10] Note that in what follows, producer prices thus exclude all taxes on goods, production and factors, including import taxes.

Table 2: Description of sectors

	Sectors	Description
1	Agriculture, Forestry and Fishing	Products of agriculture, hunting and related services; Products of forestry, logging and related services; Fish and other fishing products; services incidental of fishing.
2	Mining	Coal and lignite; peat; Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying; Uranium and thorium ores; Metal ores; Other mining and quarrying products.
3	Food, beverage and tobacco	Food products and beverages; Tobacco products
4	Textiles, wearing and leather	Textiles; Wearing apparel; furs; Leather and leather products
5	Wood, wood products and paper	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials; Pulp, paper and paper products; Printed matter and recorded media
6	Chemical, Petroleum, rubber and plastic	Coke, refined petroleum products and nuclear fuels; Chemicals, chemical products and man-made fibers; Rubber and plastic products; Other non-metallic mineral products
7	Basic metals, fabricated metal products, machinery and other manufactures	Basic metals; Fabricated metal products, except machinery and equipment; Machinery and equipment n.e.c.; Office machinery and computers; Electrical machinery and apparatus n.e.c.; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks; Motor vehicles, trailers and semi-trailers; Other transport equipment; Furniture; other manufactured goods n.e.c.; Secondary raw materials
8	Electrical energy, gas, steam and hot water	Electrical energy, gas, steam and hot water; Collected and purified water, distribution services of water
9	Construction work	Construction work
10	Trade, Transport and Communication	Wholesale trade and commission trade services, except of motor vehicles and motorcycles; Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods; Hotel and restaurant services; Land transport; transport via pipeline services; Water transport services; Air transport services; Supporting and auxiliary transport services; travel agency services; Post and telecommunication services
11	Financial intermediation services, except insurance and pension funding services	Financial intermediation services, except insurance and pension funding services; Services auxiliary to financial intermediation
12	Insurance and pension funding services, except compulsory social security services	Insurance and pension funding services, except compulsory social security services
13	Real estate and business services	Real estate services; Renting services of machinery and equipment without operator and of personal and household goods; Computer and related services; Research and development services; Other business services
14	Public administration and defense services; compulsory social security services	Public administration and defense services; compulsory social security services
15	Education, health and social work services	Education services; Health and social work services
16	Personal services	Sewage and refuse disposal services, sanitation and similar services; Membership organization services n.e.c.; Recreational, cultural and sporting services; Other services; Private households with employed persons

Source: Authors based on NBB (2007).

3.1.2. How do our production accounts look like?

The production account allow us to get a sense of the relative importance of the value added (VA) generated by each economic production activity as reflected in the standard definition of GDP. This VA is the difference between the gross value added of production (GVAP) and intermediary consumption (CI) in each sector. Both measures are reported at producer price (pp). Table 3 provides the information for 2007 based on data reported by NBB.

Table 3: Gross value added of production and Gross value added net of intermediate consumption at producer prices.

	Sectors	GVAP pp	VA pp
1	Agriculture, Forestry and Fishing	0.98%	0.79%
2	Mining	0.20%	0.11%
3	Food, beverage and tobacco	4.42%	2.07%
4	Textiles, wearing and leather	1.00%	0.70%
5	Wood, wood products and paper	2.03%	1.51%
6	Chemical, Petroleum, rubber and plastic	10.25%	5.34%
7	Basic metals, fabricated metal products, machinery and other manufactures	13.17%	7.56%
8	Electrical energy, gas, steam and hot water	1.68%	2.03%
9	Construction work	7.42%	6.18%
10	Trade, Transport and Communication	21.47%	21.80%
11	Financial intermediation services, except insurance and pension funding services	3.69%	4.33%
12	Insurance and pension funding services, except compulsory social security services	1.14%	1.20%
13	Real estate and business services	19.06%	24.30%
14	Public administration and defense services; compulsory social security services	3.54%	6.76%
15	Education, health and social work services	7.39%	12.70%
16	Personal services	2.57%	2.61%
	Total	729,964	314,253

Source: Author's estimates based on NBB (2007).

Note that even if in practice each of these sectors produced more than 1 good, we assume that each sector only produces 1 good for convenience. We adjusted intermediate consumption accordingly to ensure the robustness of the SAM through the RAS approach based on the year 2005 for which all the data needed was available. Table 4 reflects the resulting intermediate consumption (CI) and value added (VA) data used.

Table 4: Belgium, 2007. VA and CI per sector.

	Sectors	VA pp	CI pp
1	Agriculture, Forestry and Fishing	34.77%	65.23%
2	Mining	23.96%	76.04%
3	Food, beverage and tobacco	20.20%	79.80%
4	Textiles, wearing and leather	30.13%	69.87%
5	Wood, wood products and paper	32.08%	67.92%
6	Chemical, Petroleum, rubber and plastic	22.44%	77.56%
7	Basic metals, fabricated metal products, machinery and other manufactures	24.71%	75.29%
8	Electrical energy, gas, steam and hot water	51.96%	48.04%
9	Construction work	35.85%	64.15%
10	Trade, Transport and Communication	43.72%	56.28%
11	Financial intermediation services, except insurance and pension funding services	50.57%	49.43%
12	Insurance and pension funding services, except compulsory social security services	45.37%	54.63%
13	Real estate and business services	54.89%	45.11%
14	Public administration and defense services; compulsory social security services	82.22%	17.78%
15	Education, health and social work services	73.99%	26.01%
16	Personal services	43.83%	56.17%
	Total	314,253	415,711

Source: Authors' estimates based on NBB (2007).

3.1.3. How do the production factors look like?

These accounts correspond to the common disaggregation of the VA according to the payments made to factors in labor (W) and capital (defined as the gross (i.e. non-amortized) profit, EBE), with $VA=W+EBE$. The data is derived from the National Accounts and is net of production and products taxes. For capital, we also deducted all taxes on profit and capital taxes) to get net returns. For labor, we deducted all social contributions (employee and employer) and personal income taxes. This allows us to get the VASIF (VA without taxes to factors). The data on imports is simply collected from the national accounts. It is distributed between final and intermediate consumption based on the import matrix for 2005. The resulting data is reported in Table 5.

Table 5: Belgium, 2007: Distribution of VA between Labor and Capital per sector

	Sectors	In Euros			In % GDP	
		L	K	GDP pb	L	K
1	Agriculture, Forestry and Fishing	487.12	2232.26	2719.38	17.91%	82.09%
2	Mining	114.20	136.28	250.48	45.59%	54.41%
3	Food, beverage and tobacco	2640.29	2301.19	4941.48	53.43%	46.57%
4	Textiles, wearing and leather	950.46	533.88	1484.34	64.03%	35.97%
5	Wood, wood products and paper	1912.72	1683.73	3596.44	53.18%	46.82%
6	Chemical, Petroleum, rubber and plastic	5025.77	5261.89	10287.66	48.85%	51.15%
7	Basic metals, fabricated metal products, machinery and other manufactures	10407.87	6165.09	16572.96	62.80%	37.20%
8	Electrical energy, gas, steam and hot water	1354.58	3416.49	4771.07	28.39%	71.61%
9	Construction work	6007.36	6348.92	12356.28	48.62%	51.38%
10	Trade, Transport and Communication	27635.61	26636.00	54271.61	50.92%	49.08%
11	Financial intermediation services, except insurance and pension funding services	5271.40	5009.65	10281.05	51.27%	48.73%
12	Insurance and pension funding services, except compulsory social security services	1265.89	1173.76	2439.65	51.89%	48.11%
13	Real estate and business services	15805.16	41477.02	57282.18	27.59%	72.41%
14	Public administration and defense services; compulsory social security services	13989.18	1541.69	15530.86	90.07%	9.93%
15	Education, health and social work services	22479.98	6798.86	29278.84	76.78%	23.22%
16	Personal services	3847.42	2621.91	6469.33	59.47%	40.53%
	Total	119,195	113,339	232,534	51.26%	48.74%

Source: authors' computation based on NBB (2007)

3.2. The demand side

3.2.1. Private consumption

The private consumption is based on the standard national accounts definition of consumption by households. It corresponds to the consumption of domestic and imported goods and services. Added to savings, it has to add to the sum of income by the factors minus taxes paid net of transfers and subsidies. To get a sense of the equity consequences of any policy, we have decided to unbundle consumers into 2 groups: poor and rich. This is done from the "Household Budget Survey" available from Belgostat. The poor correspond to the bottom 2 quartiles, the rich to the top 2. Table 6 shows how the two groups of households spend across the 16 sectors of the economy.

Table 6: Belgium, 2007. Household consumption composition—national goods

	Sectors	POOR	RICH
1	Agriculture, Forestry and Fishing	1.31%	1.11%
2	Mining	0.02%	0.02%
3	Food, beverage and tobacco	9.09%	7.77%
4	Textiles, wearing and leather	1.01%	1.34%
5	Wood, wood products and paper	1.52%	1.77%
6	Chemical, Petroleum, rubber and plastic	3.93%	4.64%
7	Basic metals, fabricated metal products, machinery and other manufactures	2.48%	3.15%
8	Electrical energy, gas, steam and hot water	3.83%	3.11%
9	Construction work	0.21%	0.36%
10	Trade, Transport and Communication	24.99%	33.51%
11	Financial intermediation services, except insurance and pension funding services	6.36%	4.66%
12	Insurance and pension funding services, except compulsory social security services	3.44%	3.84%
13	Real estate and business services	26.75%	20.53%
14	Public administration and defense services; compulsory social security services	0.70%	0.84%
15	Education, health and social work services	8.85%	6.91%
16	Personal services	5.51%	6.45%
	Total	49,428	87,079

Source: authors' computation base one a Household Budget Survey and Belgostat.

3.2.2. How does income get distributed?

Payments to labor and capital are made by net payments to labor and payments/returns to assets ownerships respectively. The sources of payment distinguish between domestic and foreign sources. The data is available from the Household surveys and the Balance of Payment and includes transfers made by the public sector.

3.2.3. Public sector accounts.

Public sector accounts are characterized by expenditure and revenue. The difference is used to balance the SAM. It reflects the debt level needed to ensure that the economy is in equilibrium.

3.2.3.1. Expenditures

Expenditures are based on national accounts. Their distribution of investment across sectors is based on the information available on the sectoral distribution of the stock of capital of the public sector. The costs of goods and services were obtained from National Accounts. As for transfers, their details are also available from national accounts. Unfortunately, the model cannot account for transfers in kind as data on that expenditure is not available.

3.2.3.2. Tax revenue

Tax revenue is also derived from National Accounts but we rely for details on the table of supply and uses produced by ESA 95 (European System of Accounts). Specifically, taxes are unbundled in the SAM as follows:

- Production taxes and the VAT are assessed and distributed according to ESA95 (and hence vary somewhat from those reported in the national accounts)
- Import taxes are from the national accounts
- Taxes and contributions made by factors are also from the national accounts

3.2.4. Investment accounts

The data on total gross investment is from the national accounts. The unbundling of the data into domestic and imported is base on a subtraction of the imported available from the balance of payment from the total gross national investment. The unbundling of the data per sectors is also extracted from the national accounts.

3.2.5. External transactions

The data on exports and imports is from national accounts as well.

3.2.6. Net financial position of economic agents

For each sector the difference between income and expenditures defines the financial position of each economic agent of the economy. It accounts for all loans as well as interest paid or received on transactions conducted in the previous period.

4. Basic characteristics of the General Equilibrium Model

In this section we present the general characteristics of the CGE model used for the purpose of this study.

The analysis of the impact of taxing the financial sector is based on a Computable General Equilibrium Model with al basic characteristics of a Walrasian model[11]. We

[11] It is numerically solved using GAMS/MPSGE. The solution of the model is obtained using the representation of General Equilibrium and using the Mixed Complementarity Approach –see Ferris and

present hereunder a simplified analytical version to highlight the basic elements of its structure and the main drivers.

3.1. Utility maximization and budget constraint

Assume an economy with only one domestic agent, whose utility function u depends on domestic goods c, financial services c_f and services a, imported goods m and bonds held by households b^h, and labor supply L^s:

$$u\,(c,a,m,c_f,\, b^h\,,L^s).$$

The following equations correspond to the usual optimal conditions, which equal the marginal rate of substitution to relative prices given by the quotient between the price of domestic goods in international terms p^* and the prices of imported goods p^*_m:

$$[1] \qquad u_c \,/\, u_{\,m} = p^* / \, p^*_m$$

$$u_c \,/\, u_{\,f} = p^* / \, p_f$$

$$u_c \,/\, u_{\,a} = p^* / \, p_a$$

$$u_c \,/\, u_{\,b} = p^* / \, p_b$$

$$u_c \,/\, u_{\,L} = p^* / \, w$$

The last equation corresponds to the consumption/leisure decision and w represents the wage rate. Superscript h indicates the variables corresponding to households. Domestic goods include foods and beverages. Services include transportation, education, health, for example. Relative prices and mobility of resources across sectors and with the rest of the world can explain why certain industries and technologies expand or contract. Therefore in this model, production is neither mandatory nor inevitable; it is determined by market forces and relative prices. In the scenario considering the case of the open economy, domestic households are assumed to be allowed to import financial intermediaries services (i.e use the financial system of the rest of the world). We also assume that there is a

Pang (1997) for a survey of the mathematical method and Böhringer and Rutherford (2008) for a recent description on the usefulness to model energy sectors in CGE. The model is developed in the environment of GAMS/MPSGE (see Rutherford (1999)). At present it can be used in interface with GAMS

standard high elasticity of substitution of one between domestic intermediaries and those of the rest of the world.

For every period, prices are computed to simultaneously clear all markets, except the labor market (to generate unemployment). The model used is a recursive dynamic model that simulates growth for the economy, relying partially on a modeling approach presented in Chisari and Romero (2009). This is not a model of optimal growth; instead, agents make savings decisions in period t using only information for that same period; then, savings are used in the following period as additional capital. This new capital is not sector-specific but fully mobile between sectors of production. Therefore it is allocated at the same time that prices are being determined by the model. The final allocation of "new" capital responds endogenously to the relative profit opportunities and it is reallocated until the reward to new capital is the same across industries. Henceforth, the final industrial scale depends on market incentives determined by the model itself.[12] Finally, the general model includes growth and therefore investment decisions by households.

Next, the budget constraint of the domestic agent can be written as:

[2] $$(1+t)p^{*}\ c + p_m^{*}\ m + p_a a + p_b b^h + p_f c_f = wL^s + \pi\eta + \pi_a\theta + rK\eta + p_b b_0^h \ .$$

While w represents wages, L^s is the supply of labor, and π and π_a are benefits in the industries producing goods and services, respectively. Parameters η and θ represent shares of domestic agents in each one of them ($0 < \eta\ ,\ \theta < 1$). To simplify, we also assume that the participation in capital ownership coincides with the latter two (the rest of the world retains the complementary shares). Equation [2] assumes that the consumer only pays taxes on the purchase of domestic tradable goods. This is a simplification given that the model includes several other taxes observed in the economy. The last term reflects the initial bonds held by the household. In the case of financial intermediaries, when substitution by international intermediaries is admitted, we include a new service c_f^{*} that can be hired at price p_f*_ant that is a close substitute for c_f.

[12] The dynamic model was calibrated for total GDP of the economy growing at 4% for 2006, leaving aside exogenous shocks identified for the economy in 2006. The simulations assume that labor force is not growing; this is a neutral assumption taking into account that what matters are the comparative dynamics of the basic scenario of growth with respect to the simulated cases.

3.2. The supply side

From the supply side, the production function in each sector is a Leontief function between value-added and intermediate inputs, i.e. one output unit requires an *x* percent of an aggregate of productive factors (labor, physical capital, financial capital and land) and (*1–x*) percent of intermediate inputs. The intermediate inputs function is a nested Leontief function of all goods, which are strict complement in production. Instead, value-added is a Cobb-Douglas function of productive factors (with an elasticity of substitution of one). The same assumption was used at the level of utility functions of households, public sector, and rest of the world.

Regarding factor endowment, both types of capital are fully employed, while there exists labor unemployment. Wages are assumed to be fixed in real terms. For the initial year, we assumed that real wages are increased by 1.5%, to calibrate the results with the change in the rate of unemployment. When unemployment is zero, wages are determined by equalizing demand and supply of labor

For tradable goods, the production function of tradable domestic goods *c* and exports *x* in terms of capital and employment is given by:

$$x + c = F\left(L, K\right) \quad [3]$$

The benefits of the tradable industry are:

$$\pi = p^{*}\left(x + c\right) - wL - r^{*}K - p_a a^{d} - p_f a_f^{d} \quad [4]$$

where r^{*} indicates capital remuneration and $p_a a^{d}$ are expenditures in non-tradable, which are assumed in fixed coefficients with the total value added:

$$a^{d} = \alpha F\left(L, K\right) \quad [5]$$

$$a_f^{d} = \alpha_f F\left(L, K\right)$$

and $a_f{}^{d}$ stands for the intermediate demand for financial services, which is in fixed coefficient relation with production.

The maximization conditions of benefits are:[13]

$$[6] \quad \left(p^{*} - \alpha\, p_a - \gamma p^{*} - \alpha_f\, p_f\right) F_K - r^{*} = 0 \,,$$

$$[7] \quad \left(p^{*} - \alpha\, p_a - \gamma p^{*} - \alpha_f\, p_f\right) F_L - w = 0 \,,$$

when the levels of capital use and labor are determined optimally. In these expressions γp^{*} stand for expenses in intermediate tradable goods (in a Leontief relation given by γ).

At the level of the non-tradable industry, the corresponding equations to define profits, optimal conditions, and the output function are:

$$[8] \quad \pi_a = p_a\, G\left(L_a\right) - w\, L_a - \theta G\left(L_a\right) p^{*} - \theta_f G(L_a) p_f \,,$$

$$[9] \quad a^{s} = G\left(L_a\right) \,,$$

$$[10] \quad \left(p_a - \theta p^{*} - \theta_f p_f\right) G'(L_a) = w$$

The last term represents the use of tradable goods and financial services for the production of non-tradable (in fixed coefficients given by θ and θ_f respectively). It can be seen that in these equations it is assumed that the sector only employs labor to produce services. Once again, this is a simplification in this simplified version, for the general model includes capital as an argument of the production function. Labor *L* and a proportion of capital *K* (20%) are perfectly mobile between sectors while physical capital is sector-specific, involving same cost between sectors for the first two factors and sector-specific costs for the last factor.[14] Since it is allocated between sectors according to the net rate of return, it may be allocated to the foreign sector (the allocation of brand new capital is endogenous). Labor is freely mobile.

Investments of period *t* become additional mobile capital for the following period; the new capital is allocated endogenously (in the solution of the model) between sectors, to equalize the rate of return.

[13] We assume that the degree of homogeneity of F and G is less than one.

[14] The proportion of mobility of capital can easily be simulated with other values to test the importance of the assumption.

The financial intermediaries sector is a Non-Tradable for the baseline case. However, we consider also the possibility of substitution with foreign institutions in our simulations. In that case, $a_f{}^d$ and θ_f will not be constant but determined by relative prices of domestic and international services.

3.3. The demand side

The demand side is modeled through two representative households, a government and an external sector. Households buy or sell bonds, invest and consume in constant proportions (Cobb-Douglas) given the remuneration for the factors they own (and the transfers from the government). The choice of the optimal proportion of the consumption good is obtained from a nested production function into the utility function, through a process of cost minimization.

Government is represented as an agent that participates in markets for investments, consumes and makes transfers to households and has a Cobb-Douglas utility function; its main source of income is tax collection (though it also makes financial transactions through the bonds account). The Government has a budget constraint given by:

$$[11] \qquad tp^* \; c + t_x x + p_b b_0^G = wL^G + p_b b^G$$

The left side represents tax revenue, including export taxes, as well as bonds sales. [15] The right side represents the purchases of labor and bonds (so that there is a net position in bonds). Notice that here we assume that the government is not participating actively in the markets for goods or services, although that does not occur in the general model. In this simplified case, the government collects taxes and uses the proceedings to hire workers and repay debt (the general model includes investments and government consumption). For simplification, the model ignores the production function of the government and this implicitely assumes that the capital-labour ratio is constant. This simplification does not affect the results here.

The external sector buys domestic exports and sells imports, and also makes transactions of bonds and collects dividends from investments. Note that in this version, the

[15] The model includes export taxes as they generated revenue from exports for the public sector in 2007. They are however not significant and ignoring them would not have impacted the results.

external sector does not buy domestic bonds, which is also a strong assumption that we leave aside in the general model. Given these assumptions, we can obtain equilibrium in the following current account as:

$$[12] \qquad p^x x = p_m^* m + (1-\eta) r^* K + (1-\eta)\pi + (1-\theta)\pi_a$$

5. Simulations

We first compute the base line case (*Base*), taking as benchmark an initial rate of growth of the economy of approximately 3%. We show results over the first five years (periods, indicated as Pi) in the tables (where *Sim* indicates simulation). We run first two simulations, one for each tax, assuming a closed economy with respect to sales of the financial intermediaries. We then run the same simulations under the assumption of openness for the sales of financial intermediaries; that is, it is assumed that initially about 10% of observed transactions of firms and households with the financial sector were conducted through intermediaries of the rest of the world. This is counterfactual but convenient to perform the simulations with an initial level that is not zero. It is assumed that the elasticity of substitution between services of domestic and rest of the world services is 2. Thus, financial intermediation of the rest of the world is able to substitute domestic financial services. The results of the two groups of simulations make it easy to assess the differences in sensitivities to the access to international financial intermediation of the various designs of the tax.

The specific tax designs we consider are the following:

1) **VAT**: Application of VAT to the Financial Sector at 15% on all its outputs. Initially, the contribution of Sector 11 - financial services - to VAT collection is almost negligible. This tax is applicable only to domestic demand, and it is assumed that exports and investments are exempted.

2) **Sales Tax**: Tax on sales (intermediate) of Financial Sector to other production sectors and on final sales to households at 10% for all its services. This means that there is a cascading effect to all the potential uses of the product.

Two comments are required to be able to fully understand the results. First, that these two taxes are not designed to generate the same revenue and as will be seen below, they do not. This should be expected as they represent different tax bases and rates. Second, any additional fiscal revenue is assumed to be spent in the same proportions of initial total revenue; since the government makes investments, a proportion of total revenue is devoted to increases of capital of the economy and this increases the rate of growth (with respect to the benchmark, depending on the propensity to invest with respect to the economy). This effect is bigger in the case of the sales taxes, because the revenue of the government is bigger too (not equal-yield). Finally, they include all transactions by the financial sector, including their lending activities (which makes them very different from a Financial Transaction Tax).

The tables 7 and 8 present information on the evolution of selected indicators such as GDP in real terms, exports, imports and the 'fiscal result' (in this case, "welfare" of the government), the welfare of households (in equivalent variation), and the levels of activity (quantities) of the 16 production sectors. In each table, for each period, the first column indicates the benchmark (*Base*) and the second the simulation (*Sim*). The last five columns of each table show the absolute difference between the base and the simulation. All results shall be taken in a qualitative (and not quantitative) way given the magnitude of the shocks and General Equilibrium Models shall be used for long-term effects analysis only.[16]

5.1. Assuming no international mobility of capital

The inclusion of VAT (in table 7) reduces GDP by approximately 0.5 percentage points for the first year, and 0.3 percentage points cumulated over 5 years, both compared to the baseline scenario). Again, results shall be taken qualitatively instead of quantitatively. Despite the additional revenue from the tax, the final welfare of the public sector is reduced in the first years due to the reduction of the activity level of the economy but a shift of activities towards the public sector increases its welfare in the longer run.

[16] In our baseline the primary and secondary sectors grow more than the tertiary sector because services are more intensive in labor, and since wage rates are fixed while cost of capital is falling(since capital is growing), the result is biased in favor less labor-intensive activities. This would change if labor mobility between sectors were reduced.

Table 7. VAT 15%

Indicators	Period 1		Period 2		Period 3		Period 4		Period 5		Variation (Sim - Base)				
	Base	Sim	Base	Sim	Base	Sim	Base	Sim	Base	Sim	P1	P2	P3	P4	P5
Macroeconomic Indicators															
GDP	2.92	2.43	7.46	6.94	11.78	11.54	14.45	14.20	17.17	16.90	-0.49	-0.52	-0.24	-0.25	-0.27
Imports	3.26	2.65	7.89	7.24	12.33	11.91	15.36	14.91	18.42	17.95	-0.61	-0.65	-0.42	-0.45	-0.47
Exports	4.91	4.20	11.84	11.06	18.50	18.05	23.16	22.68	27.91	27.39	-0.71	-0.78	-0.45	-0.48	-0.52
Fiscal Result (welfare)	1.25	1.17	3.72	3.62	5.93	6.07	6.84	6.98	7.75	7.89	-0.08	-0.10	0.14	0.14	0.14
Rate of Unemployment	6.64	7.15	3.03	3.57	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.54	0.00	0.00	0.00
Welfare (distributional) Indicators															
Poorest Household	2.74	2.28	7.09	6.59	11.20	10.99	13.69	13.46	16.22	15.97	-0.46	-0.50	-0.21	-0.23	-0.25
Richest Household	2.70	2.28	7.04	6.58	11.15	10.99	13.59	13.41	16.07	15.88	-0.42	-0.46	-0.16	-0.18	-0.19
Sectoral Activity Level															
Agriculture	4.79	4.76	9.77	9.73	14.88	14.82	20.13	20.03	25.57	25.44	-0.03	-0.04	-0.06	-0.10	-0.13
Mining	6.26	6.08	13.56	13.35	20.84	20.77	27.34	27.24	34.03	33.89	-0.18	-0.21	-0.07	-0.10	-0.14
Food, beverage and tobacco	5.68	5.31	13.28	12.87	20.65	20.57	26.15	26.04	31.75	31.61	-0.37	-0.41	-0.08	-0.11	-0.14
Textiles, wearing and leather	4.48	3.79	12.38	11.62	19.67	19.57	23.20	23.08	26.71	26.58	-0.69	-0.76	-0.10	-0.12	-0.13
Wood, wood products and paper	4.93	4.54	11.81	11.38	18.41	18.33	23.07	22.96	27.80	27.67	-0.39	-0.43	-0.08	-0.11	-0.13
Chemical and Petroleum	4.81	4.46	11.35	10.97	17.66	17.58	22.28	22.18	26.99	26.86	-0.35	-0.38	-0.08	-0.10	-0.13
Metal products, other manufactures	4.54	3.85	12.48	11.73	19.82	19.72	23.44	23.32	27.04	26.90	-0.69	-0.75	-0.10	-0.12	-0.14
Electricity, gas and water	3.00	2.63	7.64	7.24	12.04	11.93	14.74	14.62	17.48	17.35	-0.37	-0.40	-0.11	-0.12	-0.13
Construction	2.58	2.35	6.69	6.43	10.58	10.60	12.89	12.91	15.26	15.26	-0.23	-0.26	0.02	0.02	0.00
Trade and Transport	2.22	1.94	5.70	5.40	9.00	8.93	10.99	10.91	13.02	12.92	-0.28	-0.30	-0.07	-0.08	-0.10
Financial Services	2.19	1.87	5.65	5.31	8.93	8.82	10.89	10.77	12.88	12.75	-0.32	-0.34	-0.11	-0.12	-0.13
Insurance and Pension Funding services	2.48	2.12	6.40	6.01	10.12	9.98	12.35	12.21	14.63	14.47	-0.36	-0.39	-0.14	-0.14	-0.16
Real estate and business services	2.35	2.05	6.05	5.72	9.55	9.46	11.66	11.56	13.81	13.70	-0.30	-0.33	-0.09	-0.10	-0.11
Public administration and defense services	2.04	1.80	6.65	6.39	10.80	11.04	12.17	12.41	13.55	13.79	-0.24	-0.26	0.24	0.24	0.24
Education and health	2.34	2.09	6.86	6.58	11.01	11.16	12.84	12.99	14.70	14.84	-0.25	-0.28	0.15	0.15	0.14
Personal services	4.84	4.39	11.95	11.45	18.70	18.62	23.11	23.00	27.56	27.43	-0.45	-0.50	-0.08	-0.11	-0.13

The introduction of VAT on the financial sector creates welfare losses for households in a scenario where taxes are used by the government to hire workers and repay debt. However, and as expected, they are smaller for the last years to the analysis since the increased mobility of factors - progressively, there are more workers and mobile capital than installed capital in the economy - tends to reduce the costs due to distortions. Welfare of the poor and rich families is reduced with some slight regressivity (0.45% and 0.42% respectively on average in the first year and 0.25% and 0.20% after the fifth year). Finally, all sectors are relatively equally hit in the long-run (even if proportionally the primary and secondary sectors suffer more), while the public sector progressively gains activities.

Turning to the sales tax (in table 8), GDP is decreased more dramatically whereas the welfare of the government is higher than in the VAT case. This latter appears because, as the possibilities of substitution are still more limited, welfare is transferred to public sector. This case exhibits also a smaller rate of growth of the financial sector for the first years than in the case of VAT, though effects are not very different in the fifth year. Finally, the Sales Tax seems to work as a means of redistribution as the decrease in welfare of rich families is twice the one of poor families in the longer run

Table 8. Sales Tax - Taxes on intermediate uses and final demand (10%)

Indicators	Period 1		Period 2		Period 3		Period 4		Period 5		Variation (Sim - Base)				
	Base	Sim	Base	Sim	Base	Sim	Base	Sim	Base	Sim	P1	P2	P3	P4	P5
Macroeconomic Indicators															
GDP	2.92	2.06	7.46	6.64	11.78	11.28	14.45	13.97	17.17	16.72	-0.86	-0.82	-0.50	-0.48	-0.45
Imports	3.26	2.61	7.89	7.29	12.33	12.01	15.36	15.07	18.42	18.16	-0.65	-0.60	-0.32	-0.29	-0.26
Exports	4.91	4.11	11.84	11.10	18.50	18.19	23.16	22.90	27.91	27.70	-0.80	-0.74	-0.31	-0.26	-0.21
Fiscal Result (welfare)	1.25	1.70	3.72	4.21	5.93	6.69	6.84	7.60	7.75	8.53	0.45	0.49	0.76	0.76	0.78
Rate of Unemployment	6.64	7.24	3.03	3.59	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.56	0.00	0.00	0.00
Welfare (distributional) Indicators															
Poorest Household	2.74	2.10	7.09	6.48	11.20	10.92	13.69	13.43	16.22	15.98	-0.64	-0.61	-0.28	-0.26	-0.24
Richest Household	2.70	1.78	7.04	6.15	11.15	10.59	13.59	13.04	16.07	15.55	-0.92	-0.89	-0.56	-0.55	-0.52
Sectoral Activity Level															
Agriculture	4.79	4.77	9.77	9.83	14.88	15.03	20.13	20.36	25.57	25.90	-0.02	0.06	0.15	0.23	0.33
Mining	6.26	5.55	13.56	12.95	20.84	20.48	27.34	27.07	34.03	33.84	-0.71	-0.61	-0.36	-0.27	-0.19
Food, beverage and tobacco	5.68	4.74	13.28	12.44	20.65	20.22	26.15	25.78	31.75	31.44	-0.94	-0.84	-0.43	-0.37	-0.31
Textiles, wearing and leather	4.48	3.31	12.38	11.28	19.67	19.28	23.20	22.83	26.71	26.37	-1.17	-1.10	-0.39	-0.37	-0.34
Wood, wood products and paper	4.93	4.43	11.81	11.40	18.41	18.45	23.07	23.16	27.80	27.96	-0.50	-0.41	0.04	0.09	0.16
Chemical and Petroleum	4.81	4.40	11.35	11.05	17.66	17.76	22.28	22.44	26.99	27.21	-0.41	-0.30	0.10	0.16	0.22
Metal products, other manufactures	4.54	3.35	12.48	11.36	19.82	19.40	23.44	23.04	27.04	26.67	-1.19	-1.12	-0.42	-0.40	-0.37
Electricity, gas and water	3.00	2.41	7.64	7.10	12.04	11.84	14.74	14.57	17.48	17.34	-0.59	-0.54	-0.20	-0.17	-0.14
Construction	2.58	2.25	6.69	6.40	10.58	10.61	12.89	12.96	15.26	15.35	-0.33	-0.29	0.03	0.07	0.09
Trade and Transport	2.22	1.78	5.70	5.30	9.00	8.86	10.99	10.87	13.02	12.92	-0.44	-0.40	-0.14	-0.12	-0.10
Financial Services	2.19	1.66	5.65	5.16	8.93	8.70	10.89	10.68	12.88	12.69	-0.53	-0.49	-0.23	-0.21	-0.19
Insurance and Pension Funding services	2.48	1.85	6.40	5.81	10.12	9.82	12.35	12.07	14.63	14.37	-0.63	-0.59	-0.30	-0.28	-0.26
Real estate and business services	2.35	1.86	6.05	5.59	9.55	9.37	11.66	11.51	13.81	13.68	-0.49	-0.46	-0.18	-0.15	-0.13
Public administration and defense services	2.04	2.67	6.65	7.37	10.80	12.09	12.17	13.48	13.55	14.88	0.63	0.72	1.29	1.31	1.33
Education and health	2.34	2.73	6.86	7.33	11.01	11.96	12.84	13.82	14.70	15.71	0.39	0.47	0.95	0.98	1.01
Personal services	4.84	4.20	11.95	11.40	18.70	18.65	23.11	23.11	27.56	27.61	-0.64	-0.55	-0.05	0.00	0.05

5.2. Assuming international openness of the financial intermediaries sector.

Tables 9 and 10 respectively show the same 15% VAT and 10% Sales Tax simulations as in Tables 7 and 8. But they also assume that, in the benchmark case, domestic households send 10% of their domestic portfolio abroad to be managed by (untaxed) foreign firms. The benchmark level (i.e. the base) slightly changes because of this possibility to send capital abroad, which modifies the initial rate of growth.

Table 9. VAT 15% with substitution (mobility of portfolio)

Indicators	Period 1		Period 2		Period 3		Period 4		Period 5		Variation (Sim - Base)				
	Base	Sim	Base	Sim	Base	Sim	Base	Sim	Base	Sim	P1	P2	P3	P4	P5
Macroeconomic Indicators															
GDP	2.78	2.30	7.24	6.72	11.68	11.29	14.30	14.07	16.97	16.72	-0.49	-0.52	-0.39	-0.24	-0.25
Import	2.94	2.42	7.34	6.79	11.70	11.26	14.47	14.16	17.29	16.95	-0.51	-0.55	-0.44	-0.31	-0.33
Export	4.46	3.87	11.05	10.40	17.61	17.12	21.91	21.61	26.30	25.96	-0.59	-0.64	-0.49	-0.31	-0.34
Fiscal Result (welfare)	1.16	1.08	3.57	3.48	5.88	5.90	6.78	6.93	7.68	7.83	-0.08	-0.09	0.03	0.15	0.15
Rate of Unemployment	6.82	7.35	3.30	3.86	0.00	0.29	0.00	0.00	0.00	0.00	0.53	0.56	0.29	0.00	0.00
Welfare (distributional) Indicators															
Poorest Household	2.63	2.17	6.91	6.42	11.16	10.80	13.63	13.43	16.15	15.93	-0.46	-0.49	-0.36	-0.21	-0.22
Richest Household	2.62	2.18	6.93	6.45	11.21	10.87	13.66	13.48	16.17	15.97	-0.44	-0.48	-0.34	-0.18	-0.20
Sectoral Activity Level															
Agriculture	4.71	4.72	9.64	9.63	14.69	14.66	19.85	19.80	25.20	25.12	0.01	-0.01	-0.03	-0.05	-0.08
Mining	5.81	5.71	12.80	12.68	19.87	19.81	25.93	25.96	32.17	32.16	-0.10	-0.12	-0.05	0.02	-0.01
Food, beverage and tobacco	5.18	4.93	12.42	12.13	19.65	19.52	24.74	24.79	29.93	29.95	-0.26	-0.29	-0.13	0.05	0.02
Textiles, wearing and leather	3.92	3.38	11.41	10.81	18.73	18.45	21.93	22.01	25.12	25.19	-0.54	-0.60	-0.28	0.08	0.07
Wood, wood products and paper	4.53	4.24	11.13	10.80	17.68	17.52	22.05	22.07	26.50	26.50	-0.29	-0.33	-0.16	0.02	0.00
Chemical and Petroleum	4.47	4.21	10.78	10.48	17.06	16.91	21.44	21.45	25.91	25.90	-0.26	-0.30	-0.15	0.01	-0.02
Metal products, other manufactures	4.00	3.46	11.53	10.93	18.90	18.62	22.19	22.27	25.48	25.55	-0.54	-0.59	-0.28	0.08	0.07
Electricity, gas and water	2.94	2.69	7.46	7.18	11.94	11.80	14.73	14.73	17.57	17.56	-0.25	-0.28	-0.15	0.00	-0.01
Construction	2.50	2.26	6.56	6.30	10.60	10.47	12.93	12.95	15.30	15.31	-0.24	-0.26	-0.13	0.02	0.01
Trade and Transport	2.15	1.94	5.65	5.41	9.11	8.99	11.10	11.11	13.13	13.13	-0.21	-0.23	-0.12	0.01	0.00
Financial Services	2.24	0.29	5.84	3.80	9.40	7.41	11.49	9.59	13.62	11.66	-1.94	-2.03	-1.99	-1.91	-1.96
Insurance and Pension Funding services	2.49	2.28	6.53	6.30	10.54	10.44	12.86	12.91	15.22	15.26	-0.21	-0.23	-0.10	0.05	0.04
Real estate and business services	2.57	2.34	6.39	6.13	10.19	10.03	12.69	12.64	15.23	15.17	-0.24	-0.26	-0.16	-0.05	-0.06
Public administration and defense services	1.82	1.59	6.32	6.06	10.67	10.67	11.98	12.26	13.30	13.57	-0.23	-0.26	0.00	0.28	0.28
Education and health	2.06	1.84	6.49	6.24	10.81	10.78	12.47	12.67	14.14	14.35	-0.23	-0.25	-0.03	0.21	0.21
Personal services	4.36	4.02	11.13	10.75	17.83	17.65	21.88	21.93	25.98	26.01	-0.34	-0.39	-0.18	0.04	0.02

A striking feature is the similarities of the effects of VAT on GDP and (distributional) welfare under the absence or presence of capital mobility. This reflects the well-known property of VAT neutrality vis-a-vis production decisions, thanks to the application of credit for input VAT and the destination-based principle for international transactions. The situation at the sectoral level is more complex. The openness of the economy is particularly harmful to the financial sector while the additional hit to other sectors is progressively cancelled out. The differentiated effect stems from the fact that in the case capital mobility, the economy increases its imports of financial services. In other words, financial services are hired abroad. Note that this implies that there should be a compensatory trade balance effects for goods and that additional exports and lower imports of other goods are needed in that case[17], which is why things are smoother for the rest of the economy. This is made easier by the fact that the reduction in the size of the financial sector frees resources to be used by the rest of the economy. This effect is a lot stronger with a sales tax than with a VAT as seen in the following simulations.

The simulation of a 10% sales tax on both intermediate consumption and final demand suggests a GDP decrease (compared to the base scenario) dramatically larger when international access to financial intermediation is considered. Compared to the closed economy scenario of Table 8, the decrease in GDP is over 2.5 times higher. The (distrbutional) welfare effects are however broadly similar to those of a closed economy. Finally, as in the VAT case, the openness of the economy allows non-financial sectors to make up for the initial hit but the impact on the level of activities of the financial sector is even more substantial.[18]

[17] The model is a constant-price model, with constant exhange rate so that the equality holds.

[18] Note that despite positive sectoral effects for other sectors of the economy, the size of the negative impact on the financial sector leads to a decrease in GDP. This can be seen when comparing the sum of value-added in sectors for the base and the simulation scenarios. In addition, the effect on GDP is also affected by transfers and taxes.

Table 10. Sales Tax - Taxes on intermediate uses and final demand 10% with substitution (mobility of portfolio)

Indicators	Period 1		Period 2		Period 3		Period 4		Period 5		Variation (Sim - Base)				
	Base	Sim	Base	Sim	Base	Sim	Base	Sim	Base	Sim	P1	P2	P3	P4	P5
Macroeconomic Indicators															
GDP	2.78	0.73	7.24	5.16	11.68	9.75	14.30	13.18	16.97	15.85	-2.05	-2.08	-1.93	-1.12	-1.13
Import	2.94	1.41	7.34	5.80	11.70	10.31	14.47	13.81	17.29	16.62	-1.52	-1.53	-1.39	-0.67	-0.66
Export	4.46	2.64	11.05	9.22	17.61	16.00	21.91	21.34	26.30	25.73	-1.82	-1.82	-1.61	-0.57	-0.57
Fiscal Result (welfare)	1.16	1.12	3.57	3.56	5.88	6.02	6.78	7.55	7.68	8.47	-0.04	-0.01	0.15	0.78	0.79
Rate of Unemployment	6.82	8.54	3.30	5.03	0.00	1.43	0.00	0.00	0.00	0.00	1.72	1.73	1.43	0.00	0.00
Welfare (distributional) Indicators															
Poorest Household	2.63	1.36	6.91	5.64	11.16	10.06	13.63	13.35	16.15	15.88	-1.27	-1.27	-1.10	-0.28	-0.27
Richest Household	2.62	1.03	6.93	5.32	11.21	9.77	13.66	13.05	16.17	15.56	-1.59	-1.60	-1.44	-0.61	-0.60
Sectoral Activity Level															
Agriculture	4.71	4.75	9.64	9.74	14.69	14.87	19.85	20.12	25.20	25.53	0.03	0.11	0.19	0.27	0.33
Mining	5.81	4.97	12.80	12.04	19.87	19.28	25.93	25.91	32.17	32.20	-0.83	-0.76	-0.58	-0.02	0.03
Food, beverage and tobacco	5.18	3.85	12.42	11.14	19.65	18.62	24.74	24.73	29.93	29.96	-1.33	-1.28	-1.03	-0.01	0.03
Textiles, wearing and leather	3.92	1.86	11.41	9.34	18.73	17.04	21.93	22.07	25.12	25.28	-2.06	-2.07	-1.69	0.14	0.16
Wood, wood products and paper	4.53	3.55	11.13	10.19	17.68	17.01	22.05	22.43	26.50	26.92	-0.98	-0.93	-0.67	0.37	0.42
Chemical and Petroleum	4.47	3.64	10.78	10.00	17.06	16.53	21.44	21.83	25.91	26.35	-0.83	-0.78	-0.53	0.39	0.44
Metal products, other manufactures	4.00	1.92	11.53	9.44	18.90	17.18	22.19	22.29	25.48	25.60	-2.08	-2.09	-1.71	0.10	0.12
Electricity, gas and water	2.94	2.08	7.46	6.62	11.94	11.30	14.73	14.88	17.57	17.74	-0.86	-0.83	-0.65	0.15	0.17
Construction	2.50	1.58	6.56	5.66	10.60	9.87	12.93	12.99	15.30	15.38	-0.91	-0.90	-0.72	0.06	0.08
Trade and Transport	2.15	1.39	5.65	4.90	9.11	8.52	11.10	11.19	13.13	13.24	-0.76	-0.74	-0.59	0.09	0.10
Financial Services	2.24	-2.55	5.84	0.89	9.40	4.43	11.49	7.08	13.62	9.13	-4.78	-4.94	-4.97	-4.41	-4.50
Insurance and Pension Funding services	2.49	0.51	6.53	4.52	10.54	8.66	12.86	11.72	15.22	14.07	-1.98	-2.01	-1.89	-1.13	-1.14
Real estate and business services	2.57	1.72	6.39	5.55	10.19	9.50	12.69	12.61	15.23	15.17	-0.85	-0.84	-0.70	-0.08	-0.06
Public administration and defense services	1.82	1.45	6.32	5.98	10.67	10.67	11.98	13.35	13.30	14.69	-0.37	-0.33	-0.01	1.37	1.39
Education and health	2.06	1.62	6.49	6.08	10.81	10.69	12.47	13.56	14.14	15.26	-0.44	-0.41	-0.12	1.10	1.12
Personal services	4.36	3.17	11.13	9.98	17.83	16.96	21.88	22.25	25.98	26.38	-1.20	-1.16	-0.87	0.36	0.40

6. Conclusions

The recent financial crisis has triggered an intense policy debate on the taxation of the financial sector. In particular, the benefit that the sector could derive from being exempted from VAT in the European Union has triggered renewed academic interest on its budgetary consequences and has led to policy discussion on taxing the sector. A few papers have attempted to estimate the macroeconomic effects of additional taxes on the financial sector but several important aspects have been left out of the analysis.

This paper attempts to fill these gaps and complement the existing literature on applying VAT or alternatives to the sector. Using a general equilibrium model for a small open economy – actually, calibrated for Belgium – it looks at the economic effects of applying a 15% VAT or a 10% sales tax on the total output of the financial sector. Besides the usual macroeconomic effects shown by the model, the paper innovates on several accounts. First, it looks at the redistributive effects of the two taxes. Second, it stresses the importance of openness of the financial intermediation services to international mobility in any assessment of the consequences of the taxes on the financial sector. This is important since evidence suggests that financial capital is particularly mobile and simple models often tend to overlook the importance of this dimension. Finally, the paper looks at sectoral impact of these taxes.

The simulations show that while the GDP impact of VAT is similar for closed and opened economies (confirming its neutrality), the negative impact of the sales tax is dramatically exacerbated when the economy opens. Openness has also dramatic effects on this sectoral impact. In closed economies, the application of VAT to financial services affects all sectors more or less in the same way while the sales tax may have differentiated long-term effects. When the economy is opened, the initial negative impacts on the level of activities of non-financial sectors are nullified in the long-run. With both taxes, the financial sector sees a dramatic decrease in the size of its activities, the more so with the sales tax than with VAT. Finally, the simulations show that while the application of VAT would have only slight negative effects on redistribution, the application of a sales tax would have much more significant positive redistributive effects, with and without international access to financial intermediation (i.e. openness).

These results can be useful for policy-making. It shows that the effects of these taxes may be very different for large and closed economies than for small and open economies. In particular, the size of and the degree of openness to capital movements (actual and potential) from/to the geographical scope of the application of any new tax on the financial sector will matter for its sectoral effects. Next, the possible cumulative effects of the selected tax will have non-negligible effects. On the one hand, these effects exacerbate the negative macroeconomic impacts, the more so in an open environment. On the other hand, the sales tax shows redistribution properties, unlike VAT. A possible explanation is that, under the assumption that the two taxes would collect the same amount of revenues, VAT will be passed-through and will therefore affect more directly the final consumption of financial and non-financial goods while a cumulative tax – through more distortive – is spread over the entire economy, impacts on supply and has therefore a relatively lower impact on the final consumption basket.

REFERENCES

Belgostat (2011). Databases. http://www.belgostat.be

Böhringer, C. and T. Rutherford (2008). "Combining bottom-up and top-down", *Energy Economics* 30 (2), 574-596.

Bradford, D.C. (1986), *Untangling the Income Tax*, Harvard University Press.

Brooke, A., D. Kendrick and A. Meeraus (1992). *GAMS: A User´s Guide*, *Release 2.25*, Scientific Press.

Buettner, T. and K. Erbe (2012). "Revenue and Welfare Effects of Financial Sector VAT Exemption", paper presented at the CESifo Venice Summer Institute workshop on Taxation of the Financial Sector.

Chisari O. and C. Romero (2009). *Un modelo de equilibrio general computable para la Argentina*, UNDP, Buenos Aires.

European Commission (2010), *Communication on Taxation of the Financial Sector*, COM(2010)549.

European Commission (2011), *Impact Assessment Accompanying the Proposal for a Council Directive on a common system of financial transaction tax and amending Directive 2008/7/EC*, SEC(2011)102.

Eurostat, 2008. *Eurostat Manual of Supply, Use and Input-Output Tables.*

Eurostat, 2003. *Household Budget Surveys in the EU. Methodology and recommendations for harmonization – 2003*

Eurostat (2011). Databases. http://epp.eurostat.ec.europa.eu

Ferris M. and J. Pang (1997). "Engineering and Economic Applications of Complementarity Problems", *SIAM Review*, 39(4), December, 669-713.

Genser, B. and P. Winker (1997). "Measuring the Fiscal Revenue Loss of VAT Exemption in Commercial Banking", *FinanzArchiv*, 54: 565-85.

Hemmelgarn T. and Nicodeme, G. (2012). "Can Tax Policy Help to Prevent Financial Crisis?", in *Taxation and the Financial Crisis*, J. S. Alworth and G. Arachi (eds), chapter 5, Oxford University Press.

International Monetary Fund (2010a), *A Fair and Substantial Contribution by the Financial Sector*, Final report to the G-20, June 2010.

International Monetary Fund (2010b), *Financial Sector taxation*. The IMF's Report to the G-20 and background material. Editors: S. Claessens, M. Keen and C. Pazarbasioglu.

Kehoe P. and T. Kehoe (1994). "A Primer on Static Applied General Equilibrium Models". *Federal Reserve of Minneapolis Quarterly Review*; 18:1.

Kerrigan, A. (2010). "The Elusiveness of Neutrality – Why is it so Difficult to Apply VAT to Financial Services?", *International VAT Monitor*, March/April 2010: 103-12.

Lendvai, J., Raciborski, R. and L. Vogel (2012). "Securities Transaction Taxes: Macroeconomic Implications in a General-Equilibrium Model", paper presented at the CESifo Venice Summer Institute 2012.

National Bank of Belgium (2011). Databases. http://www.nbb.be

Robinson, S., A. Cattaneo and M. El-Said (2001). "Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods", *Economic Systems Research* 13:1, pp. 47-64.

Rutherford, T. (1999). "Applied General Equilibrium Modeling with MPSGE as a GAMS Subsystem: An Overview of the Modeling Framework and Syntax", *Computational Economics*, Vol.14, Nos.1-2.

Shaviro, D. (2012), "The Financial Transactions Tax Versus (?) the Financial Activities Tax", *New York University Law and Economics Working Papers*, N° 292.