INDIRECT TAXES AND SOCIAL POLICY: DISTRIBUTIONAL IMPACT OF ALTERNATIVE FINANCING OF SOCIAL SECURITY*

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Abstract: The role of indirect taxes in social policy is investigated by 1) comparing the distributional pattern of indirect taxes with the one of personal income taxes and social security contributions; 2) calculating the indirect tax liabilities for recipients of social benefits; 3) assessing the distributional impact of shifting the financing of social security from contributions to indirect taxes. For this purpose we combine the data of the Household Budget Survey and the Socio-Economic Panel, as well as two microsimulation models, namely ASTER (for the calculation of indirect taxes) and MISIM (for the calculation of personal income taxes and social contributions).

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1 INTRODUCTION

Social security in Belgium is mainly financed through social security contributions: 45% of the budget comes from employer contributions and about 30% from own contributions (Verslag Hoge Raad voor Werkgelegenheid, 2004). As the wage cost in Belgium is high, voices are raised to reduce social contributions and to look for alternative sources. One of the ways often put forward is an increase of indirect taxes. The Belgian Planbureau (Bassilière et al., 2005) has made some simulations, calculating the macro effects of a shift from social contributions to indirect taxes. An often used argument for such a shift is that tax on labour income is a distortion that results in an efficiency loss. This is undoubtedly true, but misses the point. Fifty years of second best analysis have taught us that removing one single distortion in an environment where many other distortions remain, is not necessarily welfare enhancing. And taking the government revenue constraint into account, the real question is whether a shift from labour taxes to other forms of revenues would diminish the overall distortion. Moreover, apart from efficiency considerations, it is also important to include the distributional side of the coin. The distributional consequences of such a shift, however, have not been investigated. It is important to look at the micro level as well, given the fact that payroll taxes affect final income of households, and hence the income distribution, and given that the government takes back part of social benefits through taxes on consumption.

In this paper we take a closer look at the role indirect taxes play in social policy in Belgium, and at the distributional effects of a shift from employee social contributions to indirect taxes for financing social security. For this purpose we combine the data of the Household Budget Survey and the Socio-Economic Panel, as well as two microsimulation models, namely ASTER (for the calculation of indirect taxes) and MISIM (for the calculation of personal income taxes and social contributions). We focus on three specific issues:

1. How are indirect taxes distributed over the population in comparison with personal income taxes and social contributions? The links between taxes and benefits and their joint distribution effects are increasingly the subject of research (see e.g. Immervoll et al., 2006), though the focus is mainly on the relationship between personal income taxes and social security. The effect of indirect taxes often remains unanalysed. A first step in our analysis is to compare the distributive characteristics of indirect taxes with those of personal income taxes and social contributions.
2. How are taxes paid out of benefits distributed? As the government takes back part of social benefits through indirect taxes, the real social effort is in fact less than aggregate social expenditures would indicate (Adema, 1999; Adema & Ladaique, 2005). Adema (1999) argues that “the amount of indirect taxes paid on

consumption out of benefit income should be deducted from total benefit income in order to get the net effort of the government on social objectives".

3. What are the distributional consequences of an alternative way of funding social security? We simulate a revenue neutral shift from employee social insurance contributions to indirect taxes, and calculate the distributional consequences.

In section 2 we discuss the two datasets and the two microsimulation models that are used. Next, we compare the distribution of indirect taxes with that of personal income taxes and social contributions. The distributional effects of a shift from social contributions to indirect taxes for funding social security is the subject of section 4. The last section concludes.

2 METHODOLOGY

Indirect taxes are levied on expenditures, whereas income taxes and social contributions are levied on individual or household income. Most socio-economic datasets have reliable and detailed data on either expenditures or income. This applies also for Belgium: the Household Budget Survey (HBS) is used for the analysis of expenditures, whereas the Socio-Economic Panel (SEP) is considered to be an appropriate source for detailed income information. Therefore, we combine these two datasets by imputing expenditures of the HBS in the dataset of SEP, using semi-parametric estimation of Engel curves (see section 2.1). As the datasets do not have information on direct or indirect taxes, these are simulated using the microsimulation technique. Personal income taxes and social contributions are calculated on the SEP-data using MISIM, while indirect taxes are calculated on the expenditure data with the model ASTER (see section 2.2). Thus, this research entails not only a combination of two datasets, but also a combination of two microsimulation models.

2.1 DATA: MATCHING TWO DATASETS

Socio-Economic Panel (SEP)

The Social and Economic Panel (SEP) is a representative sample of private Belgian households, which encompasses four waves (1985, 1988, 1992 and 1997). The data can be used as a panel or as a cross section. We use here the 1997 database which includes 4,632 households and 12.260 individuals. As we work in the microsimulation model with the tax-benefit legislation of 2005, all income data have been indexed to 2005 using the consumer price index.

The SEP includes data about various kinds of income, as well as different socio-economic characteristics of the households and individual household members over the age of 18. These characteristics concern household composition and activity status, education level, occupation and hours of employment of each of the household members. In addition, the survey includes questions about the housing situation. The SEP-database also contains information about real estate and financial property of the households, and about their disposable income. The SEP-surveys measure monthly incomes. The overall disposable income of a household encompasses all net wages from primary or secondary employment, self-employment incomes, social security benefits (retirement pension, unemployment benefit, child benefit, sickness and invalidity benefit) and various other types of income (such as alimony, rental proceeds, scholarships, social assistance from local public welfare centres).

As the SEP-database contains only net monthly amounts, it does not contain direct information about the amount of income tax paid by the households, or about employees' social security payments or other personal contributions. This information is therefore calculated using MISIM (cf. infra). The SEP does not contain expenditure data either; these are imputed from the Household Budget Survey.

Household Budget Survey (HBS)

The expenditure survey of 2001 is a sample of Belgian private sociological households. In this context a household is defined as all people that live together and who jointly make decisions concerning, for example, the household budget. Collective households such as convent communities, hospitals or prisons are not included in the expenditure survey. In total 3,726 households participated in the expenditure survey 2001 representing 8,553 individuals. We can further distinguish three broad categories of information in the survey.

1. Household expenditures. These are always reported at the household level. Hence, we cannot attribute consumption expenditures to individual household members.
2. Income. Amounts are reported by the individual household members. It are mostly net incomes that we observe in the budget survey. Some incomes that are not attributable to individual household members are reported at the household level.
3. Household characteristics. At the household level we find for example dwelling characteristics, number of children, …. At the individual level it will mostly be relationship characteristics, such as the relation of a household member to the head of the household. The latter is considered the one who defends the household's interests and takes care of most of the administrative duties. Typically it is the person that has the highest income and contributes most to household income.

This information is collected by effectively contacting the respondents who fill out most of the requested information. As of 1999 a random sample of about 300 households is drawn each month. Those households then record all expenditures and income during that month. Additional questionnaires provide information concerning the dwelling and other socio-economic and demographic characteristics. This way we can think of the budget survey as a *continuous survey*.

Imputation of expenditures in SEP

The imputation of expenditures in the Socio-Economic Panel is implemented using semi-parametric estimation of Engel curves. In this section we will briefly outline the major steps undertaken in the implementation.

The general form for Engel curves can be written as:

$$w_i = g_i\left(y, \mathbf{z}\right) + \varepsilon_i, \tag{1}$$

with w_i the budget share on good i, y disposable income, $\mathbf{z}$ a vector of household characteristics, and ε_i a random error term.[2] The function $g_i\left(.,.\right)$ is an unknown function that needs to be estimated without recourse to any parametric specification. When the vector $\mathbf{z}$ has high dimension, say n, a fully nonparametric estimation of $g\left(.,.\right)$ becomes unfeasible or else would require an enormous amount of data. To circumvent this we resorted to a semi-parametric specification where we retained only disposable income and age of the household head in the nonparametric part. The other household characteristics remain in the vector $\mathbf{z}$ (now dimension $n-2$) and enter the Engel curve specification linearly. The latter can then be written as:

$$w_i = \boldsymbol{\beta}_i'\mathbf{z} + F_i\left(y, age\right) + \varepsilon_i, \tag{2}$$

where $F_i\left(.,.\right)$ is a function of age (of the household head) and disposable income with no a-priori assumed functional form. In the appendix (section 6.1) we describe some technical details on how we have implemented (2). The result of this imputation procedure is an income dataset enriched with expenditure data (hence referred to as "SEP-HBS").

2.2 MICROSIMULATION MODELS

There are two reasons for using the microsimulation technique here. Firstly, microsimulation models are ideally suited to analyse alternative policy proposals, which is done in section 4. Secondly, some crucial information is not available in the dataset(s), namely social contributions, personal income taxes and indirect taxes. Personal income taxes and social contributions are calculated on the SEP-data using MISIM, while indirect taxes are calculated on the expenditure data with the model ASTER.

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[2] We will stick to the usual terminology of *budget share* here, although we make use of shares in disposable income in the empirical application.

ASTER

ASTER is a microsimulation model for indirect taxes applicable to the Belgian indirect tax system (see Decoster, 1995; Decoster et al., 1997). As in most other countries, in Belgium, three types of indirect taxes can be distinguished: excises, VAT and ad valorem taxes. The link between the producer price and the consumer price for commodity i can be written as:

$$q_i = (1+t_i)(p_i + a_i + v_i \cdot q_i), \tag{3}$$

where q_i denotes the consumer price for commodity i, p_i the producer price, a_i the excise tax, v_i an ad valorem tax rate applied on the consumer price and t_i the VAT-rate.

For the simulations in this paper we used the 2005 indirect tax system and deflated it to 2001 values to be applied to data of the 2001 household budget survey. ASTER has 13 aggregate commodity classes covering expenditures on 974 individual items. In appendix 6.2 we explain how we have defined tax rates on consumption *aggregates*, and how we have split up the total tax rate as a percentage of the producer price (denoted below as τ_K) into a VAT- and an excise component (denoted respectively by τ_K^t and τ_K^a). The tax rates for the 13 aggregate commodities are reported in Table 1.

TABLE 1: IMPLICIT INDIRECT TAX RATES ON THE 13 AGGREGATES AND SAVING (AS A PERCENTAGE OF THE PRODUCER PRICE) USING DATA FROM THE BUDGET SURVEY 2001

aggregate	total indirect tax rate(τ_K in %)	implicit vat rate (τ_K^t in %)	implicit excise tax rate (τ_K^a in %)
food	6.2	6.1	0.1
non-alcoholic beverages	7.7	6.1	1.6
alcohol	40.9	24.5	16.4
tobacco	207.5	184.1	23.4
clothing	20.8	20.8	0.0
rent and utilities	4.2	4.0	0.1
heating	24.9	20.9	4.0
private transportation	47.4	21.9	25.5
public transportation	5.3	5.3	0.0
hygienics, health	7.7	7.7	0.0
leisure commodities	10.7	10.7	0.0
other	7.2	7.2	0.0
durables	20.9	20.9	0.0
saving	0.0	0.0	0.0
total	10.9	9.3	1.5

Table 2 and Table 3 give a picture of consumption patterns over deciles of equivalent income in the budget survey. The first decile represents the 10% least well off individuals and the last decile the 10% wealthiest individuals in the population in terms of equivalent income[3]. As is the case in many countries, also in Belgium a great part of peoples' budgets is spent on rent and the share diminishes as people become wealthier. The same pattern applies for food, the second highest budget share for individuals up to the fifth decile. In the higher deciles larger parts of the budget are spent on leisure commodities and durables. These categories typically also contain the most commodities that can be labeled as luxuries.

TABLE 2: BUDGET SHARES PER DECILE OF EQUIVALENT INCOME (BUDGET SURVEY 2001)

decile	1	2	3	4	5	6	7	8	9	10	total
food	17.8	18.0	15.7	15.8	15.7	14.5	13.7	13.4	12.7	11.1	14.8
non-alcoholic beverages	1.4	1.4	1.2	1.3	1.2	1.2	1.2	1.0	1.0	1.0	1.2
alcohol	1.1	1.5	1.3	1.4	1.5	1.4	1.4	1.4	1.6	1.6	1.4
tobacco	2.3	1.4	1.2	1.3	0.9	0.9	1.0	0.7	0.4	0.5	1.1
clothing	3.7	4.0	4.9	5.0	6.3	5.2	5.7	6.2	6.3	6.9	5.4
rent and utilities	34.5	30.5	29.7	27.7	26.2	25.0	27.2	24.7	23.2	22.1	27.1
heating	1.2	1.6	1.8	1.5	1.1	1.6	0.4	1.1	1.0	0.6	1.2
private transportation	4.2	5.3	6.1	5.8	6.5	7.2	6.6	7.4	9.0	9.4	6.7
public transportation	0.7	0.6	0.5	0.4	0.4	0.4	0.6	0.6	0.4	0.4	0.5
hygienics, health	6.3	7.1	7.1	6.6	6.8	6.3	7.1	6.8	5.9	6.2	6.6
leisure commodities	9.5	11.1	11.8	13.5	13.4	15.9	15.3	14.8	16.5	16.5	13.8
other	12.0	11.3	11.5	12.8	12.8	12.1	12.4	11.8	12.0	13.5	12.2
durables	5.4	6.4	7.1	7.0	7.1	8.2	7.5	10.1	10.0	10.3	7.9
total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Looking at income shares in Table 3, the same general patterns emerge, although food now makes up an even smaller part of income for the higher deciles. From this table it is also clear that a great part of the income of the wealthiest goes into saving, which is negative for the first four deciles and then grows to reach almost a third of total income for the highest decile.

MISIM

MISIM (*Mi*cro*SI*mulation*M*odel) is a static microsimulation model, which enables to evaluate policy alternatives in the field of social security and personal taxation. It is a tax-benefit model, developed in the line of the one presented in Atkinson & Sutherland (1988) and developed by the Centre for Social Policy (see Cantillon et al.

[3] The equivalence scale used is the square root of the number of household members.

1993a; Verbist, 2002). MISIM can perform simulations of unemployment schemes, child allowances, personal income taxes, social insurance contributions, social rent legislation, study allowances, etc.

TABLE 3: INCOME SHARES PER DECILE OF EQUIVALENT INCOME (BUDGET SURVEY 2001)

decile	1	2	3	4	5	6	7	8	9	10	total
food	19.8	17.6	15.2	14.7	13.5	12.4	11.2	10.6	9.6	6.8	13.1
non-alcoholic beverages	1.6	1.4	1.1	1.2	1.1	1.0	1.0	0.8	0.7	0.6	1.1
alcohol	1.1	1.5	1.3	1.3	1.4	1.3	1.1	1.3	1.3	1.0	1.3
tobacco	2.4	1.3	1.2	1.2	0.8	0.8	0.8	0.5	0.4	0.3	1.0
clothing	2.2	3.9	4.9	4.7	5.7	4.8	5.0	5.2	5.0	4.7	4.6
rent and utilities	38.1	30.5	29.0	25.6	23.2	22.0	22.5	19.6	17.8	13.8	24.2
heating	1.1	2.0	2.1	1.6	1.1	1.5	0.4	1.0	0.8	0.6	1.2
private transportation	2.2	5.5	6.4	5.8	6.2	6.6	5.6	6.3	7.2	6.7	5.8
public transportation	1.0	0.6	0.5	0.4	0.4	0.3	0.5	0.5	0.3	0.3	0.5
hygienics, health	6.6	7.6	7.3	6.3	6.4	5.8	6.3	5.7	4.6	4.4	6.1
leisure commodities	12.8	11.9	12.5	13.8	12.7	14.7	13.5	12.6	13.2	10.9	12.9
other	14.0	12.0	12.2	14.0	12.0	11.2	11.4	10.2	9.7	9.2	11.6
durables	6.4	10.5	10.6	9.5	9.4	10.3	8.7	13.9	12.4	9.6	10.1
saving	-9.4	-6.2	-4.4	-0.1	6.0	7.2	12.1	11.7	17.0	31.2	6.5
total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The SEP database exclusively contains information about net incomes, not gross incomes. It is, however, impossible to draw conclusions regarding distributive effects of income tax and parafiscal measures on the basis of data about net incomes. This requires information about gross incomes. In order to obtain this information, the net incomes are converted into gross amounts by means of the so-called 'net-to-gross trajectory'. To make this conversion, one first calculates the withholding tax on earnings from employment, so that one arrives at the taxable income on a monthly basis. Then on the basis of this monthly income, we calculate the personal social security contributions which yields gross income. Ultimately, income tax is calculated on the basis of annual income. The survey, however, asks about monthly earned and replacement incomes. These amounts must, therefore, be converted into annual amounts. The year under consideration is the year that precedes the moment of questioning. The survey provides some information about changes that may have occurred in the course of the previous year (i.e. the year prior to questioning). Insofar as this is possible, such transitions are taken into account in the model. We then calculate personal income taxes, following as closely as possible the tax legislation (for more details, see Verbist, 2002). We have applied here the tax legislation of income year 2005 on the indexed data of SEP.

Simulations with a microsimulation model are of course only meaningful for policy purposes if the model and the data are sufficiently realistic. A comparison with data from administrative statistics indicates that incomes simulated with MISIM on the basis of SEP-data are satisfactorily representative. We may therefore conclude that the simulations conducted by MISIM are sufficiently reliable (see Verbist, 2002).

Table 4 gives the composition of gross income over deciles of equivalent income in SEP[4]. On average, about three quarters of gross income consists of labour income, 11% are made up of pensions, and the rest comes from other benefits and other income sources. As can be expected, the proportion of income from work increases with income level: in the lowest decile, only 11% of income comes from work, against 80% at the top of the income distribution (note that the proportion of income from self-employed work is very high in this decile). The reverse pattern applies for social benefits: pensions and unemployment benefits make up 36%, resp. 26% of gross income at the bottom of the income distribution against 11% resp. 2.5% at the top.

TABLE 4: COMPOSITION OF GROSS INCOME PER DECILE OF EQUIVALENT INCOME (SEP-MISIM 2005)

decile	1	2	3	4	5	6	7	8	9	10	total
Labour income	11.2	41.7	58.6	69.5	73.1	79.3	79.3	82.0	83.4	80.4	74.4
- labour income employee	*8.3*	*37.0*	*54.0*	*63.2*	*63.7*	*72.0*	*69.7*	*74.6*	*70.2*	*58.4*	*63.1*
- labour income self-employed	*2.4*	*4.6*	*4.6*	*6.2*	*9.3*	*7.1*	*9.6*	*7.3*	*13.0*	*21.9*	*11.2*
Pensions	36.4	24.8	19.6	14.3	12.4	9.3	9.0	7.3	8.0	8.6	11.4
Sickness and invalidity benefits	3.6	7.5	3.3	3.4	1.3	2.2	1.9	2.1	0.8	0.6	2.0
Unemployment benefits	25.8	7.2	5.8	3.0	2.2	1.6	1.6	1.0	0.9	0.4	2.5
Other income (*)	23.0	18.8	12.7	9.8	11.1	7.6	8.1	7.7	6.8	10.0	9.8
total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(*) Other income includes child benefits, study allowances, social assistance, alimony

[4] The equivalence scale used is the square root of the number of household members.

3 DISTRIBUTION OF TAXES AND THE TAX BASE

We now compare the distribution characteristics of indirect taxes with those of personal income taxes and social contributions. This means that we look at the transition from gross to final income (see scheme below).

	Gross income
-	*Employee social contributions*
	Pre-tax income
-	*Personal income taxes*
	Net Income
-	*Indirect taxes*
	Final income

We first compare the distribution of indirect taxes with that of other taxes (section 3.1). We also look at the redistributive effect of the various tax types in Belgium and other countries. In section 3.2 we analyse the impact of indirect taxes on social benefits. As indirect taxes reduce the real value of consumption financed out of social benefits, and as these taxes are financial flows back to the Treasury, they in fact reduce social policy efforts.

3.1 DISTRIBUTION OF INDIRECT TAXES COMPARED TO OTHER TAXES

We compare the distribution of indirect taxes with the one of personal income taxes and own contributions. Own contributions consist of employee social contributions on salaries, contributions paid by the self-employed, and contributions paid on social benefits (more specifically on pensions and on sickness and invalidity benefits). Table 5 gives an overview of the share of the different taxes as a percentage of both gross and disposable income for deciles of equivalent income. Personal income taxes are progressive, as the average tax rate increases with income. Indirect taxes are regressive. The overall tax system remains progressive, even after taking indirect taxes into account.

TABLE 5: TAXES AND CONTRIBUTIONS AS PERCENTAGE OF INCOME (SEP-HBS)

	as % of disposable income				as % of gross income			
decile	own contri-butions	personal income taxes	indirect taxes	global taxes and contributions	own contri-butions	personal income taxes	indirect taxes	global taxes and contri-butions
1	1,2	-0,2	11,4	12,4	1,3	-0,2	12,2	13,4
2	5,8	2,8	10,8	19,5	5,9	2,8	10,9	19,6
3	8,7	8,7	10,5	27,8	8,0	8,0	9,8	25,8
4	10,8	15,2	10,5	36,5	9,4	13,2	9,1	31,6
5	11,9	18,1	10,2	40,2	10,0	15,3	8,6	33,9
6	13,3	23,5	10,0	46,9	10,6	18,7	8,0	37,4
7	14,0	27,5	9,7	51,3	10,9	21,3	7,5	39,7
8	14,4	31,1	9,5	55,0	10,8	23,3	7,2	41,2
9	15,7	35,3	9,3	60,3	11,5	25,8	6,8	44,0
10	15,6	41,9	8,6	66,1	11,0	29,6	6,1	46,7
all individuals	12,8	25,8	9,7	48,2	10,1	20,4	7,7	38,3

In Table 6, using data from the Socio-Economic Panel, we show the redistributive effect and liability progression of taxes by respectively calculating the Reynolds-Smolensky index and the Kakwani index. Both are calculated as the difference between the Gini and the appropriate concentration coefficient. Personal income taxes shift, on average, income from top to bottom, while the reverse is true for indirect taxes. Also own contributions have a positive redistributive effect, be it far smaller than personal income taxes. The fact that own contributions are progressive may be surprising, as in Belgium employee contributions are in general proportional, and self employed contributions even have a regressive structure. There are several reasons for this progressivity: 1) salaries are situated relatively more in the higher end of the income distribution (see Table 4); 2) there is a substantial reduction in contributions for low salaries; 3) also for social benefits contributions are considerably reduced for low pensions and low sickness and invalidity benefits; moreover no contributions are levied on unemployment benefits.

The combined tax/contributions system is progressive, although less so than personal income taxes taken separately. Especially the measure for liability progression decreases (by some 40%) when indirect taxes and social contributions are taken into account.

TABLE 6: REYNOLDS-SMOLENSKY AND KAKWANI INDICES FOR DIFFERENT TAXES (SOCIO-ECONOMIC PANEL)

	own contributions	personal income taxes	indirect taxes	global taxes
redistributive effect (Reynolds-Smolensky)	0.0116	0.0550	-0.0033	0.0634
liability progression (Kakwani)	0.1100	0.2150	-0.1118	0.1366

Similar patterns are found in other countries (see O'Donoghue et al., 2004). Table 7 presents the Reynolds-Smolensky coefficient for the three tax types in 12 EU-countries[5]. In all countries personal income taxes are the most redistributive instrument of the three. Also, indirect taxes are everywhere regressive, and hence anti-redistributive. Compared to other countries, the effect of indirect taxes in Belgium is relatively small, whereas the redistributive effect of both personal income taxes and social contributions is relatively high.

TABLE 7: REDISTRIBUTIVE EFFECT (REYNOLDS-SMOLENSKY) FOR DIFFERENT TAXES, INTERNATIONAL COMPARISON

	employee contributions	personal income taxes	indirect taxes
Belgium	0.023	0.065	-0.006
Finland	0.010	0.048	-0.036
France	0.014	0.035	-0.043
Greece	-0.002	0.040	-0.028
Ireland	0.009	0.058	-0.036
Italy	0.006	0.021	-0.031
Luxembourg	0.007	0.073	-0.013
The Netherlands	0.007	0.056	-0.013
Portugal	0.002	0.046	-0.035
Spain	-0.003	0.049	-0.019
Sweden	0.004	0.033	-0.020
UK	0.009	0.046	-0.030

Source: EUROMOD, O'Donoghue et al., 2004.
Note: Income has been equivalised using the modified OECD equivalence scale 1/0.5/0.3.

3.2 DISTRIBUTION OF INDIRECT TAXES PAID OUT OF SOCIAL BENEFITS

When looking for alternative paths it is also important to consider what the potential impact is on benefit recipients. In the case of a shift from employee contributions towards indirect taxes it can be expected that this may be anti-redistributive, and that social benefit recipients will be losers in the operation. Various publications of the OECD (Adema et al, 1996; Adema, 1999, Adema & Ladaique, 2005) have pointed out the fact that the net effort of the government on social objectives is lower than gross social expenditure indicators tell. Both consumption taxes and direct taxes on benefits establish a flow back to the government in tax receipts. For benefit recipients, consumption of goods and services is paid out of social benefits, which reduces the real value of consumption that can be financed out of a given level of benefits. In some countries, this is explicitly accounted for (Australia, for instance, introduced a compensation package for social

[5] The figures for Belgium in Table 7 differ somewhat from those found with SEP-HBS. The figures in Table 7 are calculated on another dataset and with another microsimulation model, and another equivalence scale is used.

benefit recipients together with the Goods and Services Taxes; Canada supports low-income households through a Goods and Services Tax rebate) (Adema & Ladaique, 2005).

Adema and Ladaique (2005) calculate the average implicit indirect tax rates of consumption out of benefit income, and express them as a percentage of GDP (see Table 8). There is a wide variation among countries. In general, countries with high gross social expenditure levels also have higher indirect taxes (e.g. Scandinavian countries), whereas the opposite applies for countries with relatively low benefit levels, such as the US, Australia and Canada. Belgium belongs to the middle group, together with other continental welfare states.

TABLE 8: INDIRECT TAXES ON CONSUMPTION OUT OF BENEFIT INCOME, AVERAGE IMPLICIT TAX RATES AND AS A PERCENTAGE OF GDP, 2001.

	average implicit indirect tax rate of consumption out of benefit income	Indirect taxes paid out of consumption of total cash transfers, in percentage of GDP
Australia	9.9	1.4
Austria	16.2	2.9
Belgium	14.4	2.5
Canada	11.2	1.2
Denmark	26.5	3.5
Finland	21.4	2.3
France	15.9	3.1
Germany	13.7	2.9
Ireland	19.9	1.6
Italy	13.1	2.2
The Netherlands	17.4	2.8
Spain	13.0	1.6
Sweden	20.7	2.9
UK	13.5	2.4
US	4.4	0.5

Source: Adema & Ladaique, 2005.

These macro figures do not tell anything about the distribution of indirect taxes paid out of social benefits. In Table 9 we give an estimate of this distribution for Belgium. Even though the VAT rate on necessities is lower than for other goods and services, and even though the relative use of this kind of goods is higher at the bottom of the distribution and among benefit recipients, also indirect taxes paid out of benefits are regressive.

TABLE 9: SOCIAL BENEFITS AS A % OF DISPOSABLE INCOME, INDIRECT TAXES PAID OUT OF SOCIAL BENEFITS

	Social benefits as % of disposable income	Indirect taxes paid out of benefits as % of benefits	Indirect taxes paid out of benefits as % of disposable income
1	75.8	11.3	8.5
2	50.3	10.6	5.3
3	39.1	10.3	4.0
4	29.1	10.2	3.0
5	24.3	9.9	2.4
6	20.4	9.9	2.0
7	19.5	9.6	1.9
8	16.4	9.6	1.6
9	14.2	9.4	1.3
10	12.1	8.6	1.0
all individuals	23.6	10.0	2.4

Source: SEP-HBS, MISIM-ASTER

4 ALTERNATIVE FINANCING OF SOCIAL SECURITY

In this part we look at a policy proposal whereby social security contributions paid by employees are reduced by 25% and the loss in revenue compensated by an increase in indirect tax rates, more specifically VAT. Taking into account the extra revenue from personal income taxes, we thus make sure that the reform is revenue neutral.

In this simulation we only look at static effects, that is, labour supply reactions are not taken into account. We also make the assumption that the reduction in social security contributions translates completely into an increase in gross labour income. Personal income taxes are of course recalculated for the changed gross income. In the microsimulation model for indirect taxes, ASTER, a detailed demand system is available. This allows to take behavioural reactions as a consequence of changes in relative prices into account. The data used come from the Socio-Economic Panel and the imputed expenditures therein.

The total net budgetary cost of the reform was calculated to be around €1329 million, i.e. the difference between the cost of the 25% reduction in social security contributions and the extra revenue collected from personal income taxes due to higher labour incomes. Since the VAT liabilities in ASTER only account for about 62% of total indirect tax revenue collected in Belgium, we limited the cost to be recovered through an increase in VAT rates to 62% of the total net budgetary cost.[6] The net budgetary cost to be financed then amounts to €824.10 million (figures for 2005). This cost was found to be exactly offset by increasing VAT tax rates by a factor 1.0773, i.e. a

[6] ASTER only includes VAT revenue from private households.

VAT rate of 6% becomes 6.46% and a rate of 21% becomes 22.62%. Table 10 summarizes the costs of the reform, the last row shows the revenue from increasing the VAT rates by a factor 1.0773.

TABLE 10: BUDGETARY COST OF REDUCTION IN EMPLOYEE SOCIAL SECURITY CONTRIBUTIONS, 2005

	cost (in million euro)
reduction of employee contributions	2791.04
increase in personal income tax revenue	1461.84
total net budgetary cost	1329.20
net budgetary cost to be recovered from private households (62% of total net cost in € of 2005)	824.10
	revenue (in million euro)
increase VAT rates by a factor 1.0773	824.10

In Table 11 we show the changes in equivalent disposable income, the change in (equivalent) consumption due to changes in relative prices, and the combined effect as a result of the reduction in employee social security contributions and the subsequent increase in VAT rates to ensure revenue neutrality.[7] Results are shown per decile of equivalent disposable income. The change in disposable income due to the reduction of social security contributions clearly favours the higher income deciles, but when we look at the change in consumption due to the increase in vat rates the effects are just the opposite: higher income deciles lose more — their consumption decreases more in absolute terms than that of lower deciles. The combined effect, however, confirms the first observation, namely that individuals in higher income deciles win more than their counterparts with less income. The combined effect of the reforms even makes individuals in the lowest two deciles worse off than they were before the reform. The change in disposable income does not cover the change in relative prices due to the increase in VAT rates. The lower deciles have relatively high income shares for some of the most heavily taxed commodities, such as tobacco and to a lesser extent heating.

[7] The decomposition of the effect on household welfare into the effect of the changed disposable income and the price change is explained in the appendix (section 6.3).

TABLE 11: EFFECTS BY DECILE OF EQUIVALENT DISPOSABLE INCOME USING SEP-HBS (ALL FIGURES IN YEARLY € OF 2005)

decile	disp. equiv. income	change in equiv. disp. income (1)	change in consumption due to relative price changes (2)	combined effect (1)+(2)
1	8209.0	13.5	-57.7	-44.2
2	11302.3	62.9	-72.2	-9.3
3	13394.4	126.1	-82.3	43.8
4	15121.7	159.7	-90.5	69.2
5	16781.3	206.3	-97.0	109.3
6	18352.6	249.9	-103.9	145.9
7	20274.4	279.8	-111.3	168.6
8	22525.1	332.4	-119.7	212.7
9	25876.5	369.1	-132.9	236.3
10	34849.4	427.9	-163.6	264.5
Total	18008.4	209.0	-100.3	108.8

FIGURE 1: WELFARE CHANGE BY DECILE OF EQUIVALENT DISPOSABLE INCOME (SEP-HBS, 2005)

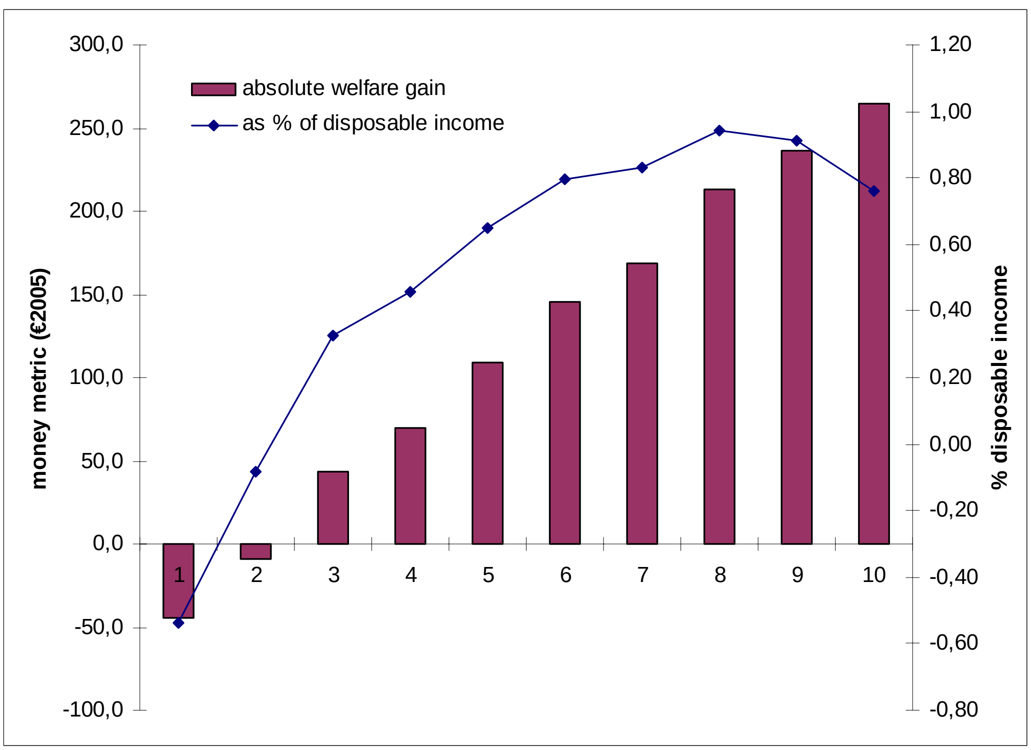


Table 12 is similar to Table 11 but it shows the effects per age class. Here there is no clear pattern in consumption changes due to changes in relative prices. All age classes lose approximately the same absolute amounts. The combined effect is more outspoken, i.e. it shows a clear loss for the two last age classes, the individuals older than 60. The change in disposable incomes for these groups is rather limited, given that the larger part in these age classes will be pensioners who do not enjoy the positive effects of a reduction in employee social security contributions.

TABLE 12: EFFECT BY AGE CLASS USING SOCIO-ECONOMIC PANEL (ALL FIGURES IN YEARLY € OF 2005)

Age class	disp. equiv. income	change in equiv. disp. income (1)	change in consumption due to relative price changes (2)	combined effect (1)+(2)
<20	18033.8	291.2	-105.3	185.7
>=20 & <30	17921.0	327.2	-106.0	221.2
>=30 & <40	18179.9	294.6	-99.0	195.9
>=40 & <50	19595.0	307.2	-104.9	202.3
>=50 & <60	20023.6	272.8	-109.3	163.7
>=60 & <70	16952.1	61.6	-100.2	-38.6
>=70	14693.7	20.1	-82.0	-61.8
Total	18008.4	209.0	-100.3	108.8

This is also illustrated by Figure 2 and Figure 3, which show the income and price change by socio-professional category: salaried workers (civil servants and employees) are clearly winners in the proposed scenario, whereas those who cannot benefit from the social contributions reduction (the self-employed and inactive) loose.

The effect on income inequality, as measured by the Gini coefficient, is slightly negative, with an increase from 0.21883 pre reform to 0.22002 post reform. This is not surprising as in this scenario the weight of a progressive, and hence redistributive, instrument (namely employee contributions) is reduced, whereas the weight of the anti-redistributive instrument (indirect taxes is increased).

FIGURE 2: WELFARE CHANGE BY DECILE OF EQUIVALENT DISPOSABLE INCOME (SEP-HBS, 2005)

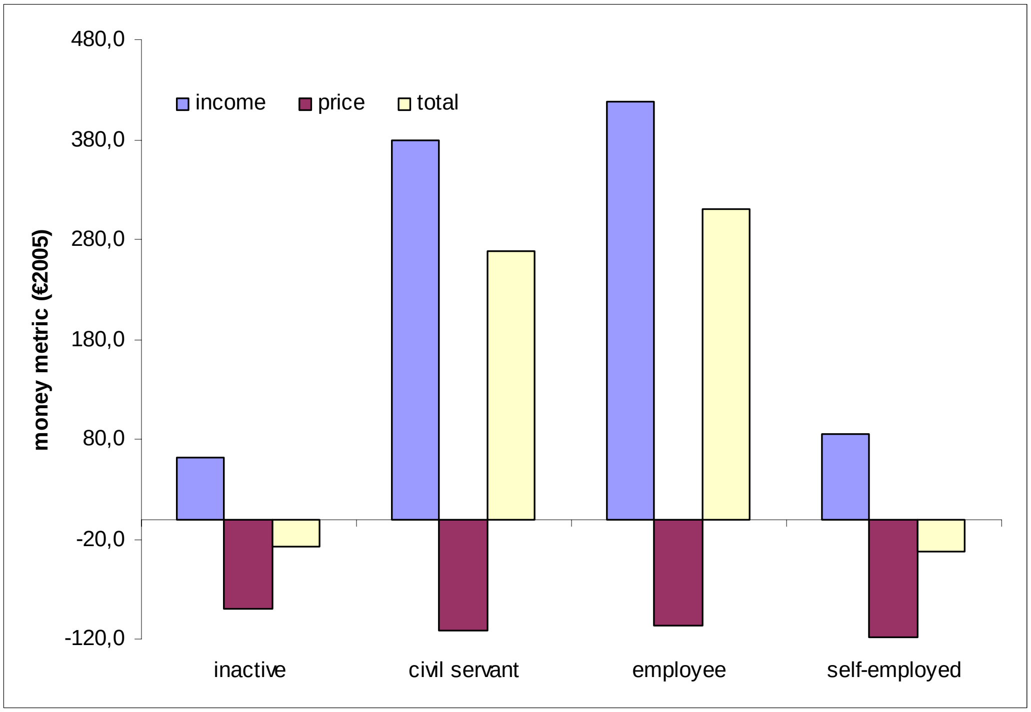
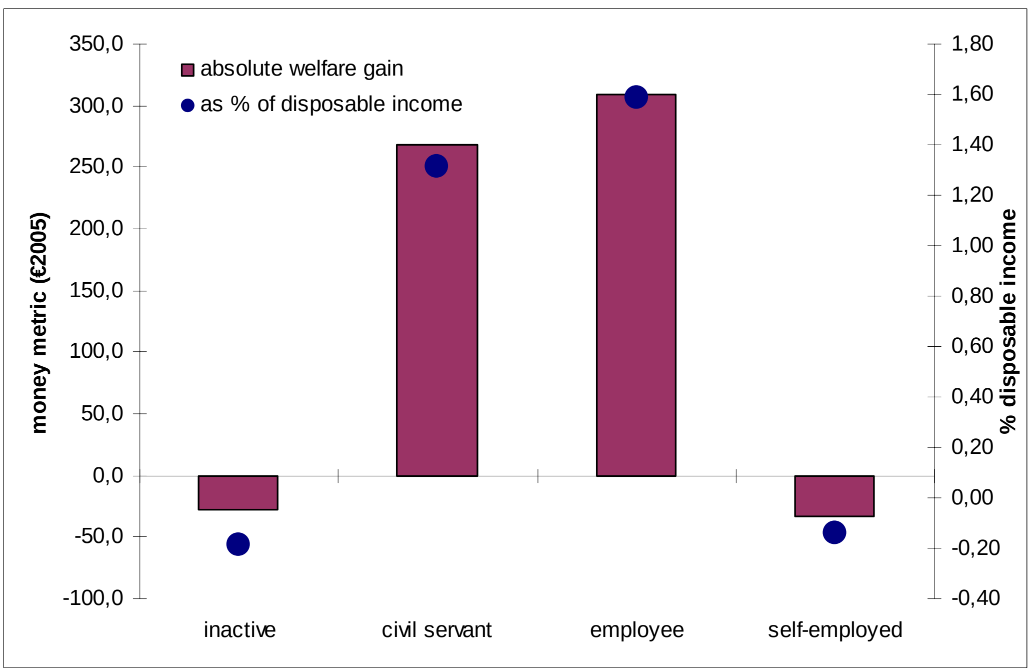


FIGURE 3: WELFARE CHANGE BY DECILE OF EQUIVALENT DISPOSABLE INCOME (SEP-HBS, 2005)



5 CONCLUSION

In this paper we have investigated the distributional consequences of an alternative way of financing social security. Proposals on alternatives mostly focus on efficiency and macro considerations, but it is also important to take account of the micro level and of distributional concerns. We have used a combined microsimulation model, as it is the most appropriate tool for this kind of distributional analysis. The policy proposal consisted of a reduction of social security contributions paid by employees with 25%, which was compensated by an increase in indirect tax rates, more specifically VAT. Taking into account the extra revenue from personal income taxes, we applied a revenue neutral reform.

Our results indicated a gain for the higher income groups, whereas those at the lower end were the losers. In this scenario, the redistributive effect of overall taxes diminished slightly. The shift from employee contributions to indirect taxes also entails an intergenerational effect: the income position of the elderly worsened, whereas that from those at active age improved. Not surprisingly, also benefit recipients were mainly losers, as their real value of consumption declined in this simulation. These results follow intuition, but it is nevertheless important to make them visible, and to show that distributional concerns do matter. If a scenario as the one we have investigated would come into being, then it might be appropriate to provide a kind of compensation for benefit recipients, as was for instance done in Australia in 2001.

6 APPENDIX

6.1 SEMI-PARAMETRIC IMPUTATION OF BUDGET SHARES ON THE SEP DATABASE

Rewriting (2) as:

$$F_i\left(y, age\right) = w_i - \boldsymbol{\beta}_i'\mathbf{z} + \nu_i, \tag{4}$$

where ν_i is a random error term with conditional expectation equal to zero allows to formulate the regression analogue of (4) as:

$$F_i\left(y, age\right) = E\left(w_i - \boldsymbol{\beta}_i'\mathbf{z}\middle| y, age\right). \tag{5}$$

Once we have estimates for the beta coefficients, (5) can be estimated by use of standard nonparametric regression techniques. Beta coefficients can be estimated from (2) by taking the expectation of (2) conditional on age and disposable income and subtracting this again from (2) to eliminate $F_i\left(y, age\right)$ to get:

$$w_i - E\left(w_i\middle| y, age\right) = \boldsymbol{\beta}_i'\left[\mathbf{z} - E\left(\mathbf{z}\middle| y, age\right)\right] + \varepsilon_i, \tag{6}$$

which can be estimated using simple OLS regression.

For the estimation, the conditional expectation terms in (6) are replaced by their nonparametric estimates which are, respectively:

$$\hat{E}\left(w_i \middle| y, age\right) = \frac{\sum_h K\left(\frac{y - y_h}{b_y}\right) K\left(\frac{age - age_h}{b_{age}}\right) w_{ih}}{\sum_h K\left(\frac{y - y_h}{b_y}\right) K\left(\frac{age - age_h}{b_{age}}\right)}, \text{ and} \tag{7}$$

$$\hat{E}\left(\mathbf{z} \middle| y, age\right) = \frac{\sum_h K\left(\frac{y - y_h}{b_y}\right) K\left(\frac{age - age_h}{b_{age}}\right) \mathbf{z}_h}{\sum_h K\left(\frac{y - y_h}{b_y}\right) K\left(\frac{age - age_h}{b_{age}}\right)}. \tag{8}$$

The functions $K(.)$ are standard Gaussian kernel functions given by:

$$K(u) = \frac{1}{\sqrt{2\pi}} e^{-\frac{u^2}{2}}, \tag{9}$$

and b_y and b_{age} are the bandwidths of respectively income and age in the budget survey. The summation is over all households h of the budget survey. To satisfy adding-up the bandwidths are chosen optimally, but are not adaptive. Hence, the bandwidths are independent of the type of commodity and are the same for all households. Filling in the estimated beta coefficients in (5) allows nonparametric estimation of the function $F_i(.,.)$ in the budget survey as:

$$\hat{F}_i\left(y, age\right) = \frac{\sum_h K\left(\frac{y - y_h}{b_y}\right) K\left(\frac{age - age_h}{b_{age}}\right) \left[w_{ih} - \boldsymbol{\beta}_i' \mathbf{z}_h\right]}{\sum_h K\left(\frac{y - y_h}{b_y}\right) K\left(\frac{age - age_h}{b_{age}}\right)}. \tag{10}$$

For imputation of budget shares in the Socio-Economic Panel we make use of the overlapping variables y, age, and the household characteristics in $\mathbf{z}$ as well as the conditional expectation of w_i:

$$E\left(w_i \middle| y, age\right) = \boldsymbol{\beta}_i' E\left(\mathbf{z} \middle| y, age\right) + F_i\left(y, age\right). \tag{11}$$

The linear part poses no problem. The estimated beta coefficients can be applied to the corresponding variables in the Socio-Economic Panel. A bit more demanding is the imputation of $F_i(y, age)$ in the Socio-Economic Panel. For this we make use of expression (10) in which the points of estimation, y and age, will now be observations from the Socio-Economic Panel. Let index bs indicate observations from the budget survey and sp observations from the Socio-Economic Panel. Households in the budget survey are identified by subscript h and households in the Socio-Economic Panel by subscript j. For *each* household j in the Socio-Economic Panel, the imputed function $F_i(.,.)$ for good i is given by (an imputed value is indicated by a tilde):

$$\tilde{F}_i^{sp}\left(y_j^{sp}, age_j^{sp}\right) = \frac{\sum_h K\left(\frac{y_j^{sp} - y_h^{bs}}{b_y}\right) K\left(\frac{age_j^{sp} - age_j^{sp}}{b_{age}}\right)\left[w_{ih}^{bs} - \hat{\boldsymbol{\beta}}_i' \mathbf{z}_h^{bs}\right]}{\sum_h K\left(\frac{y_j^{sp} - y_h^{bs}}{b_y}\right) K\left(\frac{age_j^{sp} - age_j^{sp}}{b_{age}}\right)}. \tag{12}$$

The imputed budget share for good i for household j in the Socio-Economic Panel is then calculated as[8]:

$$\tilde{w}_{ij}^{sp} = \hat{\boldsymbol{\beta}}_i' \mathbf{z}_j^{sp} + \tilde{F}_i\left(y_j^{sp}, age_j^{sp}\right). \tag{13}$$

6.2 CALCULATION OF INDIRECT TAX RATES ON CONSUMPTION AGGREGATES

Re-arranging (3) and solving for the producer price p_i we find:

$$p_i = \left[\frac{1-\left(1+t_i\right)v_i}{1+t_i}\right] q_i - a_i, \tag{14}$$

which for the case where the ad valorem rate is assumed to be zero simplifies to:

$$p_i = \frac{q_i}{1+t_i} - a_i. \tag{15}$$

Expression (15) will be used to infer the (fixed) producer price from the known consumer price q_i and excise tax a_i.

For a commodity i ($\forall i$), the *implicit proportional excise tax rate* α_i is defined as:

$$\alpha_i = \frac{a_i}{p_i}. \tag{16}$$

Replacing α_i in equation (3) by making use of (16), we obtain:

$$q_i = \left(1+t_i\right) \cdot \left(p_i + \alpha_i \cdot p_i + v_i \cdot q_i\right), \tag{17}$$

which, after re-arrangement, ca, be written as:

---

[8] Remark that, to be correct, this should read as the conditional budget share, i.e. $E\left(\tilde{w}_{ij}^{sp} \middle| y_j^{sp}, age_j^{sp}\right)$, since we do not add back an error term to the imputed value in this exercise.

$$q_i = \frac{(1+t_i)\cdot(1+\alpha_i)}{1-v_i\cdot(1+t_i)}\cdot p_i = z_i \cdot p_i, \tag{18}$$

where $z_i = \frac{(1+t_i)\cdot(1+\alpha_i)}{1-v_i\cdot(1+t_i)}$ is the ratio of consumer to producer price for commodity i. From this we can obtain the total tax rate for commodity i as:

$$\tau_i = z_i - 1 \tag{19}$$

$$= \frac{q_i - p_i}{p_i} \tag{20}$$

$$= \frac{t_i(1+\alpha_i+v_i)+v_i}{1-(1+t_i)v_i} + \frac{\alpha_i}{1-(1+t_i)v_i} \tag{21}$$

$$= \tau_i^t + \tau_i^a, \tag{22}$$

where the total tax rate τ_i has now been decomposed into an implicit VAT-rate τ_i^t and an implicit excise tax rate τ_i^a.

The total tax rates τ_i and the two components τ_i^t and τ_i^a have all been expressed in relation to the producer price for the commodity. To calculate the tax liability from observable expenditures $e_i = q_i x_i$, the following manipulations have been applied:

$$T_i = \tau_i p_i x_i \tag{23}$$

$$= \frac{\tau_i}{q_i} p_i q_i x_i \tag{24}$$

$$= \frac{\tau_i}{z_i} e_i \tag{25}$$

$$= \frac{\tau_i}{1+\tau_i} e_i \tag{26}$$

$$= \frac{\tau_i^t}{1+\tau_i} e_i + \frac{\tau_i^a}{1+\tau_i} e_i \tag{27}$$

$$= T_i^t + T_i^a, \tag{28}$$

where T_i^t and T_i^a refer to VAT and excise tax liability for commodity i respectively.

All the above formulae can be applied to individual commodities. However, in simulations, we will use tax rates on aggregates. The tax liability for commodity aggregate K, denoted by T_K, is obtained as the sum of the tax liabilities paid on the individual commodities:

$$T_K = \sum_{i \in K} T_i \tag{29}$$

$$= \sum_{i \in K} T_i^t + \sum_{i \in K} T_i^a, \tag{30}$$

from which the tax rates on the aggregates are defined as:

$$T_K = \frac{T_K}{e_K - T_K} \tag{31}$$

$$= \frac{T_K^t}{e_K - T_K} + \frac{T_K^a}{e_K - T_K} \tag{32}$$

$$= \tau_K^t + \tau_K^a. \tag{33}$$

Those tax rates are then used to calculate the tax liabilities on aggregate expenditures:

$$T_K^t = \tau_K^t \left(e_K - T_K \right) \tag{34}$$

$$= \frac{\tau_K^t}{1 + \tau_K} e_K, \tag{35}$$

and

$$T_K^a = \tau_K^a \left(e_K - T_K \right) \tag{36}$$

$$= \frac{\tau_K^a}{1 + \tau_K} e_K. \tag{37}$$

6.3 CONSUMPTION BASED WELFARE

A theoretically sound way to calculate welfare effects of income and price changes is to use the money metric based on the expenditure function $e(u,q)$, where u refers to the utility level and q to the vector of consumer prices (see King, 1983). Since disposable income of household h equals $e(u,q)$, the welfare gain of a change in disposable income and in consumer prices can be written as:

$$WG(q^0, q^1, y^0, y^1) = e(q^0, u(f(q^1, y^1)) - e(q^0, u(f(q^0, y^0))), \tag{38}$$

where we use superscripts 0 and 1 to denote pre- and post reform situations, and where *u(.)* denotes the direct utility function with as arguments the quantities consumed. The latter result from the Marshallian demand functions $f(q, y)$. In (38) we used the pre-reform prices q^0 as reference prices.

This welfare gain can be rewritten as:

$$WG(q^0, q^1, y^0, y^1) = e(q^1, u^1) - e(q^0, u^0) - [e(q^1, u^1) - e(q^0, u^1)] \\ = (y^1 - y^0) - [e(q^1, u^1) - e(q^0, u^1)] \quad (39)$$

The term in round brackets is the change in disposable income, displayed in column (1) of Table 12 of the main text. The term between square brackets captures the effect of the price change. If we refrain from making specific assumptions about the utility function, we can approximate this term by means of a Taylor expansion around the baseline prices q^0:

$$e(q^1, u^1) \cong e(q^0, u^1) + \frac{\partial e(q^0, u^1)}{\partial q'}(q^1 - q^0) \\ \cong e(q^0, u^1) + x'(q^0, u^1)(q^1 - q^0), \quad (40)$$

with $x'(q^0, u^1)$ the set of compensated demand functions for consumption goods. We have simulated these compensated demands by calculating a real income effect on observed pre-reform demands, derived from the non parametrically estimated Engel-curve.Using (40) in (39) gives us as an approximation of the welfare gain:

$$WG(q^0, q^1, y^0, y^1) \cong (y^1 - y^0) - x'(q^0, u^1)(q^1 - q^0), \quad (41)$$

The second term is an aggregate measure of the price change, and is reported in column (2) of Table 12. The welfare gain itself is then the sum of both effects and given in column (3) of the same table.

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