HORIZONTAL NEUTRALITY AND VERTICAL REDISTRIBUTION WITH INDIRECT TAXES

André Decoster, Erik Schokkaert, and Guy Van Camp

I. INTRODUCTION

There is a long-standing debate on whether the rate structure of indirect taxes should be uniform or differentiated. This debate is dominated completely by arguments concerning distributive justice. Usually the uniform system is taken as a kind of benchmark. From the distributive point of view, this is a logical choice. If we concentrate on indirect taxes paid as a proportion of total expenditures, the uniform system boils down to proportional taxation and can be considered to be redistributively neutral in two senses. There is no vertical redistribution, because inequality as measured by nearly all inequality measures will be unaffected. It is horizontally neutral, in that households with the same level of pre-tax expenditures will pay the same amount of tax.

Real world indirect tax systems are not uniform. Mainly because of distributive reasons a differentiated rate structure is introduced, setting a lower rate for necessities and a higher rate for luxuries. The proclaimed purpose is to levy a higher tax on households at a higher level of total expenditures, that is, a higher level of

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endowments. This implies some vertical redistribution. At the same time, however, differences in tastes will also lead to differences in the amount of taxes paid even for households at the same endowment level. This leads to a differentiation of the tax burden for households who were considered to be equal in the benchmark case, that is, a violation of horizontal neutrality.

With this chapter we want to present some empirical results on the magnitude and relevancy of this second effect. The possible violation of horizontal neutrality is often considered to be a problem,[1] but seldom integrated in the empirical investigation of indirect tax systems. We base our empirical analysis on the results of a microsimulation model for indirect taxes, constructed with expenditure data for a representative sample of Belgian households. We present this model and the different tax scenarios analyzed in Section II.

In our analysis, we approximate the welfare of the household by using total expenditures minus indirect taxes paid, corrected by an equivalence scale which takes into account household size. Total expenditures before taxes are interpreted as the "endowment" of the household and vertical redistribution through the indirect tax system will be measured by the reduction in the inequality of these net total expenditures. Households with the same total equivalized expenditures are considered to have equal endowments and differences in the taxes they pay will then be interpreted as due to "differences in tastes." Our purpose can be summarized as follows. Can we measure the impact of the interplay of preference variation and differentiation in the rate structure on the total redistributive power of the system? Or otherwise said: if we would make the rate structure more progressive (e.g., because we want to make it more redistributive in a vertical sense), how important would be the violation of horizontal neutrality, resulting from the variation in tastes?

Our choice of welfare concept makes the problem of disentangling endowment- and tastes-effects of indirect taxes formally similar to the problem of decomposing the redistributive effect of income taxation in its vertical and horizontal components. We can use therefore the methodology recently presented in Lambert and Ramos (1995) and in Aronson, Johnson, and Lambert (1994) for the analysis of income taxes to measure the magnitude and relevancy of *taste variation* in the context of a differentiated indirect tax structure. We summarize the methodology in Section III and discuss the results for the Belgian indirect tax system in Section IV.

While most authors seem to agree that violation of horizontal neutrality is a problem in the case of income taxes (for a deviating view, see Kaplow 1989), this is much less clear for indirect taxes.

It can be argued that people must bear full responsibility for their own "tastes" and that differences in tax payments as a consequence of taste differences are therefore irrelevant from a normative point of view. This is in line with a rapidly growing tendency in the social choice literature to differentiate between "needs" and "tastes," where a compensation would be justified for the former but not for the latter.[2] Here also we want to present some useful empirical results, without

having the ambition to settle a difficult theoretical debate. We will therefore initiate in Section V a first attempt to identify the variables which might explain the taste variation and hence the violation of horizontal neutrality. Section VI concludes.

In this chapter we are only concerned with distributive issues and we completely neglect the efficiency considerations, which are the main topic of the literature on optimal taxation in the Ramsey-tradition (see Stern 1987, for an overview of both sets of arguments and Decoster and Schokkaert 1990, for an empirical application in the Belgian context). The reason is that we want to focus on the effects of taste variation. Although horizontal neutrality has been analyzed in the optimal taxation literature, it is fair to say that the large majority of papers concentrates on differences in endowments and neglects differences in tastes.[3] An intermediate approach is followed by Yitzhaki and Slemrod (1991). They use a dominance test to determine welfare-improving indirect tax reforms. As they are concerned mainly by vertical redistribution, they largely neglect issues of horizontal neutrality and the related questions concerning the distinction between needs and tastes. However, compared to our approach, which yields an overall evaluation of the global tax structure, they are able to make more concrete policy proposals concerning the tax or subsidy rate for specific commodities. The exploration of the links between our approach and the more traditional ones is left for future work.

II. THE REFORM SCENARIOS

A comparison of the degree of violation of horizontal neutrality by different tax systems makes sense only if these tax systems raise the same amount of government revenue. We will mainly focus on systems which are revenue neutral to the existing Belgian tax system, which is described shortly in the appendix. Moreover, it is useful to take the uniform system as a benchmark case since it is horizontally neutral and keeps inequality of net total expenditures the same. Our benchmark will be a uniform system with a VAT rate of 12.8 percent on all goods (and no excises). This VAT rate has been obtained by simulating a reform which is revenue neutral to the existing Belgian tax system. All calculations of tax liabilities and tax revenues have been done with the microsimulation program ASTER which is also briefly explained in the appendix.

We have defined three reforms with respect to the uniform system. The *first* one is the introduction of the *actual Belgian indirect tax structure*. Previous work has already shown that this structure is slightly regressive. Since this is mainly due to the existence of excise and ad valorem taxes (the latter only apply to tobacco products), we have in the *second* reform defined a more progressive system by *dropping these excises and ad valorems*. We realize that this second scenario is not revenue-neutral with respect to all other scenarios. We have included it nevertheless to illustrate the regressive nature of the excises, but the results must be interpreted cautiously. Finally we have defined a *third* reform where we tried to introduce more progressivity in the system. This third scenario works with a two rate VAT structure.

Goods with a total expenditure elasticity below unity were given a VAT rate of zero, while a uniform VAT rate was determined for all goods having a higher income elasticity.[4] No excise and ad valorem rates were used and the VAT rate was again determined so that the resulting indirect tax structure was revenue neutral to the existing system. This resulted in a rate of 18.2 percent.

Let us now first split the redistribution through these three tax systems in its endowment- and its tastes-components (Sections III and IV) and then determine which variables can explain this redistributive pattern (Section V).

III. DECOMPOSITION OF THE REDISTRIBUTIVE EFFECT IN AN ENDOWMENT AND A TASTES COMPONENT

The welfare measure in our analysis is *equivalized expenditures net of indirect taxes*. As in Yitzhaki (1994), expenditures net of indirect taxes can be interpreted as a measure of quantities consumed because tax liabilities are calculated under the assumption of fixed producer prices. We use equivalence scales to translate expenditures into a welfare -or endowments- concept.[5] We will return to these equivalence scales in our discussion of the empirical results.

From a theoretical point of view, net equivalent expenditures are only a poor indicator of the welfare of the household. To define a better measure we would have to start from the indirect utility function or the money metric utility of the household. However, it is far from settled in the literature how one should handle welfare comparisons if preferences differ. From a pragmatic point of view, it is worth emphasizing that the use of net total expenditures as a welfare measure is certainly representative for the real world practice which we want to evaluate in this chapter.[6] It seems therefore acceptable to assume that net equivalized expenditures are a reasonable first approximation of the endowments of the households.

The working of the indirect tax system can now be illustrated by Figure 1, which is a slightly adapted version of the figure in Aronson, Johnson, and Lambert (1994). As has been described, we have chosen the uniform indirect tax system as the benchmark case. Therefore we have put on the horizontal axis *net equivalent expenditures under the uniform system*: we call the uniform system the system "before the reform." Any of the three reforms, described in the previous section, will induce a (different) mapping from the net expenditures before reform (i.e., under the uniform system) into the net expenditures after the reform. On the vertical axis we plot *net equivalent expenditures under the non uniform system*. Consider now two groups of households. The net equivalent expenditures under the uniform system are different between the two groups (the poor group has x_1, the rich group has x_2), but within each group all households have exactly the same level of net equivalent expenditures. Given the characteristics of the uniform system all households within each group have also the same level of equivalent expenditures in a world without indirect taxes, that is, the same level of endowments. Now assume we introduce a differentiated rate structure. *If* there would be no preference variation

within each equal-endowment group, then all households with equal net equivalent expenditures under the uniform system (i.e., before the reform) will also end up with equal net equivalent expenditures after the reform. In that case, the new differentiated tax system would map x_1 into y_1 (for all households starting at x_1) and x_2 into y_2 (for all households starting at x_2). The figure is drawn for the case where luxuries are taxed more heavily under the new system than necessities: therefore (y_1/x_1) is larger than (y_2/x_2). This is commonly called the vertical redistribution through the tax system.

In reality, however, there will be preference variation within each group of households with equal endowments. Therefore, introducing a differentiated rate structure will lead to different tax payments for households with the same endowments. In Figure 1 this leads to the fan AB around y_1 and CD around y_2. We will call this the tastes-effect. It is a violation of what we have called "horizontal neutrality," but for the moment we simply note the existence of the effect without attaching any normative significance to it. We will return to the normative question in Section V.

Figure 1 was initially proposed by Aronson, Johnson, and Lambert (1994) in the context of direct taxation. They call the former effect the "vertical" and the latter (fan out) effect the "horizontal" component of the total redistributive effect. In two related papers Lambert and Ramos (1995) and Aronson, Johnson, and Lambert (1994) propose a methodology to quantify the relative importance of these two components. We propose to use the same methodology to quantify the "endowment" and the "tastes"-component in the redistribution through indirect taxes.

We define the total *redistributive effect* of any indirect tax system as:

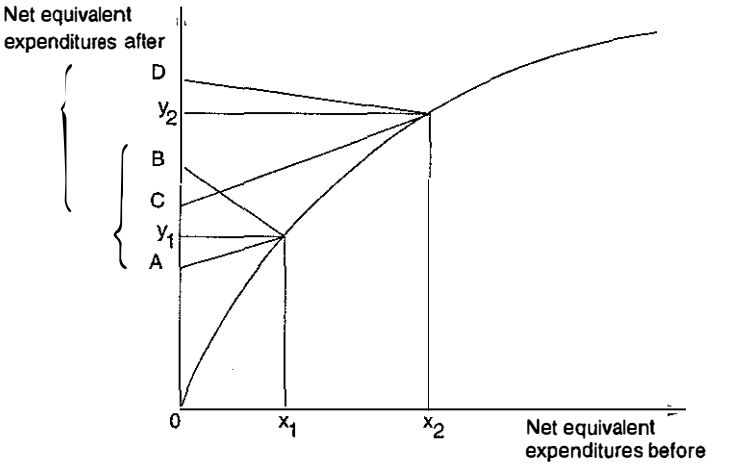

Figure 1. Relation Between Post Reform and Pre Reform Net Expenditures

$$RE = I^b - I^a \tag{1}$$

where I^b stands for the inequality measured in the pre-tax situation and I^a for the inequality measured in the situation with taxes. Any inequality measure can be used for I. As we measure inequality in terms of net equivalized expenditures, we know that for all scale-invariant inequality measures $I^b = I^u$, where I^u is the inequality under the uniform (proportional) system of indirect taxes. Therefore RE in (1) also measures the redistributive effect of a move from uniform to non-uniform indirect taxes.

Since all commonly used inequality measures are symmetric (or anonymous), the measure I^a in (1) is only based on the post reform distribution and does not use any information on the pre reform distribution. Therefore (1) cannot be used as such to distinguish between the vertical redistribution (or endowment effect) and the effect of tastes. If we want to make this distinction, we have to construct a *counterfactual* post reform distribution which assigns to each household a tax liability *as if* there would have been only differences in endowments and no taste variation. In Figure 1 all households with pre reform net expenditures x_1 would get y_1 in the counterfactual distribution, and all households with x_2 would get y_2. The inequality registered by I^a can then be decomposed into the inequality between the groups of pre reform equals (*inter*-group inequality) and the inequality within each group (*intra*-group inequality). The former is the inequality in the counterfactual distribution and captures the effect of endowments, the latter follows from the differences in tastes.

The exact decomposition depends on the inequality measure used and recently two approaches have been followed. The more recent is in Lambert and Ramos (1995) and exploits the additive decomposability of the generalized entropy class of inequality measures. More specifically, they propose to work with the mean logarithmic deviation. If it is assumed that there are J distinct subgroups in the population, in each of which the members have the same endowments,[7] then the decomposability characteristic allows us to write:

$$I^a = I_0^a + \sum_{j=1}^{J} w_j I_j^a \tag{2}$$

where the post reform inequality within group j is measured by I_j^a, and the inequality between the group means in the post reform situation is I_0^a. The weight w_j in (2) is the population share of group j.[8] Substituting (2) into (1) then gives:

$$RE_{MLD} = I^b - (I_0^a + \sum_{j=1}^{J} w_j I_j^a)$$

$$= (I^b - I_0^a) - \sum_{j=1}^{J} w_j I_j^a$$

$$= V_{MLD} - T_{MLD} \tag{3}$$

Given our definitions, the V_{MLD}-term measures the effect of differences in endowments. It results from the interplay between the differentiation of the rate structure and the different expenditure elasticities for the various commodities. This is the "vertical redistribution" through the indirect tax system, the intended purpose of deviating from the uniform system. The T_{MLD}-term measures the additional effect of variation in tastes within the groups of households with the same endowments. While there was no pre-reform inequality within these groups, the tax reform does lead to within-group inequalities after the reform and T_{MLD} is simply the weighted sum of these created inequalities. Apparently this is an unintentional (and perhaps undesirable) side effect of the rate differentiation.

Another decomposition is proposed in Aronson, Johnson and Lambert (1994) and based on the Gini coefficient. It is well known that the Gini coefficient is not easily decomposable in between and within group inequality, but the authors show that the remainder of the Gini decomposition can be seen as a quantification of the reranking component in the traditional definition of horizontal inequity. In our setting and interpreted in Figure 1 this can be interpreted as the degree of overlap between the different fans. With analogous notation as above we can decompose the Gini as:

$$RE_G = G^b - G^a$$

$$= G^b - (G_0^a + \sum_j \tilde{w}_j G_j^a + R)$$

$$= (G^b - G_0^a) - \sum_j \tilde{w}_j G_j^a - R$$

$$= V_G - T_G - R \tag{4}$$

The groups and inequality measures are defined as in the first method, but the weights $\tilde{w}_j$ are now the product of the population and the income share of the groups. Apart from the vertical redistribution (V_G), we now distinguish two tastes components: T_G (analogous to T_{MLD}) and R, the reranking component. Reranking is an effect between unequals: it refers to the situation where the welfare ranking between two individuals i and j is reversed through the tax system. This can be illustrated with Figure 1: if someone with initial endowment x_1 ends at B (after the tax reform), we have reranking for all households who have initial endowment x_2 and after-tax expenditures smaller than OB. Such reranking is often interpreted as an infringe-

ment on horizontal neutrality, in the sense that the latter individuals are treated in an unfair way. From Figure 1 it is immediately clear that reranking can only occur if T_G is not equal to zero. We feel that the ethical status of the reranking component is somewhat unclear, and we therefore prefer decomposition (3) over (4).

IV. RESULTS FOR THE BELGIAN SCENARIOS

To apply the methodology of Section III in empirical work, one needs to define groups of equals. Since our relevant endowment-variable is continuous (net equivalized expenditures), there are hardly any "exact equals" and we will have to work with "close equals." We have chosen to take all households within the same 5 percent-quantile as "equals." This procedure is somewhat ad hoc. In fact, almost every group member will be more similar to some people outside his group than to people belonging to his group. However, at the end of this section and in the appendix we will show that our basic insights are not very sensitive to the specific choice of group width.

In Table 1 we present for the three "reforms" defined in Section II the redistributive effect and its decomposition by the Lambert/Ramos-method. The value of RE_{MLD} for the first simulation reveals that the actual indirect tax system is regressive in terms of equivalized net expenditures. As could be expected, this regressivity disappears for the second and the third scenario. The second simulation reveals that the excises are responsible for the regressivity. Moreover the third scenario shows that it is not difficult to make the indirect tax system much more progressive. All this is not very surprising.

But let us now turn to the decomposition results. Here the results for the actual Belgian tax system (the first scenario) are rather revealing. *If* it would be possible to give all pre reform equals the same tax treatment (which is equivalent to assume

Table 1. Redistributive Effect Decomposed by Mean Logarithmic Deviation (equals are defined by taking 5%-quantiles)

	Inequality Pre Reform	***0.10773***			
	Reform	I^a	RE_{MLD}	V_{MLD}	T_{MLD}
1	Belgium 1995	101.5502	**–1.55194**	1.1708	**2.72273**
		0.1094	–0.00167	0.00126	0.00293
2	Belgium 1995 without excises	99.69368	**0.3055**	2.74102	**2.43544**
		0.1074	0.00033	0.00295	0.00262
3	two rate VAT	95.65581	**4.34642**	6.64263	**2.2963**
		0.10305	0.00468	0.00716	0.00247

Note: The *second line* of figures for each simulation gives the value of I^a, RE_{MLD}, V_{MLD}, and T_{MLD}; the *first line* expresses these figures relative to I^b (in percentage)

that all households with the same endowments also have the same tastes), then even the current Belgian indirect tax system would be slightly progressive. This means that the rate structure is indeed "progressive," in the sense that on average luxuries are taxed more heavily than necessities. But there is a considerable loss of possible vertical redistribution because of the different expenditure patterns of households who are considered to be equal (to be at the same level of endowments) in the pre-reform situation. This implies that there is in general a negative covariance between the taste-variables which induce a higher consumption of luxuries and our endowment-variable (net equivalised expenditures). This may have to do with the weakness of our equivalence scales. We will return to that in the following section.

The decomposition makes it possible to get some additional insights. Removing the excises out of the system has hardly any influence on the tastes-component but it increases the vertical redistribution-effect. The same is true for the highly progressive two rate-VAT-system: here we see a huge increase in V_{MLD}, while T_{MLD} goes down slightly. Note that the move from scenario 1 to scenario 3 gradually decreases the degree of rate differentiation in the indirect tax system. As could be intuitively expected, this decreases the tastes-component but the effect is rather minor. On the other hand, making the rate structure more progressive has a strong effect on V_{MLD}. In any case, simulations 2 and 3 point to the conclusion that we can make the system much more progressive without changing its degree of horizontal neutrality.

In Table 2 we present the results for the decomposition by means of the Gini coefficient. While the quantification of the effects is of course measure dependent, the conclusions emerging from the previous table are largely corroborated. Note that, contrary to what is usually found for the income tax, the reranking-component R_G (measuring the overlap of the fans) is rather unimportant and is dominated completely by T_G. This tastes-component is again considerable and rather stable

Table 2. Redistributive Effect Decomposed by Gini (equals are defined by taking 5%–quantiles)

	Inequality Pre Reform	***–0.25733***				
	Reform	G^a	RE_G	V_G	T_G	R_G
1	Belgium 1995	100.7267	**–0.72766**	0.05324	**0.72782**	**0.05309**
		0.2592	–0.00187	0.00014	0.00187	0.00014
2	Belgium 1995 without excises	99.81347	**0.18757**	0.84246	**0.64606**	**0.00882**
		0.25685	0.00048	0.00217	0.00166	0.00002
3	two rate VAT	97.84712	**2.15435**	2.77263	**0.61326**	**0.00502**
		0.25179	0.00554	0.00713	0.00158	0.00001

Note: The *second line* of figures for each simulation gives the value of G^a, RE_G, V_G and H_G; the *first line* expresses these figures relative to G^0 (in percentage)

over the different scenarios. The overall regressivity (measured by RE_G) disappears if excises are removed and the two rate system is much more redistributive.

As mentioned in the beginning of this section, to apply the decomposition-methodology a more or less arbitrary decision has to be taken with respect to the definition of equals. We show the results of a sensitivity analysis in Appendix C. We only present results for the first decomposition (based on the mean logarithmic deviation) but the results for the Gini-decomposition are similar. Here we want to draw attention to the two main conclusions of the sensitivity analysis. In the first place (and not surprisingly), the exact quantitative results are indeed crucially dependent on the class width defined on the horizontal axis of Figure 1. The broadening of the classes of equals in the pre-reform situation leads to a reallocation of the preference variation from "between" groups to "within" groups. With broad classes, the counterfactual distribution of endowments needed to calculate I_0^a is very equal, and hence a lot of variation in the taxes paid is ascribed to differences in tastes. This is an artefact of the technique used and therefore the exact numbers in Tables 1 and 2 have to be interpreted cautiously. But in the second place our conclusions in comparing the three different scenarios are not very much affected by the definition of the classes of equals. Since this comparison is the main purpose of the whole exercise, we find the sensitivity analysis rather reassuring.

V. TRYING TO EXPLAIN THE HORIZONTAL INEQUITY

Let us now turn to our second question. Given that there is an important tastes-component in the redistribution through indirect taxes, what are the normative conclusions to be drawn from this finding? Is such a violation of horizontal neutrality problematic or can we consider households to be fully responsible for their own tastes? As mentioned already in the introduction, a deep analysis of the previous question would require us to go beyond welfarist analysis and to enter into the social choice literature on "compensation." We would then have to return to the basic questions from the literature on horizontal neutrality: who should be considered to be "equal" and what can be considered to be "equal treatment?"

One (definitional) answer to this question has been more or less implicit in our theoretical approach, where we have divided the characteristics of the households into "endowment" and "taste"-related. Our "endowment"-variable was an equivalized measure, however, and meant to account for differences in "needs." It could then be argued that all remaining differences between households are only differences in purely subjective tastes and therefore no longer relevant from a normative point of view. Society would not have to care about differences in tastes (and the resulting inequality in tax payments), that is, about the T-component in our decomposition, under the express condition that all characteristics for which inequality is undesirable are captured in the "endowment"-measure. Although the

T-component can be considered as problematic because it lowers the redistributive effectiveness of the indirect tax system, it is not problematic *in se*. But this point of view explicitly requires the equivalence scales to be perfect and this seems like putting the cart before the horse.

As before, we will not try to solve these basic questions, but take a purely pragmatic approach. While the problem should ideally be analyzed on the basis of the complete consumption patterns of the households, we concentrate directly on the level of total equivalized expenditures. Some *first insights* into the empirical dimensions of the problem can be gained by looking at Figure 1 and ask the question: what variables "explain" the variation around the "average" tax-schedule? To answer this question, we have run a simple regression analysis with

$$y_i = f(x_i, \text{other variables}) \tag{5}$$

where y_i = equivalized expenditures net of indirect taxes in system i
x_i = equivalized expenditures net of indirect taxes in the uniform system

We specify the function f to be linear.[9] Table 3 gives the results for the three simulations (between brackets are standard errors). The coefficient of equivalized net expenditures in the uniform system is close to 1 in all simulations. It is lower in simulation 3 than in simulation 1, which together with the larger intercept in simulation 3 reflects the fact that vertical redistribution is stronger in the two rate system.[10]

Let us now turn to the effects of the other variables. Many of them are significant. This implies that they have a significant influence on equivalized net expenditures *on top of* the influence through net expenditures in the uniform system (for which the regression corrects). In this sense these variables suggest how to explain the preference differences which lead to what we have called the *T*-component in the decomposition. The explanation of this *T*-component is not the same for the different simulations, however, which suggests that its normative relevancy also might be different.

A first set of variables relates to *family size*. This is taken into account here through the household type in the *EC*-classification. Singles without children are the reference group. For identical equivalized net expenditures in the uniform system, the shift towards the actual Belgian system is worse for pairs without children and better for pairs with more than three children, but the effect is not very strong. If we only consider the VAT-rates (simulation 2) singles without children are the main winners of the reform. And the same is true for the "progressive" system in simulation 3. In simulations 2 and 3 the effects are extremely significant.

Given the imperfections of our methodology, it is far from easy to interpret these results. Household composition is the kind of variable for which most people will

Table 3. Explanation of the Variation in the Indirect Taxes Paid Under Different Tax Systems (dependent variable: net equivalized expenditures in thousands of Belgian francs)

Variable	*Simulation 1 (Belgium 1995)*	*Simulation 2 (without excises)*	*Simulation 3 (two rate VAT)*
Intercept	**5409**	**9349**	**9818**
	(1383)	(1022)	(594)
Net expenditures uniform	**0.98591**	**1.020742**	**0.97090**
	(0.00097)	(0.00072)	(0.00042)
Household type (single)	—	—	—
Couple no children	**–2142**	**–3807**	**–764**
	(685)	(506)	(295)
Couple with 1 child	**–977**	**–4850**	**–2614**
	(859)	(635)	(369)
Couple with 2 children	**642**	**–4718**	**–3258**
	(886)	(655)	(381)
Couple with 3+ children	**2522**	**–4365**	**–3682**
	(1014)	(749)	(436)
Single adult with children	**–1510**	**–4648**	**–3118**
	(1448)	(1070)	(622)
Other type of household	**–1351**	**–5258**	**–3240**
	(747)	(552)	(321)
Age of head of household	**119**	**33**	**45**
	(17)	(12)	(7)
House ownership (yes)	—	—	—
Renting a house	**–6173**	**–4544**	**784**
	(460)	(340)	(198)
Other	**–4545**	**–3798**	**–167**
	(1185)	(876)	(509)
Dummy for car ownership	**–9706**	**–3261**	**190**
	(537)	(397)	(231)
Dummy for smokers	**–6577**	**–1602**	**1532**
	(392)	(290)	(169)
R^2	0.9975	0.9987	0.9995
RMSE	10706	7911	4601
Mean Dependent Variable	396492	415551	404344
C.V.	2.70014	1.90375	1.13787

want to compensate. Therefore, *if* we would consider our equivalence scales to be perfect, that is, if equivalized net expenditures are seen as a perfect needs-corrected measure of endowments, then the indirect tax systems apparently induce an unwarranted differential treatment of households with the same "needs." This could at first sight be seen as a genuine example of "horizontal *in*equity." But even here this interpretation might be somewhat too easy, because the consumption pattern of different demographic groups may differ because of taste differences which are quite unrelated to needs.

More importantly, the equivalence scales we use are probably far from perfect. The effects of household type in the regression can then be seen as a "correction" of the inadequacies of the equivalence scales themselves and, hence, would not reflect any inequity. This answer really begs the normative question, however. Indeed, Table 3 shows that the "corrections" by different indirect tax systems go in different directions. At least for one of them, there is a problem. To decide for which one, we have to determine for which social groups our equivalence scales are problematic. And this brings us immediately back to the basic questions about needs and tastes.

The interpretational difficulties following from the imperfections of the equivalence scales are less severe for the other coefficients, because these can now be interpreted as reflecting the effect of taste variables on indirect taxes paid, keeping both endowments and household type fixed. Somewhat optimistically, one could take the position that the problems related to the specification of the equivalence scales are solved (or at least side-stepped) by the explicit introduction of the variable "household type" in our regressions.

It then turns out that consumption patterns, and hence indirect taxes paid, differ according to *age*. In all three simulations families with an older household head end up at a higher level of equivalized net expenditures after the reform. *Renters* are significantly worse off than owners in the actual Belgian system (with or without excises). The effect is much less strong and in the opposite direction in simulation 3. Owners of a *car* and *smokers* pay more taxes in the existing Belgian system and this remains the case, even after dropping the excises. This is a nice example of "preferences" for which many people would feel that consumers should bear themselves the consequences. Results are quite different in simulation 3, where smokers end up with higher net equivalized expenditures. Finally there is some unexplained variation left. A root MSE of about Bef 10,000 in the actual system cannot be neglected. Depending on the causes of this variation, this part of the T-component may be problematic or not. However, in so far as it is linked to unobservable variables, it will be very difficult to account for it in the construction of the indirect tax system.

What normative conclusions can be drawn on the basis of these results? Let us compare simulations 1 and 3: both are revenue-neutral and we demonstrated in the

previous section that the latter leads to more vertical redistribution (component V and hence RE) and about the same violation of horizontal neutrality (component T). Table 3 suggests, however, that the *nature* of this T-component is quite different. Looking at the absolute values of the coefficients the current Belgian system is mainly "horizontally inequitable" (if we may use this word) towards those who rent a house, are smoking and have a car. Is this "inequity?" The "progressive" system in simulation 3 is "horizontally inequitable" towards households with children. It gives a preferential treatment to smokers. This seems to be more conform to the usual intuitions on horizontal inequity. Clearly, much more work is needed to disentangle and evaluate these different effects.

VI. CONCLUSION

An important part of the policy discussions on the differentiation of the structure of indirect tax rates concentrates on the vertical redistribution. This is usually measured through taxes paid as a fraction of total expenditures. At the same time, however, rate differentiation also leads to large differences in the amount of taxes paid by households at the same level of total expenditures. This latter effect is due to the interaction of taste differences and rate differentiation. It could be seen as a violation of horizontal neutrality.

In this chapter we presented some empirical results concerning the magnitude and the normative relevancy of this "tastes"-effect. We apply the decomposition methodology proposed by Aronson, Johnson, and Lambert (1994) and Lambert and Ramos (1995). The tastes effect turns out to be considerable and to counteract the vertically redistributive effect of the rate differentiation. This suggests that there is a negative covariance between the taste variables inducing a higher consumption of luxuries on the one hand and net equivalized expenditures on the other hand. Overall, mainly because of this tastes component, the Belgian system is slightly regressive. However, simplifying the rate structure decreases the tastes component slightly and it is not difficult to devise a two rate VAT-system which would be much more progressive than the current system.

While the tastes component may be undesirable because it interferes with vertical redistribution, it is much more difficult to decide whether it is also problematic *in se*. In the last section we give a first indication about the variables which are related to the differences in tastes. Household type, age, house ownership, car ownership and smoking behavior have a significant influence on indirect taxes paid. Is it acceptable that households pay very different taxes just because of differences in subjective tastes, linked to these variables? This question leads us straight into the actual philosophical debate on needs versus tastes and on the limitations of a purely welfarist approach to social choice problems. Such a normative question can never be settled by empirical research. However, we feel that our empirical exercises illustrate the importance of the questions and hence may stimulate the debate.

APPENDIX

A. Data and Microsimulation Model

The simulation takes place on a budget survey of 3,235 Belgian households, dating from 1987–1988. It contains expenditures on more than 750 items and plenty of information on the socio-economic characteristics of the households. The budget survey has been used to estimate the total expenditures elasticities of the microsimulation model but, due to lack of price variation in the survey, the price effects have been estimated on the National Accounts.

The microsimulation model *ASTER* is described in Decoster (1995). The choice of the functional form of the demand system is highly inspired by the SPIT-model of IFS-London. The model specifies budget shares and is an extension of the widely used AID-model (see Blundell, Pashardes, and Weber 1993; Baker, McKay, and Symons 1990). The functional form to be estimated for each budget share reads as:

$$w_{ih} = \alpha_i + \beta_i \log\left(\frac{y_h}{P}\right) + \lambda_i \left(\log\left(\frac{y_h}{P}\right)\right)^2 + \sum_j \gamma_{ij} \log p_j + \varepsilon_{ih} \qquad \text{(A.1)}$$

with: $\log P = \sum_j w_{jh} \log p_j$ (the Stone price index)
and:

w_{ih} the share of expenditures on good i in the total expenditures of household h or

$$w_{ih} = \frac{y_{ih}}{y_h}$$

y_h total expenditures of household h
y_{ih} expenditures of household h on good i
p_j consumer price for good j
β_i, λ_i total expenditure effects (to be estimated)
γ_{ij} price effect of price j on good i (to be estimated)
ε_{ih} disturbance term

Because we have chosen for a rather disaggregated demand system of 32 commodities, we have estimated the demand system under the restriction of *weakly separable preferences*. The results are summarized in the last but one column of Table A.1. For ease of interpretation we have transformed the original parameters into elasticities.[11] The limitation to own price elasticities follows from obvious space limitations. Most of the commodities are rather price inelastic (only two have an elasticity exceeding unity).

For the total expenditure effects (the β_i's and λ_i's) we could make use of the budget survey. Since the real expenditure effect seems to be correlated with being a smoker or

Table A.1. Prices, Price Changes (%), Price and Total Expenditure Elasticities for the 32 Aggregates

	Commodity	*Pre Reform Price*	*Price Change S1*	*Price Change S2*	*Price Change S3*	*Own Price Elasticity*	*Total Exp Elasticity*
1	Bread	1.128	–6.03	–6.03	–11.35	–0.4519	0.4543
2	Meat	1.128	–6.03	–6.03	–11.35	–1.1864	0.5314
3	Fish	1.128	–2.58	–2.58	–11.35	–0.4309	0.8039
4	Dairy products	1.128	–6.03	–6.03	–11.35	–0.1125	0.4717
5	Oils and fats	1.128	–4.36	–4.36	–11.35	–0.2009	0.2134
6	Potatos, vegetables, fruit	1.128	–5.31	–5.31	–11.35	–0.7275	0.5715
7	Coffee and tea	1.128	–2.03	–6.03	–11.35	–0.2137	0.3825
8	Sugar and jam	1.128	–6.03	–6.03	–11.35	–0.6468	0.6891
9	Other food	1.128	–6.03	–6.03	–11.35	–0.7272	0.5757
10	Soft drink	1.128	19.8	6.83	–11.35	–0.1481	0.6564
11	Beer	1.128	23.92	6.83	–11.35	–0.8802	0.6892
12	Alcohol	1.128	74.08	6.83	–11.35	–1.0055	0.8674
13	Wine	1.128	18.1	6.83	4.79	–0.5597	1.1589
14	Tobacco	1.128	166.52	6.83	–11.35	–0.8072	0.1439
15	Clothing	1.128	6.83	6.83	4.79	–0.7994	1.0621
16	Rent, tax, water	1.128	–10.05	–1.05	4.79	–0.0382	1.183
17	Coal	1.128	–0.71	–0.71	–11.35	–0.122	–0.0503
18	Natural gas	1.128	12.17	6.83	–11.35	–0.1461	0.5335
19	Electric heating	1.128	10.01	6.83	4.79	–0.0482	1.3088
20	Fuel	1.128	16.69	6.83	–11.35	–0.7037	0.4419
21	Electric lighting	1.128	7.95	6.83	–11.35	–0.1472	0.4742
22	Durables	1.128	6.71	6.71	4.79	–0.7395	1.8031
23	Maintenance of the house	1.128	–0.47	–0.47	4.79	–0.9388	1.1453
24	Hygienics	1.128	–4.67	–4.67	4.79	–0.1581	1.0825
25	Use of private transport	1.128	–3.43	–3.43	4.79	–0.6992	1.1321
26	Gasoline	1.128	241.01	6.83	–11.35	–0.6291	0.6587
27	Gasoil	1.128	142.49	6.83	–11.35	–0.7786	0.9006
28	LPG	1.128	6.83	6.83	–11.35	–0.5474	0.8723
29	Public transport	1.128	–6.33	–6.33	–11.35	–0.4319	0.7965
30	Other transport	1.128	–8.84	–8.84	4.79	–0.7266	1.2364
31	Leisure goods	1.128	–0.22	–0.22	4.79	–0.3499	1.0051
32	Services	1.128	–3.86	–3.86	4.79	–0.2254	1.0573

not and having a car or not, we have estimated the Engel curves of (A.1) for four different subgroups of households: car owners/smokers, car owners/non smokers, non car owners/smokers and non car owners/non smokers. We also included a white collar dummy, a dummy for higher education, the number of actives and the number of children in the household, the age of the head of the household and a dummy for the household living in a rural area. In the last column of Table A.1 we have for the sake of brevity calculated a weighted average of the total expenditure elasticities for the four subgroups. Coal is the only inferior good.

B. Indirect Taxes in Belgium (January, 1st 1995)

There are *four VAT rates* and the expenditure shares for the average consumer on the commodities having these rates are as follows:

VAT rate (%)	*Expenditure share (%)*
0.0	35.0
6.0	19.0
12.0	0.9
20.5	44.8

The *excises* have been transformed into *tax rates*, and in terms of the aggregates of the demand system they are as follows:

Commodity	*Excise (%)*
Coffee and tea	4.26
Soft drink	12.14
Beer	16.00
Alcohol	62.95
Tobacco	21.32
Gas	5.00
Electric Heating	2.98
Fuel	9.23
Electric Lighting	1.05
Gasoline	219.22
Gasoil	127.00

The *ad valorem* tax only applies for tobacco products and amounts to: 42.6 percent.

The first four columns of Table A.1 translate these taxes into information about the pre and post reform price regimes. With a normalization of all producer prices at unity, the first column gives the consumer price pre reform, and hence also the implied total indirect tax rate (by subtracting 1). The next three columns give the percentage price change in the simulations described above.

C. Sensitivity Analysis

For the three tax systems, the following three tables show the decomposition based on the mean logarithmic deviation for different definitions of "close equals." The band width has been increased from BEF 25000 to BEF 250000 for the division in classes with equal width, and from 1 percent to 5 percent for the classes defined as quantiles.

Table A.2. Sensitivity of the Decomposition with Respect to the Definition of equals—Simulation 1 (Belgium 1995)

Inequality Pre Reform	***0.10773***			
Width of classes of net equivalized expenditures (pre reform)	I^a	RE_{MLD}	V_{MLD}	T_{MLD}
1%-quantiles	101.55017	**–1.55194**	**–0.71831**	**0.8336**
	0.1094	–0.00167	–0.00077	0.0009
5%–quantiles	101.55017	**–1.55194**	**1.1708**	**2.72273**
	0.1094	–0.00167	0.00126	0.00293
BEF 25,000	101.55017	**–1.55194**	**–0.86764**	**0.68428**
	0.1094	–0.00167	–0.00093	0.00074
BEF 50,000	101.55017	**–1.55194**	**–0.11378**	**1.43813**
	0.1094	–0.00167	–0.00012	0.00155
BEF 100,000	101.55017	**–1.55194**	**2.62935**	**4.18119**
	0.1094	–0.00167	0.00283	0.0045
BEF 250,000	101.55017	**–1.55194**	**32.13497**	**33.687**
	0.1094	–0.00167	0.03462	0.03629

Note: The *second line* of figures for each simulation gives the value of I^a, RE_{MLD}, V_{MLD}, and T_{MLD}; the *first line* expresses these figures relative to I^b (in percentage).

Table A.3. Sensitivity of the Decomposition with Respect to the Definition of Equals—Simulation 2 (Belgium 1995 without excises)

Inequality Pre Reform	***0.10773***			
Width of classes of net equivalized expenditures (pre reform)	I^a	RE_{MLD}	V_{MLD}	T_{MLD}
1%-quantiles	99.69368	**0.3055**	**0.85505**	**0.54954**
	0.1074	0.00033	0.00092	0.00059
5%-quantiles	99.69368	**0.3055**	**2.74102**	**2.43544**
	0.1074	0.00033	0.00295	0.00262
BEF 25,000	99.69368	**0.3055**	**0.74186**	**0.43636**
	0.1074	0.00033	0.0008	0.00047
BEF 50,000	99.69368	**0.3055**	**1.46338**	**1.15789**
	0.1074	0.00033	0.00158	0.00125

(continued)

Table A.3. (Continued)

Inequality Pre Reform	***0.10773***			
Width of classes of net equivalized expenditures (pre reform)	I^a	RE_{MLD}	V_{MLD}	T_{MLD}
BEF 100,000	99.69368	**0.3055**	**4.17321**	**3.86763**
	0.1074	0.00033	0.0045	0.00417
BEF 250,000	99.69368	**0.3055**	**33.35747**	**33.05207**
	0.1074	0.00033	0.03594	0.03561

Note: The *second line* of figures for each simulation gives the value of I^a, RE_{MLD}, V_{MLD}, and T_{MLD}; the *first line* expresses these figures relative to I^b (in percentage).

Table A.4. Sensitivity of the Decomposition with Respect to the Definition of Equals—Simulation 3 (Two rate VAT)

Inequality Pre Reform	***0.10773***			
Width of classes of net equivalized expenditures (pre reform)	I^a	RE_{MLD}	V_{MLD}	T_{MLD}
1%-quantiles	95.65581	**4.34642**	**4.80952**	**0.46316**
	0.10305	0.00468	0.00518	0.0005
5%-quantiles	95.65581	**4.34642**	**6.64263**	**2.2963**
	0.10305	0.00468	0.00716	0.00247
BEF 25,000	95.65581	**4.34642**	**4.72375**	**0.37739**
	0.10305	0.00468	0.00509	0.00041
BEF 50,000	95.65581	**4.34642**	**5.3985**	**1.05217**
	0.10305	0.00468	0.00582	0.00113
BEF 100,000	95.65581	**4.34642**	**8.00538**	**3.65906**
	0.10305	0.00468	0.00862	0.00394
BEF 250,000	95.65581	**4.34642**	**35.87116**	**31.52418**
	0.10305	0.00468	0.03864	0.03396

Note: The *second line* of figures for each simulation gives the value of I^a, RE_{MLD}, V_{MLD}, and T_{MLD}; the *first line* expresses these figures relative to I^b (in percentage).

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NOTES

1. Atkinson and Stiglitz (1976) refer to the nice example of Pigou (1947), who tells that when England and Ireland were united under the same taxing authority, the Irishmen felt to be treated inequitably by higher taxes on spirits, because they preferred whiskey to beer while the Englishmen preferred beer over whiskey.

2. See, for example, the work of Arneson (1989), Cohen (1989), Dworkin (1981), Fleurbaey (1995), Sen (1985) and the empirical results on justice opinions in Yaari and Bar-Hillel (1984).

3. Our previous statement that a uniform indirect tax system can be considered as *redistributively neutral* has nothing to do with optimality in a framework based on the maximization of a social welfare function. As shown in Atkinson and Stiglitz (1976) uniformity does not follow from the requirement of horizontal neutrality, as they define it in tenns of utility functions. Moreover, the requirement may come in conflict with the maximization of social welfare when tastes are identical. Stiglitz (1982) shows that violation of horizontal neutrality may even lead to a Pareto improvement.

4. From Table A.1 in the appendix it is seen that the following goods have a total expenditure elasticity exceeding unity: Wine, Clothing, Rent Tax Water, Electric Heating, Durables, House Maintenance, Hygienics, Use of Private Transport, Other Transport, Leisure and Services.

5. The equivalence scales used are those of the Belgian National Statistical Institute who has carried out the budget survey used in the simulation. This is the old scale of the League of Nations and available in the dataset itself. The choice of equivalence scale may be important (see, e.g., Coulter, Cowell, and Jenkins 1992), but the aim of the paper was not to investigate the sensitivity of the results w.r.t. the specification of the scales and hence we have not elaborated more sophisticated scale specifications.

6. A similar pragmatic criterion is also used by Yitzhaki (1994).

7. For the moment we abstract from the empirical problem of defining these discrete groups when we work with a continuous variable like net equivalent expenditures.

8. Lambert and Ramos (1995) propose to work with the mean logarithmic deviation, because this is the only one in the generalized entropy family where the weights for the subgroup inequality contributions are simply the population shares and, more specifically, do not depend on the income shares of the subgroups.

9. Results with a logarithmic specification are similar.

10. Remember that simulation 2 is not revenue-neutral.

11. The elasticities are not constant, but vary with the budget shares. They have been evaluated for the average share in the budget survey.

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