REFORMING TAXES AND IMPROVING HEALTH: A REVENUE-NEUTRAL TAX REFORM TO ELIMINATE MEDICAL AND PHARMACEUTICAL VAT

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Reforming Taxes and Improving Health: A Revenue-Neutral Tax Reform to Eliminate Medical and Pharmaceutical VAT

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Abstract

The aim of this paper is to analyse a tax reform consisting of an increment of the indirect taxes on alcohol and tobacco to finance the elimination of VAT on health and pharmaceutical services. We first estimate an Almost Ideal Demand System for the purpose of evaluating expenditure and price elasticities. We then micro-simulate the abolition of VAT on health services combined with a increment on alcohol and tobacco excise duties, so that total revenue remains unchanged. This reform would generate small private and social welfare gains complemented with externalities derived from the tobacco and alcohol demand cut.

Keywords: Micro-simulation, tax reforms, health, pharmaceutical products, welfare.

JEL classification numbers: D12, H23, H31.

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1. INTRODUCTION

The economic modelling of this research can be encompassed within the increasing interest in taxes which would target the enforcing of significant reductions in the consumption of alcohol and tobacco, thereby reducing addictive behaviour (Duffy, 2006; Markowitz, 2005; Young and Likens, 2000) and public funds devoted to finance their negative effects on citizens' health. In fact, fiscal policies that attempt to promote health can be justified in terms of the externalities that they will induce. If externalities are defined as the benefits and costs that result from unplanned side-effects of economic activities that concern individuals other than the parties involved in the activity, then air pollution related to tobacco and the health effects derived from alcohol and tobacco consumption are illustrative examples of externalities. Both these examples are negative externalities, of which one of the major contributory factors is alcohol and tobacco addiction. Obviously, they could be reduced by enforcing by law anti-addictive behaviour (Escaria and Molina, 2004).

One way to increase demand for healthcare provision could be by decreasing the tax on health services. Moreover, if, as expected, alcohol and tobacco consumption and health services are substitutive goods, to enforce stronger effects, this decrease could be financed by an increase in alcohol & tobacco-related taxation. Furthermore, these simultaneous changes could be calculated in order to constitute a revenue-neutral tax reform. The most radical of such a type of fiscal reform is analysed in this paper, since we propose the abolition of Value Added Tax (VAT) on health services, while maintaining revenue constant by means of the corresponding increase of VAT on alcohol and tobacco[1]. Health policies involving tax-cut proposals are often drawn up without taking into account all of their potential economic effects. That is to say, they generally lack the support provided by empirical evidence, which would justify their approval. However, there are other economic tools which allow us to understand the effects of such proposals. One of these tools is micro-simulation (Sonsbeek and Gradus, 2006; Alcock and Docwra, 2005; Liu, Vliet and Watling, 2006), which enables the assessment of public reforms even before they are passed by Parliament. These techniques are increasingly used in developed countries (Algers et al. 1997; Mertz 1991, O'Donoghue (2001).

The main aim of this paper is to shed some light on this debate by using micro-simulation tools to analyse the expected demand shifts and their effects on consumers'

welfare. A motivation for our simulation derives from Stigler and Becker's (1977) hypothesis that tastes neither change capriciously nor differ importantly between people. It is the difference in income and prices that determine differences in consumer behaviour. This hypothesis has been tested for alcohol consumption at OECD level (Selvanathan, 2006). Based on the resulting evidence we simulate the tax changes that will affect price and income and therefore, will orientate consumer behaviour and attitudes in favour of health services and pharmaceutical products and away from tobacco and alcohol consumption.

In order to meet this objective, the first stage of this research is to examine consumers' behaviour. Thus, we will assess the own-price elasticities, cross-elasticities and expenditure elasticities of 16 different groups of consumer goods. This will allow us to analyse issues such as the consumers' response to price or income changes, as well as the complementary or substitute nature of the different goods. Nevertheless, it is crucial to understand, from an economic perspective, demand patterns and the effectiveness of public policies which support these goods and services.

The econometric basis of our microsimulation exercise is the estimation of an Almost Ideal Demand System (AIDS), proposed by Deaton and Muelbauer (1980a, 1980b), which will permit us to control all cross-effects due to any price or real income changes. The data set to estimate this model is the Spanish Continuous Household Expenditure Survey (ECPF).

The paper is organised as follows: in Section 2, we describe the contextual setting; in Section 3, we present the Almost Ideal System; in Section 4, we estimate the elasticities; in Section 5, we estimate the distributive and welfare results; and finally, in Section 6, we discuss the results and present the conclusions.

2. CONTEXTUAL SETTING

In Spain, as in other European Union countries, indirect taxation on consumption is concentrated primarily on Value Added Tax (VAT) and the different excise duties imposed on specific consumer goods, such as spirits, beer, hydrocarbons, tobacco, electricity and vehicle registration, Romero et al. (2003) and Sanz et al. (2003).

Since joining the European Union (EU) in 1986, the Spanish tax on consumption has been adapted to the European norm of indirect taxation harmonisation. This process has been of particular relevance in the case of VAT, since it is the most important EU consumption tax, levied on sales. Since the 6th EU directive on tax, approved on 17th May

1977, all member-states have had to comply with the same tax rules (exemptions, deductions, etc.). This situation signifies that it is not possible for any EU state to change its tax regime unilaterally, in accordance with the stipulations of the EU directive. However, national governments can propose tax changes, which must be approved by the other countries, as has happened recently with regard to cultural goods. Therefore, the simulation of tax changes has to take into consideration this legal framework. Its practical application would require approval at EU level.

However, the 6th EU directive permits exemption for the following health services (article 13): health services delivered by hospitals and health centres, namely those recognised as health services by the state; blood and milk and other health products; dental services; women's contraceptive products and products and services used by the disabled. In Spain, pharmaceutical products are non-exempt and are taxed at a VAT rate of 4%, while medical products, including optical products and other corrective devices are taxed at 7%. Additionally, transport services related to hospital attendance are also taxed at 7%.

Furthermore, taxes on tobacco and alcohol are also harmonised at EU level, but each EU member-state is free to set the VAT rate, beyond a minimum level. Thus, whereas any changes in tobacco and alcohol products are easily attained, this is not the case for health-related products, European Union (2005a,b).

3. A COMPLETE DEMAND SYSTEM: DATA AND ESTIMATION PROCESS

The database used in this paper is The Spanish Continuous Household Expenditure Survey (ECPF). The ECPF is a panel created and distributed by the Spanish National Institute of Statistics (INE). The survey provides quarterly and annual information on household incomes and consumption, including personal consumption, self-supply and payment in kind. It is targeted at 3,200 families chosen by sampling techniques and one eighth of the sample is renewed each quarter. In addition, it includes exhaustive information on household characteristics such as employment status, demographics, etc.[2] Unfortunately the ECPF does not provide data on prices, although it is essential to estimate a system of demand. To solve this problem, information on prices has been obtain from the Laspeyres price indexes available from the Spanish National Institute of Statistics.

The empirical study adopted in this paper consists of two stages: an estimation stage and a simulation stage. The first stage obtains the price elasticity and expenditure elasticity matrix by using ECPF data corresponding to the period from 1985 (third

quarter) to 1995 (fourth quarter). Based on these results, the second stage then simulates the effects of a tax reform, taking the 1998 ECPF data as a reference.

The model used in the estimation phase is the Almost Ideal Demand System (AIDS) proposed by Deaton and Muellbauer (1980a and 1980b). The main attraction of AIDS is that it allows a first-order approximation to an unknown demand system (Nicol, 1989). The model is estimated on the basis of the assumption that individuals will alter their spending decisions as a result of the price changes generated by the simulated reform. For each group of goods, the following equation has been estimated:

$$w_{iht} = a_{ih} + \sum_{j=1}^{16} \gamma_{ij} \log p_{jt} + \beta_i \log y_{ht} + \varepsilon_{iht} \qquad [1]$$

where i notes the i-th houshold, j the j-th group of goods and t is the time. Hence, w_{iht} is the expenditure share of good i-th for the household h-th at perid t; p represents prices and y is the real expenditure, which is obtained from the expenditure on all goods deflated by the Stone Index.

Parameter *a* is modelled using a series of dummies which allow households to be categorised by home tenure, alcohol and tobacco consumption, education, size of town of residence, employment status (active or inactive) and employment category. The model is estimated under the assumption that individuals will alter their expenditure decisions as a result of the price changes generated by the simulated reform. Hence, the share that each good has in the total expenditure, w_i, must be predicted and adjusted by the prediction error, ε, where $w_i = Y_i\hat{\beta} + \hat{\varepsilon}_i$. Moreover, to fulfil the theoretical properties of the theory of consumption, the parameters of this equation system have been estimated imposing the homogeneity (equation [2], [3]) and a symmetry constraint [4]:

$$\sum_{i=1}^{16} a_{ih} = 1 \qquad [2]$$

$$\sum_{i=1}^{16} \beta_i = \sum_{i=1}^{16} \gamma_{ij} = 0 \qquad [3]$$

$$\gamma_{ij} = \gamma_{ji} \quad \forall i, j \qquad [4]$$

Moreover, the add up of all the expenditure shares, w_i, should verify:

$$\sum_{i=1}^{16} w_{iht} = 1 \qquad [5]$$

Given that the AIDS is composed of a system of dependent linear equations, n-1 equations of the system have been estimated, excluding the equation which corresponds to consumer durables. The parameter values of the equation that is omitted in the estimation have been obtained by taking the constraints included in equations [2] to [5] into account. Seasonal variation, on the other hand, is corrected by including a variable which takes account of the trend of the series, and by introducing a dummy variable for each quarter of the series (the variable which corresponds to the fourth quarter is omitted in the estimation).[3]

Infrequent purchase and seasonal variation are among the main econometric problems with this type of data. To avoid the first of these problems, the model has been estimated using instrumental variables in a three-stage least squares estimation process.[4]

4. DEMAND SYSTEM ESTIMATION

The expenditure and price elasticities of this demand system are obtained from the following expressions:

$$e_i = \frac{\beta_i}{w_i} + 1 \qquad [6]$$

$$\varepsilon_{ij} = \frac{1}{\left(1 + \beta_i \ln P_i\right)} \left[\frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i} \left[w_j + P_j \sum_{k \neq i}^{n} \ln P_k \frac{\partial w_k}{\partial P_j} \right] \right] - \delta_{ij} \qquad [7]$$

where $\delta_{ij} = 1$, if $i = j$ and 0 in all other cases.

The estimated expenditure elasticity and the Marshallian own-price elasticity are presented in Tables 2 and 3. As can be seen, all goods are observed to have positive expenditure elasticity; that is to say, none of the categories is an inferior good. This is the expected outcome, since the expenditure items considered in the equations involve a certain degree of aggregation and although it may be the case that a specific good is inferior, it is unlikely that an entire category of goods would meet that definition. However, several expenditure groups are defined as necessities since their expenditure elasticity is less than one (including food, as might be expected). Tobacco and alcohol products are addictive normal goods and therefore they have an expected expenditure elasticity between zero and one, as it is the case. This result is in line with other research such as Selvanathan

(2006), Duffy (2006) and Chaloupka and Wechsler (1997). However, medical and pharmaceutical products and services can be considered luxurious goods since they have an estimated expenditure elasticity close to, but higher than, one, Bradford (2003).

The own-price elasticities have the expected sign for almost all the groups of goods. Furniture and household services is the only group that exhibits a positive price elasticity mean. In any case, as can be seen in Table 2, this elasticity presents negative values at least for the last ten percentiles. So, since the zero value is included in any two-tail confidence interval for the standard confidence levels, we can consider that the elasticity of such goods is not significantly different from zero. Moreover, all the goods analysed exhibit inelastic demands with the exception of private and public transport services and durable goods. Consequently, we cannot expect more than proportional changes in the demand for health services as a reaction to VAT rate reductions.

Table 3 lists the cross-elasticities between the 16 groups of goods and the three groups concerned by the tax reform. For substitutes, cross-elasticity has to be positive. On the other hand, complementary goods have a negative cross-elasticity. The evidence in Table 3 confirms the expectation that alcohol and tobacco are complementary goods, but medical and pharmaceutical products and services are substitutive with respect to tobacco and alcohol goods. Furthermore, with regard to health services, the most important substitution relations occur with gas, tobacco, education, alcohol and private transport. The relations of the most complementarity are with leisure, consumer durables, furniture, public transport and fuel. On the other hand, education followed by health are the consumption groups with the highest positive cross-elasticity with respect to alcoholic beverages. Hence, education and health (the two principal publicly-provided services) are substitutes with respect to alcohol and this relationship is stronger than that between other groups and alcohol. The strongest observed substitution relationship between tobacco and other consumption goods is with public transportation. Finally, the strongest observed complementarity between tobacco and other consumption goods is with private transport.

After the estimation phase had been completed, the proposed tax reform, consisting of an increment of the tax applied on tobacco and alcohol and the application of an exemption on medical and pharmaceutical products and services was simulated. To

determine the exact magnitude of the excise duties on tobacco and alcohol required to keep tax revenue constant, an iterative procedure was designed. It adjusted the fiscal parameters trying to remove any deviation of the tax revenue. The tax increment was evaluated in a fifteenth percent rise of the excise duties on tobacco and alcohol.

When P_j varies, it can be proved that shares variations are approximately equal to:

$$\Delta w_i = w_i\left(\varepsilon_{ij} + \delta_{ij}\right)\frac{\Delta P_j}{P_j} \qquad [8]$$

where $\frac{\Delta P_j}{P_j}$ is approximately the VAT rate change and $\delta_{ij} = 1$, if $i = j$ and 0 otherwise. It can be observed that, according to equation [8], an inelastic good will increase its share – although its demand will decrease - if its price rises, as should be the case of tobacco and alcohol with the proposed reform. On the other hand, if own-price elasticity is lower than one, in absolute values, the share and demand quantity will decrease where there is a price reduction, as expected for medical and pharmaceutical products and services. Furthermore, substitute goods will decrease their demand and share of total expenditure when prices decrease because of tax cuts, as expected with respect to tobacco and alcohol due to the proposed exemption of VAT on heath services. On the other hand, we expect a rise in health services demand and expenditure share due to the simultaneous increments of tobacco and alcohol prices. Changes in the shopping basket induced by the simulated reform, using the consumption behaviour implicit in the AIDS model, are shown in Table 4. Such changes in the shares of each group of goods within total expenditure are a direct consequence of the own- and cross-effects on spending derived from the reform. Moreover, although the proposed reform is revenue-neutral, it will induce changes in the real expenditure of households and hence, an expenditure effect is also incorporated in these changes.

Since medical and pharmaceutical products and services have an inelastic demand and are substitutes for tobacco and alcohol, the proposed reform must lead unambiguously to an increment in its demand but not in its expenditure share, as shown in Table 4. In fact, the estimated percentage decline in its share (-0.075%) is smaller than the tax cut (-2.46%). Therefore, it is clear that the proposed indirect tax reform will induce a higher level of

health products and services consumption. In fact, the demand quantity variation, which can be assessed by applying simple algebra, is almost a 2-percent rise.

Moreover, we may also expect a rise in the tobacco and alcohol shares, since their demand is inelastic and their prices are increasing. However, these effects would be partially counterbalanced by the decrease in those of medical and pharmaceutical products and services. The total effect of the proposed reform would be a fall in the demanded quantity of tobacco and alcohol. However, the tobacco share would increase and alcohol decrease when we consider simultaneously all the cross-effects.

5. DISTRIBUTIVE AND WELFARE RESULTS

In this section, the distributive and welfare outcomes are analysed using population values. Even when dealing with revenue-neutral tax reforms, a thorough assessment of such reform requires prior knowledge of at least two critical issues. Firstly, it is necessary to calculate the effects of the tax reform on the expenditure distribution. Secondly, the effect on individual well-being and social welfare must be evaluated. The set of results obtained will enable us to establish a clearer view of the likely effect induced by the implementation of the analysed tax reform. These effects will be calculated from the elasticities presented in the previous section and derived from the AIDS model.

First, we analyse the revenue effects by groups evaluated at population values that are displayed in Table 5. Obviously, these changes are related to changes in Table 4 (although these referred to the sample used to estimate the AIDS model).

It can be observed that the revenue changes for the goods groups that would not suffer a price modification have the same sign as the changes in their expenditure shares displayed in Table 4, since the tax weight in their price would remain constant. Hence, for these groups revenue or share changes are related to changes in their demand due to relative price changes and, to a lesser extent, real expenditure changes. Another issue that should be considered is the increment in the tobacco VAT revenue. It has to be taken into account that VAT is applied on the price once the excise duties are imputed; so, VAT percentage increments below the excise duty rise would not imply an increment in the consumption but a reduction in the final quantity demanded.

These changes in the revenue prove that the changes in indirect tax revenue are not equally distributed. Hence, with regard to expenditure distribution, we can assert that the reform considered here leads to slightly increased inequality, as shown in the Gini indices in Table 6.

In addition, the reforms considered here impair the redistributive capacity of indirect taxation, as revealed by the Reynolds-Smolensky index in Table 6. This is due mainly to the loss of progressiveness of indirect taxation, computed via the Kakwani index.

The effects of such reforms on the individual well-being may be studied through Hicks' Equivalent Variation and Compensating Variation (1939) and King's Equivalent Expenditure (1983), which assume that households reallocate expenditure where relative prices change.

The equivalent expenditure, given a vector of reference of prices, P_R , is defined as the expenditure level that allows the household to attain a reference level of utility, v_R. That is, if the indirect utility function is known, the equivalent expenditure can be obtained by solving the following equation:

$$v(P_R, G_e) = v_R \qquad [9]$$

That can be expressed in terms of the expenditure function as:

$$G_e = e(P_R, v_R) \qquad [10]$$

In order to evaluate a fiscal reform, the equivalent expenditure measure can be computed at the initial level of utility achieved by the household, v^0, and will be identified as the initial equivalent expenditure, G_e^0, or at the post-reform level of utility, v^1, and be called final equivalent expenditure, G_e^1:

$$G_e^0 = e(p^1, v^0) \qquad [11]$$

$$G_e^1 = e(p^0, v^1) \qquad [12]$$

A fiscal reform that generates welfare gains will imply that: $G_e^0 < G < G_e^1$ where G represents the actual level of expenditure. If the reform means losses, then this order is reversed, having: $G_e^0 > G > G_e^1$.

In Table 7, these measures are presented by deciles. In all the cases, the final equivalent expenditure is higher than the real expenditure and this, in turn, is higher than the initial equivalent expenditure. Hence, according to this measure, the proposed reform will imply gains along all the expenditure distribution.

This order can be informative, but the particular value of the welfare gain or loss for each taxpayer can be assessed as the difference between his initial and final equivalent expenditures:

$$GEB_i = G_{e_i}^1 - G_{e_i}^0 \quad [13]$$

The Compensating Variation (CV) and the Equivalent Variation (EV) are also metrics that represent monetary equivalents of changes in welfare. CV is defined as the monetary amount by which the impaired households should be compensated, or which should be demanded from the gainers due to the price change induced by the reform. This compensation allows us to maintain households on the initial indifference curve. EV is identified with the amount of money that the households which lost (gained) in the reform would be willing to pay to prevent (ensure) the actual occurrence of the change in the price vector. The Equivalent Variation and the Compensating Variation, as King (1983) proved, can be expressed in terms of the equivalent expenditure as:

$$VC = e\left(p^1, v^0\right) - e\left(p^0, v^0\right) = G_e^0 - G \quad [14]$$

$$VE = e\left(p^1, v^1\right) - e\left(p^0, v^1\right) = G - G_e^1 \quad [15]$$

CV and EV thus defined (Deaton and Muelbauer, 1980b; Creedy, 1999) will both take on negative values when there is a gain in welfare and positive values if there is a loss.

These measures depend on the particular form of the indirect utility function. In the particular case of an AIDS model, the aforementioned function, expressed in logarithmic terms, is (Baker, Blundell and Micklewright, 1989):

$$\ln v = \frac{\ln y - \ln a(p)}{b(p)} \qquad [16]$$

where *b(p)* and $\ln a(p)$ are defined as:

$$b(p) = \beta_0 \cdot \prod_{i=1}^{16} p_i^{\beta_i} \qquad [17]$$

and:

$$\ln a(p) = a_0 + \alpha_i \sum_{i=1}^{16} \ln p_i + \frac{1}{2} \sum_{i=1}^{16} \sum_{j=1}^{16} \gamma_{ij} \ln p_i \ln p_j \qquad [18]$$

Thus, taking into account the equivalent expenditure definition, we have:

$$\frac{\ln G - \ln a(p)}{b(p)} = \frac{\ln G_e - \ln a(P_R)}{b(P_R)} \qquad [19]$$

Hence, the explicit function of the equivalent expenditure used in this empirical research is:

$$\ln G_e = \frac{b(P_R)}{b(p)} [\ln G - \ln a(p)] + \ln a(P_R) \qquad [20]$$

Therefore, the initial and final equivalent expenditures that we have computed for the micro-simulation of the proposed tax reform are defined, respectively, as:

$$\ln G_e^o = \frac{b(p_1)}{b(p_0)} [\ln y - \ln a(p_0)] + \ln a(p_1) \qquad [21]$$

$$\ln G_e^1 = \frac{b(p_0)}{b(p_1)} [\ln y - \ln a(p_1)] + \ln a(p_0) \qquad [22]$$

The static monetary variation evaluates changes in the total monetary expenditure in the short run, that is, just before the consumers have had enough time to modify their behaviour under the new prices. It is defined as:

$$SMV = \sum_{i=1}^{16} w_{ih}^0 x_{ih}^0 \left(p_i^0 - p_i^1 \right) / \, p_i^0 \qquad [23]$$

x_{ih}^0 being the pre-reform demanded quantity for the i-th good and the j-th household and w_{ih}^0 the expenditure share for the same good and household. This index will take positive values if the tax reform increases welfare and will have a negative sign otherwise.

Differences in the consumption patterns along the expenditure distribution compel us to study how gains originated by the proposed reform are distributed. As a starting point, Table 8 contains the distribution of such gains by expenditure deciles. As stated previously in Table 7, the results in Table 8 show that the proposed reform would induce, on average, welfare gains in the short and long terms, regardless of the index used to evaluate these changes.

Three effects must be stressed. Firstly, welfare gains are substantially greater if we take into account household behaviour (SME takes the smallest values in absolute terms) in the upper half of the expenditure distribution. Secondly, in absolute terms, these average welfare gains are not very important, since they represent a small percentage in the average household's spending. Finally, results clearly indicate that welfare gains grow with expenditure. Even more, welfare gains of the households from the last decile are almost 20 times greater than those from the first decile.

To complete this distributional analysis, we have also computed the revenue changes by deciles displayed in Table 9. It can be observed that the lower the decile, the higher the revenue loss, that is, households in the lower part of the expenditure distribution would support the proposed tax reform. This can explain the expected inequality increment measured by the Gini index. The total effect is mainly due a two opposite effects. First, there is an expected increment of tobacco revenue when we move up in the expenditure distribution. Second, we expect a decrease in the pharmaceutical and medical products and services revenue more important at the upper deciles of the expenditure distribution, which more than counterbalance revenue effects on tobacco.

As a supplement to the analysis of individual well-being, the effects on social welfare of the proposed tax reform have been analysed. Specifically, Table 10 shows the results for the Atkinson indices and King's lambda for different values of the inequality aversion parameter, ε. These results show small gains in social welfare when only price changes effects are taken into account. However, the proposed tax reform would generate

important externalities derived from the tobacco and alcohol tax increment and the pharmaceutical and medical services tax cut. Hence, we consider that the total social gains are much more important than the effects captured by the traditional social welfare index, such as those displayed in Table 10, that only take into account the monetary outcomes.

6. CONCLUSIONS

In this paper, we have simulated a fiscal reform that seeks to improve health by means of an increase in tobacco and alcohol excise duties and a cut in pharmaceutical and medical products and services VAT. We adopted a two-step procedure, the first of which was to estimate the elasticities of demand by group of goods, using an Almost Ideal Demand System of equations (Deaton and Muelbauer, 1980a, 1980b). Next, we have simulated the change on alcohol and tobacco needed to finance the elimination of VAT in health services in order to leave total revenue unchanged, Lewitt and Coates (1982). Although the proposed reform does not have overall effects on revenue, since we haved impose revenue-neutrality in our analysis, we expect a small increment in the expenditure inequality measured by the Gini index and a decrease of progressiveness of indirect taxation, computed via the Kakwani index. These effects are related to revenue rises at the bottom deciles of the expenditure distribution and revenue reductions at the upper deciles.

However, the proposed tax reform would generate small private and social welfare gains for all the deciles. Moreover, although both alcohol and tobacco are not luxury goods, differences in the consumption pattern along the expenditure distribution signify that the higher the income decile, the higher the average gains associated with the proposed reform measured using either the Compensating Variation or the Equivalent Variation.

The results displayed enable us to draw the conclusion that this policy can be enforced in Spain because the monetary gains would be complemented with important externalities derived from the tobacco and alcohol tax increment and the pharmaceutical and medical services tax cut.

Therefore, this policy would lead to urgently needed decreases in illnesses related to the addiction to alcohol and tobacco and to an increment in the pharmaceutical and medical demand that should help to increase health. However, we recognise that more investigation is needed to clarify the present results.

NOTES

[1] For a general analysis of indirect taxes on welfare, see Creedy (1999).

[2] This survey has been used, for instance, in Browning and Collado (2001).

[3] The estimated coefficients and their standard errors are not reported in this paper but they are available from correspondence author.

[4] The exogenous variables are a set of dummy variables capturing if the household owns its house (or has a second house), if some members smoke or drink, household head's education level, if the household is living in a municipality smaller than 10000 inhabitants or greater than 500000 inhabitants, some member is unemployed or retired or self-employed, white or blue collar. Prices and temporal variables temporal to capture terms and tendency were also included as exogenous variables. The expenditure shares and the total expenditure in real terms were the endogenous variables.

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Table 1
Expenditure elasticities, by group of goods

Expenditure group	Mean	Percentile 90	Percentile 99
1. Food and non-alcoholic beverages	0.629	0.776	0.849
2. Alcoholic beverages	0.663	0.857	0.948
3. Tobacco	0.809	0.914	0.955
4. Clothing and footwear	1.139	1.070	1.041
5. Housing	0.793	0.876	0.922
6. Furniture and household equipment	0.944	0.966	0.984
7. Gas	0.691	0.846	0.930
8. Medical and pharmaceutical products and services	1.059	1.026	1.010
9. Fuel	1.246	1.128	1.073
10. Private transport services	1.201	1.093	1.045
11. Public transport	1.015	1.006	1.002
12. Communications	0.864	0.922	0.961
13. Leisure, entertainment and holidays	1.437	1.228	1.146
14. Education	1.300	1.114	1.048
15. Consumer durables	1.488	1.178	1.065
16. Other goods not listed above	1.275	1.137	1.040

Note: Population values

Table 2
Own-price elasticities, by group of goods

Expenditure group	Mean	Percentile 90	Percentile 99
1. Food and non-alcoholic beverages	-0.242	-0.513	-0.647
2. Alcoholic beverages	-0.332	-0.714	-0.894
3. Tobacco	-0.874	-0.940	-0.966
4. Clothing and footwear	-0.647	-0.827	-0.904
5. Housing	-0.814	-0.869	-0.899
6. Furniture and household equipment	0.506	-0.096	-0.556
7. Gas	-0.571	-0.784	-0.899
8. Medical and pharmaceutical products and services	-0.815	-0.921	-0.970
9. Fuel	-0.817	-0.911	-0.955
10. Private transport services	-1.853	-1.398	-1.198
11. Public transport	-1.003	-1.001	-1.001
12. Communications	-0.980	-0.987	-0.992
13. Leisure, entertainment and holidays	-0.668	-0.857	-0.931
14. Education	-0.123	-0.670	-0.865
15. Consumer durables	-1.570	-1.233	-1.109
16. Other goods not listed above	5.411	2.186	-0.062

Note: Population values

Table 3
Ordinary cross-elasticities

	Alcoholic beverages	Tobacco	Medical and pharmaceutical products and services
1. Food and beverages	0.0058	0.0879	0.0077
2. Alcoholic beverages	-0.3321	-0.2461	0.2997
3. Tobacco	-0.0993	-0.8742	0.0309
4. Clothing and footwear	0.0189	-0.1663	-0.0326
5. Housing.	-0.0108	-0.0056	0.0279
6. Furniture and household equipment	-0.0158	-0.0124	-0.0429
7. Gas	-0.1996	0.0806	0.3905
8. Medical and pharmaceutical products and services	0.1144	0.0230	-0.8155
9. Fuel	-0.0128	-0.0105	-0.0803
10. Private transport services	-0.8155	-0.2960	0.0861
11. Public transport	0.6319	0.2464	-0.0710
12. Communications	0.0132	-0.0315	0.0467
13. Leisure, entertainment and holidays	-0.0107	-0.0045	-0.2081
14. Education	0.9725	-0.1201	0.1434
15. Consumer durables	-0.2099	-0.0357	-0.1369
16. Other goods not listed above	0.5093	0.4576	0.9756

Note: Population values

Table 4
Expenditure shares pre- and post-reform (behavioural impact)

Expenditure group	Initial scenario		Final scenario		% variation
	Mean	Std. Dev.	Mean	Std. Dev.	
1. Food and beverages	0.1998	0.1023	0.2014	0.1023	0.787
2. Alcoholic beverages	0.0077	0.0147	0.0076	0.0147	-2.191
3. Tobacco	0.0198	0.0278	0.0201	0.0278	1.542
4. Clothing and footwear	0.0713	0.0553	0.0702	0.0553	-1.499
5. Housing.	0.2385	0.1224	0.2382	0.1224	-0.156
6. Furniture and household equipment	0.0898	0.0554	0.0897	0.0554	-0.040
7. Gas	0.0143	0.0131	0.0143	0.0131	-0.494
8. Medical and pharmaceutical products and services	0.0288	0.0377	0.0288	0.0377	-0.075
9. Fuel	0.0361	0.0393	0.0362	0.0393	0.157
10. Private transport services	0.0260	0.0323	0.0249	0.0320	-3.916
11. Public transport	0.0092	0.0163	0.0097	0.0163	5.049
12. Communications	0.0210	0.0153	0.0209	0.0153	-0.412
13. Leisure, entertainment and holidays	0.1366	0.1013	0.1374	0.1012	0.528
14. Education	0.0165	0.0292	0.0165	0.0292	-0.195
15. Consumer durables	0.0662	0.1185	0.0660	0.1184	-0.221
16. Other goods not listed above	0.0184	0.0267	0.0189	0.0267	2.946

Note: Sample values

Table 5
Revenue by groups of goods
(in millions of €)

Expenditure group	Initial scenario		Final scenario		Total revenue variation in %
	excise duties	VAT	excise duties	VAT	
1. Food and beverages	0.000	2068.481	0.000	2086.687	0.880
2. Alcoholic beverages	115.247	215.899	127.859	210.655	2.225
3. Tobacco	2167.826	525.244	2305.511	533.832	5.431
4. Clothing and footwear	0.000	2019.747	0.000	1989.077	-1.518
5. Housing.	0.000	0.000	0.000	0.000	0.000
6. Furniture and household equipment	175.196	2427.498	175.122	2426.468	-0.042
7. Gas	323.981	355.900	322.155	353.893	-0.564
8. Medical and pharmaceutical products and services	0.000	142.330	0.000	0.000	-100.00
9. Fuel	4088.883	1075.105	4095.070	1076.732	0.151
10. Private transport services	0.000	492.527	0.000	472.427	-4.081
11. Public transport	0.000	127.832	0.000	134.050	4.864
12. Communications	0.000	542.919	0.000	540.386	-0.467
13. Leisure, entertainment and holidays	0.000	2104.743	0.000	2114.474	0.462
14. Education	0.000	480.043	0.000	479.206	-0.175
15. Consumer durables	672.854	2810.615	671.815	2806.275	-0.154
16. Other goods not listed above	0.000	348.260	0.000	359.435	3.209

Note: Population values

Table 6
Distribution, progressiveness and redistribution indices

	Pre-reform	Post-reform
Gini gross expenditure	0.31782913	
Gini net expenditure	0.3134844	0.3135677
Reynolds-Smolensky index	0.0043447	0.0042615
Average rate	0.1137857	0.1137857
Kakwani progressiveness index	0.0385543	0.0380730
Reordenation income index	0.0006055	0.0006269

Note: Population values

Table 7
Distributive analysis of welfare (in €)

Decile	Expenditure (G)	Initial equivalent expenditure (G_e^0)	Final equivalent expenditure (G_e^1)
1	5793.62	5787.71	5799.54
2	9241.68	9229.52	9253.86
3	11766.52	11749.16	11783.92
4	14150.16	14127.53	14172.84
5	16473.55	16445.54	16501.63
6	19019.09	18984.92	19053.35
7	21979.54	21937.93	22021.27
8	25904.45	25852.53	25956.51
9	31988.39	31919.73	32057.24
10	48288.01	48170.17	48406.22
Average	20460.50	20420.47	20500.64

Note: Population values

Table 8
Distributive analysis of welfare (in €)

Decile	Equivalent welfare change	Static monetary variation	Equivalent variation (EV)	Compensating variation (CV)
1	11.83	6.54	-5.92	-5.91
2	24.34	12.64	-12.18	-12.16
3	34.76	20.41	-17.4	-17.36
4	45.31	24.51	-22.68	-22.63
5	56.09	23.85	-28.08	-28.01
6	68.43	31.10	-34.26	-34.18
7	83.34	35.69	-41.72	-41.62
8	103.98	34.43	-52.06	-51.92
9	137.51	32.00	-68.85	-68.66
10	236.05	34.43	-118.21	-117.84

Note: Population values

Table 9
Distributive analysis of revenue (in €)

Decile	Total revenue variation	Alcohol revenue variation	Tobacco revenue variation	Pharmaceutical and medical revenue variation
1	1.047	0.212	3.209	-2.669
2	0.869	0.358	5.959	-5.519
3	1.624	0.492	8.612	-7.212
4	1.909	0.525	10.275	-8.389
5	0.183	0.578	11.171	-10.878
6	1.038	0.764	13.640	-12.378
7	1.979	0.940	15.296	-12.919
8	0.089	0.937	16.453	-15.762
9	-3.328	0.833	18.211	-20.435
10	-5.415	0.712	23.300	-26.568

Table 10
Atkinson index & King's lambda

ε	Pre-reform		Post-reform		
	Atkinson index	**Initial equally-distributed equivalent expenditure**	**Atkinson index**	**Final equally-distributed equivalent expenditure**	**King's lambda**
0	0.000	17605.322	0.000	17674.436	1.0039
0.5	0.081	16176.465	0.081	16236.390	1.0037
1	0.159	14802.736	0.160	14854.067	1.0035
1.5	0.234	13477.730	0.235	13521.002	1.0032
2	0.307	12198.293	0.308	12234.014	1.0029
2.5	0.377	10967.233	0.378	10995.948	1.0026
3	0.444	9795.360	0.445	9817.732	1.0023
3.5	0.506	8701.248	0.507	8718.113	1.0019
4	0.562	7707.071	0.563	7719.423	1.0016
4.5	0.612	6831.115	0.613	6840.000	1.0013
5	0.655	6081.141	0.656	6087.516	1.0011

Note: Population values

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