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## Abstract

The final aim of this paper is to study the impact on welfare and revenue of changes in the Spanish indirect tax system. First, we estimate a complete flexible demand model on non durable goods exclusively, then we conduct a simulation exercise for two hypothetical reforms of VAT rates. The analysis is all done at micro level. It is desirable and, even necessary, if we want to know how demographic characteristics affect the behaviour of households and how taxes affect the welfare for different groups of the population. We conclude that the welfare effects (progressive, regressive or neutral) of increases in VAT, depend on good categories and type of households under consideration.

# 1 Introduction

The impact of changes in the system of indirect taxation within ECC countries has been an issue of interest for quite a few years, especially given the emphasis which the European Commission placed on the harmonisation of VAT rates as a previous step towards the creation of a single market (see Lee, Pearson and Smith, 1988). The study of such impact on Spanish households was the original motivation for this research. The changes that the Spanish indirect tax system would have to undergo look likely to affect households in a non trivial way. Also, recent announcements of forecoming adjustments to VAT rates in order to balance the budget deficit increase the interest of the exercise, for it can be used as a revenue predicting tool.

The analysis is done at micro level. This is necessary if we want to obtain a good picture on how taxes affect the welfare of different groups of the population (King, 1983). It is also desirable in the sense that different demographic characteristics affect the behaviour of households in a significant way (Blundell et al., 1993, and Baker et al., 1990). Any simulating device which did not take care of different characteristics in terms of age, occupation, number of children, etc., would fail to capture a good deal of consumer behaviour (Blundell et al., 1993).

In general lines, the exercise consists in specifying an overall framework for consumer behaviour in which a demand system is estimated. This is done in Section 2. Subsequently, a convenient functional form for such demand system is introduced in Section 3 and the advantages of using microdata are debated in Section 4. The econometric treatment is explained in Section 5, where the estimates of the model are presented. Section 6 is devoted to an explanation of the simulation methodology for both welfare and revenue. A presentation of the results for two hypothetical reforms concludes the paper.

## 2 Modelling framework

We shall be concerned with the modelling of expenditure on non durable goods. This is a result of the scarce knowledge we have on consumer behaviour with respect to durable goods. In many senses, the purchase of durables is best treated as an investment rather than a consumption decision. If there are difficulties when modelling consumer durables, things get worse when microdata is use. It turns out that many budget surveys (including our data source) do only collect information on purchases during reference periods of up to one quarter. In these circumstances, expenditure on cars, housing or appliances does not measure the flow of services that those goods yield.

We also exclude tobacco and petrol from our system. Previous experience from Spanish data (García and Labeaga, 1992, Labeaga, 1992, and Labeaga and López, 1992b) suggests that these two expenditure categories follow a peculiar consumption pattern in the sense that a proportion of households do not consider them as items of consumption because the household is non smoker and/or the household does not own a car (see Baker et al., 1990). In the absence of qualitative information about these characteristics, these two goods are best treated in a single equation context. Thus, we assume expenditure on the remaining non durable goods weakly separable from the rest of expenditure decisions.

Preferences are weakly separable if the direct utility function $U(x_1, \ldots, x_n)$ can be written in the following form (see Phlips, 1974):

$$F[(U_1(q_1), \ldots, U_k(q_k)] \tag{1}$$

for $k$ groups; or equivalently, if the marginal rate of substitution (MRS) between any two goods belonging to the same group is independent of the level of consumption of goods outside the group. This can be shown to imply that the allocation of expenditure amongst items of one particular group is made without reference to prices or quantities outside the group (Deaton and Muellbauer, 1980a). Such allocation depends only on outlay going to the group under consideration and the relative prices of its components. Weak separability justifies the use of the concept of two stage budgeting (see Figure 1).

The latter refers to the idea of agents allocating expenditure amongst broad groups first and, then, to commodities within each of those groups in a sequential process.

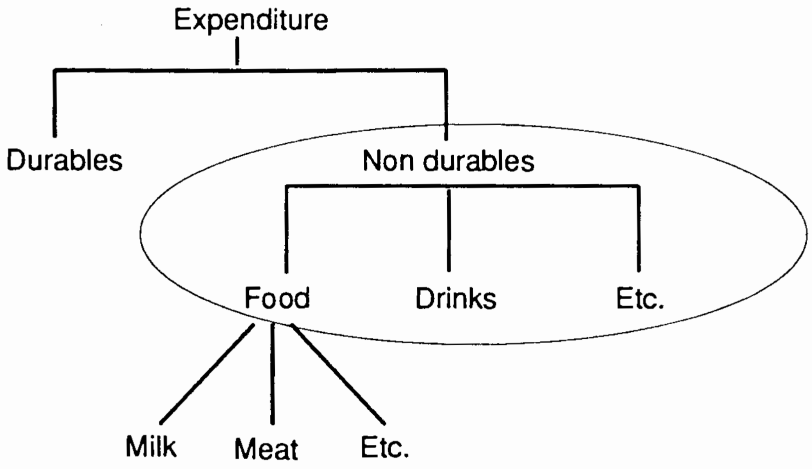


Figure 1: Two stage budgeting. We shall be estimating the circled stage, i.e. the allocation of expenditure on non durable goods amongst the seven groups.

It should be said that, while econometrically convenient, this assumption is somehow restrictive for it is unlikely that desirable expenditure decisions (or even labour supply decisions), bear no substitution effects on expenditure on transport or leisure goods, as a good deal of empirical evidence suggests (see Blundell and Walker, 1982, and Browning and Meghir, 1991).

A possible alternative would be to estimate expenditure on non durable goods conditional on durable tenure decisions (and/or on labour supply). The advantages of this methodology are exposed in Browning and Meghir (1991). For the purpose of our analysis, we would simply get around the unrealistic assumption of weak separability [1] without modelling explicitly the determination of the conditioning variables. Unfortunately, our data source does not contain information on tenure of durable goods, it only records whether there has been some expenditure on those commodities within the reference period. Therefore, we cannot use the conditional approach and are forced to invoke weak separability.

[1]Because we let the MRS of non durable goods depend on the tenure of durable ones and on labour decisions.

The process of allocation of expenditure will consist in a first stage where savings, labour supply and durable goods tenure are determined and a second stage where the remaining expenditure is split between a range of non durable categories. This whole process can be viewed within a life cycle consistent framework in which preferences are intertemporably separable. Current demands are expresed as a function of a variable that picks up past decisions and future anticipations of economic circumstances. In our analysis such variable is current expenditure and the influence of the model by letting the first stage of the process depend on interest rates, lagged prices, unemployment indicators and other macroeconomic variables (see Blundell, 1988).[2]

There remains the discussion on which commodity groupings should be chosen. Here, the purpose of the exercise is a main determining factor, at least in suggesting that commodities bearing different tax rates should not be grouped together. When defining broad categories of goods, we are making use of weak separability again, once expenditure has been allocated to the group "food", the MRS between milk and bread will not be affected by consumption of any item in the broad group "clothing and footwear" say, interactions between groups are exclusively income effects. Therefore, one criterion to be followed is to keep items bearing either substitution or complementarity with one another always in the same group. For the moment, we seek to isolate groups of particular policy interest. Attending to this criterion and to the current structure of indirect taxes in Spain, we choose the following categories: Food and non alcoholic beverages, alcoholic beverages, clothing and footwear, fuel for housing, houselhold non durable goods, public transport and a residual collecting the remaining non durable expenditure.

# 3 Functional form

What we might expect from our demand system is the ability to obtain a realistic picture of the substitution, own price and income effects that may arise after a change in the

[2]Criticisms to this intertemporal separability approach are based on the fact that the potential effects of habits are ruled out. Also, to some extent, this static representation has been blamed for rejections of homogeneity, because consumers might need some adjustment period to ellude money illusion.

structure of relative prices. In this sense, some forms of preferences can only be a second best option for our analysis. In particular, to use additively separable preferences, that is

$$U(q_1, \ldots, q_n) = F\left[\sum_s U_s(q_s)\right] \tag{2}$$

would imply that cross price derivatives are proportional to income derivatives in a way such that the factor of proportionality is independent of the good whose response we want to measure (see Phlips, 1974). This can be shown to exclude the possibility of negative expenditure elasticities and negative substitution effects, thus inferior goods and complementarity are ruled out, a priori, and clearly this is too strong an economic assumption to impose on the data (Deaton, 1974).

Previous exercises with Spanish data (Labeaga and López, 1992a) have used the Linear Expenditure System (LES) which has also been extensively used in the demand analysis literature ever since its creation by Stone (1954). One of the main attractions of this model is the ability to retrieve its parameters from small samples (most of its applications up to recent dates have been aggregate data studies) without price variation. However, this model embodies the additive separability undesirable properties alluded to previously. In particular, if concavity is to be preserved in the model, all marginal propensities to consume must be positive, therefore inferior goods are ruled out. Similarly, the requirements for concavity render cross price elasticities always positive and, therefore, all goods are forced to be substitutes (Deaton and Muelbauer, 1980a).

In this study we use the Almost Ideal Model (AIM) of Deaton and Muellbauer (1980, b). This is originated from an approximation to a cost function taking the form

$$\begin{aligned} \log c(u,p) &= \alpha_0 + \sum_k \alpha_k \log p_k + \\ &+ \frac{1}{2}\sum_k \sum_1 \gamma^*_{kl} \log p_k \log p_1 + u\beta_0 \prod p_k^{\beta_k} \end{aligned} \tag{3}$$

whose demand equations in budget share form for the ith good are given by

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log(\frac{x}{P}) \tag{4}$$

where

$$\begin{aligned} \log P &= \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2} \sum_k \sum_l \gamma_{kl} \log p_k \log p_l \\ \gamma_{ij} &= \frac{1}{2}(\gamma^*_{ij} + \gamma^*_{ji}) \end{aligned} \tag{5}$$

and $x$, $P$ are total expenditure and prices, respectively. The model embodies the following theoretical restrictions:

$$\begin{array}{lllll} \text{Adding up}: & \sum_i \alpha_i = 1, & \sum_i \gamma_{ij} = 0, & \sum_i \beta_i = 0 \\ \text{Homogeneity}: & \sum_j \gamma_{ij} = 0 & & \\ \text{Symmetry}: & \gamma_{ij} = \gamma_{ji} & & \\ \text{Negativity}: & s_{ij} < 0 & \forall i = j & \end{array} \tag{6}$$

where $s_{ij}$ are compensated elasticities.

There is a number of reasons why this is the most appropriate choice of functional form for the purposes of this study. Firstly, the preferences from which the AIM is derived (see Deaton and Muellbauer, 1980a for a discussion of PIGLOG preferences) do not embody additive separability and thus permit flexible price responses. Also, its Engel curves belong to the Working-Leser form, i.e. linear in the logarithm of total expenditure and thus non linear in expenditure. The theoretical reasons why this is desirable is that linear (in expenditure) Engel Curves imply that marginal propensities to consume are constant and identical for all individuals so every agent spends the same proportion out of very extra unit of income at all his levels of income and moreover, this spending pattern is the same for poor and rich households for every particular good. This is, a priori, unreasonable and has also been empirically rejected (see Blundell and Ray, 1984).

Another consideration concerning flexibility is the rank of a demand system. This concept can be defined as the number of linearly independent functions of income entering individual Engel Curves (Forni and Brighi, 1990). In this sense the AIM is rank two and the LES is rank one. There is now a bulk of evidence pointing towards demand systems having rank three (see Lewbel, 1991 for the non-parametric case and Blundell et al., 1993 for the AIM case). The convenient extension to the standard model, for which we also present estimates, would be the following

$$w_i = \alpha_i + \beta_i \log x + \delta_i (\log x)^2 + \sum_j \gamma_{ij} \log p_j \tag{7}$$

We will therefore be dealing with a functional form which precludes the imposition of, a priori, implausible price responses on the data and maximises the degree of flexibility in income responses. In addition, the AIM can be integrated back to a cost function which proves crucial when studying the welfare impact of the reforms.

# 4 Data

Perhaps more important than the choice of functional form is the choice of data on which the model is estimated. There is not usually much of a choice here but, in the case of Spain, we are fortunate enough to count with both aggregate time series and a series of cross-sections of family budget surveys (see the Data Appendix for details). The demand system is estimated on microdata exclusively. In our opinion this is desirable because of the following reasons.

Firstly, the size of aggregate datasets restricts the number of parameters that can be estimated. This might be of no importance when we want to retrieve a single demand equation, but, if we want to consider a wide range of commodities, the virtually unlimited number of degrees of freedom which micro datasets offer do effectively make a big difference.

Secondly, there is the problem of aggregation. The use of aggregate data to retrieve estimates of demand systems rests on the assumption that there exist functions which relate aggregate consumption to prices and aggregate expenditure or some index summarising the effects of the distribution of individual expenditures. The conditions under which such functions exist have been surveyed by Forni and Brighi (1990). As these authors point out, these conditions place restrictions on micro demand functions and these restrictions, in many cases, preclude the use of estimated demand systems for exercises like the one this study is aimed at. Systems derived from Gorman Polar Form cost functions, the LES for example, satisfy exact aggregation conditions because they display linear Engel curves and these are assumed to have the same slope for all agents.

Therefore, aggregate consumption depends on aggregate expenditure regardless of the distribution of the latter amongst the population. This, as explained above, has very restrictive implications. On the other hand, members of the Price Independent Generalised Linear family of preferences (Muellbauer, 1976), a special case of which is the AIM model, allow for exact aggregation without imposing such severe restrictions, because the effects on demand of the distribution of income are accounted for (see Deaton and Muellbauer, 1980a). On the practical side, this requires information on individual characteristics which must be retrieved from microdata. Therefore, the use of aggregate data to retrieve an AIM would only be theoretically consistent if microdata was available too.

Thirdly, the exclusion of demographic explanatory variables (which may be correlated with total expenditure and prices) makes difficult the separation of income and price effects from the effects of the former. In order to avoid this "aggregation bias" the use of microdata for our exercise is fully justified. We will therefore use a pool of cross-sections on family budget out of the "Encuesta de Presupuestos Familiares" and "Encuesta Continua de Presupuestos Familiares", details of which can be found in the Data Appendix.

# 5 Econometric implementation

The restrictions that ensure the integrability of demand equations back to utility or cost functions have to be satisfied if our estimates are to be used for welfare analysis (equation (6) for the AIM). Adding up is a cross-equation restriction that is immediately satisfied if Working-Leser type models are estimated with linear methods (Deaton and Muellbauer, 1980a). Homogeneity is a single equation restriction and as such it can be imposed and checked using an F-test. Symmetry requires cross- equation restrictions. These can be imposed by means of a minimun distance method such as the Chi-squared; this is a two step method whereby estimates satisfying the other single equation restrictions are obtained at a first stage, together with their covariance matrix, which are used at a second stage to impose symmetry (Blundell et al., 1993).

In principle, therefore, we could retrieve estimates using OLS on each equation and then impose symmetry. However, the use of microdata presents the problem of households recording zero expenditures even after aggregating into broad categories and, it is well known that when the dependent variable is censored OLS yields biased estimates. Therefore, it is crucial to treat the problem of zero records adequately and the first measure is to establish which of the following is or are their cause:

i. Because the household is maximising utility at zero consumption for his current budget (corner solution).

ii. Because the household does not participate in the consumption of some commodity (case of non-smoking households, for instance).

iii. Because no purchase has been made during the monitoring period but the household is a regular consumer of the good (infrequency of purchase).

The rotating panel nature of the data we use, can elucidate to some extent which of these reasons apply. Table 1 shows the proportion of positive expenditures on the categories we consider after one sweep and after aggregating over 8 sweeps for the set of households who cooperate 8 quarters in the "Encuesta Continua de Presupuestos Familiares" (a total of 1,123 out of 13,711).

Table 1: EVIDENCE ON INFREQUENCY OF PURCHASE FROM THE PANEL

| Category | After one sweep | Sum over 8 (sweeps) |
|---|---|---|
| Food and refreshments | .994 | .999 |
| Alcoholic beverages | .700 | .951 |
| Clothing and footwear | .900 | .990 |
| Fuel for housing | .990 | 1.000 |
| Household non durables | .780 | .970 |
| Public transport | .460 | .800 |
| Other non durable goods | .780 | .960 |

We note that after only one snapshot at the household behaviour, there is a number of categories which present a high proportion of zero records, especially alcoholic drinks, household non durables, public transport and other non durable goods. After taking 8 snapshots, the cause for the overwhelming majority of zero records seems to be infrequency of purchase [3], except perhaps in the case of public transport where no participation and corner solutions might play an important role.

When infrecuency of purchase is present, Keen (1987) has shown that OLS yields biased estimators due to the existence of correlation between the error term and the total expenditure regressor and, in order to overcome this problem, total expenditure can be instrumented sucessfully with total income which, in principle, should not display correlation with the error term since this variable is not affected by the decision to purchase.

Thus, the AIM is estimated by three stages least squares (3SLS)[4]. We provide a number of exogenous variables ranging from total income to seasonal dummies and demographic characteristics which determine total non durable expenditure in the first stage. Also, a number of important demographics are introduced in the model to help explain the budget shares. The construction of all the variables entering the second stage can be found in the Data Appendix.

[3]This is due to an excessively short reference period for the affected goods.

[4]In this case 3SLS is equivalent to two stages least squares because each equation contains the same variables on its right hand side.

The model is non linear in its original form but one of the features that have made it popular is the relative ease with which it can be transformed into a linear form for estimation. Ever since its origins, the following approximation to $\log P$ in equation (6) has been used (see Deaton and Muellbauer, 1980a, or Blundell et al., 1993).

$$\log P = \sum_k w_k \log p_k \tag{8}$$

In the line with those previous studies, we shall also apply the approximation, that is, we construct an Individual Stone Index to deflate expenditure[5]. With respect to the imposition of theoretical restrictions the following points are relevant:

In order to avoid the singularity of the error variance matrix (because of the additivity of the system, any equation is a linear combination of the others), the last equation is left out in estimation and its parameters are retrieved from the adding up restriction which, as mentioned before, is satisfied automatically by linear estimators.

The homogeneity restriction is imposed by entering all prices relative to the one of the excluded good, and it is tested by means of an F-test against the unrestricted model equation by equation. Symmetry, which is a whole system restriction, is imposed by the minimum distance method and again tested by means of an F-test[6].

## 5.1 Model estimates

Tables 5 to 11 present the estimation results for the AIM we use in the simulation analysis. The first column in the tables contains homogeneity restricted rank 2 model, thus the seventh price parameter is not estimated directly but can be calculated from the homogeneity restriction. The second column contains the symmetry restricted price parameters. The third column contains the real expenditure term of the rank 3 model as well as two inter-

[5]We are aware of the possibility to introduce a bias when using this procedure. The problem reduces to a case of ommited variables bias, as investigated by Pashardes (1992).

[6]Since the resulting compensated elasticities vary for each household, we might find that some households do not adhere to concavity conditions.

actions between demographics and real expenditure for the purpose of comparison with the rank 2 version. R-squared values and the F-statistic for the homogeneity restriction are supplied too.

With respect to the rank 2 model we find that the homogeneity restriction cannot be rejected except for the case of public transport. This has to be interpreted in regard to the significance of the price parameters in the model.

It is generally accepted that with microdata samples the threshold of significance has to be raised in proportion with the number of observations. A commonly used criterion is that a critical value equal to the logarithm of the square root of the number of observations should be used (e.g. Atkinson et al., 1989), which in our case is 3.05. In these circumstances, only two parameters would appear to be significant in the food, household non durable goods and public transport equations; one parameter in the alcohol and residual equations and none in the clothing and fuel equations. However, if we were to take the usual threshold, we would find a substantial number of significant parameters. In all equations they are jointly significantly different from zero. In this case, the lack of significance of some parameters is a result of the multicollinearity that can be detected in the price series during the time span of our sample.

Therefore, the acceptance of the homogeneity restriction should be treated with caution for it might be due to lack of strong significance in some parameters or, on the other hand, a sign of the adequacy of microdata to describe consumer behaviour in line with other studies (see Blundell et al., 1993). The case for symmetry, however, is of a clear rejection of the null hypothesis[7]. Thus, we force this restriction upon the data in order to obtain integrability conditions.

The real expenditure parameters are well determined in all equations, as we would except, given the amount of variation in expenditure within the sample. With respect to the appropriateness of the rank 3 model, we find that the parameters on the squared log of real expenditure term are significantly different from zero (on the above criterion) in

[7]The test statistic is $F(15, \infty) = 17.97$ against a critical value of $F(15, \infty) = 1.67$ at the 1%.

the case of alcohol, fuel and public transport. It would be possible to use a rank 3 model for revenue and welfare simulation too, since a cost function exists due to the work of Banks et al. (1992). However, we choose to use the rank 2 model for the current exercise leaving experiments with the rank 3 version for subsequent research.

The effects of real expenditure and prices on each household are given by their respective elasticities according to the following expressions:

$$\begin{aligned} e_i^h &= \frac{\beta_i}{w_i^h} + 1 \\ e_{ii}^h &= \frac{\gamma_{ii}}{w_i^h} - 1 \end{aligned} \tag{9}$$

Table 2 presents such effects calculated at the mean of the sample.

Table 2: EXPENDITURE AND OWN PRICE ELASTICITIES

| **Category** | **Expenditure** | **Own Price** |
|---|---|---|
| Food and refreshments | 0.76 | -0.87 |
| Alcoholic beverages | 0.88 | -1.03 |
| Clothing and footwear | 1.32 | -0.89 |
| Fuel for housing | 0.86 | -0.53 |
| Household non durable goods | 1.49 | 0.14 |
| Public transport | 1.13 | -1.27 |
| Other non durable goods | 1.43 | 1.43 |

In general, the pattern of expenditure elasticities falls within the expected classification that is, food, fuel and, perhaps a bit surprisingly, alcohol are neccessities whereas the rest can be classed as luxuries including public transport, which other European microdata studies report as a necessity.

The sign of the price elasticities is the expected one except for the case of household non durable goods, whose own price parameter is not significantly different from zero, and the residual category.

With respect to the effect of demographic variables, we find that children have a significant effect on the predicted share of several equations, for instance, one additional child increases the share of household non durable goods by one percentage point. Every additional member increases the share of food by 2% and has a significant effect on the rest of expenditure categories. In the case of alcohol and household non durables, one extra earner increases the share by nearly 5% of its mean. The age of the head has a significant positive impact in the case of food, fuel, household non durable goods and a negative one in the case of alcohol, clothing and public transport.

The effect of self-employment is to increase spending by a rough 10% of the mean share in the case of fuel and household non durable goods and it decreases the predicted share by 25% of the mean in the case of public transport. Unskilled workers spend 20% more on alcohol out of total expenditure, 10% more on clothing and fuel, 15% more on household non durables, 36% less on public transport and roughly 10% less on the residual category than the base household. Being out of the labour market only has a significant impact for expenditure on household non durable goods, where it increases the predicted share by a rough 10% of the mean share with respect to the base household. Having estimated a complete demand system, we proceed to carry out the tax simulations.

# 6 Tax simulations

This section describes the methodology of the tax simulation routine and presents the results for two tax reforms which we consider of particular interest. The first reform consists in a projected tax scenario for 1993, which we set to an increase in two percentage points for the standard VAT rate at 12% and an increase in 3 points for the reduced rate at 6%. The second reform is defined as revenue neutral, that is, we find a single tax rate which, if levied on every good, yields the same revenue as in the initial situation. Since we do not include goods with the special rate at 33%, we deal only with reduced and standard rates. For the current analysis we ignore excise duties since they afect only alcohol out of our seven categories. The following table pictures the two VAT reforms.

Table 3: CHANGE IN RATES FOR THE SIMULATED REFORMS

| Category | Initial rate | Reform 1 | Reform 2 |
|---|---|---|---|
| Food and resfreshments | 6% | 9% | 9% |
| Alcoholic beverages | 12% | 14% | 9% |
| Clothing and footwear | 12% | 14% | 9% |
| Fuel for housing | 12% | 14% | 9% |
| Household non durables | 12% | 14% | 9% |
| Public transport | 6% | 9% | 9% |
| Other non durable goods | 12% | 14% | 9% |

## 6.1 Definition of the reforms

The basic assumption in this study and similar ones (see Baker et al., 1990) regarding how taxes affect consumers is that supply is perfectly inelastic and therefore retail prices fully reflect changes in taxes. The treatment of the excluded goods in this simulation consists in assuming that their pre-reform level of expenditure remains fixed. The alternative would be to assume that it is the quantity what remains fixed, therefore the total expenditure on the categories in our system would be affected. Thus, tax reforms can be defined as the following linear mapping of the budget set (expenditure allocated to non durable goods and prices) for every household

$$\{y_h^0, p^0\} \rightarrow \{y_h^0, p^1\} \tag{10}$$

Let $p_i^0$ be the pre-reform retail price of the ith good, then it can be expressed as

$$p_i^0 = (1 + v_i^0)q_i = q_i + q_i\ v_i^0 \tag{11}$$

where $v_i^0$, $q_i$ are the initial VAT rate and the net of tax price of good $i$. Therefore, if $v_i^1$ is the new tax rate, the after tax price is given by

$$p_i^1 = (1 + v_i^1)q_i \tag{12}$$

or

$$p_i^1 = p_i^0 + \Delta p_i^0 \tag{13}$$

where

$$\frac{\Delta p_i^0}{p_i^0} = \frac{q_i(v_i^1 - v_i^0)}{(1 + v_i^0)q_i} = \frac{(v_i^1 - v_i^0)}{1 + v_i^0} \tag{14}$$

therefore

$$p_i^1 = p_i^0 \frac{(v_i^1 - v_i^0)}{1 + v_i^0} + p_i^0 \tag{15}$$

## 6.2 Welfare and revenue simulation

The issue we consider, as far as the welfare implications of the tax reforms are concerned, is the money metric impact of the price changes on the households, in particular, we calculate equivalent gain for each household. This concept is defined as the amount of money that the household would have paid (or accepted) in order to remain at the initial level of utility with the final set of prices. This is easily computable since we have an estimated cost function [8]. First, we calculate equivalent income which is implicitly defined as:

$$v(p^r, y_e) = v(p, y) \tag{16}$$

where v(.) is the indirect utility function, $p^r$ is a reference price vector and thus inverting (16)

$$y_e = c(v, p^r) = c(p^r, p, y) \tag{17}$$

that is, the level of budget which at the reference price level (initial price in our case) is equivalent in terms of utility to the actual budget of the household at the final prices. For the AIM cost function, equivalent income is given by:

$$\begin{aligned} \log y_e \quad = \quad & \alpha_0 + \sum_k \alpha_k \log p_k^r + \frac{1}{2}\sum_k \sum_j \gamma_{kj} \log p_k^r \log p_j^r + \\ & \prod_k \left[\frac{p_k^r}{p_k}\right]^{\beta_k} (\log y - \alpha_0 - \sum \alpha_k \log p_k - \frac{1}{2}\sum_k \sum_j \gamma_{kj} \log p_k \log p_j) \end{aligned} \tag{18}$$

[8]The methodology followed here is that of King (1983).

then, equivalent gain for any household is naturally $EG^h = y_0^h - y_e^h$ where $y_0^h$ is initial expenditure.

Concerning the particularities of revenue simulation, the first step consists in calculating the new predicted budget shares using the parameter estimates of the rank 2 AIM and the new prices. When doing this, we must take into consideration the fact that the model does not predict shares in a perfect manner. Since we are interested in the price and real expenditure effects, it is desirable to separate these components from the overall expenditure on each commodity.

Thus, we define the share prediction error as (Baker et al., 1990):

$$\begin{aligned} e_i &= w_i^0 - \hat{w}_i(p^0, x^0, \gamma_i, \beta_i, \delta_i) \\ e_i &= w_i^0 - \left[\sum_j \gamma_{ij} \log p_j^0 + \beta_i \log \left[\frac{x}{P^0}\right]\right] \end{aligned} \tag{19}$$

that is, the part of each share not explained by prices and real expenditures or equivalenty, the component of the share explained by household characteristics, locational, seasonal and other non price and non real expenditure variables plus the residual.

Thus, the post-reform shares are defined as

$$w_i^1 = \left[\sum_j \gamma_{ij} \log p_j^1 + \beta_i \log \frac{x}{P^1}\right] + e_i \tag{20}$$

Once the new shares have been computed, the levels of revenue from every household are calculated according to the following expresion:

$$TR_h = \sum_i \left[\frac{v_i^1}{v_i^1 + 1}\right] E_i^1 \tag{21}$$

where $E_i^1$ is the post-reform level of expenditure on the ith category and $v_i^1/(v_i^1 + 1)$ is the implicit VAT rate.

## 6.3 Simulation results

Charts 12 to 18 contain the simulation results in 1989 pesetas per quarter by deciles of expenditure and by a demographic breakdown. The first two colums in each table show the pattern of observed expenditures and the rest of colums show the increase in tax payment after simulating the changes in behaviour to reforms 1 and 2.

In the case of food, we observe how the poorest households (in terms of total expenditure) have a share nearly double of that of the richest households. The presence of children does not seem to push the share up substantially unless there are four or more. Retired households have a share similar to household within the seventh expenditure decile. This pattern of expenditures suggests that any tax on this category is likely to be regressive in the sense that poor households will end up paying a higher percentage of their total expenditure than rich households. This is confirmed by the increase in payments forecast. The latter ranges between 1,039 and 6,691 pts. per quarter and a 1.63% and a 0.97% of total expenditure. Thus, poor households pay 2/3 more of food tax than rich households with respect to their total expenditures. The second reform offers similar results in terms of the distribution of payments but the amount is slightly increased.

In the case of alcohol, the share increases with total expenditure across the first 50% of its distribution but the variation in percentage points is very small. This leads the increase in tax to represent a nearly constant percentage of total expenditure. This increase, however, ranges from 25 to 291 pts. per quarter. The second reform implies a fall in tax payments.

Clothing and footwear is clearly a luxury. The average share rises from a 10% in the first decile to a 30% in the top one. This means that the effect of the tax is progressive, as the simulation results show for both reforms. For instance, if the first reform were implemented, the top decile would be paying a 0.40% more of its expenditure on tax than the poorest one, whereas the second reform would lead to a saving of a 0.60% of total expenditure more.

Fuel is again a case of a clear necessity with respect to total expenditure. The share falls from 8 percentage points from the lowest to the highest decile. Retired households have a higher share too (equal to that of the fifth decile). This implies regresiveness in the pattern of tax payments.

Expenditure on household non durable goods is observed to vary between 3.75% and 5% of the total, consequently, the resulting tax payments represent a nearly constant percentage for all expenditure groups. Public transport is similar to household non durable goods in that the average share does not change substantially across the different groups. The rest of non durable goods are a luxury. Their share moves from 8% to 23% as total expenditure rises. Such pattern results in a progression in the increase of tax payments to the two reforms.

Therefore, in general lines, it can be said that none of the price changes is big enough to result in changes in tax payments in the opposite direction, that is, where prices increase (decrease) tax payments increase (decrease). Though this is hardly surprising in the case of the two categories with positive own price elasticities, it means that the change in behaviour is not big enough to result in a decrease (increase) in consumption yielding less (more) revenue. Finally, as a normative output, it is clear that increases in VAT will have a regressive effect on food and fuel, a progressive effect on clothing and the residual category and a roughly "neutral" effect on the rest of categories.

With respect to welfare effects, Table 19 shows the money metric welfare change associated to the two reforms. As we can tell from the table, the EG associated to the first reform ranges between -2,204 and -22,375 pts. per quarter but in terms of percentage out of total expenditure, it represents between a 3.25% and a 3.50%. Therefore, the reform cannot be said to be either progressive nor regressive. Concerning reform 2, the main point to comment upon is that it does not improve the welfare of any household while it generates the same revenue for the Exchequer. Finally, revenue simulation is carried out by calculating every household's tax payment before and after the reforms and then grossing it up.

The following table shows the pattern of revenues from the two reforms.

Table 4: FORECASTS OF REVENUE CHANGES TO REFORMS 1 AND 2

| CATEGORY | PRE-REFORM | REFORM 1 | REFORM 2 |
|---|---|---|---|
| Food and refreshments | 80,105 | 117,070 | 117,750.0 |
| Alcoholic beverages | 9,843 | 11,107 | 7,653.3 |
| Clothing and footwear | 67,437 | 77,212 | 52,977.0 |
| Fuel for housing | 14,017 | 16,717 | 11,500.0 |
| Household non durables | 13,958 | 16,034 | 10,303.0 |
| Public transport | 3,554 | 5,907 | 4,778.2 |
| Other non durables | 47,376 | 53,100 | 36,073.0 |
| **TOTAL** | **236,290** | **297,147** | **241,034.5** |

Note: All figures in millions pts.

As we can see, the bulk of revenue is raised by food, which is the category with the biggest share amongst the included in our system. It is useful to recall that it is not the total of revenue what is important (because we have ommitted a number of important expenditure categories which generate a lot of revenue) when interpreting the table. Rather, it is interesting to see the reaction from every single category. In this sense, it is noteworthy the increase in the revenue accrued from food in the two reforms, an increase of 46% to an increase in three points in VAT. The case or alcohol shows that a move from 12% to 14% would increase revenue by a 12%, whereas the loss would be of a 22% if a 9% rate was applied. The same patter applies to clothing, where reform 1 would raise a 14% more and reform 2 a 21% less. From household and other non durable goods the Exchequer would also lose twice as much with the second reform as they would gain with the first, in percentage. Public transport would originate 66% and 34% more revenue with the first and second reforms, respectively.

There is a couple of facts that emerge from these results. Firstly, amongst the reduced rate goods and public transport seems to be able to generate more revenue proportionally than food only if all taxes go up together. Thus, the application of a single rate would shift the burden towards food, which is a necessity. Not surprisingly the reform does not improve the welfare of households, as mentioned before. Secondly, amongst the standard rate goods, the one with the highest capacity to generate revenue in proportion to the initial level is fuel for housing, which not surprisingly is a necessity and has a low own price elasticity. This is followed by clothing and household non durable goods, which are classed as luxuries and accordingly could be used as revenue generating instrument with a presumable lower impact on welfare.

## 7 Summary and conclusion

We have estimated a complete flexible demand system on microdata and then used it to carry out indirect tax simulations. In our opinion, the system could still be improved in terms of price parameters significance if only we had counted with more years of microdata and thus more relative price variation. More experiments with rank 3 specifications could also improve the information about the nature of some categories of consumption. Another field in which further research could yield improvements for the system is the inclusion of tobacco and petrol, for they bear special taxes, and durable goods.

However, the current results seem to confirm, a priori, the ideas we had in terms of sign and size of price and expenditure elasticities for the majority of categories and, therefore, serve as a good simulation basis to start with, given the quality of the data available. Thus, we are able to obtain predictions of the increment in tax that household would have to pay and, moreover, this is done at the individual level. The implications for the assessment of different tax policies on welfare grounds is that a detailed monitoring of who are the losers and the winners to a particular fiscal measure can be done. The exercise does also produce a good picture of the capacity which each commodity has as a revenue generating instrument and, again, this takes into account the behaviour of households.

Our view, also, is that this exercise increases its usefulness when its results are compared with other predictions, be it from time series or any other forecast instrument. Consequently, it may turn out to be an interesting aid in policy making. The tax simulation exercise is novel for the case of Spain, and, even if some exercises of demand system estimation can be found in the Spanish literature, our opinion is that our estimates are a good choice for the many uses to which a demand system can be put, for instance, optimal taxation.

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# DATA APPENDIX

The data we use for the estimation of the demand system is a pool of two microdata surveys covering the period 1980-1989, the "Encuesta de Presupuestos Familiares" (EPF) and the "Encuesta Continua de Presupuestos Familiares" (ECPF) both organised by the Instituto Nacional de Estadística (see INE 1983, 85,). This combination has been necessary in order to obtain sufficient price variation in the estimating sample. The first survey has contributed with about 2,000 households taken at random out of the 24,000 that it includes in the period 1980-81. The second survey contributes with about 9,000 households within the period 1985-89. These latter are the households that enter the survey for the first time every quarter.

The whole sample is random and is extracted from a stratification process that makes it representative of the whole of Spain. The sample of the ECPF is rotated in a 12.5% every quarter. This means that a balanced panel of 400 households should be obtained from every group of 8 quarters. In practice, however, the rate of attrition is quite high and only 1,123 out of a total of 13,711 households complete the eight quarter term of cooperation. Attrition leads to substitution of the household in a way such that the representativity of the sample is preserved.

The households used for both welfare and revenue simulation are those who form the last data edition of 1989. Every household has a grossing up factor which indicates the number of households which it theoretically represents in the whole of the nation.

The variables appearing in the specification of the shares are the following:

*Constant shifters:*

- Number of children in the household.
- Number of members in the household.
- Number of earners of income in the household.
- Age of the head of the household.

- Own Employment = 1 if the head is self employed.
- Unskilled = 1 if the head is and unskilled worker.
- Not active = 1 if the head is out of the labour force.

*Slope:*

- Log of real Expenditure and its square: Natural logarithm of total expenditure deflated by the Stone index.
- Log $P_i$ (i = 1, ..., 6): Natural logarithm of prices relative to the price of the seventh good.

*Interactions with the expenditure term in rank 3 version:*

- Child*lrx: Interaction of number of children with log of real expenditure.
- Age*lrx: Interaction of age of head with log of real expenditure.

Table 5: FOOD AND NON ALCOHOLIC BEVERAGES

| | RANK 2 | | RANK 3 |
|---|---|---|---|
| Variable | Unrestricted | Restricted | |
| Constant | 1.820<br>(24.9) | | |
| # Children | -0.001<br>(0.62) | | |
| # Members | 0.020<br>(22.0) | | |
| # Earners | -0.003<br>(1.80) | | |
| Age of head | 0.0007<br>(6.00) | | |
| Own employ | -0.004<br>(1.20) | | |
| Unskilled | 0.004<br>(0.72) | | |
| Not active | -0.005<br>(1.50) | | |
| Log real ex. | -0.128<br>(37.0) | | 0.38<br>(0.56) |
| Log real square | - - | | -0.0092<br>(2.77) |
| Child*lrx | - - | | 0.0019<br>(0.59) |
| Age*lrx | - - | | 0.00004<br>(.10) |
| Log P1 | -0.051<br>(4.38) | 0.068<br>(11.7) | |
| Log P2 | -0.041<br>(0.79) | 0.013<br>(4.80) | |
| Log P3 | -0.512<br>(2.60) | 0.037<br>(4.70) | |
| Log P4 | 0.005<br>(0.11) | -0.014<br>(3.97) | |
| Log P5 | -0.212<br>(2.10) | 0.012<br>(2.87) | |
| Log P6 | 0.447<br>(8.41) | 0.004<br>(4.80) | |
| R-squared | .217 | | .218 |
| F | | 1.09 | |

*Notes:*

1. Absolute t-ratios are in parenthesis.
2. F is a test of homogeneity.

Table 6: ALCOHOLIC BEVERAGES

| | RANK 2 | | RANK 3 |
|---|---|---|---|
| **Variable** | **Unrestricted** | **Restricted** | |
| Constant | 0.070<br>(3.28) | | |
| # Children | -0.001<br>(3.86) | | |
| # Members | 0.0008<br>(2.30) | | |
| # Earners | 0.0014<br>(1.78) | | |
| Age of head | -0.0001<br>(3.68) | | |
| Own employ | -0.0005<br>(0.56) | | |
| Unskilled | 0.0051<br>(2.61) | | |
| Not active | -0.0008<br>(0.74) | | |
| Log real ex. | -0.003<br>(3.58) | | 0.0537<br>(2.71) |
| Log real square | - - | | -0.0032<br>(3.32) |
| Child*lrx | - - | | 0.0017<br>(1.79) |
| Age*lrx | - - | | 0.0000004<br>(0.06) |
| Log P1 | 0.0005<br>(0.14) | 0.0131<br>(4.80) | |
| Log P2 | 0.011<br>(0.71) | -0.001<br>(0.13) | |
| Log P3 | -0.133<br>(2.60) | -0.048<br>(1.64) | |
| Log P4 | -0.0127<br>(0.86) | -0.016<br>(1.85) | |
| Log P5 | -0.069<br>(2.41) | -0.020<br>(1.48) | |
| Log P6 | 0.050<br>(3.20) | -0.006<br>(0.78) | |
| R-squared | 0.13 | | 0.15 |
| F | | 0.02 | |

*Notes:*

1. Absolute t-ratios are in parenthesis.
2. F is a test of homogeneity.

Table 7: CLOTHING AND FOOTWEAR

| | RANK 2 | | RANK 3 |
|---|---|---|---|
| Variable | Unrestricted | Restricted | |
| Constant | -.3695<br>(5.66) | | |
| # Children | 0.0005<br>(0.38) | | |
| # Members | -0.0053<br>(4.98) | | |
| # Earners | 0.0004<br>(0.28) | | |
| Age of head | -0.0009<br>(9.04) | | |
| Own employ | -0.0023<br>(0.79) | | |
| Unskilled | 0.013<br>(2.23) | | |
| Not active | 0.002<br>(0.60) | | |
| Log real ex. | 0.054<br>(17.8) | | -0.0370<br>(0.62) |
| Log real square | - - | | 0.0050<br>(1.82) |
| Child*lrx | - - | | -0.0039<br>(1.35) |
| Age*lrx | - - | | 0.00003<br>(0.18) |
| Log P1 | 0.024<br>(2.32) | 0.0371<br>(4.74) | |
| Log P2 | -0.070<br>(1.48) | -0.048<br>(1.64) | |
| Log P3 | 0.059<br>(0.34) | 0.018<br>(0.16) | |
| Log P4 | -0.018<br>(0.41) | 0.004<br>(0.01) | |
| Log P5 | 0.101<br>(1.17) | 0.080<br>(1.70) | |
| Log P6 | 0.106<br>(2.25) | 0.041<br>(1.38) | |
| R-squared | .123 | | .132 |
| F | | 4.22 | |

*Notes:*

1. Absolute t-ratios are in parenthesis.
2. F is a test of homogeneity.

Table 8: FUEL FOR DOMESTIC USE

| Variable | RANK 2 Unrestricted | RANK 2 Restricted | RANK 3 |
|---|---|---|---|
| Constant | 0.164<br>(5.63) | | |
| # Children | 0.002<br>(3.28) | | |
| # Members | -0.0053<br>(11.2) | | |
| # Earners | 0.0006<br>(0.93) | | |
| Age of head | 0.0001<br>(2.74) | | |
| Own employ | 0.006<br>(4.70) | | |
| Unskilled | -0.007<br>(2.69) | | |
| Not active | 0.002<br>(1.97) | | |
| Log real ex. | -0.0079<br>(5.74) | | -0.080<br>(2.93) |
| Log real square | - - | | 0.004<br>(3.27) |
| Child*lrx | - - | | 0.001<br>(1.00) |
| Age*lrx | - - | | -0.0001<br>(1.89) |
| Log P1 | -0.0059<br>(1.27) | -0.014<br>(3.97) | |
| Log P2 | -0.015<br>(0.74) | -0.0169<br>(1.85) | |
| Log P3 | 0.0186<br>(0.23) | 0.004<br>(0.17) | |
| Log P4 | 0.0337<br>(1.69) | 0.028<br>(1.73) | |
| Log P5 | -0.008<br>(0.22) | -0.008<br>(0.50) | |
| Log P6 | 0.020<br>(0.98) | 0.060<br>(5.9) | |
| R-squared | .061 | | .065 |
| F | | 0.36 | |

*Notes:*

1. Absolute t-ratios are in parenthesis.
2. F is a test of homogeneity.

Table 9: HOUSEHOLD NON DURABLE GOODS.

| | RANK 2 | | RANK 3 |
|---|---|---|---|
| **Variable** | **Unrestricted** | **Restricted** | |
| Constant | -.256<br>(7.37) | | |
| # Children | 0.010<br>(12.5) | | |
| # Members | -0.009<br>(16.2) | | |
| # Earners | 0.002<br>(2.51) | | |
| Age of head | 0.0003<br>(6.7) | | |
| Own employ | 0.0062<br>(3.82) | | |
| Unskilled | 0.008<br>(2.79) | | |
| Not active | 0.0063<br>(3.53) | | |
| Log real ex. | 0.0236<br>(14.3) | | -0.016<br>(0.50) |
| Log real square | - - | | 0.003<br>(1.92) |
| Child*lrx | - - | | 0.004<br>(3.40) |
| Age*lrx | - - | | -0.0003<br>(3.34) |
| Log P1 | 0.0189<br>(3.42) | 0.0128<br>(2.87) | |
| Log P2 | 0.0064<br>(0.256) | -0.0205<br>(-1.48) | |
| Log P3 | 0.0253<br>(0.27) | 0.080<br>(1.70) | |
| Log P4 | -0.0001<br>(0.01) | -0.008<br>(0.50) | |
| Log P5 | 0.038<br>(0.83) | 0.005<br>(1.81) | |
| Log P6 | -0.082<br>(3.27) | -0.058<br>(-4.10) | |
| R-squared | .040 | | .044 |
| F | | 0.14 | |

*Notes:*

1. Absolute t-ratios are in parenthesis.
2. F is a test of homogeneity.

Table 10: PUBLIC TRANSPORT

| | RANK 2 | | RANK 3 |
|---|---|---|---|
| Variable | Unrestricted | Restricted | |
| Constant | 0.0377 (1.33) | | |
| # Children | -0.0071 (10.9) | | |
| # Members | 0.001 (3.90) | | |
| # Earners | 0.0009 (1.40) | | |
| Age of head | -0.00032 (6.99) | | |
| Own employ | -0.006 (4.67) | | |
| Unskilled | -0.008 (3.38) | | |
| Not active | 0.002 (1.50) | | |
| Log real ex. | 0.003 (2.28) | | -0.1018 (3.82) |
| Log real square | - - | | 0.005 (3.84) |
| Child*lrx | - - | | -0.0011 (0.895) |
| Age*lrx | - - | | 0.0002 (3.01) |
| Log P1 | -0.002 (0.44) | 0.004 (1.13) | |
| Log P2 | -0.004 (0.22) | -0.006 (0.08) | |
| Log P3 | -0.085 (1.12) | 0.041 (1.38) | |
| Log P4 | 0.063 (3.28) | 0.060 (5.96) | |
| Log P5 | -0.137 (3.65) | -0.058 (4.10) | |
| Log P6 | 0.025 (1.24) | -0.006 (0.53) | |
| R-squared | .027 | | .028 |
| F | | 7.17 | |

*Notes:*

1. Absolute t-ratios are in parenthesis.
2. F is a test of homogeneity.

Table 11: OTHER NON DURABLE GOODS.

| Variable | RANK 2 Unrestricted | RANK 2 Restricted | RANK 3 |
|---|---|---|---|
| Constant | -0.473<br>(5.36) | | |
| # Children | -0.0026<br>(1.32) | | |
| # Members | -0.009<br>(6.39) | | |
| # Earners | -0.002<br>(1.09) | | |
| Age of head | -0.0001<br>(1.30) | | |
| Own employ | -0.003<br>(0.95) | | |
| Unskilled | -0.016<br>(2.01) | | |
| Not active | -0.0069<br>(1.52) | | |
| Log real ex. | 0.058<br>(13.9) | | 0.143<br>(1.77) |
| Log real square | - - | | -0.0053<br>(1.34) |
| Child*lrx | - - | | -0.0049<br>(1.24) |
| Age*lrx | - - | | 0.0002<br>(0.71) |
| Log P1 | 0.015<br>(1.10) | -0.12 | |
| Log P2 | 0.114<br>(1.80) | 0.077 | |
| Log P3 | 0.627<br>(2.65) | -0.132 | |
| Log P4 | -0.071<br>(1.19) | -0.053 | |
| Log P5 | 0.287<br>(2.46) | -0.061 | |
| Log P6 | -0.568<br>(8.89) | -0.035 | |
| R-squared | .126 | | .129 |
| F | | 3.73 | |

*Notes:*

1. Absolute t-ratios are in parenthesis.
2. F is a test of homogeneity.

Table 12: FOOD AND NON ALCOHOLIC BEVERAGES.

| | Initial pattern | | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|---|
| Variable | Exp. | Share | △ tax | % tot. | △ tax | % tot. |
| 1 | 40,112 | 63.2 | 1,039 | 1.63 | 1,059 | 1.67 |
| 2 | 68,220 | 61.8 | 1,770 | 1.60 | 1,804 | 1.63 |
| 3 | 86,255 | 58.9 | 2,241 | 1.53 | 2,285 | 1.56 |
| 4 | 101,576 | 56.9 | 2,641 | 1.48 | 2,693 | 1.51 |
| 5 | 117,852 | 56.3 | 3,066 | 1.46 | 3,127 | 1.49 |
| 6 | 130,424 | 53.4 | 3,398 | 1.39 | 3,465 | 1.41 |
| 7 | 149,677 | 52.2 | 3,903 | 1.36 | 3,979 | 1.38 |
| 8 | 167,201 | 49.3 | 4,367 | 1.28 | 4,450 | 1.31 |
| 9 | 188,523 | 45.2 | 4,934 | 1.18 | 5,028 | 1.20 |
| 10 | 253,868 | 36.8 | 6,691 | .97 | 6,789 | .98 |
| Retired | 99,459 | 52.0 | 2,599 | 1.36 | 2,639 | 1.38 |
| 0 Child | 131,476 | 47.3 | 3,435 | 1.23 | 3,500 | 1.25 |
| 1 " | 145,099 | 48.3 | 3,788 | 1.26 | 3,862 | 1.28 |
| 2 " | 143,696 | 47.9 | 3,752 | 1.25 | 3,824 | 1.27 |
| 3 " | 160,698 | 48.3 | 4,208 | 1.26 | 4,282 | 1.28 |
| 4 " | 185,875 | 55.8 | 4,850 | 1.45 | 4,932 | 1.48 |

Notes.

1. Results in 1989 pts. per quarter.

Table 13: ALCOHOLIC BEVERAGES.

| | Initial pattern | | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|---|
| Variable | Exp. | Share | △ tax | % tot. | △ tax | % tot. |
| 1 | 1,862 | 2.93 | 25 | .04 | -45 | .07 |
| 2 | 3,014 | 2.73 | 40 | .03 | -73 | .06 |
| 3 | 4,623 | 3.15 | 62 | .04 | -112 | .07 |
| 4 | 5,446 | 3.05 | 72 | .04 | -131 | .07 |
| 5 | 7,156 | 3.42 | 96 | .04 | -172 | .08 |
| 6 | 7,995 | 3.27 | 106 | .04 | -191 | .07 |
| 7 | 9,518 | 3.32 | 128 | .04 | -227 | .07 |
| 8 | 10,536 | 3.11 | 142 | .04 | -250 | .07 |
| 9 | 12,536 | 3.00 | 173 | .04 | -295 | .07 |
| 10 | 20,309 | 2.95 | 291 | .04 | -476 | .06 |
| Retired | 5,985 | 3.13 | 82 | .04 | -144 | .07 |
| 0 Child | 8,737 | 3.14 | 121 | .04 | -207 | .07 |
| 1 " | 9,696 | 3.23 | 132 | .04 | -230 | .07 |
| 2 " | 8,893 | 2.96 | 119 | .03 | -210 | .07 |
| 3 " | 9,549 | 2.86 | 126 | .03 | -226 | .06 |
| 4 " | 5,870 | 1.76 | 74 | .02 | -138 | .04 |

Notes.

1. Results in 1989 pts. per quarter.

Table 14: CLOTHING AND FOOTWEAR.

| | Initial pattern | | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|---|
| Variable | Exp. | Share | △ tax | % tot. | △ tax | % tot. |
| 1 | 6,293 | 9.9 | 98 | .15 | -134 | .21 |
| 2 | 15,216 | 13.7 | 236 | .21 | -338 | .30 |
| 3 | 22,374 | 15.2 | 347 | .23 | -502 | .34 |
| 4 | 30,911 | 17.3 | 480 | .26 | -700 | .39 |
| 5 | 36,407 | 17.4 | 565 | .27 | -825 | .39 |
| 6 | 50,781 | 20.7 | 789 | .32 | -1,165 | .47 |
| 7 | 61,314 | 21.3 | 952 | .33 | -1,409 | .49 |
| 8 | 82,765 | 24.4 | 1,285 | .37 | -1,917 | .56 |
| 9 | 108,632 | 26.0 | 1,688 | .40 | -2,522 | .60 |
| 10 | 186,146 | 27.0 | 2,890 | .42 | -4,317 | .62 |
| Retired | 31,188 | 16.3 | 486 | .25 | -700 | .36 |
| 0 Child | 63,510 | 22.8 | 983 | .35 | -1,463 | .52 |
| 1 " | 73,794 | 24.5 | 1,145 | .38 | -1,709 | .56 |
| 2 " | 75,047 | 25.0 | 1,168 | .38 | -1,739 | .58 |
| 3 " | 68,838 | 20.6 | 1,074 | .32 | -1,575 | .47 |
| 4 " | 73,446 | 22.0 | 1,152 | .34 | -1,693 | .50 |

Notes.

1. Results in 1989 pts. per quarter.

Table 15: FUEL FOR DOMESTIC USE.

| | Initial pattern | | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|---|
| Variable | Exp. | Share | $\Delta$ tax | % tot. | $\Delta$ tax | % tot. |
| 1 | 6,404 | 10.9 | 120 | .19 | -138 | .21 |
| 2 | 8,394 | 7.6 | 168 | .14 | -175 | .15 |
| 3 | 9,418 | 6.4 | 188 | .12 | -191 | .13 |
| 4 | 10,665 | 5.9 | 214 | .12 | -215 | .10 |
| 5 | 11,343 | 5.4 | 231 | .11 | -225 | .10 |
| 6 | 12,432 | 5.0 | 254 | .10 | -244 | .10 |
| 7 | 12,606 | 4.3 | 264 | .09 | -240 | .08 |
| 8 | 13,760 | 4.0 | 290 | .08 | -258 | .07 |
| 9 | 15,847 | 3.8 | 333 | .05 | -294 | .07 |
| 10 | 18,389 | 2.6 | 403 | .10 | -302 | .04 |
| Retired | 10,338 | 5.4 | 209 | .09 | -205 | .10 |
| 0 Child | 12,073 | 4.3 | 251 | .09 | -230 | .08 |
| 1 " | 13,165 | 4.3 | 271 | .08 | -252 | .08 |
| 2 " | 12,370 | 4.1 | 257 | .07 | -233 | .07 |
| 3 " | 11,978 | 3.5 | 255 | .07 | -214 | .06 |
| 4 " | 12,305 | 3.7 | 264 | .07 | -219 | .06 |

Notes.

1. Results in 1989 pts. per quarter.

Table 16: HOUSEHOLD NON DURABLE GOODS.

| | Initial pattern | | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|---|
| **Variable** | **Exp.** | **Share** | **△ tax** | **% tot.** | **△ tax** | **% tot.** |
| 1 | 2,738 | 4.31 | 49 | .07 | -73 | .11 |
| 2 | 4,143 | 3.75 | 74 | .06 | -112 | .10 |
| 3 | 5,865 | 4.00 | 101 | .06 | -162 | .11 |
| 4 | 8,789 | 4.92 | 146 | .08 | -241 | .13 |
| 5 | 9,143 | 4.37 | 151 | .07 | -256 | .12 |
| 6 | 9,055 | 3.70 | 148 | .06 | -259 | .10 |
| 7 | 10,732 | 3.74 | 173 | .06 | -308 | .10 |
| 8 | 13,765 | 4.06 | 218 | .06 | -396 | .11 |
| 9 | 19,326 | 4.63 | 300 | .07 | -544 | .13 |
| 10 | 34,371 | 4.99 | 514 | .07 | -962 | .13 |
| Retired | 8,139 | 4.26 | 135 | .07 | -226 | .11 |
| 0 Child | 10,654 | 3.83 | 172 | .06 | -304 | .10 |
| 1 " | 12,663 | 4.21 | 199 | .06 | -360 | .12 |
| 2 " | 15,779 | 5.26 | 243 | .08 | -437 | .14 |
| 3 " | 22,270 | 6.68 | 338 | .10 | -604 | .18 |
| 4 " | 15,413 | 4.63 | 230 | .06 | -438 | .13 |

Notes.

1. Results in 1989 pts. per quarter.

Table 17: PUBLIC TRANSPORT.

| | Initial pattern | | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|---|
| **Variable** | **Exp.** | **Share** | **△ tax** | **% tot.** | **△ tax** | **% tot.** |
| 1 | 863 | 1.36 | 40 | .06 | 18 | .02 |
| 2 | 2,246 | 2.03 | 89 | .08 | 48 | .04 |
| 3 | 3,686 | 2.51 | 135 | .09 | 79 | .05 |
| 4 | 3,494 | 1.95 | 138 | .07 | 72 | .04 |
| 5 | 4,599 | 2.19 | 174 | .08 | 97 | .04 |
| 6 | 5,821 | 2.38 | 214 | .08 | 117 | .04 |
| 7 | 4,666 | 1.62 | 194 | .06 | 81 | .02 |
| 8 | 5,948 | 1.75 | 238 | .07 | 104 | .03 |
| 9 | 9,708 | 2.32 | 352 | .08 | 187 | .04 |
| 10 | 14,369 | 2.08 | 526 | .07 | 261 | .03 |
| Retired | 3,397 | 1.77 | 135 | .07 | 65 | .03 |
| 0 Child | 7,231 | 2.60 | 255 | .09 | 143 | .05 |
| 1 " | 6,021 | 2.00 | 231 | .07 | 112 | .03 |
| 2 " | 4,373 | 1.45 | 189 | .06 | 81 | .02 |
| 3 " | 5,336 | 1.60 | 223 | .06 | 95 | .02 |
| 4 " | 4,558 | 1.37 | 206 | .06 | 86 | .02 |

Notes.

1. Results in 1989 pts. per quarter.

Table 18: OTHER NON DURABLE GOODS.

| | Initial pattern | | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|---|
| **Variable** | **Exp.** | **Share** | **$\Delta$ tax** | **% tot.** | **$\Delta$ tax** | **% tot.** |
| 1 | 5,139 | 8.10 | 52 | .08 | -137 | .21 |
| 2 | 9,055 | 8.21 | 89 | .08 | -245 | .22 |
| 3 | 14,182 | 9.68 | 151 | .10 | -378 | .25 |
| 4 | 17,427 | 9.77 | 190 | .10 | -461 | .25 |
| 5 | 22,597 | 10.80 | 255 | .12 | -595 | .28 |
| 6 | 27,698 | 11.34 | 324 | .13 | -722 | .29 |
| 7 | 38,128 | 13.30 | 472 | .16 | -983 | .34 |
| 8 | 44,712 | 13.20 | 555 | .16 | -1,149 | .33 |
| 9 | 62,097 | 14.90 | 808 | .19 | -1,580 | .37 |
| 10 | 160,665 | 23.34 | 2,287 | .33 | -4,086 | .58 |
| Retired | 32,518 | 17.02 | 421 | .22 | -831 | .43 |
| 0 Child | 44,210 | 15.90 | 574 | .20 | -1,127 | .40 |
| 1 " | 39,743 | 13.23 | 502 | .16 | -1,020 | .33 |
| 2 " | 39,747 | 13.25 | 509 | .17 | -1,018 | .33 |
| 3 " | 53,937 | 16.20 | 720 | .21 | -1,375 | .41 |
| 4 " | 35,061 | 10.54 | 426 | .12 | -914 | .27 |

Notes.

1. Results in 1989 pts. per quarter.

Table 19: WELFARE RESULTS.

| | Initial pattern | REFORM 1 | | REFORM 2 | |
|---|---|---|---|---|---|
| **Decile** | **Expenditure** | **E. G.** | **% tot.** | **E. G.** | **% tot.** |
| 1 | 63,413 | -2,204 | 3.47 | -1,966 | 3.10 |
| 2 | 110,291 | -3,786 | 3.47 | -3,301 | 2.99 |
| 3 | 146,406 | -4,997 | 3.43 | -4,308 | 2.94 |
| 4 | 178,310 | -6,051 | 3.41 | -5,155 | 2.89 |
| 5 | 209,101 | -7,076 | 3.39 | -5,998 | 2.86 |
| 6 | 244,210 | -8,236 | 3.38 | -6,932 | 2.83 |
| 7 | 286,644 | -9,628 | 3.37 | -8,035 | 2.80 |
| 8 | 338,690 | -11,320 | 3.35 | -9,357 | 2.76 |
| 9 | 416,672 | -13,834 | 3.34 | -11,259 | 2.70 |
| 10 | 688,119 | -22,375 | 3.32 | -17,369 | 2.52 |
| Retired | 191,028 | -6,378 | 3.25 | -5,244 | 2.74 |
| 0 Child | 277,894 | -9,247 | 3.33 | -7,595 | 2.73 |
| 1 " | 300,185 | -10,046 | 3.32 | -8,328 | 2.77 |
| 2 " | 299,909 | -10,011 | 3.34 | -8,205 | 2.73 |
| 3 " | 332,897 | -11,115 | 3.33 | -9,177 | 2.75 |
| 4 " | 332,530 | -11,250 | 3.38 | -9,394 | 2.82 |

Notes.

1. Results in 1989 pts. per quarter.

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