Redistributive effects of changes in indirect taxation[1]

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Abstract

The aim of the paper is to outline the methodological solution adopted in modelling the effects of changes in indirect taxation on household expenditure in Italy. More specifically, an analysis is carried out on the results of the application of a preliminary version of the model with a focus on the evaluation of the effect of the tax reforms introduced in 2011 to support the consolidation process of public accounts. Finally, the effects on household expenditure deriving from the increase of the standard value added tax (VAT) rate (from 20% to 21%) and of fuel excise duties are discussed.

Keywords: Value added tax, fuel excise duties, household expenditure.

JEL Code: H20, H22, H23

1. Introduction

In the last decades, microsimulation models have been extensively used in evaluating the redistributive effects of public policies, due to the gain in terms of accuracy of the analysis offered by models which consider explicitly heterogeneity of the agents.

This paper presents the microsimulation model developed in Istat with the aim of analysing effects of changes in indirect taxation on the households expenditure in Italy. According to the taxonomy proposed in Bourguignon and Spadaro (2006) the model is an *arithmetical* one, since it ignores any behavioural reaction by households to a change in indirect taxation.

The paper is organized as follows. Microdata used to build the model and the underlying assumptions are outlined in paragraph 2, where the equations that specify the model are also introduced. In paragraph 3, the results of the application of a preliminary version of the model for the evaluation of the effect of the tax reforms introduced in 2011 are discussed. Moreover, the analysis investigates the change in the composition of households expenditure over the period 1997-2011, by VAT rates and quintile expenditure groups. Paragraph 4 concludes by sketching out the directions for the future development of the model.

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2. Building the model: data and hypothesis

To derive microdata input for simulation we use the dataset of the Household Budget Survey (HBS) by Istat. The HBS, in fact, provides information on household expenditures for consumption (good and services), including own final consumption data, goods and services provided directly to workers by employers, imputed rental costs from owner-occupied houses and free rental cost houses. Since 1997, when the survey design was completely renewed, the Italian HBS has been providing time series data on yearly basis[4].

Specifically, in 2011 the survey involved 28,000 households having residence in Italy representative of a total of 25,165,002 households with an average monthly expenditure equal to 2,487.91 euros. The collected information has been organized in a data set containing, at the individual level, the main socio-demographic characteristics of households and their consumption expenditures referred to 277 aggregates of products.

The aim of estimating the effects of changes in indirect taxation on households budget, requires, as a preliminary step, to link each single expenditure to the appropriate VAT rate[5] and, for fuels, to the excise duty.

The link between HBS aggregate expenditures and fiscal parameters is carried out by using the information collected by Consumer price index survey for the calculation of the Harmonized Index of Consumer Price at Constant Tax. The HICP-CT is a satellite index of the headline inflation indicator calculated by ISTAT according to the European Union regulations in force and which is used to estimate the development of consumer prices on a comparable basis at EU level[6]. Precisely, the HICP-CT is defined as an index where tax rates are kept constant so that, in the event of a tax rate change, the difference between the current HICP-CT and HICP would measure the effect of the tax rate change on final prices, under the hypothesis that any rise (decline) in tax rates is completely and suddenly passed on as a price increase (decrease). For the compilation of the Italian HICP-CT, the tax rates levied on more than 600 products included in the basket of the HICP are monthly monitored, together with the excise duties on fuels and tobacco products.

To associate each HBS expenditure aggregate with the appropriate tax rate (or tax rates), all the items in the HICP basket are grouped according to the HBS classification structure. As a result, the following two possible cases occur:

1) One or more products in the HICP basket, charged with the same VAT rate, are associated to a single HBS aggregate;
2) More than one product in the HICP basket, charged with different VAT rates, are associated to a single HBS aggregate;

Generally, the products classified in a single HBS aggregate are all subjected to the same (standard or reduced) tax rate, they are all exempted or are out of the scope of VAT

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[4] From 2005 the survey has included a new variable that allows to classify households as poor or not poor according to the definition of absolute poverty.

[5] In Italy, the Value added tax is split in three rates. In 2011 the tax rates were 4%; 10% and 20%. In September of the same year, the standard rate was increased to 21% . More recently (October 2013) another increase pushed the standard rate to 22%. However, it should be noted that certain goods and services are exempt from VAT (for example, postal services, medical care, insurance). For these cases, the VAT tax rate is considered to be equal to 0.

[6] More details on HICP-CT and more generally on the Consumer price indices survey can be found in (Istat 2013a).

(as for imputed rents). However, in a number of cases, the link is "one to many": it is, in fact, possible that different VAT rates are levied on the prices of different products included in the same HBS aggregate expenditure. This is the case, for example, of fresh and UHT milk, whose final prices include respectively 4% and 10% VAT rates or, to make another example, the case of TV and Pay-TV subscriptions which include in turn 4% and 21% VAT rates (22%, after 1st October 2013).

While in the first case it is possible to link unambiguously the appropriate tax rate to HBS aggregates, in the second one the relative weight of different tax rates linked to the same aggregate have to be estimated[7]. Or equivalently, a weighted average tax rate has to be calculated. It is easy to show that the weight of each tax rates should be proportional to the ratio of the corresponding tax base on the total. Formally, let x_i be the expenditure for the i-th aggregate of products. For the sake of simplicity (but the argument can be extended to the general case) let us assume that only two products are included in aggregate i whose prices are charged with two different VAT rates. That is:

$$x_i = x_{i,1} + x_{i,2} = \tilde{x}_{i,1} \cdot (1 + \alpha_1) + \tilde{x}_{i,2} \cdot (1 + \alpha_2)$$

where the tilde is used to denote the tax base and α_1 and α_2 are the two VAT rates. In this case, it is possible to express x_i as follows:

$$x_i = \tilde{x}_i \cdot (1 + \bar{\alpha}_i)$$

where:

$$\tilde{x}_i = \tilde{x}_{i,1} + \tilde{x}_{i,2}$$

and

$$\bar{\alpha}_i = \frac{\tilde{x}_{i,1}}{\tilde{x}_i} \cdot \alpha_1 + \frac{\tilde{x}_{i,2}}{\tilde{x}_i} \cdot \alpha_2 = w_{i,1} \cdot \alpha_1 + w_{i,2} \cdot \alpha_2$$

According to the last expression, in order to calculate the weighting coefficients for VAT rates, the corresponding tax bases have to be determined. To this aim, we exploit the consumption expenditure estimates used within the HICP framework for the computation of the weights assigned to the products in the basket of the index. It should be noted that these consumption estimates refer to the whole population. Therefore, their use in the microsimulation model introduces the implicit assumption that, within the HBS expenditure aggregates, the ratio of tax bases is constant across households.

A second issue addressed by the model concerns the monetary effects of a change of the excises on fuels. Since these are per unit taxes, to estimate such effects, households expenditure for fuels need to be decomposed into price and quantity components. To this

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[7] Moreover, since a limited number of HBS aggregate expenditures are not included in the domain of the HICP (such as life insurance or major repairs connected with dwelling) the corresponding VAT rates are defined using other sources of information.

aim, data concerning average prices of unleaded petrol, Diesel oil and liquefied petroleum gas (GPL), released by the Italian association of petroleum companies (Unione Petrolifera) are used.

3. Modelling the effect of indirect tax changes

This section introduces the equations used to estimate the effect of the indirect taxation change on households' expenditures. The literature on microsimulation models distinguishes two different approaches according to (on the basis of) their underlying hypotheses about the behaviour of economic agents. In *behavioural* models, agents are assumed to modify their decisions when the variables defining their economic environment change. In this approach, households are supposed to adjust their consumption pattern in response to a change in indirect taxation. At the opposite, in the *arithmetical* approach, reactions by households are ruled out of the model[8]. This is also the approach adopted by the module of Istat microsimulation model dealing with indirect taxation. More precisely, the equations of the model are based on two main hypothesis, which may be both considered a consequence of the assumption of rigid consumers demand (zero elasticity of substitution):

1) the quantities purchased by households remain constant when tax rates are changed;
2) any change in indirect taxation is completely passed on final prices.

In what follows, we will address the VAT case first and then present the formula for the evaluation of the impact of changes in the excises on fuels.

Let α_j^0 and α_j^1 be the VAT rates in force in period 0 and 1 respectively, where $j = 1, \ldots, 3$ refers to the VAT rates class[9].

Since the consumption decisions of the households are supposed to be unaffected by fiscal policies, the expenditure change for the *i*-th aggregate between period 0 and 1 is then estimated as follows[10]:

$$\Delta x_i = x_i^1 - x_i^0 = \tilde{x}_i \cdot (\bar{\alpha}_i^1 - \bar{\alpha}_i^0)$$

or equivalently,

$$\Delta x_i = x_i^0 \cdot \sum_j w_{i,j} \cdot \frac{\alpha_j^1 - \alpha_j^0}{(1 + \bar{\alpha}_i^0)}$$

where, as before:

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[8] The conditions under which the arithmetical approach can be theoretically justified are discussed in Bourguignon and Spadaro (2006)

[9] That is, super-reduced rate (j=1), reduced rate (j=2), standard rate (j=3).

[10] Notably, by ignoring behavioral responses by households, the weights used to calculate the average VAT rate do not depend on the value of α_j.

$$\bar{a}_i^t = \sum_j w_{t,j} a_j^t \qquad t = 1, 2$$

and

$$w_{t,j} = \frac{x_{t,j}}{x_t}$$

It is important to note that, in this framework, the increase (decrease) of households expenditure corresponds to the rise (decline) of tax revenues:

$$\Delta x_i = \sum_j w_{t,j} \frac{x_i^0}{(1 + \bar{a}_i^0)} \cdot a_j^1 - \sum_j w_{t,j} \frac{x_i^0}{(1 + \bar{a}_i^0)} \cdot a_j^0$$

Concerning the effect of excises on fuels, let x_f^0 denote the expenditure for fuel f in period 0 and p_f^0 the corresponding gross price. p_f^0 is given by:

$$p_f^0 = \left(\mathring{p}_f^0 + e_f^0 \right) \cdot (1 + a_f^0)$$

where $\mathring{p}_f^0$ is the net price, e_f^0 and α_f^0 are respectively the excise and VAT rate.

Accordingly, the expenditure change between period 0 and 1 can be expressed as follows:

$$\Delta x_f = \left(\frac{p_f^1}{p_f^0} - 1 \right) \cdot x_f^0$$

with p_f^1 given by:

$$p_f^1 = \left(\frac{p_f^0}{1 + a_f^0} + \Delta e_f \right) \cdot (1 + a_f^1)$$

In the next section, we discuss the result of the simulation carried out on a preliminary version of the model to estimate the effect of the increase of the standard value added tax rate and the changes of the fuel excise duties that have been recently introduced in Italy[11].

4. Microsimulation results

Microsimulation analysis has been focused on the quantitative assessment of the impacts on household expenditure of some indirect tax reforms that have come into force

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[11] The architecture of the model has been developed in Stata environment by Corrado Pollastri and Alessandro Brunetti.

during 2011. In detail, analysis has focused on the increase of the standard VAT rate that has come into force on September 2011 modifying the standard rate from 20% to 21%, and on the increase in some excise duties on motor fuel as specified in Table 1.

Table 1 – Main Indirect Tax Reforms. 2011-2012

Indirect tax	reform
VAT	standard rate increase from 20% to 21%
Excise duty on petrol	excise rate increase from EUR 564.00 to 728.40 on 1000 liters
Excise duty on heavy fuel oil	excise rate increase from EUR 423.00 to 617.40 on 1000 liters
Excise duty on LPG	excise rate increase from EUR 125.27 to 147.27 on 1000 liters

The impact on household expenditure has been estimated ranking households according to their equivalised expenditure[12]. Moreover, households have been divided into five groups of equal size. The bottom quintile group represents households with the lowest amount of expenditure while the top quintile represents households with the highest amount of expenditure. As specified above, estimates are made under the assumption of constant pre-tax prices and constant quantity of goods purchased. Thus, the tax increase is completely passed forward to consumers[13].

In detail, Figure 1 shows the total impact of the tax rise due to the various reforms. The bottom quintile group of households pays less in tax rise as a percentage of their total expenditure than the top quintile group (respectively 0.78% and 0.86%). As to the other three quintile groups, under the stated assumption of constant quantities, the increases in expenditure (from 0.88 to 0.92) are higher than the increase bearing on the top quintile group. However, if we disaggregate the total expenditure increase in the two components due to the VAT rise and the excise duty rise, results show a different distribution among quintile groups. In detail, looking at the increase of the excise duties, the tax incidence on the household expenditure is higher for the bottom quintile group than the top group (respectively 0.53 and 0.48%). As to the other groups they all bear an equal increase in total expenditure (0.60%) which is as well higher than the increase of the top group. Thus the excise duty increase is slightly regressive as it hits the poorest harder.

With regard to the incidence of the VAT standard rate, results show that incidence increases for higher level of total expenditure. The percentage increases in total expenditure range from 0.25 of the bottom group to 0.38 of the top group. Thus estimates indicate a progressive path for the five quintile groups, since the VAT increase has affected goods that are bought in a lower proportion by poorest households compared to the richer groups. In fact, the VAT increase does not affect the reduced rates which are applied to goods (such as

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[12] Equalisation is used in order to adjust expenditure according to differences in household size. The equivalence scale used is the Carbonaro scale (1985).

[13] Recent studies on the price impact of tax reforms on consumption (Carbonnier, 2007) show that the tax increase could be partially absorbed by producers. Results of our estimates about the impact on different groups of household would be confirmed if the producer behaviour were equal among household groups.

food, housing, health and education) consumed in a higher proportion by poorest households (see Table 2).

Figure 1 – Incidence on total expenditure of increases in the standard VAT rate from 20 to 21 per cent and excise duties: by equivalised household expenditure groups in 2011
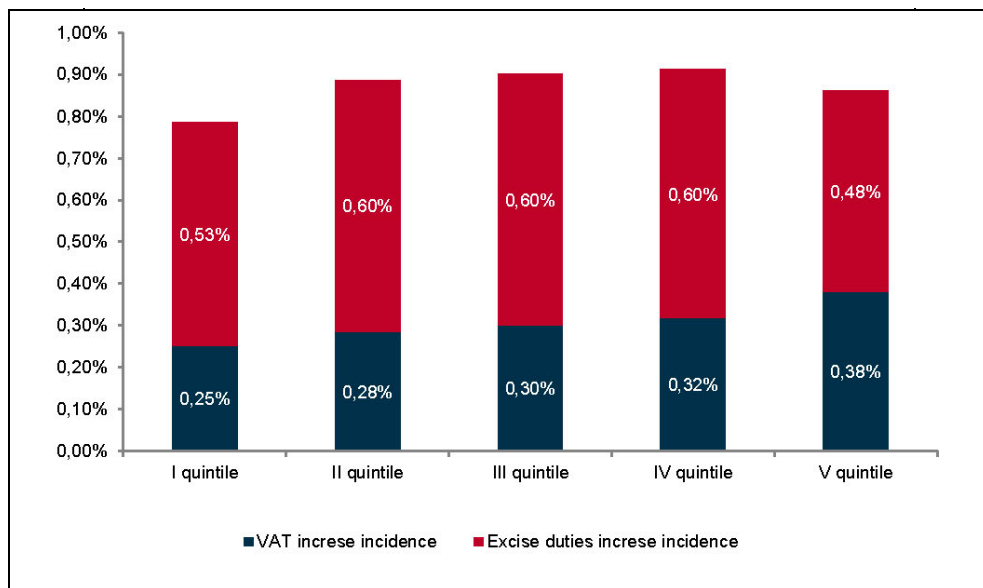
Source: **Household Budget Survey, estimates - Istat**

On the contrary, as shown in Table 2, the increase of the excise duties on fuels affects goods that are bought in a higher proportion by the bottom quintile group with respect to the top quintile. This causes the higher incidence on total expenditure for the bottom group, showing a regressive impact of this part of the tax reform.

Nevertheless, increases in VAT rates can also be regressive if we take into account the changing spending patterns of poorest households during the last years. To this effect, analysis has investigated the changing proportion of household expenditure on standard VAT rate items and reduced VAT items by household groups during the period from 1997 to 2011. Specifically, it has been calculated the percentage deviation between the proportion of household expenditure on different VAT rate of the bottom quintile group of households with respect to the top group.

With reference to standard VAT rate items, during the considered period Figure 2 shows a converging path among the two household groups, that is the value of the percentage deviation decreases. Analysis shows also a decrease in the percentage deviation related to the reduced VAT rate (4%) items. Actually, in the past poorest households were used to allocate a high proportion of their expenditure on these items, but nowadays this proportion is lower. As to those VAT-exempt items and as well as for 10 per cent reduced VAT rate

items, during the examined period the percentage deviation value between the bottom and the top quintile groups is always quite small.

Table 2 – Proportion of household expenditure on different VAT rate items and on total excise duty items: by equalised household expenditure groups in 2011

Expenditure quintile groups	VAT 4%	VAT 10%	VAT 21%	VAT-exempt	Imputed house rental costs	Total	share of fuels on total expenditure
I quintile	12.3	25.9	26.6	13.9	21.3	100.0	5.4
II quintile	10.8	24.4	29.9	11.2	23.7	100.0	5.6
III quintile	9.8	24.5	31.3	10.2	24.3	100.0	5.4
IV quintile	9.0	24.6	32.9	10.9	22.7	100.0	5.1
V quintile	6.7	25.2	39.4	10.8	17.9	100.0	3.8
Total households	8.8	24.9	34.0	11.0	21.2	100.0	4.8

Figure 2 – Percentage deviations between the bottom and the top quintile groups' expenditure proportions on different VAT taxed items – years 1997-2011
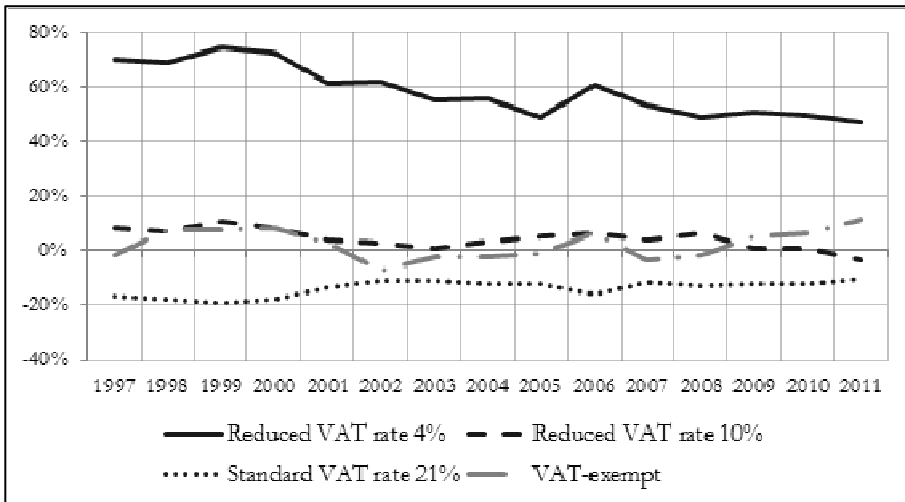
In conclusion, analysis has shown that due to these changing spending patterns the Italian VAT rate structure seems to be less able to protect poorest households by assuring a progressive or neutral impact of these tax reforms.

5. Conclusions and further research

Results from this microsimulation study highlight the potentials of this analytical tool

drawing also the attention on future research needs. In particular, analysis is built on two main assumptions: the first assumes that the quantity of a good purchased remains constant after a change in taxes on expenditure and the second assumes that the pre-tax price remains the same, that is the full effect of a tax increase is passed on to the consumer. Removing these assumptions, research could investigate how tax changes affect price in different markets referring also to studies on purchase price dynamics and developing behavioral models for determining consumer reactions to changes in taxes on expenditure and thus in retail prices. In such a way this tool of analysis could be used to assess the impacts of public policies in specific markets or policies to guide consumer expenditure.

Moreover, the measurement of tax returns from changes in sales taxes requires the development of behavioral models for the economic agents that take also into account tax evasion and are linked with macro data from the national accounts.

Finally, changes in indirect taxes do not directly affect household incomes but they affect the amount of consumption and consequently they can affect the general level of economic welfare of the household. However, a better assessment of the distributional impacts of tax reforms requires the measurement of the impacts both on household expenditure and income. To this effect it would be important to integrate in a comprehensive database detailed survey information on household expenditure and on household disposable income.

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