

**PLUTOCRATIC AND DEMOCRATIC CONSUMER PRICE INDEXES:
AN ESTIMATION OF A DEMOCRATIC INDEX FOR ITALY 1995-2005***

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* We thank P. Ercolani for helpful discussion and comments. All errors are ours.

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ABSTRACT

The consumer price indexes for the entire country and those for individual households are weighted arithmetic averages of relative prices, and they differ essentially in terms of their weighting systems. Whereas the former use the proportions of total expenditure on goods and services, the latter use the proportions of expenditure by each household. In the usual calculation of the index for the entire country, each household contributes to determining the national index with a weight proportional to its expenditure. In other words, the households that spend more – that is, the wealthier ones – are represented in calculation of the national index to a greater extent, and this explains why the latter is termed the ‘plutocratic index’. In contraposition to plutocratic indexes are the ‘democratic’ ones in which the same weight is assigned to each household.

The paper presents a first estimation of the democratic price indexes for Italy in the period 1995-2002. The results show significant differences between the two calculation methods.

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1. Introduction¹

When a national consumer price index is used, the shopping basket to be priced corresponds to the total purchases of each good or service by all the consumers present in the country.

But it is also possible to refer the shopping basket purchased to a particular section of the population. One can think, for example, of a regional price index or a price index for the elderly, for the poor, and so on².

In theory, a consumer price index can also be constructed for a household. Every household, in fact, has its own spending pattern on which price variations have an entirely specific impact.

Two important issues arise from reflection on price indexes for groups or for individual households. Firstly, households differ with respect to both the shopping basket of goods purchased and the prices paid, which in general may differ even for the same good. Secondly, one should inquire whether and how it is possible to relate the single national index to the plurality of indexes calculated at the level of the individual household.

The problem of aggregating household price indexes into a national price index can be more easily addressed by assuming that each household pays the same price for each of

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² See Istat (2007) for a recent research on this topic.

the goods considered. By contrast, if households pay different prices to purchase the same product, it becomes much more difficult to analyse the aggregation of household indexes. In a well-integrated economy with moderate transport costs like Italy's, the assumption that all households pay the same prices for the same goods is generally acceptable, although there are obvious exceptions: spending on healthcare and housing, for example.

Let us therefore imagine an economy in which the first of the two above hypotheses holds. In the indexes normally used by the national statistical institutes, prices are weighted in proportion to household expenditure in the index relative to the individual household, and they are weighted in proportion to aggregate expenditure in the national index. These indexes, in fact, are calculated as weighted averages of relative prices. The weights are therefore the shares of each good in total expenditure at both the household and the national level. Consequently, under the above-stated hypothesis regarding prices, the two indexes differ only in the weights used: for the national index, the weights correspond to the shares of each good in total expenditure by the country as a whole; for the family index, they correspond to the shares of each good in total expenditure by each household. Given that the national price index is a weighted average of the indexes of individual households, those of the latter that spend more obviously have a greater impact on the country's spending. Wealthier households therefore count for more in determination of the national index. This weighting is pointedly called 'plutocratic'.³

The alternative, where the contribution of each individual household corresponds to its own price index, is termed a 'democratic' price index, which must be calculated as the unweighted average of the household price indexes. In general, democratic and plutocratic price indexes seem to differ not only in their amounts but also in their dynamics. For example, an increase in the price of cigarettes impacts, consumption remaining equal, more on low-income households; and this increases the democratic index to a greater extent than it does the plutocratic index.

³ It should be borne in mind that, for various reasons, the price indexes produced by national statistical institutes are always calculated using the plutocratic method.

It should also be pointed out that, in terms of economic theory, democratic indexes are just as valid as plutocratic ones (Kokoski, 2000).

In what follows, starting from the hypothesis that households pay the same prices for the same goods, we construct the democratic price indexes for Italy in the period 1995-2002.

2. Plutocratic and democratic indexes: formal aspects

Indicating with⁴:

$$\underline{p}_t = [p_{1t} \quad \dots \quad p_{kt}]', \quad t = 0, 1; \quad (1)$$

the vector (column) of the prices of the k goods and services considered with regard to the base situation (t=0) and the reference situation (t=1), and with the same notation for the corresponding vector of quantities:

$$\underline{q}_t = [q_{1t} \quad \dots \quad q_{kt}]', \quad t = 0, 1; \quad (2)$$

we can define the Laspeyres price index⁵ as follows:

$$P_L(\underline{p}_0, \underline{p}_1, \underline{q}_0) = \frac{\underline{p}_1' \underline{q}_0}{\underline{p}_0' \underline{q}_0} = \frac{S_{10}}{S_{00}} \quad (3)$$

Moreover, as well known, this index can be written as a function of the k relative prices and of the shares of spending s_{it} defined as:

$$s_{it} = \frac{p_{it} q_{it}}{\underline{p}_t' \underline{q}_t} = \frac{p_{it} q_{it}}{S_{tt}}; \quad i = 1, \dots, k; \quad t = 0, 1. \quad (4)$$

Using (4), we can rewrite the index defined by (3) as:

$$P_L(\underline{p}_0, \underline{p}_1, \underline{q}_0) = \frac{S_{10}}{S_{00}} = \sum_{i=1}^k \frac{p_{i1}}{p_{i0}} s_{i0}. \quad (5)$$

The shopping baskets of goods and services \underline{q}_t considered thus far refer to the total quantities consumed by the H households of the country for which the price index is

⁴ The quote ' character defines the transposition operation.

⁵ To be stressed is that entirely similar relations between the various types of indexes hold for Paasche indexes as well.

calculated. Consequently, using \underline{q}_{th} to denote the shopping basket relative to the generic h-th household, we have:

$$\underline{q}_t = \sum_{h=1}^H \underline{q}_{th} \quad (6)$$

Supposing that on each occasion ($t = 0, 1$) households experience the same configuration of prices \underline{p}_t , the above expressions can be used to construct a price index for each household.

The price index for the generic h-th household is:

$$P_{Lh}(\underline{p}_0, \underline{p}_1, \underline{q}_{0h}) = \sum_{i=1}^k \frac{p_{i1}}{p_{i0}} s_{i0h} \quad h=1, \dots, H, \quad (7)$$

where $S_{00h} = \sum_{i=1}^k p_{i0} q_{i0h}$ is total spending by the h-th household in the base period, while

$s_{i0h} = p_{i0} q_{i0h} / S_{00h}$ represents to proportion of spending on the i-th good.

Both the price index (3) for the entire country and the price indexes (7) calculated for individual households are weighted arithmetic averages for the same relative prices p_{i1}/p_{i0} , and they differ only in their weighting systems. In fact, while the aggregate index (5) uses the proportions s_{i0} of total expenditure, the individual index (7) uses the proportion s_{i0h} of expenditure by the h-th household.

These two systems of weights are tied by the following relation:

$$s_{i0} = \frac{p_{i0} q_{i0}}{S_{00}} = \sum_{h=1}^H \frac{S_{00h}}{S_{00}} s_{i0h} \quad i=1, \dots, k. \quad (8)$$

Relation (8) shows that the shares of national expenditure for each good or service are the weighted averages of the shares of individual household budgets, where the weights are the proportions of expenditure by each household in national expenditure. Taking account of (5), (7) and (8), we can specify the national index in terms of the individual household indexes by means of the relation:

$$P_L(\underline{p}_0, \underline{p}_1, \underline{q}_0) = \sum_{h=1}^H \frac{S_{00h}}{S_{00}} P_{Lh}(\underline{p}_0, \underline{p}_1, \underline{q}_{0h}). \quad (9)$$

It is evident from (9) that each household contributes to determination of the national index with a weight proportional to its expenditure; and this justifies, as said, the definition of the plutocratic index. Contraposed to plutocratic indexes are the ‘democratic’ indexes in which the same weight is assigned to each household. Hence the democratic index opposable to the plutocratic index (9) is:

$$P_L^*(\underline{p}_0, \underline{p}_1, \underline{q}_0) = \frac{1}{H} \sum_{h=1}^H P_{Lh}(\underline{p}_0, \underline{p}_1, \underline{q}_{0h}). \quad (10)$$

On comparing (9) and (10), one may ascertain that plutocratic indexes coincide with democratic ones if:

- each household sustains the same amount of expenditure ($S_{0h} = \text{constant}$, $h=1, \dots, H$);
- the proportions of the various goods and services purchased by households are the same ($q_{i0h} = q_{i0} / H$; $i=1, \dots, k$; $h=1, \dots, H$);
- the relative price variation is the same for each good or service ($p_{i1}/p_{i0} = r_{01}$, $i=1, \dots, k$).

Vice versa, the more the actual situation differs from that described by these conditions, the greater the differences between the values assumed by the two types of index will be.

The choice of adopting a democratic or a plutocratic index is determined, not by formal considerations, but by the use that is to be made of the consumer price index.

It is preferable to choose democratic indexes when addressing welfare policy problems where each household should have the same importance. Vice versa, for the purposes of national accounting, it is preferable that the same weight be assigned to each monetary unit, so that in this case plutocratic indexes are better.

3. The democratic index: a first attempt at estimation⁶

Now described is a first attempt to calculate democratic indexes using Istat data on household consumption and regional economic accounts. The calculation was based on the

⁶ For further details, see the Appendix.

hypothesis that households are homogeneous within 44 groups created on the basis of territorial districts (4 classes) and household type (11 classes). These indexes are reported in the first section of Table 1. In order to calculate the democratic indexes of the four geographic areas considered, we aggregated the indexes of each row in this section with a weight equal to the frequency of households in the various types (second section of Table 1). In other words, assuming that all households in the same group experienced exactly the same value of the price index, the latter contributed to determination of the national index with a weight proportional to the numerical size of the group. This determined the democraticness of the index calculated, which was no longer based on the group's total expenditure, as in plutocratic indexes, but on its numerical size.

Comparison between these two indexes (Table 2) clearly shows that the plutocratic index always assumes values lower than those of the democratic index. Consequently, compared with the latter, it tends to furnish a more attenuated picture of inflation for both the four geographic areas and the country as a whole. The difference between the values of the plutocratic and democratic price indexes is known as the 'plutocratic bias', and it can be interpreted as a synthetic index expressing the extent to which price rises differentially affect households. One deduces from the data that the plutocratic bias is just under one half percentage points for Italy as a whole and

Table 1 – Consumer price indexes and number of households by geographic area and household type, 1995-2002.

Democratic consumer price indexes by type of household, 1995-2002.

TERRITORIAL DISTRICTS	HZ TYPE										
	Single person aged under 35	Single person aged 35-64	Single person aged over 65	Childless couple with householder aged under 35	Childless couple with householder aged 35-64	Childless couple with householder aged over 65	Couple with 1 child	Couple with 2 children	Couple with 3 or more children	Single parent	Other
CONSUMER PRICE INDEXES (1995=1)											
NORTH-WEST	1.271	1.266	1.293	1.247	1.269	1.278	1.256	1.248	1.247	1.259	1.252
NORTH EAST.	1.245	1.239	1.254	1.232	1.239	1.24	1.228	1.223	1.221	1.228	1.228
CENTRE	1.263	1.247	1.264	1.246	1.244	1.251	1.23	1.23	1.225	1.232	1.232
SOUTH.	1.201	1.188	1.183	1.195	1.186	1.183	1.184	1.183	1.181	1.182	1.182
NUMBER OF HOUSEHOLDS											
NORD-WEST	200,231	689,685	1,001,156	155,735	533,950	667,438	1,290,379	934,413	155,735	489,454	266,975
NORD-EAST.	111,240	378,215	622,942	133,488	355,967	444,958	845,421	667,438	133,488	289,223	311,471
CENTRE	133,488	422,710	578,446	88,992	266,975	489,454	778,677	756,429	133,488	311,471	378,215
SOUTH.	133,488	444,958	978,908	111,240	378,215	689,685	1,179,140	1,757,585	667,438	578,446	333,719
ITALY	578,446	1,935,569	3,181,452	489,454	1,535,106	2,291,535	4,093,617	4,115,865	1,090,148	1,668,594	1,290,379
DEMOCRATIC CONSUMER PRICES INDEXES (1995=1)											
ITALY	1.248	1.239	1.246	1.231	1.237	1.236	1.224	1.213	1.201	1.222	1.222
Δ% WITH RESPECT TO NAT. DEMOC. CPI	1.998	1.098	1.798	0.298	0.898	0.798	-0.402	-1.502	-2.702	-0.602	-0.602

Table 2 – Democratic and plutocratic consumer price indexes, 1995-2002

GEOGRAPHIC AREA	CONSUMER PRICE INDEXES (1995=1)		
	Democratic indexes (a)	Plutocratic indexes (b)	[(a)-(b)]%
NORD-WEST	1.265	1.236	2.889
NORTH-EAST	1.234	1.217	1.757
CENTRE	1.241	1.220	2.085
SOUTH	1.184	1.183	0.101
ITALIA	1.228	1.214	1.441

peaks at around 3 points for the North-West.

To provide more detail, it is possible to disaggregate the national democratic index by the various household types. In this case, too, the results seem to reflect an opinion widely held by the public but which to date has been merely a perception: namely that price increases impact to different extents on spending by the distinct household types. In particular, the bottom row of Table 1 shows values consistently above the average for single-person households, while the values for households with two or more children are below the national average.

4. Conclusions

The consumer price indexes for the entire country and those for individual households are weighted arithmetic averages of relative prices, and they differ essentially in terms of their weighting systems. Whereas the former use the proportions of total expenditure on goods and services, the latter use the proportions of expenditure by each household. In the usual calculation of the index for the entire country, each household contributes to determining the national index with a weight proportional to its expenditure. In other words, the households that spend more – that is, the wealthier ones – are represented in calculation of the national index to a greater extent, and this explains why the latter is termed the ‘plutocratic index’. In

contraposition to plutocratic indexes are the ‘democratic’ ones in which the same weight is assigned to each household.

The paper has presented a first estimation of the democratic price indexes for Italy in the period 1995-2002. The results are extremely interesting, in that they highlight significant differences between the two calculation methods.

Considering the importance of the topic addressed, these preliminary findings on the one hand induce the authors to recommend that Istat should conduct targeted surveys on the matter, and on the other, to continue with more detailed inquiry.

Appendix

A1. Paasche democratic index .

Using the notation followed in the text, the Paasche plutocratic index (P_P) is defined as follows:

$$P_P(\underline{p}_0, \underline{p}_1, \underline{q}_1) = \frac{\sum_{i=1}^k p_{i1} q_{i1}}{\sum_{i=1}^k p_{i0} q_{i1}} = \frac{S_{11}}{S_{01}} = \sum_{i=1}^k \frac{p_{i1}}{p_{i0}} s_{i01} \quad (\text{a.1})$$

where $s_{i01} = \frac{p_{i0} q_{i1}}{S_{01}}$ is the proportion of spending on the i -th good, valued at base

period prices while the quantities relate to the reference period.

Supposing that on every occasion ($t = 0, 1$) families experience the same configuration of prices \underline{p}_t , for the generic h -th family, the Paasche price index is:

$$P_{Ph}(\underline{p}_0, \underline{p}_1, \underline{q}_{1h}) = \sum_{i=1}^k \frac{p_{i1}}{p_{i0}} s_{i01h}, \quad h=1, \dots, H, \quad (\text{a.2})$$

Where $s_{i01h} = p_{i0} q_{i1h} / \sum_{i=1}^k p_{i0} q_{i1h} = \frac{p_{i0} q_{i1h}}{S_{01h}}$ represents the proportion of spending

for the i -th good sustained by the h -th family, at the base period prices.

Taking account that the weights that appear in (a.1) and (a.2) are tied by the relationship:

$$s_{i01} = \frac{p_{i0}q_{i1}}{S_{01}} = \sum_{h=1}^H \frac{S_{01h}}{S_{01}} s_{i01h} \quad i = 1, \dots, k, \quad (\text{a.3})$$

we can express the national index (a.1) in terms of the single family indexes (a.2) through the expression:

$$P_P(\underline{p}_0, \underline{p}_1, \underline{q}_1) = \sum_{h=1}^H P_{Ph}(\underline{p}_0, \underline{p}_1, \underline{q}_{1h}) \frac{S_{01h}}{S_{01}} \quad (\text{a.4})$$

To obtain the Paasche democratic index (P^*_p) we assign the same weight to each family:

$$P^*_P(\underline{p}_0, \underline{p}_1, \underline{q}_1) = \frac{1}{H} \sum_{h=1}^H P_{Ph}(\underline{p}_0, \underline{p}_1, \underline{q}_{1h}). \quad (\text{a.5})$$

A2. Procedure followed in the empirical application.

As already said in the main text, the two sources of data used are derived from the Regional Economic Accounts (Istat, 2004a) and the Household Expenditure Survey (Istat, 2004b) conducted by Istat.

To obtain comparable data⁷, the spending items (Regional Economic Accounts) and the consumption groups (Household Expenditure Survey) have been aggregated into the following 10 items (denoted in the formulas with the subscript i):

1) Food, beverages and tobacco, 2) Clothing and footwear, 3) Housing, water, electricity, gas and other fuels, 4) Furnishing, household equipment, routine maintenance of the house, 5) Health, 6) Transport, 7) Communication, 8) Recreation and culture, 9) Education 10) Miscellaneous goods and services.

Again for comparability, we choose as geographical level of detail the following territorial districts (denoted in the formulas with the subscript r):

1) North West, 2) North East, 3) Centre and 4) South.

⁷ For further details on inconsistencies between Household Expenditure Survey and National Accounts estimates see Istat (2000).

Let:

$$2002C_{ir2002} \quad \text{and} \quad 1995C_{ir2002} \quad i=1, \dots, 10; \quad r=1, \dots, 4,$$

be the spending, from the Regional Accounts, of families resident in the r-th district to purchase the i-th category of good and services, valued, respectively, at current prices and at 1995 prices. The price indexes are calculated through the relationships:

$$1995P_{ir2002} = \frac{2002C_{ir2002}}{1995C_{ir2002}} \quad i=1, \dots, 10; \quad r=1, \dots, 4.$$

Likewise, drawn from the Household Expenditure Survey is $2002C_{irh2002}$, which expresses spending to purchase the i-th category of good and services, in the r-th district, by the h-th family type⁸, valued at current prices.

The same spending, valued at 1995 prices: $1995C_{irh2002}$, can be calculated under the hypothesis that in each district prices do not depend on the type of family considered, through the following relationship:

$$1995C_{irh2002} = \frac{2002C_{irh2002}}{1995P_{ir2002}} \quad i=1, \dots, 10; \quad r=1, \dots, 4; \quad h=1, \dots, 11.$$

From this information it is possible to obtain the price indexes by district and family type:

$$\begin{aligned} 1995P_{rh2002} &= \frac{\sum_{i=1}^{10} 2002C_{irh2002}}{\sum_{i=1}^{10} 1995C_{irh2002}} = \\ &= \frac{2002C_{\bullet rh2002}}{1995C_{\bullet rh2002}} \quad r = 1, \dots, 4; \quad h = 1, \dots, 11. \end{aligned} \quad (b.1)$$

⁸ Refer to the tables in the text for a detailed description of the 11 family items considered.

Price indexes (b.1) represent the basic components to build plutocratic or democratic type consumption price indexes for the higher levels of aggregation.

In particular, the plutocratic consumption price index for the r-th district is:

$$\begin{aligned}
 {}_{1995}P_{r2002} &= \frac{\sum_{h=1}^{11} \sum_{i=1}^{10} {}_{2002}C_{irh2002}}{\sum_{h=1}^{11} \sum_{i=1}^{10} {}_{1995}C_{irh2002}} = \frac{\sum_{h=1}^{11} {}_{2002}C_{\bullet rh2002}}{\sum_{h=1}^{11} {}_{1995}C_{\bullet rh2002}} \quad \text{and substituting (b.1):} \\
 {}_{1995}P_{r2002} &= \frac{\sum_{h=1}^{11} {}_{1995}P_{rh2002} {}_{1995}C_{\bullet rh2002}}{\sum_{h=1}^{11} {}_{1995}C_{\bullet rh2002}}. \tag{b.2}
 \end{aligned}$$

To obtain the corresponding democratic index, it is necessary to modify the weighting system of (b.2) replacing the spending on consumption by the h-th family type, resident in the r-th district, (${}_{1995}C_{\bullet rh2002}$) with the corresponding number of families (n_{rh}):

$${}_{1995}P_{r2002}^* = \frac{\sum_{h=1}^{11} {}_{1995}P_{rh2002} n_{rh}}{\sum_{h=1}^{11} n_{rh}}, \tag{b.3}$$

Likewise, the plutocratic consumption price index for the h-th family type is:

$${}_{1995}P_{h2002} = \frac{\sum_{r=1}^4 {}_{1995}P_{rh2002} {}_{1995}C_{\bullet rh2002}}{\sum_{r=1}^4 {}_{1995}C_{\bullet rh2002}} \tag{b.4}$$

while the corresponding democratic index is:

$${}_{1995}P_{h2002}^* = \frac{\sum_{r=1}^4 {}_{1995}P_{rh2002} n_{rh}}{\sum_{r=1}^4 n_{rh}} . \quad (\text{b.5})$$

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