The interpretation of the divergences between CPIs at territorial level: Evidence from Italy

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1. Introduction

Usually the National Statistical Institutes (NSIs) produce and disseminate a system of Consumer Price Indices (CPIs): a general price index (all-item index) and partial indices, which are indices by groups of commodities and expenditure classes and by geographical area, regions or cities.
CPIs computed and published at territorial level are very useful in order to evaluate consumer price evolution across different areas in the same country. They are more widely used in the countries where the indices are used for escalating incomes and salaries. Furthermore, analysis of local area CPIs can illustrate and explain the impact of local economic conditions on consumer prices and household behaviour on the process of inflation.
Considering the procedure of computation, a divergence emerging from a comparison between the CPIs referred to two areas depends on two main factors: the different evolution of the prices of the products and services (elementary indices), and the differences regarding the behaviour of consumers in their purchases, that is on the share of the expenditure devoted to the different products and services (system of weights). In order to interpret the divergences and analyse if the process of inflation is similar or different in several areas, it is important to be able to examine and decompose the divergences between the CPIs in different regions or cities so we can understand which are the most important factors that cause these divergences.
The aim of this paper is twofold. Firstly to suggest a simple method to carry out the decomposition of the divergences between two CPIs or, at least, to have an approximate measure of the importance of the factors that affect it. Secondly to present some empirical analyses by using CPIs and the elementary price indices utilized by the Italian National Statistical Institute (ISTAT) for the construction of the CPIs at level of chief regional towns. The analyses are carried out essentially to show the usefulness of the proposed decomposition measures in order to interpret the divergences between different indices.
The paper is organized in the following way. In Section 2 an improved version of the decomposition originally proposed in Biggeri and Giommi (1987) is suggested in order to analyse the divergence between CPIs calculated at different territorial level and to examine and interpret the factors that can affect local estimates of inflation. In Section 3, after a brief description of the way in which CPIs are calculated in Italy at territorial level, the data set used for the analyses is presented. In Section 4 the results of the experimental computations are illustrated and examined and the main empirical findings are reported. The concluding remarks of the paper focus on the usefulness of the method suggested to investigate the inflation processes over different territorial areas but also in order to get information on the extent of the divergences and possible further developments of the analyses are suggested.

2. The divergence between CPIs at territorial level: a method for decomposing and interpreting it

2.1 A method for the decomposition of the divergence between CPIs

For the construction of CPIs most NSIs make use of the Laspeyres type index, which is expressed at time t as a weighted arithmetic mean of the price ratios, or *price relatives*, $\frac{p_{tk}}{p_{rk}}$ for a basket of n products and services using as weights the expenditure shares on commodity or service k in the base period r, expressed by ${}_r w_k$. In formula:

$$ {}_r\mathbf{P}_t = \sum_{k=1}^{n} \frac{p_{tk}}{p_{rk}} \cdot {}_r w_k = \sum_{k=1}^{n} {}_r P_{k,t}\, {}_r w_k \qquad [1] $$

where ${}_r P_{k,t}$ are elementary price indices and $\sum_k {}_r w_k = 1$.

The divergence between two different CPIs , ${}_r\mathbf{P}_t^A$, and ${}_r\mathbf{P}_t^B$, can be written as follows:

$$ {}_r\mathbf{P}_t^A - {}_r\mathbf{P}_t^B = \sum_{k=1}^{n} {}_r P_{k,t}^A \cdot {}_r w_k^A - \sum_{k=1}^{n} {}_r P_{k,t}^B \cdot {}_r w_k^B \qquad [2] $$

As we can see from [2] the difference is influenced both by the set of the elementary price indices and the weighting system in the two areas.
Starting from Bortkiewicz's theorem it is possible to decompose the divergence between price indices associated with different systems of weights and this can be done by identifying different factors and elements (Schultz, 1997, ILO, 2004 pp.207-214).
For the purpose of this paper it seems preferable to refer to the decomposition method presented in Biggeri and Giommi (1987) and Biggeri and Leoni (2004) where the two CPIs considered shared the same set of elementary price indices (${}_r P_{k,t}^A = {}_r P_{k,t}^B \quad \forall k = 1,...n$).
In this case formula [2] becomes:

$$ {}_r\mathbf{P}_t^{A,w_A} - {}_r\mathbf{P}_t^{B,w_B} = \sum_{k=1}^{n} {}_r P_{k,t} \left({}_r w_k^A - {}_r w_k^B \right) \qquad [2bis] $$

where the divergence between the two aggregate indices depends only on the differences in the weighting system referred to A and B ("weight effect").
Formula [2bis] can be decomposed as follows:

$$ {}_r\mathbf{P}_t^{A,w_A} - {}_r\mathbf{P}_t^{B,w_B} = n \cdot s_P \cdot s_d \cdot R_{P,d} \qquad [2\ ter] $$

where $d_k = \left({}_r w_k^A - {}_r w_k^B \right)$ is the difference between the weights used for the aggregation of the same elementary price indices, s_P and s_d are the standard deviation of the elementary price indices and of the differences between weights respectively and $R_{P,d}$ is the linear coefficient between the elementary price indices and the differences in the corresponding weights.

Following the same approach it is possible to decompose [2], considering the general case when the two indices differ even in the set of the elementary indices which are referred to products with the same number and characteristics.

Consequently, by adding and subtracting $\sum_{k=1}^{n} {}_rP_{k,t}^A \cdot {}_rw_k^B$, the divergence between the two indices can be written as follows :

$$ {}_r\mathbf{P}_t^A - {}_r\mathbf{P}_t^B = \sum_k {}_rw_k^B \left({}_rP_{k,t}^A - {}_rP_{k,t}^B \right) + \sum_k {}_rP_{k,t}^A \cdot \left({}_rw_k^A - {}_rw_k^B \right) \qquad [3] $$

In equation [3], the divergence between the two aggregate indices is decomposed additively in two parts. The first sum on the right hand side of [3] can be a measure of the "elementary price index effect", while the second sum refers to the "weight effect".

The interpretation of the elementary price effect in equation [3] is straightforward : given ${}_rw_k^B$, the higher $\left({}_rP_{k,t}^A - {}_rP_{k,t}^B \right)$, the higher is ${}_r\mathbf{P}_t^A$ in respect to ${}_r\mathbf{P}_t^B$.

Obviously the importance of the "elementary price index effect" depends on the weight ${}_rw_k^B$ too and on the correlation between ${}_rw_k^B$ and $\left({}_rP_{k,t}^A - {}_rP_{k,t}^B \right)$.

Regarding the interpretation of the weight effect, it should be noted that, for a given ${}_rP_{k,t}^A$, the higher the difference $\left({}_rw_k^A - {}_rw_k^B \right)$, the higher is ${}_r\mathbf{P}_t^A$ in respect to ${}_r\mathbf{P}_t^B$. which, in turn, will tend to move the divergence between the two aggregate CPIs in the opposite direction. In conclusion, as for the elementary price effect, the magnitude of the "weight effect" depends on the correlation between ${}_rP_{k,t}^A$ and $\left({}_rw_k^A - {}_rw_k^B \right)$.

By expressing $\delta_k = \left({}_rP_{k,t}^A - {}_rP_{k,t}^B \right)$ the difference between the set of elementary price indices A and B, the decomposition [3] can be equivalently stated as :

$$ {}_r\mathbf{P}_t^A - {}_r\mathbf{P}_t^B = \left(n \cdot s_{w^B} \cdot s_\delta \cdot R_{w^B,\delta} + \overline{\delta} \right) + \left(n \cdot s_{P^A} \cdot s_d \cdot R_{P^A,d} \right) \qquad [3 \text{ bis}] $$

where referring to the "elementary price index effect" the linear coefficient between the weighting system ${}_rw_k^B$ and the difference δ_k is expressed by $R_{w^B,\delta} = \sum_{k=1}^{n} \left({}_rw_k^B - {}_r\overline{w}_k^B \right) \cdot \left(\delta_k - \overline{\delta} \right) \Big/ n \cdot s_{w^B} \cdot s_\delta$, while s_{w^B} and s_δ are the standard deviation of the weights and of δ_k respectively and $\overline{\delta} = \frac{1}{n} \sum_k \delta_k$ represents the distance between the centres of the two distributions of elementary price indices. In fact $\overline{\delta} = \frac{1}{n} \sum_k {}_rP_{k,t}^A - \frac{1}{n} \sum_k {}_rP_{k,t}^B = {}_r\overline{P}_{k,t}^A - {}_r\overline{P}_{k,t}^B$.

Considering the "weight effect", s_{P^A} and s_d are the standard deviations of elementary indices of A and of the difference between the weights respectively while $R_{P^A,d}$ is the linear correlation coefficient between the elementary price indices and the difference in the corresponding weights.

2.2 The decomposition and the interpretation of the divergence between CPIs at territorial level

Considering CPIs calculated at territorial level it is reasonable to assume that the products purchased are the same (number and characteristics) across different areas in the same country[1]. In this case considering area l as reference area we can express the difference between the CPI for area j, ${}_r\mathbf{P}_t^j$, and for area l ${}_r\mathbf{P}_t^l$, for each aggregation level, as follows:

$$ {}_r\mathbf{P}_t^j - {}_r\mathbf{P}_t^l = \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^j - \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^l \qquad [4] $$

Using the same approach illustrated above a first procedure for obtaining a decomposition of the difference [4] is to add and subtract the hybrid index obtained as weighted arithmetic mean of the elementary price indices of area j by using the weights of area l. Consequently, the divergence between the two indices can be written as follows :

$$ \begin{aligned} {}_r\mathbf{P}_t^j - {}_r\mathbf{P}_t^l &= \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^j - \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^l + \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^l - \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^l = \\ &= \sum_{k} {}_rw_k^l \left({}_rP_{k,t}^j - {}_rP_{k,t}^l \right) + \sum_{k} {}_rP_{k,t}^j \cdot \left({}_rw_k^j - {}_rw_k^l \right) \end{aligned} \qquad [5] $$

By using a similar procedure to that used above the decomposition [5] can be equivalently stated as:

$$ {}_r\mathbf{P}_t^j - {}_r\mathbf{P}_t^l = \left(n \cdot s_{w^l} \cdot s_\delta \cdot R_{w^l,\delta} + \overline{\delta} \right) + \left(n \cdot s_{P^j} \cdot s_d \cdot R_{P^j,d} \right) \qquad [5\ bis] $$

where the "elementary price index effect", $\left(n \cdot s_{w^l} \cdot s_\delta \cdot R_{w^l,\delta} + \overline{\delta} \right)$, is influenced by s_{w^l}, the standard deviation of the weights concerning area *j*, by s_δ the standard deviation of the elementary price index differences in the two areas compared, by $R_{w^l,\delta}$, the linear correlation coefficient between the weighting system of the index in the area l and the difference in the elementary indices in the two areas and by $\overline{\delta} = \frac{1}{n}\sum_k \delta_k$ the difference between the means of the two distributions of elementary price indices.

Similarly, the "weight effect" $\left(n \cdot s_{P^j} \cdot s_d \cdot R_{P^j,d} \right)$ is determined by analogous factors, that is by s_{P^j}, the standard deviations of elementary indices of area *j*, by s_d, the standard deviation of the difference between the weights in the two area compared and $R_{P^j,d}$, the linear correlation coefficient between the elementary price indices and the difference in the corresponding weights.

Obviously the decomposition of the difference between two local CPIs, as expressed in [5], can be also obtained by adding and subtracting the hybrid index obtained as weighted arithmetic mean of the elementary price indices of area l using the weights of area *j*. Thus:

[1] If this hypothesis is not satisfied the results of the decomposition are approximate.

$$
\begin{aligned}
{}_r\mathbf{P}_t^j - {}_r\mathbf{P}_t^l &= \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^j - \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^l + \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^j - \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^j = \\
&= \sum_k {}_rw_k^j \left({}_rP_{k,t}^j - {}_rP_{k,t}^l \right) + \sum_k {}_rP_{k,t}^l \cdot \left({}_rw_k^j - {}_rw_k^l \right) = \qquad [6] \\
&= \left(n \cdot s_{w^j} \cdot s_\delta \cdot R_{w^j,\delta} + \overline{\delta} \right) + \left(n \cdot s_{P^l} \cdot s_d \cdot R_{P^l,d} \right)
\end{aligned}
$$

where the factors that influence the "weight effect" and the "elementary price effect" are the counterparts of those identified in [5bis].

From a different point of view, by considering area *j* as reference area, it is possible to express a similar difference between two local CPIs :

$$
{}_r\mathbf{P}_t^l - {}_r\mathbf{P}_t^j = \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^l - \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^j \qquad [7]
$$

By applying the same procedure to that used in [5] and [6] two different forms of the decomposition of the CPI difference [7] can be achieved. To begin with, by adding and subtracting the hybrid index obtained as weighted arithmetic mean of the elementary price indices of area *l* using the weights of area *j* we can state that:

$$
\begin{aligned}
{}_r\mathbf{P}_t^l - {}_r\mathbf{P}_t^j &= \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^l - \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^j + \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^j - \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^j = \\
&= \sum_k {}_rw_k^j \left({}_rP_{k,t}^l - {}_rP_{k,t}^j \right) + \sum_k {}_rP_{k,t}^l \cdot \left({}_rw_k^l - {}_rw_k^j \right) \qquad [8] \\
&= \left(n \cdot s_{w^j} \cdot s_\delta \cdot R_{w^j,\delta} + \overline{\delta} \right) + \left(n \cdot s_{P^l} \cdot s_d \cdot R_{P^l,d} \right)
\end{aligned}
$$

where taking into account that $d_k = \left({}_rw_k^l - {}_rw_k^j \right)$ and $\delta_k = \left({}_rP_{k,t}^l - {}_rP_{k,t}^j \right)$ the factors that influence the weight and the elementary price index effects give a similar interpretation as above.
Then by adding and subtracting the hybrid index obtained as weighted arithmetic mean of the elementary price indices of area *j* using the weights of area *l* the decomposition of the two local CPI difference can be expressed as:

$$
\begin{aligned}
{}_r\mathbf{P}_t^l - {}_r\mathbf{P}_t^j &= \sum_{k=1}^{n} {}_rP_{k,t}^l \cdot {}_rw_k^l - \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^j + \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^l - \sum_{k=1}^{n} {}_rP_{k,t}^j \cdot {}_rw_k^l = \\
&= \sum_k {}_rw_k^l \left({}_rP_{k,t}^l - {}_rP_{k,t}^j \right) + \sum_k {}_rP_{k,t}^j \cdot \left({}_rw_k^l - {}_rw_k^j \right) \qquad [9] \\
&= \left(n \cdot s_{w^l} \cdot s_\delta \cdot R_{w^l,\delta} + \overline{\delta} \right) + \left(n \cdot s_{P^j} \cdot s_d \cdot R_{P^j,d} \right)
\end{aligned}
$$

where the factors that influence the two effects in which the total difference is decomposed are the opposite number of those identified in [8].
Although the factors that influence the two components of the difference between two local CPIs are conceptually similar in the four decompositions suggested, they can give two different results since they are defined relating to different distributions of weight, elementary price indices and corresponding differences.

As we can see, by using equations [6] and [8] the results obtained are the same, and only differ in the sign (positive or negative). On the other hand, by applying decomposition [5] and [9] it is possible to obtain identical results differing only in the sign but are different from those obtained by using the two decompositions [6] and [8][2]. The only factor which has the same value in all decomposition forms is the difference between the two arithmetic means of elementary price index distributions which considering two local CPIs becames:

$$\bar{\delta} = \frac{1}{n}\sum_k {}_rP_{tk}^{\ j} - \frac{1}{n}\sum_k {}_rP_{tk}^{\ l} = {}_r\bar{P}_t^{\ j} - {}_r\bar{P}_t^{\ l} \qquad [10]$$

This factor, which has an interesting interpretation from an economic point of view, plays an important role both in determining the "price effect" and influencing the overall difference between the two CPIs considered.

The unweighted arithmetic mean of the period *r* to *t* price relatives, for example in area *j* $\frac{1}{n}\sum_k {}_rP_{tk}^{\ j} = \frac{1}{n}\sum_k \frac{p_t^{\ j}}{p_r^{\ j}}$, which is the Carli index, can be considered as the best estimator under the assumption of normally distributed elementary indices or price changes.

Therefore, the divergence between two local CPIs, and the evaluation of the degree of the influence of the factors in which it is decomposed, depends on the shape of the distribution of the two elementary indices compared. If area *j* shows a negatively skewed distribution of price changes while in area *l* there is a symmetric or positively skewed distribution of price changes, the overall difference between CPIs will be mainly influenced by the "weight effect" and in particular by the correlation between price changes and weights. In this case the value of $\bar{\delta}$ is negative and this shows that the products which are more widely consumed and therefore have a higher expenditure weight, experience a major increase in price and this has a rising effect on the aggregate price index.

By understanding how the dispersion of the elementary price index distribution affects the difference between CPIs at territorial level can provide us with an important insight into the behaviour of consumers and the process of inflation [3].

3. The organisation of the decomposition analyses on Italian data

In order to evaluate the usefulness of the proposed decomposition methods of the divergence between two CPIs, some empirical computation and analyses have been conducted on the Italian CPIs compiled at territorial level. To explain the work done, a summary of the procedures followed for the construction of the CPIs for the chief regional towns in Italy and then the organisation of the computation carried out are presented.

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[2] In actual fact a unique measure of the difference could be achieved but it is irrelevant to the aim of this paper so we will leave this issue for further development.

[3] [3] It is well known, that the distributions of prices and elementary prices are very important to explain the economic behaviour and, consequently, the process of inflation (Cfr. for example: Baye M. R. (1985), Binette A. and Martel S. (2005), Lach S. (2002).

3.1 The procedures for the construction of the Italian CPIs

ISTAT elaborates three different CPIs using, as many other NSIs, a chain index of the Laspeyres type. Here CPIs computed with reference to the consumption of the whole population, called NIC[4] , are considered.
Concerning products, the COICOP hierarchical classification (Classification of Individual Consumption by Purpose) is used, as underlined by the International Labour Office (ILO, 2004) The *elementary aggregates*, that are groups of relatively homogeneous goods and services (that can serve as strata for sampling purposes) have been aggregated in sub-classes (in the year 2007 equal to 208), in *classes* (108), in *groups* (38), up to 12 *divisions* (chapters of expenditure) [5].
Within each elementary aggregate, the *representative products* (540 in the year 2007) are selected to represent the price movements of all the goods and services in the elementary aggregate and for which a system of weights should be estimated. Moreover, in some cases the representative products are "composite product" so more *items* or products can be selected for price collection (in 2007 more then 1,000).
The collection of item prices is carried out both centrally, by the staff of Istat and locally, in the chief towns of the provinces (85 Municipalities in the year 2007), by the staff of each Municipal Statistical Office (MSO), following two different procedures (Istat, 2007). Istat collects item prices for products and services defined by national pricing policies and show a unique price throughout the whole country, and for prices that are difficult to observe directly at local level because of rapid and continuous technological changes of the products (the elementary items so collected represent about the 20% of the products in the CPI).
The different MSOs included in the survey observe prices from individual outlets at territorial level (nearly 40,000). The outlets are selected by MSOs for each product using a non-probability stratified sample, according to the size and the demographic importance of the local district (municipality), the characteristics of the area (urban and non-urban and so on) inside the municipality, the type of distribution channel and products sold; the size of the outlet; the variability of the price of the product. The selection is made, through a kind of *quota sampling*, to be representative of the behaviour of the consumers in the municipality, using various sources of information (for example, the local Chamber of Commerce).
The selection of these **items** is purposive or judgmental; the significant difficulties involved in defining an adequate sampling frame (that is, a list of all the individual goods and services bought by households) preclude, in this moment, the use of traditional random sampling methods.
Therefore, in each outlet selected for a specific product of the basket, collectors gather the price of the *most sold elementary item* of the product. Then the prices of these items are collected throughout the year, with different frequency. About 400,000 elementary prices are collected, mostly on a monthly basis, some twice a month (for fresh vegetables and fruits, fresh fish and automotive fuels), and some on a quarterly basis.
Due to ease of computation, timeliness and clear meaning, for calculating the CPIs on a territorial level, the Municipal CPIs, Istat uses the Laspeyres type formula which has the same structure of [1], but with *annual revision of the system of weights*, referred to the December of the previous year; so

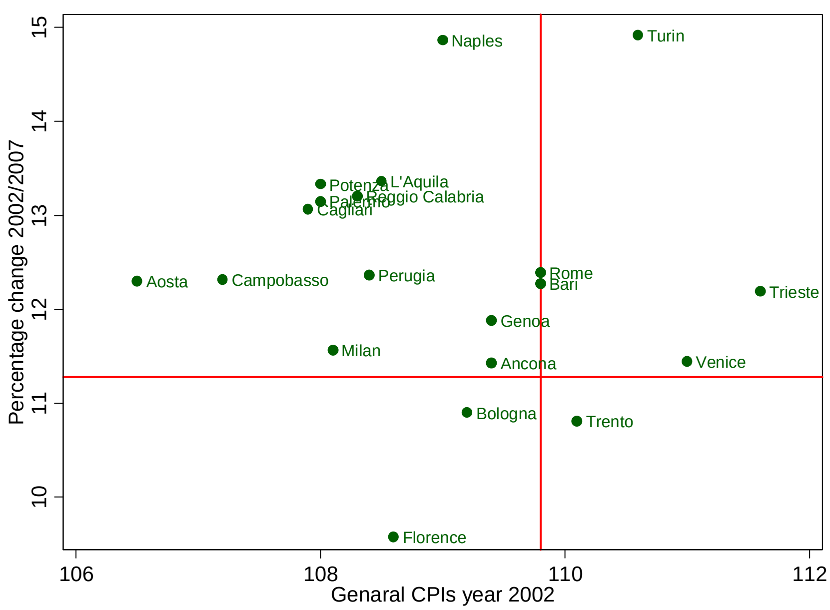
[4] The main Italian domestic measure of inflation for macroeconomic purposes is the CPI for the whole nation (*Indice nazionale dei prezzi al consumo per l'intera collettività nazionale, NIC*). In addition, the CPI for blue and white collar worker non agricultural households (*Indice dei prezzi al consumo per le famiglie di operai ed impiegati non agricoli, FOI*) and the Harmonized Index of Consumer Prices (HICP) in the framework of the EU CPI harmonization are calculated.
[5] The following example shows the possible coverage of the different aggregates. The entire set of consumption goods and services covered by the NIC is divided into divisions, such as "food and non-alcoholic beverages". Each division is then divided into groups such as "food"; then each group is further divided into classes, such as "fish". Moreover, each class is divided into more homogeneous sub-classes, such as "fresh fish". Finally, a sub-class may be further subdivided to obtain the elementary aggregates and inside of these to select the representative product such as "freshwater fish".

that for all the months of the subsequent year the indices are computed referring to the base period December of the previous year (that is the indices are computed as ${}_{t-1,12}\mathbf{P}^{j}_{t+m}$ where t is the current year and m= 1,…,12 refers to the months). The Municipal CPIs are calculated for 85 municipalities (chief town of the provinces) using household expenditure share as weights, computed taking into account two main sources of data: the HES (the Households Expenditures Survey) and the National Accounts estimates for household final consumption expenditures (additional information are also obtained from production and trade statistics, scanner data gathered from cash registered data, and so on).

3.2 The Data set available and the computations carried out

Monthly CPIs for 540 elementary aggregates and the corresponding expenditure weights, for 85 municipalities and for each month of the period from January 2002 until December 2007, are available for our analyses.
As the purpose of the paper is to illustrate the usefulness of the decompositions suggested above, and to avoid a computational overload, we decided to limit the analysis to December of the years 2002 and 2007 and limit the comparisons to 9 chief towns of regions or autonomous provinces.
The selection of the municipalities was carried out taking into account the level of the chained general CPIs in the year 2002 and the different evolution of the CPIs between 2002 and 2007, thus considering the cities where it is reasonable to assume a different behaviour of the sellers and consumers and a different evolution of attitude regarding sale and purchase. The choice was based on the results shown in figure 1. The territorial location of the cities in the north, centre and south Italy were also considered.

Fig 1. Comparisons of chained General CPIs at year 2002 and its changes from 2002 and 2007



The final choice includes the following cities: Turin, Trento, Venice, Trieste, Florence, Rome, Naples, Potenza and Palermo.

The decomposition of the differences between the CPIs of the 9 cities and therefore the evaluation of the "elementary price index effect" and the "weight effect" were computed using the formulae [5] and [8] that lead to different results, so that for each binary comparison two estimations are obtained as shown in the tables at the end of the Section 4. Information regarding the standard deviations and correlation coefficients and the factor $\overline{\delta}$ related to the different effects, necessary for the interpretation of the results, are provided as well. Some descriptive statistics can be seen in tables 1 and 10 referring to December of the years 2002 and 2007 respectively.
As the *representative products* can differ in number and characteristics over the different cities and over the different years, the results obtained are approximate, and therefore need to be interpreted carefully.

4. Analysis of the results

The results of the decomposition of the divergences between the 9 Municipal CPIs reported in the tables 1-18 need some explanation.
Table 1 and table 10 report some moments of the elementary price index distribution and the weight distribution; therefore besides presenting information concerning skewness and kurtosis they show the results concerning two important factors necessary for the interpretation of the decomposition [5] and [8], that is the standard deviation of the elementary price index distribution and the standard deviation of the corresponding weight distribution.

By making bilateral comparisons of the CPIs calculated in these cities using formulae [4] and [7] we can obtain the matrices of the overall differences shown in table 2 for the year 2002 and in table 11 for the year 2007. In order to estimate the different factors that influence the above differences, by applying the decomposition [5] and [8] respectively we can obtain the results presented in tables 3-9 for the years 2002 and in tables 11-18 for the year 2007.
All the above tables, organized as matrices, show the names of the municipalities compared in rows and columns and in each entry shows the corresponding differences (or the factors) thus in the main diagonal the values are zero.
Data must be read by row: the entries below the main diagonal refer to the computations involved in applying formula [5] and therefore present the divergences ${}_{t-1,12}\mathbf{P}^{j}_{t+m} - {}_{t-1,12}\mathbf{P}^{l}_{t+m}$ where j and l ($j, l = 1,...,9$) are the municipalities and the former city is reported in the row; on the contrary, data shown above the main diagonal refers to the computations involved in calculating formula [8] and therefore presents the results of the divergences ${}_{t-1,12}\mathbf{P}^{l}_{t+m} - {}_{t-1,12}\mathbf{P}^{j}_{t+m}$ where in this case l is the municipality reported in the row.
Looking at the results for December 2002 it is possible to see in table 2, that there is a high variability in the indices of the different cities: Naples shows the highest inflation rate (3.82%), while Florence shows the lowest inflation rate (2.13%), with a difference of 1.69 percentage points.
To analyse the decomposition of the divergences of the binary comparisons, some examples are presented below.
Comparing Naples with the other cities the differences between the CPIs are all positive, but with different values which have a "hidden meaning" concerning the degree of importance of the various factors that affected the CPI differences.
Considering the divergence of Naples with Turin, the value of 0.885 (table 2) can be decomposed in a "*price effect*" which is equal to 0.516 (table 3) and in a "*weight effect*" which amounts to 0.369 (see table 7). However the decomposition of the price effect shows that $\overline{\delta}$ is equal to -0.639 (table

4), that is, it produces a negative contribution to the price effect. Since $\overline{\delta}$ measures the difference between the arithmetic mean of elementary price index distributions of the two cities compared, analysing the shape of the distributions (Skewness and Kurtosis, in table 1) it can be said that Naples presents a negatively skewed distribution of the elementary indices, while in Turin the asymmetry of the corresponding distribution is positive. Nevertheless by examining the values of the other components (tables 5, 6, 7, 8 and 9) it is clear that in this case the weight effect is higher than in other comparisons and the correlation between elementary indices and weights is positive in Naples (r= 0.06) and negative, although near to zero, in Turin (-0.01). This indicates that in Naples the prices of products and services which are more widely consumed have increased more than average. On the contrary, products and services of wide consumption in Turin did not show a major increase in price.

Considering the decomposition of the overall divergence between the two CPIs of Naples and Florence, which shows the highest value equal to 1.691 (table 2), it is interesting to emphasize that the "*price effect*" is equal to 1.396 (table 3) while the contribution of the "*weight effect*" is 0.295 (see table 7). In this comparison, the divergence is mostly due to the price effect, where the contribution of $\overline{\delta}$ is equal to 0.596 (table 4), which has the same sign of the price effect and it is this factor which makes the value of price effect so high.

By analysing the distributions of the elementary indices of the two cities (table 1), summarized by the moments and correlation coefficient between price changes and weights, we can see that Florence shows a higher negatively skewed distribution than that of Naples; on the contrary the correlation coefficient is lower in Florence than in Naples.

Finally, comparing Florence with Venice, the decomposition of the divergence between the two CPIs, which amount to -1.200 (table 2), shows a "*price effect*" equal to -1.222 (table 3) and a "*weight effect*" equal to 0.022 (see table 7). In this case the structure of the system of weights is quite similar and the all divergence is due to the price effect (on average the elementary price indices are more increased in Venice than in Florence) and the contribution of $\overline{\delta}$ is equal to -0.851 (table 4), which is quite high and of the same sign of the price effect. In fact, the distributions of the elementary price indices show a lower negative asymmetry in Venice than in Florence and, at the same time, there is a higher correlation between elementary indices and weights for Venice.

Before considering some general conclusions, it is interesting to examine the results of the analyses shown above the main diagonal, where the comparisons refer to the divergences ${}_{t-1,12}\mathbf{P}^{l}_{t+m} - {}_{t-1,12}\mathbf{P}^{j}_{t+m}$ and the decompositions are computed by using the formula [8].

Considering the comparison between Turin and Naples it is clear that the overall divergence is the same as illustrated above, but with different sign, in fact it is -0.885 (table 2). The estimations of the different effects obviously change sign, but are also slightly different (as seen in the comment concerning decomposition in Section 2, the value of $\overline{\delta}$ is the same but with inverse sign). The estimation of price effect is -0.584 (table 3) and the weight effect is -0.301 (table 7). However the conclusions of the analysis of the decomposition of the divergence are the same. A similar situation can be noticed by examining the other divergences between different CPIs, although in some cases the differences on the estimated effects can be even higher.

The analyses of the decomposition of the divergences between the CPIs of the cities considered, demonstrates that the evolutions of the consumer prices at territorial level is quite different across Italy and influence the divergences between the CPIs in different ways and degrees. In general, we can say that from December 2001 to December 2002 the divergences in the evolution of the CPIs depend mostly on the price effects, that is on the different evolution of elementary indices. On the other hand, the effect of the different share of expenditures regarding the various goods and services is in some cases important as well. This occurs, for example in every comparison concerning

Palermo and Potenza, two southern cities, with all the other cities. Moreover it is evident that divergences between the CPIs are strongly affected by the characteristics of the corresponding distribution of the elementary price indices and by the value of the correlation between elementary indices and weights. As the results show, low differences in the distributions of elementary indices and, above all, very low levels and differences in the correlation coefficients can have strong effects on the divergences between two CPIs as well.
Finally, looking briefly at the results for December 2007, it is possible to see in table 11 that there is still high variability in the indices of the different cities, and even higher than December 2002. In this case Palermo shows the highest inflation rate (3.35%), on the contrary, Trento shows the lowest inflation rate (1.57%), with a difference of 1.785 percentage points. We can also see that the evolution of each municipal CPI has changed in comparison to the year 2002, and therefore the ranking of the CPIs for the various cities has changed too. However, the analyses of the results of the decomposition of the effect of the divergence between the different CPIs show that, in general, they are quite similar to year 2002. The divergences depend mostly on the price effects, that is on the different evolution of elementary indices. On the other hand, in 2007 the effect of the different share of expenditures regarding the various goods and services is only high in some cases. This is the case of every comparison concerning Potenza, and to less extent Palermo. Moreover it is still evident that divergences between the CPIs are strongly affected by the characteristics of the respective distribution of the elementary price indices and by the value of the correlation between elementary indices and weights; this situation in 2007 is still closely similar as in 2002. Obviously, the analysis of the each divergences between the CPIs of the different cities give different results, but the related comments are irrelevant to the purpose of the paper.

Tables for the decomposition analyses of 9 Municipal CPIs of December 2002 in Italy. December 2001=100.

(In order to correctly understand the results reported in the following tables it is possible to refer to Sections 2 and 4)

Table 1 Moments of Price changes and weight distributions

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
Elementary Price distribution									
Mean	103.03	101.93	102.65	101.93	101.80	103.00	102.40	101.43	101.38
Standard Deviation	5.25	8.49	7.00	12.76	6.07	6.64	12.34	12.16	13.19
Skewness	2.252	-5.662	-5.387	-6.021	-7.541	-5.059	-6.900	-5.630	-6.226
Kurtosis	16.616	76.769	89.810	50.848	144.262	113.889	58.908	53.182	49.506
Weight distribution									
Standard Deviation	0.00354	0.00349	0.00355	0.00376	0.00371	0.00411	0.00368	0.00317	0.00356
Correlation Coefficient	-0.009	0.047	0.049	0.033	0.026	0.000	0.056	0.036	0.044

Table 2 Overall Differences between pairs of cities

		TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
	Nic dic_02	**102.940**	**102.726**	**103.334**	**102.815**	**102.134**	**103.003**	**103.825**	**102.222**	**102.839**
TURIN	**102.940**		0.214	-0.394	0.125	0.806	-0.064	-0.885	0.718	0.101
TRENTO	**102.726**	-0.214		-0.608	-0.089	0.592	-0.278	-1.099	0.504	-0.113
VENICE	**103.334**	0.394	0.608		0.519	1.200	0.331	-0.491	1.112	0.495
TRIESTE	**102.815**	-0.125	0.089	-0.519		0.681	-0.189	-1.01	0.593	-0.024
FLORENCE	**102.134**	-0.806	-0.592	-1.2	-0.681		-0.87	-1.691	-0.088	-0.705
ROME	**103.003**	0.064	0.278	-0.331	0.189	0.870		-0.822	0.781	0.165
NAPLES	**103.825**	0.885	1.099	0.491	1.010	1.691	0.822		1.603	0.986
POTENZA	**102.222**	-0.718	-0.504	-1.112	-0.593	0.088	-0.781	-1.603		-0.617
PALERMO	**102.839**	-0.101	0.113	-0.495	0.024	0.705	-0.165	-0.986	0.617	

Table 3 Price effect

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		0.284	-0.373	0.306	0.873	0.117	-0.584	1.022	0.319
TRENTO	-0.400		-0.619	-0.046	0.567	-0.376	-1.190	0.492	-0.190
VENICE	0.161	0.565		0.575	1.124	0.165	-0.394	1.156	0.417
TRIESTE	-0.413	0.014	-0.747		0.467	-0.473	-1.020	0.313	-0.201
FLORENCE	-0.863	-0.585	-1.222	-0.659		-0.839	-1.515	-0.058	-0.714
ROME	-0.024	0.318	-0.298	0.253	0.865		-0.703	0.873	0.214
NAPLES	0.516	1.129	0.325	0.890	1.396	0.361		1.771	0.725
POTENZA	-1.473	-1.118	-1.697	-0.900	-0.446	-1.369	-2.347		-1.174
PALERMO	-0.397	-0.081	-0.795	-0.133	0.561	-0.291	-1.038	0.654	

Table 4 Composition of Price Effect $\overline{\delta}$

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		1.100	0.384	1.105	1.235	0.037	0.639	1.603	1.655
TRENTO	-1.100		-0.716	0.005	0.135	-1.063	-0.461	0.503	0.554
VENICE	-0.384	0.716		0.721	0.851	-0.347	0.255	1.219	1.271
TRIESTE	-1.105	-0.005	-0.721		0.130	-1.068	-0.466	0.498	0.550
FLORENCE	-1.235	-0.135	-0.851	-0.130		-1.198	-0.596	0.368	0.419
ROME	-0.037	1.063	0.347	1.068	1.198		0.602	1.566	1.617
NAPLES	-0.639	0.461	-0.255	0.466	0.596	-0.602		0.964	1.016
POTENZA	-1.603	-0.503	-1.219	-0.498	-0.368	-1.566	-0.964		0.052
PALERMO	-1.655	-0.554	-1.271	-0.550	-0.419	-1.617	-1.016	-0.052	

Table 5 Composition of Price Effect Standard deviation of elementary price index differences

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		8.761	7.115	13.351	6.534	7.142	13.029	12.265	13.445
TRENTO	8.761		7.558	11.708	7.773	9.108	13.156	14.164	13.203
VENICE	7.115	7.558		12.525	5.371	8.105	12.000	13.174	14.364
TRIESTE	13.351	11.708	12.525		12.651	12.540	14.173	17.703	15.046
FLORENCE	6.534	7.773	5.371	12.651		8.017	12.131	12.580	14.602
ROME	7.142	9.108	8.105	12.540	8.017		12.228	13.467	12.173
NAPLES	13.029	13.156	12.000	14.173	12.131	12.228		17.350	13.538
POTENZA	12.265	14.164	13.174	17.703	12.580	13.467	17.350		17.246
PALERMO	13.445	13.203	14.364	15.046	14.602	12.173	13.538	17.246	

Table 6 Composition of Price Effect Correlation coefficient between elementary price index differences and weight

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		-0.0470	-0.0528	-0.0280	-0.0263	0.0048	-0.0450	-0.0263	-0.0491
TRENTO	0.0398		0.0064	-0.0020	0.0263	0.0323	-0.0265	-0.0004	-0.0279
VENICE	0.0381	-0.0101		-0.0054	0.0241	0.0270	-0.0259	-0.0027	-0.0294
TRIESTE	0.0258	0.0008	-0.0010		0.0126	0.0203	-0.0187	-0.0058	-0.0247
FLORENCE	0.0283	-0.0292	-0.0343	-0.0196		0.0192	-0.0363	-0.0188	-0.0384
ROME	0.0009	-0.0413	-0.0394	-0.0304	-0.0197		-0.0511	-0.0286	-0.0570
NAPLES	0.0441	0.0256	0.0240	0.0140	0.0313	0.0337		0.0259	-0.0106
POTENZA	0.0053	-0.0219	-0.0180	-0.0106	-0.0029	0.0062	-0.0382		-0.0351
PALERMO	0.0465	0.0181	0.0164	0.0130	0.0318	0.0467	-0.0008	0.0227	

Table 7 Weight effect

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		-0.07	-0.022	-0.181	-0.067	-0.19	-0.301	-0.304	-0.219
TRENTO	0.186		0.011	-0.043	0.025	0.098	0.091	0.012	0.077
VENICE	0.234	0.043		-0.056	0.076	0.166	-0.097	-0.044	0.078
TRIESTE	0.288	0.075	0.228		0.214	0.284	0.01	0.279	0.177
FLORENCE	0.058	-0.007	0.022	-0.022		-0.031	-0.176	-0.03	0.009
ROME	0.088	-0.041	-0.033	-0.064	0.005		-0.118	-0.092	-0.05
NAPLES	0.369	-0.03	0.166	0.12	0.295	0.461		-0.168	0.261
POTENZA	0.756	0.614	0.585	0.307	0.534	0.588	0.744		0.5571
PALERMO	0.296	0.194	0.3	0.157	0.144	0.126	0.052	-0.037	

Table 8 Composition of Weight Effect: Standard deviation of weight differences

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		0.0011	0.0013	0.0013	0.0013	0.0017	0.0015	0.0017	0.0017
TRENTO	0.0011		0.0011	0.0011	0.0011	0.0016	0.0019	0.0017	0.0019
VENICE	0.0013	0.0011		0.001	0.0011	0.0019	0.0019	0.0015	0.0019
TRIESTE	0.0013	0.0011	0.001		0.0013	0.0019	0.0019	0.0017	0.002
FLORENCE	0.0013	0.0011	0.0011	0.0013		0.001	0.0018	0.0018	0.0018
ROME	0.0017	0.0016	0.0019	0.0019	0.001		0.002	0.0025	0.002
NAPLES	0.0015	0.0019	0.0019	0.0019	0.0018	0.002		0.0019	0.0014
POTENZA	0.0017	0.0017	0.0015	0.0017	0.0018	0.0025	0.0019		0.0016
PALERMO	0.0017	0.0019	0.0019	0.002	0.0018	0.002	0.0014	0.0016	

Table 9 Composition of Weight Effect: Correlation coefficient between weight differences and elementary price index

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		-0.0217	-0.0057	-0.0479	-0.0181	-0.0356	-0.0659	-0.0594	-0.0423
TRENTO	0.0354		0.0021	-0.0083	0.0048	0.0127	0.0101	0.0015	0.0086
VENICE	0.0463	0.0103		-0.0143	0.0175	0.0223	-0.0129	-0.0074	0.0104
TRIESTE	0.0312	0.0097	0.0321		0.0219	0.0208	0.0007	0.0226	0.0124
FLORENCE	0.0134	-0.002	0.0058	-0.0047		-0.009	-0.0291	-0.0048	0.0014
ROME	0.0137	-0.0067	-0.0047	-0.0091	0.0012		-0.016	-0.0099	-0.0067
NAPLES	0.0343	-0.0023	0.0125	0.0092	0.024	0.0335		-0.013	-0.013
POTENZA	0.0637	0.0535	0.0568	0.0261	0.0421	0.0346	0.0582		0.0499
PALERMO	0.0228	0.0138	0.0212	0.0106	0.0106	0.0086	0.005	-0.00304	

Tables for the decomposition analyses of 9 Municipal CPIs of December 2007 in Italy. December 2006=100.

Table 10 Descriptive statistics

	TORINO	TRENTO	VENEZIA	TRIESTE	FIRENZE	ROMA	NAPOLI	POTENZA	PALERMO
Elementary Price distribution									
Mean	103.03	101.93	102.65	101.93	101.80	103.00	102.40	101.43	101.38
Standard Deviation	5.1348	8.1211	4.4595	6.9226	5.0154	6.0829	9.7147	11.2610	7.8070
Skewness	2.252	-5.662	-5.387	-6.021	-7.541	-5.059	-6.900	-5.630	-6.226
Kurtosis	16.616	76.769	89.810	50.848	144.262	113.889	58.908	53.182	49.506
Weight distribution									
Standard Deviation	0.00336	0.00497	0.00348	0.00340	0.00351	0.00372	0.00355	0.00321	0.00350
Correlation Coefficient	0.0056	-0.0058	0.0171	0.0761	0.0516	0.0592	0.0173	0.0888	0.0511

Table 11 Overall Differences between pairs of cities

		TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
		102.784	**101.570**	**102.157**	**102.599**	**102.186**	**102.673**	**102.871**	**103.087**	**103.355**
TURIN	**102.784**		1.214	0.627	0.185	0.598	0.112	-0.086	-0.302	-0.571
TRENTO	**101.570**	-1.214		-0.587	-1.029	-0.616	-1.102	-1.3	-1.516	-1.785
VENICE	**102.157**	-0.627	0.587		-0.442	-0.029	-0.515	-0.713	-0.929	-1.198
TRIESTE	**102.599**	-0.185	1.029	0.442		0.413	-0.074	-0.272	-0.488	-0.756
FLORENCE	**102.186**	-0.598	0.616	0.029	-0.413		-0.486	-0.684	-0.9	-1.169
ROME	**102.673**	-0.112	1.102	0.515	0.074	0.486		-0.198	-0.414	-0.682
NAPLES	**102.871**	0.086	1.3	0.713	0.272	0.684	0.198		-0.216	-0.484
POTENZA	**103.087**	0.302	1.516	0.929	0.488	0.9	0.414	0.216		-0.268
PALERMO	**103.355**	0.571	1.785	1.198	0.756	1.169	0.682	0.484	0.268	

Table 12 Price effect

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		1.419	0.572	0.209	0.814	0.502	0.332	-0.243	-0.422
TRENTO	-0.944		-0.527	-0.666	-0.497	-0.829	-0.69	-0.925	-1.127
VENICE	-0.66	0.722		-0.209	0.096	-0.296	-0.665	-0.894	-1.104
TRIESTE	-0.597	1.175	0.084		0.175	-0.334	-0.797	-0.822	-1.143
FLORENCE	-0.653	0.828	-0.047	-0.375		-0.494	-0.675	-0.802	-1.13
ROME	-0.487	1.212	0.245	-0.084	0.382		-0.362	-0.495	-0.694
NAPLES	-0.118	1.367	0.585	0.307	0.651	0.252		-0.22	-0.315
POTENZA	-1.425	1.614	0.475	-0.003	0.393	-0.229	-1.512		-0.745
PALERMO	0.032	1.648	0.873	0.461	0.944	0.424	0.091	0.197	

Table 13 Composition of Price Effect: $\overline{\delta}$

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		1.0341	0.7178	1.1007	1.0363	0.7830	0.1835	1.3780	0.6400
TRENTO	-1.0341		-0.3163	0.0667	0.0022	-0.2511	-0.8506	0.3439	-0.3941
VENICE	-0.7178	0.3163		0.3830	0.3185	0.0652	-0.5343	0.6602	-0.0778
TRIESTE	-1.1007	-0.0667	-0.3830		-0.0644	-0.3178	-0.9172	0.2772	-0.4607
FLORENCE	-1.0363	-0.0022	-0.3185	0.0644		-0.2533	-0.8528	0.3417	-0.3963
ROME	-0.7830	0.2511	-0.0652	0.3178	0.2533		-0.5994	0.5950	-0.1430
NAPLES	-0.1835	0.8506	0.5343	0.9172	0.8528	0.5994		1.1944	0.4565
POTENZA	-1.3780	-0.3439	-0.6602	-0.2772	-0.3417	-0.5950	-1.1944		-0.7380
PALERMO	-0.6400	0.3941	0.0778	0.4607	0.3963	0.1430	-0.4565	0.7380	

Table 14 Composition of Price Effect Standard deviation of elementary price index differences

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		8.300	4.747	7.588	4.891	6.065	9.924	11.308	7.254
TRENTO	8.300		8.125	10.329	7.972	9.326	10.686	11.461	10.039
VENICE	4.747	8.125		7.432	4.536	5.790	9.807	10.930	7.326
TRIESTE	7.588	10.329	7.432		7.517	8.333	12.062	12.852	9.058
FLORENCE	4.891	7.972	4.536	7.517		6.217	9.923	11.242	7.524
ROME	6.065	9.326	5.790	8.333	6.217		10.731	11.938	7.987
NAPLES	9.924	10.686	9.807	12.062	9.923	10.731		12.867	10.008
POTENZA	11.308	11.461	10.930	12.852	11.242	11.938	12.867		12.507
PALERMO	7.254	10.039	7.326	9.058	7.524	7.987	10.008	12.507	

Table 15 Composition of Price Effect Correlation coefficient between elementary price index differences and weight

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		0.017300	-0.016400	-0.063900	-0.023900	-0.023000	0.007800	-0.082800	-0.077400
TRENTO	0.005987		-0.013800	-0.038600	-0.033000	-0.030800	0.007800	-0.063900	-0.038600
VENICE	0.006697	0.018629		-0.043400	-0.025700	-0.031000	-0.006925	-0.082000	-0.074120
TRIESTE	0.036554	0.044810	0.033429		0.016800	-0.001000	0.005200	-0.049000	-0.039900
FLORENCE	0.043111	0.038827	0.031872	-0.031802		-0.019300	0.009300	-0.058000	-0.051600
ROME	0.026828	0.038417	0.028520	-0.026213	0.010880		0.011500	-0.052600	-0.036500
NAPLES	0.003655	0.018020	0.002732	-0.027534	-0.010720	-0.016117		-0.063500	-0.040900
POTENZA	-0.002303	0.063672	0.055236	0.011623	0.034428	0.015230	-0.012860		-0.000300
PALERMO	0.050972	0.046543	0.057761	0.000040	0.038380	0.017541	0.028492	-0.024950	

Table 16 Weight effect

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		-0.205	0.055	-0.024	-0.216	-0.390	-0.419	-0.059	-0.149
TRENTO	-0.270		-0.061	-0.363	-0.119	-0.273	-0.610	-0.591	-0.658
VENICE	0.033	-0.135		-0.232	-0.125	-0.220	-0.049	-0.035	-0.093
TRIESTE	0.412	-0.146	0.358		0.238	0.261	0.525	0.335	0.388
FLORENCE	0.055	-0.212	0.076	-0.038		0.008	-0.009	-0.099	-0.038
ROME	0.375	-0.110	0.270	0.157	0.104		0.164	0.081	0.011
NAPLES	0.204	-0.067	0.128	-0.035	0.034	-0.054		0.004	-0.170
POTENZA	1.728	-0.098	0.454	0.490	0.507	0.643	1.728		0.477
PALERMO	0.539	0.137	0.324	0.295	0.224	0.258	0.393	0.071	

Table 17 Composition of Weight Effect: Standard deviation of weight differences 2007

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		0.0034	0.0014	0.0014	0.0012	0.0013	0.0014	0.0015	0.0016
TRENTO	0.0034		0.0024	0.0029	0.0027	0.0030	0.0036	0.0036	0.0036
VENICE	0.0014	0.0024		0.0010	0.0008	0.0013	0.0020	0.0016	0.0019
TRIESTE	0.0014	0.0029	0.0010		0.0011	0.0015	0.0020	0.0016	0.0019
FLORENCE	0.0012	0.0027	0.0008	0.0011		0.0010	0.0017	0.0016	0.0018
ROME	0.0013	0.0030	0.0013	0.0015	0.0010		0.0015	0.0019	0.0017
NAPLES	0.0014	0.0036	0.0020	0.0020	0.0017	0.0015		0.0016	0.0015
POTENZA	0.0015	0.0036	0.0017	0.0016	0.0016	0.0019	0.0016		0.0015
PALERMO	0.0016	0.0036	0.0019	0.0019	0.0018	0.0016	0.0015	0.0015	

Table 18 Composition of Weight Effect: Correlation coefficient between weight differences and elementary price index

	TURIN	TRENTO	VENICE	TRIESTE	FLORENCE	ROME	NAPLES	POTENZA	PALERMO
TURIN		-0.021300	0.013700	-0.005900	-0.063500	-0.103200	-0.102300	-0.014600	-0.032700
TRENTO	-0.017811		-0.005800	-0.028600	-0.010000	-0.020900	-0.038200	-0.037100	-0.041300
VENICE	0.009496	-0.023533		-0.099900	-0.063700	-0.069700	-0.010300	-0.008900	-0.020500
TRIESTE	0.074497	-0.013499	0.099014		0.056700	-0.010300	0.070100	0.055800	0.054000
FLORENCE	0.016630	-0.028923	0.034160	-0.012442		0.003000	-0.001900	-0.022700	-0.008100
ROME	0.083904	-0.011207	0.062830	0.030940	0.032660		0.032400	0.013200	0.002100
NAPLES	0.026351	-0.003489	0.012540	-0.003356	0.003711	-0.006620		0.000500	-0.021700
POTENZA	0.194137	-0.004416	0.045360	0.050256	0.052009	0.056830			0.053100
PALERMO	0.077900	0.008945	0.040710	0.036361	0.030241	0.036360	0.062749	0.011387	

5. Concluding remarks

NSIs compute and disseminate CPIs at territorial level across the country which are important for evaluating the possible different rate of inflation in the different areas and the impact of local economic conditions on consumer price and household behaviour on the process of inflation. Sometimes, the indices are used also for escalating incomes and salaries.

Frequently these indices present high divergences among one another so it is important to analyse the reasons for these differences.

The paper proposes a simple method for calculating the decomposition of the divergence between two CPIs or, at least, to obtain an approximate measure of the importance of the factors that affect it. That is: the different evolution of the prices of the products and services (elementary indices), and the differences on the share of the expenditure regarding the different products and services (system of weights). Four equivalent methods were proposed that provide two estimations of the effects which differ sligly.

The analyses carried out on the divergences from the CPIs of 9 Italian cities for December 2002 and December 2007, provided very interesting results showing that the divergences depend mostly on the price effects, that is on the different evolution of elementary indices. However, the effect of the different share of expenditures concerning the various goods and services are also important, especially for the comparisons regarding the CPIs of the southern cities. Moreover the divergences between the CPIs of the different cities are strongly affected by the characteristics of the corresponding distribution of the elementary price indices and by the value of the correlation between elementary indices and weights, which in the years 2002 and 2007 result quite similar.

Further research needs to be carried out in this field and we are trying to improve the method of the decomposition of the divergences between the CPIs in order to obtain only one synthetic estimation of the effects and carry out a systematic estimation and analyses of the different effects of the divergences of the Italian municipal CPIs for each year from 2002 to 2007. The analysis will be performed for CPIs by classes and groups of products to understand the importance of the different products in affecting the price and weights effects. In addition, it is also important to analyse the degree of the price and weights effects during periods with different inflation rates.

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