Time-space Harmonisation of Consumer Price Indexes in the Euro-zone Countries

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Abstract: The objective of this paper is to discuss the possibilities of attaining a time-space harmonisation of the price indexes that are elaborated by the 12 European Union (EU) Euro-zone countries and by Eurostat. After focusing on the duality of the time and space domains for price indexes elaboration, the basic elements of the methodology of estimation of consumer price indexes are delineated, both in time and space. Then, the harmonisation of formulae and baskets is outlined, with emphasis on the latter. The current system of surveys for price collection is reviewed and its limits are underlined, in order to suggest a methodology for a consumer basket harmonised approach which ensures better harmonised indexes comparability, reduction of list of products and unification of quality adjustment methods.

Keywords: Consumer Price Index; Time Consumer Price Index, Purchasing Power Parity; Harmonised Index of Consumer Prices; Harmonisation; Time Domain; Space Domain; International Comparisons Programme

JEL classification: E31

1 Introduction and Background

In the unified treatment that the authors intend to pursue in this paper, Consumer Price Indexes (CPI) are defined as synthetic price indicators elaborated to measure the relative price changes *over time or over space* of a basket of consumer goods and services purchased by households.

CPI are used for a wide variety of purposes:

(A) in time domain: (i) for inflation measurement; (ii) for the indexation of commercial contracts, wages, social protection benefits or financial instruments; (iii) as a guide for monetary policy; (iv) as a tool for deflating the national accounts aggregates or calculating changes in national consumption or standards of living.

(B) in space domain: (i) for comparing the price levels and the standards of living in different countries or geographical areas; (ii) for international or inter-area comparisons of Gross Domestic Product (GDP) and/or its components.

In time domain, CPI are elaborated nearly by all countries all over the world. Hereinafter, these will be denoted by Time Consumer Price Indexes (TCPI).

Since 1997, besides the specific national TCPI, each Member State of the European Union (EU) has been calculating the Harmonised Indexes of Consumer Prices (HICP), according to rules specified in a series of European Regulations developed by the European Union Statistical Office (Eurostat) in agreement with the EU Member States (Eurostat, 2001a)[1].

HICP are used to compare inflation rates across the EU, as well as to monitor performance against the convergence criterion for price stability in the Maastricht Treaty framework. Since January 1999, the European Central Bank (ECB) has also used them for the measure of price stability across the Euro-area (Eurostat, 2004).

Moreover, since the creation of the European Monetary Union (EMU) among 12 EU countries in March 1998, Eurostat calculates the Monetary Union Index of Consumer Prices (MUICP), an aggregate index covering the countries within the Euro-area[2], and the European Index of Consumer Prices (EICP) for the Euro-area plus the other EU countries[3].

The latter indexes are calculated using statistics provided by the Member States on consumer price changes and the consumption patterns of households within their economic territories. The aggregation across countries uses country weights from household final monetary consumption expenditure.

While HICP provide the best statistical base to make EU comparisons of inflation and represents considerable progress in the harmonisation of methodologies, it is still hard to imagine a complete harmonisation of time consumer price indexes. In this respect, technical agreement on different aspects will still have to be proposed. Among these, are the treatment of quality adjustments, the source of the weighting structure, the choice of formula (fixed base versus chained), and the homogenisation in price collection and the methodological treatment of specific lots.

It should be outlined that HICP cover all areas of household final monetary consumption expenditure but the relative importance of consumers' expenditure on each good or service varies from country to country. Hence, there is no *uniform basket* applying to all Member States. The differences between HICP and the individual national TCPI concern the treatment of subsidies, healthcare and education[4], and the treatment of owner-occupied housing[5].

In space domain, Eurostat, in the framework of the European Comparison Programme (ECP), as a specific project of the International Comparison Programme (ICP), elaborates the so-called GDP Parities (GDPP), in order to undertake comparisons of GDP volumes among European countries (Eurostat, 2000). The GDPP are now elaborated according to the Gini-Eltetö-Koves-Szulc (GEKS) (1931; 1964) approach at any aggregation level. For this purpose, Eurostat proposes a unique list of consumer goods and

services for which prices must be collected, for all the EU countries, other than the baskets used for the HICP.

Within the GDP Parities, based on a basket of household consumption prices, Eurostat elaborates and disseminates the so-called Purchasing Power Parities (PPP), typically space CPI.

Due to the fact that the time and space domains are regarded as disjoint fields and that HICP and the TCPI are calculated individually by each EU member country, whereas the PPP are calculated by Eurostat, the two sets of price indexes are elaborated independently and no attempt has been undertaken to achieve a harmonised treatment.

As a consequence, not only a full harmonisation of the HICP is still missing, but above all, there is no harmonisation between HICP and TCPI on the one hand, and PPP on the other hand, whereas there should be because of the dual nature of the question.

It is worth emphasizing that every National Statistical Institute (NSI) of the EU member state draws out two different baskets of goods and services concerning household expenditures for which to survey prices: (i) for the national TCPI and for the HICP, and (ii) for the PPP (based on the list provided by Eurostat). These different methods of extraction can cause many problems due to: (i) not perfect time comparability of price movements; (ii) time, work and resources wasting; (iii) non-uniformity between time and space variations; and (iv) impossibility to elaborate the PPP, if not monthly, at least quarterly or yearly.

Thus, harmonisation should be pursued since, as it will be shown later, there is a duality in time and space consumer price indexes domains. This is what the authors intend to do in this paper, as regards the 12 countries of the Euro-zone.

The harmonisation process can be regarded both from the theoretical/methodological point of view, and also from the practical one of producing a uniform basket through the unification of the two baskets of goods and services into a single basket on which each NSI and Eurostat can conduct the elaborations.

Nevertheless, the paper will briefly deal with the first issue, to then concentrate our attention on the practical aspects. Moreover, the discussion will concern the Euro-area countries.

Thus, the paper is organised as follows. In Section 2 the above duality will be discussed, by giving a concise theoretical settlement to an already existing, even though implicit, harmonised way of looking at the problem, including a brief re-reading of the methodology both in time and space frameworks. The discussion will avoid as much as possible the liturgical way of presenting the topic, usually with wide illustration of elementary indexes aggregating formulae, various indexes discussion and comparison of their performance, properties and so on, and will be restrained instead to the very essential questions useful to the harmonisation purposes.

In Section 3 the authors will highlight the many common points and similarities between time and space consumer price indexes, and elaborate a harmonisation of time and space formulae and baskets.

The conclusion of the paper, presented in Section 4, will focus on the critical appraisal of the existing situation as compared to the one proposed by the authors, and provide a summary of the suggestions emerging from the overall approach to the matter.

2 Methodology of Estimation of Consumer Price Indexes

2.1 Overview

The duality between time and space consumer price indexes domains as outlined in the Introduction can easily be seen by reflecting on the fact that in both domains the aim of the index is to measure changes in levels of prices of a given basket of goods and services, and that the way of pursuing the objective is, *mutatis mutandis*, exactly the same (this is also the idea of Rao (2001), even though in a more general price indexes context).

As anticipated, it will be avoided here a discussion of the theoretical foundations, to pass instead, after a brief overview of the two contexts, to the illustration of the points salient to our purpose and traceable in EU NSI and Eurostat estimation activity, following our own re-reading.

While the nature of the questions underlying the two domains is similar, of course, as pointed out by Balk (2001), multilateral international comparisons are not simple translations of multilateral intertemporal comparisons. Indeed, some important differences between these two types of comparisons may hold, that do not anyway affect the above stressed common nature: (i) time is a continuous variable whereas the number of the countries involved in the comparison stays fixed; (ii) unlike time periods, countries do not exhibit a natural ordering; (iii) in a intertemporal comparison the time periods considered are of the same size whereas countries are by nature not equally important.

To make duality more evident, let's comparatively analyse TCPI and PPP.

TCPI can be defined as the number of money units needed to purchase at time t the same basket of consumer goods and services that was purchased at time 0 with one money unit. In other words, they measure the ratio of price levels in time 0 and t, relative to the same basket.

Besides representing a tool for inflation measurement, TCPI play a prominent role in monitoring the effects of both economic and monetary government policies, and provide an efficient and objective index for automatic adjustment of salaries, wages, rents and all the other kind of indexation used in welfare state policy. Moreover, they are widely used as National Accounts (NA) time aggregates deflators, first of all, GDP.

PPP are defined as the number of money units needed to purchase in country or region or whatever administrative or conventional space aggregation A, the same basket of

consumer goods and services that can be purchased in country or region or whatever administrative or conventional space aggregation B with one unit of money. In other words, they measure the ratio of price levels between space A and B relative to the same basket.

PPP represent the tool for "spatial inflation" measurement and are crucial too as spatial deflators in space NA aggregates comparisons, namely, for GDP international or inter-area comparisons.

What should be stressed is that the base for elaborating the two indicators is represented in both cases by price elementary parities:

in time domain, they are "time parities", which define the number of monetary units necessary to purchase at time t a unit of the good or service that is purchased with a monetary unit at time 0, that is, which establish that in terms of that good or service, a unit of money of time 0 is equivalent to i units at time t. In other words, this is the parity that compensates the different price level in the two times;

in space domain, they are "spatial parities", which define the number of monetary units in country or region B that are equivalent to a monetary unit in country or region A in terms of the given good or service, that is, which establish that in terms of that good or service, a monetary unit in A is equivalent to p monetary units in B. In other words, the parity that compensates the different price level in the two countries or regions.

2.2 The TCPI Elaboration

The formula used by all the NSI in the Euro-area countries and by Eurostat for calculating the TCPI at time t, based time 0, is the Laspeyres one:

$_0L_t = \sum_{h=1}^{k} \frac{p_t}{p_0} w_0$, where p_0 and p_t are prices at times 0 and t respectively, k is the number of goods and services in the consumer basket and $w_0 = \frac{p_0 q_0}{\sum_{h=1}^{k} p_0 q_0}$ is the weighting structure.

In most of the countries, the prices are collected in a non-probabilistic sample of selling points; in some others, in a probabilistic way. The weights are expenditure shares, taken either from Household Budget Survey (HBS) or from National Accounts (NA) data.

Notwithstanding the many drawbacks, Laspeyres price index is used due to its positive character of being "quasi-transitive", what allows the time chaining. In fact, the ratio of two Laspeyres price indexes, let's say $\frac{_0L_t}{_0L_{t-1}} = \frac{\sum_{h=1}^{k} p_t q_0}{\sum_{h=1}^{k} p_{t-1} q_0}$ gives an index that

measures the price variation from t-1 and t of a basket of time 0 (instead that of a basket of time t-1, as it should be).

This feature of being quasi-transitive is so appealing that it compensates for any drawbacks and drives the NSI to use Laspeyres formula.

In order to overcome the substitution bias, even if not to eliminate it (Ferrari, 1999), due to changes in relative prices and to tastes, habits and quality modifications, some countries have started the elaboration of chained Laspeyes price indexes, which, while maintaining the base year – which, according to Eurostat recommendations, should be updated after 5 years – have the *calculation* base put on a month of the year preceding the one for which the monthly indexes are calculated.

While not avoiding the substitution bias, this can sharply subdue it, as the shortening of the distance from the calculation month and the base year undoubtedly reduces the substitution effect[6].

2.3 The PPP Elaboration

At present, the formula used by Eurostat for calculating PPP for country i relative to country i', at any aggregation level, is the GEKS one:

$$_{i}GEKS_{i'} = (\prod_{s=1}^{n} {}_{i}F_{s}\ {}_{s}F_{i'})^{\frac{1}{n}} = (\prod_{s=1}^{n} {}_{i}F_{s}\ {}_{i'}F_{s})^{\frac{1}{n}} = [({}_{i}F_{i'})^{2} \prod_{s\neq i,i'}^{n} {}_{i}F_{s}\ {}_{s}F_{i'}]^{\frac{1}{n}},$$

where n is the number of countries involved in comparison and F denotes the Fisher price index. GEKS PPP transforms the non-transitive Fisher index in a transitive price index as a combination of Fisher price indexes.

3 Time-space Harmonised Consumer Price Indexes

3.1 Similarities in TCPI and PPP

Since, as was claimed above, the time and space domains are to be regarded in a dual perspective, the two kinds of indexes are compared now, in order to illustrate the many similarities and to critically analyse the few dissimilarities due to very specific features, that at any rate do not imply structural differences. This comparison will be performed both as regards the properties that the consumer price indexes should satisfy in space framework and in light of the Fisher tests.

The representativeness concept is equally perceivable in both contexts: the goods and services in the basket must represent in an adequate way the consumption of the population which they refer to and equi-represent it in both time and space. Indeed, at time t, the basket should represent as properly as at time 0 the population consumption set, and this may not be easy to achieve due to substitution effect (changes in quality, habits, tastes,

relative prices). Likewise, in space A, the basket of consumer goods and services should be the same as in space B, in order for the comparison to make sense. Never the less, in space framework, the choice of the goods and services to be inserted in the list might seem more problematic, due just to the different entities that select the list and, above all, to differences and peculiarities in consumption habits, tastes, and goods and services quality.

The characteristicity of goods and services is equally important in both domains: even though it might seem that the fact that a good or service is equi-characteristic is more relevant in space framework, as a matter of fact in time framework too this relevance, although less evident, is not, at least in principle, negligible. It is undeniable that in space domain the phenomenon of non equi-characteristicity occurs more easily: it is quite frequent to find a good or service which is characteristic in space A and not in space B or vice-versa. In time domain this is less frequent, as for a good or service to stop being characteristic from time 0 to time t, there is a need for a very long time lag.

The problem of modification of quality of products is as important in time domain as in the spatial one. However, in time domain its incidence is likely to be weaker thanks to the limited time lag between the surveys, particularly when chain price indexes are used, as well as to the very detailed product specification. In space domain, the distance is more an ideal one and is dictated by the differences in history, orography, culture, and consequently, it is likely to have a bigger relevance on quality differences. It must be said, however, that today's global village world, with its ease of circulation of goods and the spread of publicity, undoubtedly mitigates the problem, as it is likely to find exactly the same extremely detailed product specification nearly everywhere.

It may seem that in space domain there is a need for a more detailed specification of goods, but this is not the case: the problem of specification and the eventual one of excessive specification and related difficulty or even impossibility of practical product identification has precisely the same relevance in both domains.

From the point of view of the tests that the formulae should pass, the situation is similar both in time and space domains. In what follows, the most relevant tests will be compared, for the sake of the confirmation of domain duality.

The fulfilment of some tests, although important, in time framework can be neglected or one can accept them to be weakly satisfied with no relevant practical effect, whereas in space framework their fulfilment is undoubtedly more relevant: this is the case of the base reversal test, whose fulfilment is not that important in time framework but is particularly relevant in space framework.

In fact, in multilateral time framework there is a kind of lexicographic ordering dictated by the natural flow of time that leads to ordering the index by taking as the base a time preceding that of reference, so actually by ignoring the test. However, also in case the current time is taken as the base one, the non fulfilment of the base reversal test does not create problems, as no practical relevant consequence is implied.

The situation is different in space framework, where the non fulfilment of the test prevents it from operating, as it is definitely influential to the choice of one or another space as the base: in fact there is not a natural ordering in countries and the fact that the index is different as the base changes takes any logical basis off the index elaboration.

Conversely, transitivity plays the same crucial role both in time and space domains. However, unlike what occurs as regards the base reversal test, the non fulfilment of this test cannot be disregarded neither in time nor in space domains, where there is a decisive need of chaining the indexes.

Similarly, the factor reversal test, particularly important in time comparisons of NA aggregates, namely GDP, in order to express them in real terms through deflation, is likewise important in space comparisons of GDP and the non fulfilment of this test would cause the same problems in both domains.

3.2 The Harmonisation of Formulae

From the theoretical/methodological point of view, one can reason in the following way: in Laspeyres price index, instead of considering time only, let's refer, for instance, to times 0 and t and to spaces A and B.

Thus, one can insert the time variation in the spatial one. By putting $p_{A/B,t} = \frac{p_{A,t}}{p_{B,t}}$ and $p_{A/B,0} = \frac{p_{A,0}}{p_{B,0}}$, the Laspeyres price index becomes:

$${}_{A}L_{B,t/0} = \frac{\sum_{h=1}^{k} \frac{p_{A,t} \big/ p_{B,t}}{p_{A,0} \big/ p_{B,0}} \frac{p_{A,0}}{p_{B,0}} q_0}{\sum_{h=1}^{k} \frac{p_{A,0}}{p_{B,0}} q_0} = \frac{\sum_{h=1}^{k} \frac{p_{A,t}}{p_{B,t}} q_0}{\sum_{h=1}^{k} \frac{p_{A,0}}{p_{B,0}} q_0} = \frac{\sum_{h=1}^{k} p_{A/B,t} q_0}{\sum_{h=1}^{k} p_{A/B,0} q_0}$$

, where k is the number of goods and services in the basket, and the Paasche one:

$${}_{A}P_{B,t/0} = \frac{\sum_{h=1}^{k} p_{A/B,t} q_t}{\sum_{h=1}^{k} p_{A/B,0} q_t}.$$

These two indexes give the variation from time 0 to time t of the price ratio between space A and B.

Accordingly, the Fisher price index transforms into:

$${}_{A}F_{B,t/0} = \left({}_{A}L_{B,t/0} \cdot {}_{A}P_{B,t/0} \right)^{\frac{1}{k}}$$

and the GEKS price index for the generic country i as compared to the generic country i' (i,i'=1,…,n; n = number of countries in comparison)

$$_{i}GEKS_{i',t/0} = (\prod_{s=1}^{n} {}_{i}F_{s,t/0} \cdot {}_{s}F_{i',t/0})^{\frac{1}{n}} = (\prod_{s=1}^{n} {}_{i}F_{s,t/0} \cdot {}_{i'}F_{s,t/0})^{\frac{1}{n}} = [({}_{i}F_{i',t/0})^{2} \prod_{s\neq i,i'}^{n} {}_{i}F_{s,t/0} \cdot {}_{s}F_{i',t/0}]^{\frac{1}{n}},$$

which gives the variation from time 0 to time t of the price ratio between space i and space i'.

This is a comprehensive information. But what is needed is the disjoint price variation between 0 and t and between A and B, that can be obtained through the separate elaboration of TCPI and PPP based on basket harmonisation, which will be dealt with in next paragraph.

3.3 The Harmonisation of Baskets

Let's have a look of the existing situation first. Then, the paper will discuss the features of the different baskets and suggest a way of harmonizing them.

The degree of homogenisation and convergence among the economies of the 12 countries that, since January 2002, have introduced Euro as the common currency, that is, the Euro-area, can be considered relatively high, even taking into account the existing social, cultural and climatic differences among countries (e.g., between Greece and Finland). It is destined to increase, as favoured by the free circulation of goods whose selling price, fixed in a common currency, is not affected by the biasing and speculative effects of the rates of exchange.

The Euro-area is facing a situation that has no precedents in the history of nations. The 12 members countries are subject to a unique monetary policy, run by the ECB, which holds the functions previously entrusted to the national central banks.

However, these countries are ruled in an independent way and do not share the same economic policy, with the risk that an expansive or restrictive action decided at EU central level (for instance, the variation of the interest rate) may produce heavy differential effects in the various countries.

For this reason, there is a strong need to dispose of short-time and structural indicators on the degree of development of each country and of each region, as represented by a system of consumer price indexes.

Currently, this system is formed by the following information set:

(i) International TCPI (ITCPI). These are the MUICP and the EICP, based on the HICP estimated by each NSI of the EU. The HICP are sent to Eurostat which in turn elaborates the aggregated indexes MUICP and EICP. As said in the Introduction, such indexes are one of the indicators prepared to evaluate the convergence of the EU Euro-area economies in the starting phase of the Euro-

area and are at present the main tool for monitoring inflation and for the monetary policy of the ECB;

(ii) National TCPI (NTCPI). These indexes have been developed independently by the NSI, above all in the last 50 years, to provide a monthly estimation of inflation, one of the most relevant parameters for the national central banks monetary policy, before the creation of the ECB;

(iii) Intra-national TCPI (INTCPI) for each region, or city, of each country. They are a by-product or an aggregation step of the country CPI and represent the territorial differences of the overall inflationary dynamics of each country;

(iv) International PPP (IPPP). At present they are elaborated by Eurostat for the EU member states and therefore, of course, for the Euro-area. They allow a comparison of the price level among the EU countries and may be considered a by-product of the PPP calculated by Eurostat on the basis of a continuative survey conducted in 31 European capital cities, which in turn belongs to the ICP.

To this set of TCPI and PPP, a further indicator should be added:

(v) Intra-national PPP (INPPP), for each region of each country. They would allow a comparison of the price level among cities, regions or areas of a country. At present, no indexes are elaborated, on a regular basis, neither by Eurostat nor by any NSI of the 12 Euro-area countries.

This system of TCPI-PPP indexes can be illustrated by Figure 1, where three countries, A, B, and C are represented, each of them including its own capital city (bigger dot) and two other cities (smaller dots).

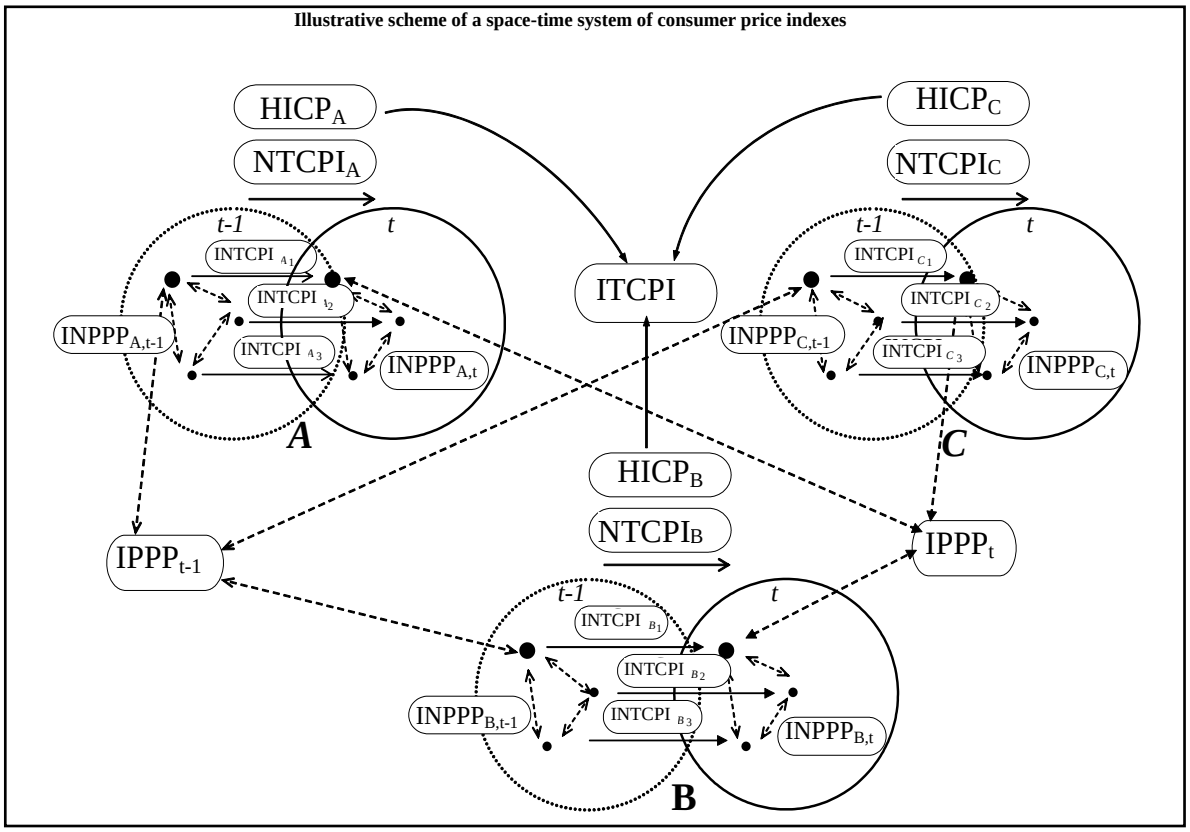
Time flows are represented by continuous lines, while space comparisons are marked by dashed lines and a bi-directional arrow, to underline the requisite of transitivity.

In the figure there are three different TCPI that measure price change between t-1 and t: intra-national (INTCPI), for each region, or city, of each country; national, for each of the three countries, calculated according to the rules defined by the country (NTCPI) or by the harmonisation process (HICP); international (ITCPI), as an aggregation of the countries HICP.

Spatial comparisons can be made separately at time t-1 and at time t and they are of two kinds: intra-national (INPPP), between the cities of each country, international (IPPP), between the capital cities of each country, as happens in the current methodology.

The graph depicts a harmonised approach that, as already said, at present doesn't exist, as the surveys that lead to TCPI and PPP, while sharing several features, do actually have different characteristics, shown by the following description.

FIGURE 1
System of TCPI-PPP indexes



3.3.1 Main Characteristics of the National TCPI and HICP

Reference background: transactions undertaken in the economic territory of the country, where the buyer is a household (private consumptions);

Price definition: actual retail selling price, against cash payment (without interest), including the taxes paid by the buyer;

Territory: each country is subdivided in R regions or sub-regions, where the price survey is carried out. The national index is obtained through weighted aggregation of the regional indexes;

Periodicity of the survey: monthly;

Frequency of the indicator: monthly;

Products selection: for each of the C items of the COICOP, every NSI identifies T_c products (c = 1,…,C), according to non uniform criteria and ways. Every country has its own basket, with different kind and number of goods and services, used both for the national CPI and for the HICP;

Units of survey selection: for each product t_c (t=1,…,T) of the basket, k_{r,t_c} shops representative of the purchasing habits of households are identified in each region r (r=1,…, R). The number of selected shop depends on: i) variability of the price dynamics; ii) scattering of the shops; iii) importance of the product; iv) survey unitary cost;

Sample of survey units selection: for each product of the basket, in every sample shop, a unique quotation is selected according to some criterion.

The number of quotations monthly surveyed is therefore equal to $\sum_{r=1}^{R}\sum_{c=1}^{C}\sum_{t_c=1}^{T_c} k_{r,t_c}$.

In the Appendix, as an example, the methodology of elaboration of TCPI and HICP in Italy is shown.

3.3.2 Main Characteristics of the Eurostat PPP (Household Consumption Survey Only)

Reference background: transactions undertaken in the economic territory of the country, where the buyer is a household (private consumption);

Price definition: actual retail selling price, against cash payment (without interest), including the taxes paid by the purchaser;

Territory: national, with the price surveyed in the capital city of each country (denoted by g) of the 12 Euro-area countries;

Periodicity of survey: triennial (rotating);

Frequency of the indicator: annual;

Basic headings selection: for each of the C items of the COICOP, S_c (c = 1,…,C) basic headings are identified. The list of basic headings is unique for all countries;

Basic headings specifications selection: for each s_c basic heading (s = 1,…,S), a list of possible specifications d_{s_c} (d = 1,…,D) are selected, according to characteristics

(brand, variety, wrapping, quantity, etc.) in such a way to guarantee simultaneously the representativeness of each country and comparability among countries;

Units of survey selection: for each basic heading s_c of the basket, k_{s_c} shops representative of the households purchasing habits are identified in the capital city of each country. In every shop of the sample, the price of all specifications are surveyed. The number of selected shops depends on: i) price variability; ii) scattering of the shops; iii) importance of the product; iv) survey unitary cost.

Sample of survey units selection: in every sample shop, the price of all specifications are surveyed. Therefore, the number of quotations surveyed in each complete cycle of triennial surveys is equal to: $\sum_{g=1}^{12}\sum_{c=1}^{C}\sum_{s_c=1}^{S_c}\sum_{d_{s_c}=1}^{D_{s_c}} k_{d_{s_c}}^{g}$.

The methodology used by Eurostat for calculating the PPP is described in the Appendix.

3.3.3 Drawbacks of the Current System

The time and space surveys on consumer prices have been developed according to different times and modalities and represent two different entities, from both the methodological and the organizational-managerial points of view. In both respects, the current system is not fully satisfactory.

As far as the TCPI and HICP are concerned, with the starting of the harmonisation process, the national TCPI are progressively losing importance to the advantage of HICP, which is more and more extensively used to measure the inflation differentials. Moreover, the national governments, although continuing in many cases to refer to the internal measures of inflation for the preparation of their own economic policy, devote increasing attention to MUICP.

In turn, the harmonisation process of the TCPI may be said to be anything but concluded. After the initial effort, which thanks to the approval of a Council Regulation framework and of some related specific regulations has allowed for the creation of a common nucleus for the calculation of comparable indexes, a number of important aspects has remained unsolved.

Some countries calculate yearly chained TCPI, whereas others utilize fixed-base systems with non uniform adjustment frequency. The weighting structure is based in some cases on NA data adjusted via information taken from HBS, combined with additional macroeconomic information, both from survey and administrative sources, whereas in other cases only HBS is referred to (Mostacci, 1999). The sampling designs and the quality adjustment procedures are different from country to country and a common methodology for the treatment of the seasonal products is missing.

Even from the point of view of the definition and the identification of the basket, the situation is far from being satisfactory. As an example, with a number of quotations 3-4 times greater than that of the Netherlands, in Italy about 1,000 products are surveyed, against about 16,000 in the Netherlands. Evidently, without mentioning the implications related to the weighting up, while in Italy a broader definition is used that allows a bigger margin to the choice in the field of the more representative specification, in the Netherlands a tight one is preferred, keeping the operations of sampling specifications selection at a centralized level.

In recent years, the difficulty of making the concepts, the definitions, the methods and the practices uniform and, consequently, of making the HICP more comparable, seems to clash with the resistance of the countries in defending the choices already made as regards the TCPI, believed to be the best possible, given the local situation of consumption, the information context and the available resources.

Should these be the causes that prevent a full realization of the harmonisation process, substantial progress in the short-medium term will hardly be achieved, unless there is a revision of the whole strategy that drives to perceive the advantages of better comparability, at least as far as the Euro-area countries are concerned.

A glance to the PPP will show that the current space indexes system presents weak points as well.

The exercise of calculating the PPP for GDP has become for Eurostat by far more difficult now that it is extended to 31 countries, which exhibit a greater heterogeneity degree - both as regards the contents and as regards the degree of development of the economies - than when it was carried out for the initial nucleus of 6 countries (Germany, France, Italy, Belgium, Netherlands, Luxembourg) which, in late ‘60s gave life to the calculation of PPP (when, it should be said, the number of traded goods and services and the selling methods were fewer).

The first consequence of the growth in the number of participating countries has been the sub-division of the 31 countries into 3 groups, which are only relatively more homogeneous. This has caused a re-organization of work (previously co-ordinated by Eurostat only) in two levels: the first level regards a specific area, comprising different countries, that are entrusted to a co-ordinating country; the second level regards the group leaders, that are under the control of Eurostat.

The Euro-area countries have been spread out in all the three groups: North (Finland and Ireland); Centre (Germany, Austria, Belgium, Luxembourg and Netherlands); South (Spain, France, Greece, Italy and Portugal).

The second consequence is the widening of the list size, which sharply increases the survey and processing costs, or, resources being unchanged, ends up by driving the quality of results to decline. In fact, since the representativeness and the comparability conditions are inconsistent with each other, as the number of countries increases, the number of specifications to be considered increases as well. If, at worst, a product specification is consumed in a country but not in any other country of the comparison, such a specification

should be excluded, as the requisite of comparability is missing. In the meantime, one should not consider specifications that, although present in all the countries and hence fully comparable, are not representative of the consumption of any of them.

Further shortcomings of the current system are: (i) the triennial periodicity of the survey, (ii) the collection of prices restricted to the capital cities only and (iii) the interaction of these two factors.

In the first case, for the purpose of calculating annual indicators, it is necessary to update the price average levels with their time dynamics: currently, generic indicators are used, not specifically referable to the price to be updated.

In the second case, the ratio between the price level in the capital city and the national average varies from country to country, and in order to perform a reliable comparison it is necessary to utilize some specific coefficients of extension of a price surveyed in the capital city to the national one. The estimation of such coefficients is particularly difficult and burdensome, as it requires the extension of the spatial survey to an adequate number of other cities[7].

Moreover, as the ratio between the price level in the capital city and the national average is changing over time, the use of coefficients of time adjustment in the years when the survey is not carried out should account for this factor.

Finally, the overall quality of the current PPP is not fully satisfying, because of objective measurement difficulties that seem to increase as time goes on (Eurostat 2001b, OECD 2001). In the meantime, the survey findings are used for very delicate purposes, such as, for instance, the contribution fees of each EU country or the splitting up of the structural funds to the less developed areas.

3.3.4 Method of Construction and Advantages of a Survey Harmonised Approach

In order to overcome the shortcomings of the current TCPI and PPP surveys, it is necessary, as previously claimed, to adopt a harmonised view which, by exploiting the substantial uniqueness of the objective of the surveys, and in the meantime by safeguarding its diversity, leads to a unique organizational and operational system.

From this point of view, the recent creation of the EMU among relatively homogeneous countries as regards the level of development of their economies and the progressive convergence of markets, has created a need for having a more complete and reliable system of consumer price statistics. Such a need may represent a chance and a pulse for the NSI and favour the creation of a unique system.

The transition should occur in a gradual way, ensuring the continuity of time statistics, as regards the process of European harmonisation, and of the spatial ones, as regards the ICP and the European PPP.

The harmonisation of the two surveys is subordinated to the choice of a single survey system. At present, the degree of intersection between the two surveys, that is, the number of common specifications, is very low, which causes a useless waste of resources.

Manifold are the explanations of this situation. The list of specifications for the PPP privileges the comparability among countries and is decided at the central level (Eurostat), whereas the list for TCPI and HICP is defined independently by each NSI. The periodicity of the price survey is triennial in the first case and monthly in the second case. The geographic coverage is wide for the TCPI and HICP and restricted to the sole capital city for the PPP (with a need for having a coefficient of extension to the national average price).

In some countries, like, for instance, Italy, the survey for the PPP is carried out directly by the NSI, whereas for the TCPI and HICP it is entrusted to peripheral and independent structures.

Even in countries where both surveys are managed by the NSI, there are usually two different staffs that care of them, sometimes without any co-ordination between the two structures.

In order to attain the objective of a single survey system it is necessary to remove these differences, by focusing on the modalities of the basket selection and on the sample of outlets.

As for the identification of products, the starting level, for both surveys, is a position c of the COICOP. Nonetheless, while in time surveys each NSI selects a given number of elements, T_c, with an anything but homogeneous methodology, in spatial comparisons the single list, decided by Eurostat after consultation with the NSI, is formed by S_c elements.

The harmonisation process of the product list suggested in this paper is articulated into three stages.

First of all, one should succeed in obtaining a list of T_c^+ products which does not depend on country g and is not the mere union of the countries' lists, $T_c^+ \neq T_c^1 \bigcup T_c^2 \bigcup ... \bigcup T_c^g ... \bigcup T_c^{12}$, as, in such a case one would have a useless cost increasing only. To this aim, it is necessary that the 12 countries of the Euro-area, under the co-ordination of Eurostat, adjust the definitions and the selection criteria.

This can be done in an easier way in some categories of goods or services where the consumption habits are more homogeneous across countries, like, for instance, food or durable goods, and in a more difficult way in more heterogeneous categories of goods and services, like, for instance, clothes or some services. If one considers that each NSI already manages a single list for the whole territory of its own country, the creation of a single list for the 12 countries of the Euro-area, although being a complex task, does not seem impossible.

The second step consists of getting a final list of P_c[8] products (basic headings), by comparing the t_c and the s_c. The overall result should be $T_c \leq P_c \leq S_c$, that is to say, the list of basic headings is expected to be wider than the one needed for the time comparisons, but smaller than the one currently utilized for the space comparisons, where one has to take into account a larger number of countries with more heterogeneous consumption.

The third step consists of identifying for each basic heading p_c (p = 1,…,P) the specifications d_{p_c} to be surveyed, in the same way as is done for the definition of the list in space comparisons.

To restrain the number of the d_{p_c}, it will be advisable to give up in some cases the perfect identity in space comparison, by resorting to methods of evaluation of the different quality, as suggested by Rao (2001).

Taking into account the greater homogeneity of the 12 countries as well, it will result, however, in $d_{p_c} < d_{s_c}$.

As far as the shop selection criteria are concerned, it is evident that the requisites of representativeness requested for the time surveys and for the space surveys are practically the same, so it is useless, as well as costly, for every NSI to manage two different ways of selection and keeping. As for the identification of the survey units, it would not be difficult to succeed in fulfilling the condition $k^g_{t_c} = k^g_{d_{s_c}}$, for every g.

In view of the increasing spread of the same kind of retail stores throughout Europe, it might be interesting, for the purpose of augmenting the effectiveness of comparability, to include them in the sample of survey units of each country where they do exist.

Since for the TCPI, for want of information about the selling shares of each product it is preferable to survey a unique quotation in each outlet, the harmonised survey of a generic basic heading in the capital city of a country can be represented by Table 1, where it is assumed that 5 specifications have been selected and that the sample is formed by 6 outlets.

The star * denotes the most sold specification in the outlet, assuming that this is the way of selecting the specification for the TCPI. The symbol x denotes the presence of the specification in the outlet and the symbol – the absence.

TABLE 1
Harmonised Survey of a Generic Basic Heading in the Capital City of a Country

	Outlet 1	**Outlet 2**	**Outlet 3**	**Outlet 4**	**Outlet 5**	**Outlet 6**
Specification 1	-	x	x	-	*	-
Specification 2	x	-	x	*	-	x
Specification 3	-	-	-	-	-	-
Specification 4	*	*	*	x	x	*
Specification 5	x	-	-	x	x	-

In 2 outlets out of 6, 2 specifications are present; in the remaining 4 outlets, it is possible to survey 3 specifications out of 5.

Specifications 1 and 2 are the most sold, respectively in outlet 5 and 4; in addition, specification 1 is present in outlets 2 and 3, whereas specification 2 is present in outlets 1, 3 and 6.

Specification 3 cannot be surveyed in any outlet (one may assume that it has been included as representative in countries other than the one under consideration).

Vice-versa, specification 4 can always be surveyed and it is the most sold in outlets 1, 2, 3 and 6.

Finally, specification 5, although being surveyed in 3 outlets out of 6, is not the most sold in any of them.

The basic heading price index, for TCPI purpose, is obtained as a geometric mean of the price ratios of the item market with *[9].

The advantages of this harmonised selection scheme that concerns both the products and the outlets are evident for both time and space surveys.

In time surveys, a single list of products, generated according to uniform criteria and ways of selections among countries, sharply increases the comparability of the harmonised indexes, by ensuring in the meantime the representativeness of each national index.

In case of forced substitution, for example, if since a certain month m in the outlet 1 specification 4 is no longer sold and the specification with the greater purchasing frequency becomes item 5, to calculate the quality adjustment between the price of specification 5 in month m and the price of specification 4 in month m-1, for the purpose of achieving an unbiased estimation of the pure price change, the NSI, either can have the availability of additional information about the ratio between the prices of the two specifications in the outlet where the substitution has proved to be necessary (although concerning a previous period). Alternatively, the NSI may decide to collect the information, updated at month m, in another outlet where the two specifications continue to be present (for instance, either outlet 4 or 5).

This way, all the countries can apply the same quality adjustment method, which represents one of the most crucial points of the HICP, that the Eurostat Working Group has been trying to solve with little success for many years.

A common solution, although it will not necessarily increase the indexes' precision, is desirable as it ensures a better comparability.

In spatial comparisons the advantages due to the harmonised approach appear even more evident, if only for the reduction of the product list, whose size presently continues to increase time to time to reach critical levels, without a corresponding increasing of the available resources.

The outlet list is kept updated, as it is used monthly for the time indexes, so the current procedure of re-sampling is unnecessary.

A greater frequency of surveying becomes possible with a limited cost increase. In fact, for the sake of simplicity, the cost function for the price survey in a given outlet can be written as $C = C_f + C_v$, where C_f represents the fixed part, the most relevant, linked to the time, and the expenditure needed for the surveyor to reach the outlet and $C_v = C_1 + \sum_{i=2}^{n} C_i$, where C_1 is the cost (time) of collection of the most sold specification and $\sum_{i=2}^{n} C_i$ the time needed for the movements inside the outlet and the price recording for the (n-1) additional specifications.

Since $C_f + C_1$ are covered by the monthly survey for time indexes, the additional cost can be bearable at least once a year[10], also taking into account that the collected additional prices can be used for a more precise evaluation of the quality adjustments, according to what was said above.

A harmonised scheme favours the planning and the accomplishment of intra-national spatial comparisons as well, a need more and more perceived by any NSI. To this aim, the specification list can be further reduced as regards the one needed for the international comparisons and even in this case, a rotating survey of outlets can be foreseen, so as to collect the prices at least with a yearly time frequency.

Therefore, the whole system for a country foresees to collect, as a minimum goal:

(i) the price of the most sold specification in each outlet of each city or region on a monthly basis (for intra-national, international, national TCPI);
(ii) the prices of all specifications in each outlet of the capital cities at least once a year (for international PPP);
(iii) the prices of a subset of specifications in each outlet of each city or region at least once a year (for intra-national PPP).

Even if the NSI would decides not to publish the intra-national TCPI due to technical or political reasons, the collected information is however necessary for the implementation of international PPP, as they can be used to estimate the existing ratio between the price level in the capital city and the national average, in a more adequate way than is currently done.

4. Conclusions

Following the analysis conducted in previous paragraphs, a brief summary and some remarks are in order.

Let's first stress again the dual view with which the authors intended to approach the matter of consumer price indexes: in fact, since the very beginning, they have been denoted by CPI, regardless of their time or space nature.

To denote then time consumer indexes by TCPI and space consumer price indexes by PPP was a matter of mere convenience to avoid misunderstandings. Nevertheless, this symbology might be adopted, by leaving the CPI acronym for the generality.

Space-time harmonisation of the price indexes produced in EU framework is a very relevant objective that should be pursued by the EU NSI and Eurostat.

In this paper, the crucial points related to this objective are raised and discussed as regards the 12 Euro-zone countries and it seems that the path to follow, although not simple at all, is worth pursuing, also as a basis for eventual enlargement to all the EU countries.

Two points of view have been analysed: the "pure" methodological, that is, the eventual adjustment of formulae, and the practical – even though methodological in itself – that is, the unification of baskets, that currently represents perhaps the crucial field of discussion. From both of them, the conclusion that clearly emerges is that harmonisation is possible and worthwhile, in spite of the several difficulties to be overcome and the quite great deal of time implied.

The harmonisation of formulae does not produce a concretely usable frame, as it provides an overall and not separable result. Nevertheless, it can be used in combination with the harmonised methodology of basket construction that is suggested in the paper.

Moreover, it can be regarded as a way open to further manipulations aiming at achieving more comprehensive and operational results.

The harmonisation of baskets promises, at present, more and in shorter time. Indeed, the methodology suggested in this paper, based on a comprehensive survey system, attained by focusing on the modalities of the basket and on the sample of outlets, allows harmonisation to be achieved.

This can be obtained through a three-stage procedure: (i) attainment of a list T_c^+ of products that is not a mere sum of the countries' individuals lists of products used for TCPI calculation; (ii) attainment of a list of products as basic headings through comparison between T_c^+ and the list of products for the PPP elaboration, that should be longer than the former but shorter than the latter; (iii) identification, for each basic heading, of the specification to be surveyed, in the same way as is done for the definition of the list in space comparisons. A relaxation of the condition of perfect identity joined to the strong homogeneity of the 12 countries will result in a number of specifications to be surveyed smaller than what is presently necessary for the ECP needs.

As for the outlet selection, while the representativeness condition is practically the same, the method of selection can be the same for both time and space domains, and the number of outlets the same as for the current elaboration of the TCPI.

A harmonised selection scheme can therefore be designed, where, in each outlet of the capital city of a country, a basic heading can be selected of which a unique, most sold, quotation is surveyed, as requested for the TCPI elaboration.

There are several advantages in this harmonised approach and subsequent single product list survey:

- in time domain, it ensures comparability and representativeness of each national TCPI, besides making it possible for the countries to use the same quality adjustment method;
- in space domain, the reduction of the products list and its updating – with no need for the now used triennial re-sampling procedure - is perhaps the most evident finding, along with the possibility of carrying out surveys at a greater time frequency, at a limited additional cost. Moreover, it makes it possible to plan and carry out intra-national spatial comparisons, based on an even further reduced specification list and survey time frequency.

Thus, the survey can be based on: (i) a monthly collection of the price of the most sold specifications in each outlet of each city or region of each country; (ii) a yearly (or even quarterly) collection of all specifications in each outlet of the capital city of each country; (iii) a yearly (or quarterly) collection of a subset of specifications in each outlet of each city or region of each country.

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APPENDIX

The TCPI and HICP in Italy

As an example of how the time consumer price indexes, both TCPI and HICP are elaborated in the 12 Euro-area countries, let's take the case of Italy, that can adequately and without loss of generality represent all the other countries. Moreover, Italy produces two TCPI, the very general one and a second one for a more restricted set of consumers that can be taken as an example of sub-index. Finally, these two TCPI are chained as well.

The consumer price index for the whole country (*Indice nazionale dei prezzi al consumo per l'intera collettività, NIC)* is the main Italian domestic measure of inflation for macroeconomic purposes.

In addition, the Italian NSI, ISTAT, calculates the consumer price index for blue and white collar worker households *(Indice dei prezzi al consumo per le famiglie di operai ed impiegati, FOI)* and, for European purposes, a Harmonised Index of Consumer Prices (HICP) for Italy.

The three above consumer price indexes measure the average change from month to month in the prices of consumer goods and services purchased in Italy, although there are differences in target population (the FOI target population is a subset of the NIC target one), economic aggregates (NIC and FOI refer to the Households Actual Final Consumption while HICP refers to the Households Final Monetary Consumption Expenditure, HFMCE), coverage (NIC and HICP unlike FOI cover all goods and services consumed on Italian territory by resident households and non- resident households, for example, tourists) and uses (FOI is used as a mean of adjusting income payments).

In particular, as underlined above, the HICP is used to measure inflation in the context of international, mostly inner-European, comparisons. It should ensure comparability of measured inflation rates across Member States, something which is not possible with national consumer price indexes because of differences in coverage and construction methods.

It is worth emphasizing that these three consumer price indexes are calculated from the same monthly sample survey on consumer prices.

The sampling design is a stratified one, according to three criteria: i) geographic criterion (prices are collected in 85 municipal district throughout Italy covering the 90.2% of the population); ii) product types (the basic structure resembles the COICOP)*;* iii) type of shops (a sample of outlets, stratified by sales channel, is constructed to take into account the differences in price movements for each sales channel).

They are Laspeyres-type price indexes, calculated as chain indexes: the base is a year – at present 1995 for NIC and FOI and at 2001 for HICP – whereas the reference period (the so-called calculation base) is a month, December of the previous year for all the three indexes.

Therefore, for instance, the index in month *m* of year *t*, reference base 1995=100, is obtained by multiplying the index of December of year *t-1*, base 1995=100, by the index of month *m* of year *t* referred to December of year *t-1*.

The weights, as expenditure shares, are basically represented by NA expenditure data, in turn largely obtained by using information taken from the HBS. Since the NA expenditure data is not as detailed as the item prices, it is further subdivided into more detailed categories using several sources on consumer spending patterns (public or private statistics; for example AC Nielsen data for grocery goods).

It should be stressed that the methodology of estimation of the three indexes is similar; it differs as the HICP does not include some categories of expenditure (for example, national lottery). In particular, since HICP refers to HFMCE, social transfers are excluded and only the net expenditures of consumers are covered (the difference is particularly evident for drugs, pharmaceutical products, medical services and hospital services).

The PPP Elaborated by Eurostat

In the framework of the ICP, Eurostat has launched the ECP for price level comparisons among European countries.

Eurostat estimates PPP initially for each basic heading in the sample (Ferrari-Riani, 1998). A basic heading consists of a fairly homogeneous group of specifications that are priced in different outlets in the countries and represents the smallest aggregates for which expenditure data are available. Then the resulting basic or individual PPP are aggregated using the basic heading expenditure as weights. In order to obtain this expenditure, Eurostat issues an annual questionnaire to participant countries. The data sources used to fill in the requested information differ from one country to another (Eurostat, 2000).

In order to ensure the best possible international price comparability, the insertion of a basic heading in the sample is made according to the criteria of: (i) representativeness, i.e., the product should be inserted in the list if it is purchased in such a quantity for its price to be typical in the national market; (ii) comparability, i.e., either a branded product

is inserted in the list or an exhaustive definition is given that allows to identify identical or sufficiently similar products in the different countries (this will avoid distortions due to quality differences; (iii) equi-characteristicity, i.e., every product should be equally characteristic in consumption bundle in all countries, in order to avoid the so-called Gerschenkron effect due to the negative correlation that generally prevails between price ratios and quantity ratios[11]. Equi-characteristicity is ensured if each country includes in the list at least one specification which is characteristic or typical of its own consumption for each basic heading, by indicating it with a star.

The size of the sample is roughly 3000-3500 specifications. They cannot be necessarily priced by all countries. Therefore, in the initial stages of the calculations, the sample does not necessarily allow each country to be compared directly with all of the others, but just with those with which it has the highest affinity.

This can be seen as an application of the graduality principle at the basic heading level, which is just the practical consequence of the simultaneous application of the two principles of product comparability, i.e., identity or exhaustiveness of definition and equi-characteristicity. In subsequent stages of the calculation process, it becomes possible to compare each country with each of the others.

For the purposes of the ECP, prices are collected by the NSI of each country, under the coordination of Eurostat. The surveys are carried out in the capital cities of each country. The prices collected should be the market prices actually paid by purchasers. They should be representative of the whole national territory and correspond to the annual average of the reference year. To this end, some NSI supply spatial coefficients by group of products that can be used to convert the capital city price to the national average price. Other NSI conduct surveys in some cities simultaneously, thereby directly obtaining an average price that is believed to be representative of the whole national territory.

The surveys are spread over three years. As the target averages prices are the annual average prices for the reference year, the average prices at the time of the survey have to be converted to the annual average prices for the reference year. Where the NSI do not supply specific time adjustment coefficients for a particular survey, the adjustment is calculated on the basis of the detailed monthly consumer price indexes that are supplied by the NSI, covering 219 basic headings.

The outlets where prices are to be collected are selected by the NSI. Moreover, this choice should fit the national structure of retail sales by outlet types, depending on the group of products in question. Accordingly, the prices recorded are weighted in order to get an average price which is representative of the country's retail sales consumption. Retail outlets are divided into the following categories: 1) department stores, popular; 2) supermarkets and hypermarkets; 3) hard discount; 4) mini-markets, neighbourhood shops, service station shops; 5) traditional shops; 6) markets; 7) service enterprises in the private sector; 8) service enterprises in the public sector; 9) other (mail order, sales at the customers' premises, mobile shops).

For purely statistical reasons, on account of the different nature of the data, a distinction is made between the calculation methods used within the basic headings and the methods used for the aggregations. However, the required methodological principles and properties are the same, namely the equi-characteristicity of the basket underlying the comparison and the transitivity of the results.

The calculation of basic headings PPP follows a five-stage procedure:

1. Calculation of Laspeyres and Paasche price ratio matrices.
   For each pair of countries, say A and B, a Laspeyres-type parity is obtained as the geometric mean of the price ratios for the specifications that are characteristic of country A[12]. In symbols, ${}_A\widehat{L}_B = \left(\prod_{i=1}^{k} \frac{{}_Ap_B^i}{{}_Ap_A^i} \right)^{1/k}$,where k is the number of the above price ratios and ${}_Ap_B^i$ and ${}_Ap_A^i$ are the average prices in countries B and A of specification i. A Paasche-type parity is then calculated for the same pair of countries as the geometric mean of the price ratios for the specifications that are characteristic of country . In symbols, ${}_A\widehat{P}_B = \left(\prod_{r=1}^{k'} \frac{{}_Bp_B^i}{{}_Bp_A^i} \right)^{1/k'}$,where k' is the number of the above price ratios and ${}_Bp_B^r$ and ${}_Bp_A^r$ are the average prices in countries B and A of specification r.
2. Calculation of "Fisher" price ratio matrix. In order to obtain a price ratio for a basket which is equi-characteristic of the two countries, a Fisher type parity is calculated as geometric mean of the Laspeyres-type and the Paasche-type parities: ${}_A\widehat{F}_B = \left({}_A\widehat{L}_B \cdot {}_A\widehat{P}_B \right)^{1/2}$.
3. Completing the "Fisher" matrix. The matrix of Fisher-type binary parities may be incomplete because certain binary Laspeyres or Paasche parities could not be calculated as some prices are missing. The missing Fisher-type ratios have therefore to be estimated by calculating the geometric mean of all the available indirect Fisher-type price ratios connecting (or bridging) the countries for which the ratios are missing.
4. Building the GEKS matrix of transitive parities. By applying the GEKS procedure a full table of transitive parities for the basic heading is obtained. The underling principle of quadratic minimization leads to this formula for execution:
   $${}_h\mathrm{GEKS}_j = \left(\prod_{s=1}^{n} {}_hF_s \cdot {}_sF_j \right)^{1/n}$$
   where ${}_hF_s$ is the Fisher price index for country s relative to country h. The Fisher indexes themselves are not transitive, but the GEKS agglomeration of Fisher indexes is.
5. Standardising the GEKS matrix. In the GEKS matrix of transitive parities, the parities in each column are expressed with the corresponding country as a base. To obtain a set of standardized parities, that is, with the group of countries as a base,

each element of the matrix is divided by the geometric mean of its column elements.

FOOTNOTES

[1] Following Eurostat (2001), the aim of the HICP is to measure inflation by means of the consumer price index on a comparable basis, taking into account differences in national definitions. The classification of goods and services in HICP is the COICOP (Classification Of Individual COnsumption by Purpose).
[2] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.
[3] Before the creation of the EMU, this index was calculated from the HICP of the fifteen European Union member states. But since the calculation of MUCPI, the EICP is calculated as the weighted average of MUCPI and HICP of countries that do not belong to MU (Denmark, Sweden and the United Kingdom).
[4] HICP include the net price paid by consumers (after reimbursements), while some national TCPI exclude these purchases or record the gross price.
[5] In HICP, owner-occupiers' shelter costs, expressed as imputed rents or mortgage interest payments, are not regarded as part of the inflationary process and therefore are excluded.
[6] The substitution bias could be eliminated by putting the index construction into the "economic approach" framework, so called to distinguish it from the one discussed here, called "statistical approach". Indeed, the economic approach, while being by far more satisfying and allowing the fulfilment of all the economic conditions, is not used by any NSI, due to the many practical, statistical and econometric estimation problems that prevent it from obtaining satisfactory results. Moreover, in all cases where the approach has been tested, the results have been only slightly different from those obtained with the statistical approach, in contrast with the higher cost of the many complicated manipulations and time needed.
[7] It should be stressed that the latest estimation of such coefficients goes back to 1989.
[8] Every NSI should be in a position to define weighting coefficients for each p_c, so that the estimation of the indicators for each specification of the COICOP is obtained as a weighted average. Should this not be possible for some countries, it will be necessary to define an intermediate level of aggregation between the p_c and the specification c, so to achieve the aggregation in two stages, the first one simple and the second one weighted.
[9] Alternatively, weighted means can be used if more detailed information on the selling shares of each outlet is available.
[10] By using a sample design with a rotation of the outlets panel, the additional cost can be subdivided in a uniform way over all months so to distribute the heavier load over the surveyors, without the need of engaging others.
[11] Compared to the base country, a country will usually absorb relatively large quantities of goods that are comparatively cheap and relatively small quantities of those that are comparatively expensive.
[12] In terms of asterisks: "that have an asterisk in at least one of the two countries".