ON THE ESTIMATION OF PURCHASING POWER PARITIES ON THE BASIC HEADING LEVEL

BY HUGO KRIJNSE LOCKER

EUROSTAT

The estimation procedure for purchasing power parities is generally divided into two parts, one for calculating transitive PPP's within basic headings and a second beyond this most detailed level up to gross domestic product. This paper only concerns the first step. It provides a description of the work carried out by the European Communities in 1980 within the United Nations International Comparison Project (ICP) framework. The estimated PPI's for basic headings are put forward together with the procedures for product selection and specification, the classification used for these purposes and the impact on the estimation of transitive PPP's. Instead of the country-product dummy (CPD) method used in the ICP, a revised Elteto–Köves–Szulc (EKS) procedure is proposed in which the estimation method and product selection constitute one integrated procedure.

The purpose of this paper is to describe the problems related to the estimation of transitive purchasing power parities on the level of basic headings (or detailed categories). This estimation constitutes the first step in the estimation procedures followed in the United Nations International Comparison Project (ICP) as well as by the Statistical Office of the European Communities (SOEC) in their work. The second stage, which is the aggregation of basic heading parities up to the level of Gross Domestic Product, is completely left out in this paper.

The paper underlines the interdependence of a set of elements which are of essential importance for the estimation of parities for basic headings. The classification used and the definition of basic headings within this classification, the selection of products to be included in the price surveys, the definition of these selected products and finally the estimation procedure used for the calculation of transitive parities should all be considered together in a consistent way. Two different conditions play an important role in this area: the transitivity of the parities for a group of countries and the necessity of respecting equal characteristicity of the transitive parities calculated for each basic heading and for each participating country.

During the preparation and execution of the 1980 exercise for the twelve participating countries a discussion took place within the SOEC, and in particular with Mr. Dino Gerardi and Mr. Louis de Marcillac on these aspects and in addition the SOEC proposals were discussed at length by the working group on Price Statistics during the meetings held to set up the price surveys and to determine the procedures for estimating transitive parities.

The results of these discussions, and consequently the agreed procedures with the participating countries, constitute a compromise between what is theoretically desirable and what is practically possible.

Clearly the solutions adopted are elaborated first of all for the European Communities (EC) countries and the other participating countries (Spain and

Portugal), because the intra-community comparison constitutes the main objective of the work. However, the comparison with other countries as well as the world wide comparison is also of great interest for the EC countries and in addition the procedure followed in other regions or on the world level also raises the problem if and how far intra-community results are affected. For this reason SOEC is also interested in the procedures followed in other regions or on the world level. Furthermore, it is necessary to see whether the SOEC method applied in 1980 can be extended to comparisons outside the EC, between regions and on the world level.

These questions have given rise to further consideration of product lists and the relationship between regions and in particular how regions can be linked through product lists. These problems are described in the light of the condition of equal characteristicity of the parities for each basic heading which is determined by the product selection, as well as the number of products for which prices are collected. It was concluded that the SOEC procedures can be easily applied on a larger geographical scale and even on the world level without augmenting the total amount of price collection effort for each participating country. The EKS procedure combined with a special "star" product method can provide appropriate transitive parities not only for a region like the EC but also between regions or for the world as a whole.

CLASSIFICATION AND BASIC HEADINGS

The classification used for final uses (of gross domestic product) constitutes the framework for the ICP work. The breakdown of each of these uses

(1) is the basis for the value figures in national currency used in the aggregation process, and

(2) constitutes the basis for the delimitation of product groups from which products are selected for pricing.

The ICP classifications used are, in principle, those of the UN System of National Accounts (SNA) or the SOEC European system of Accounts (ESA). However, in some cases SNA classifications are not very appropriate for ICP purposes.

For final household consumption, a classification by object is used which is worked out in further detail. Not all objects cover groups of homogeneous products. Transport is an example, because it includes products like cars, repair, petrol, public transport, cabs, insurance, etc. Food is an example of an object covering similar products. For the purpose of product selection as well as for the calculation of PPP's it has been necessary to define groups of homogeneous products and this has been obtained by a detailed breakdown of the object categories.

For government consumption the SNA provides a breakdown by function (COFOG) which is used only to a limited extent for ICP purposes (in particular "education" and "health"). In addition, in order to provide a suitable frame for comparisons based on input prices, the total value of government services is broken down according to the industry of origin of goods and services bought (ISIC, the UN kind of activity classification, or NACE, the SOEC version).

For gross fixed capital formation, classifications by products or groups of products can be taken for ICP purposes. The classification for producers durables (equipment goods) is very detailed (ISIC or NACE); however, it is less detailed for construction and civil engineering and therefore not completely appropriate for ICP.

The basic heading (or detailed category) can be defined as the smallest item of the classification for which value data (consumption or investment) are used; within a basic heading no value figures are used, although some kind of weighting within the basic headings is possible and desirable. The choice of basic headings is a compromise between two elements: availability of reliable data on consumption or investment, and need for homogeneity of product groups in terms of price ratios.

In the ICP, 154 basic headings are used; for 1980 in the EC exercise 328 basic headings were defined. In the African comparison, however, it will be very difficult to obtain reliable data for 154 basic headings.

It is necessary to underline that the delimitation of basic headings is more or less based on the titles of the headings and not with reference to a classification of goods and services like the UN International Classification of Goods and Services (ICGS). In 1980 EC tried to improve the definition of the basic headings by using for goods its foreign trade product classification (NIMEXE). This point is very important for the comparability of value data provided by the countries. For services no appropriate classification was available and the content of the basic headings is mainly based on titles of the headings.

BASIC HEADINGS, PRODUCT SELECTION AND DEFINITIONS

Once the basic headings have been established it is possible to select the products to be included in the pricing exercise. A basic heading covers a set of similar products, but it is difficult to enumerate all products included, because the number of products depends on the strictness of the definition of each product. "Bread" may be considered a "product", but in the ICP it covers a great variety of types of bread and the number of varieties increases if the definition is made stricter. This brings us to the important question: how strict should the product definition be? The answer depends on the purpose of the comparison. The purpose of the ICP is to calculate PPI's which are designed to estimate quantity ratios of national accounts aggregates between countries. The rules in the ICP should thus be in line with national accounts requirements.

By taking again the example "bread" these rules and their application can be illustrated. As was said before "bread" is a product covering a great variety of different types of "breads" depending on raw materials used, the weight, packing, etc. and all these characteristics have an impact on the price per unit. Moreover, the most representative variety is not the same in each of the countries which excludes the possibility of taking one single variety to be priced in all the countries. The solution of broadening the definition would give an average price of bread in each country, which is equal to the price of the most representative variety of bread in each country. This comparison of average prices is certainly not in line with national accounts requirements because these average prices will

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correspond to different products and the quantity ratio derived from the PPP's would reflect ratios between physical quantities of bread consumed. In national accounts quantities should also include the quality of the product and in order to ensure this, prices should correspond to equivalent products, defined in a very strict way.

The fact that the product specification should be as strict as possible has important consequences for the ICP procedures.

First it is necessary to establish detailed specifications for selected products, and enumerators are needed who are able to identify the products when doing the price collection. It is possible to use brand names, models or reference numbers for some products, which facilitates the establishment of specifications as well as identification in the outlets during the price surveys. However, in many cases it will be necessary to work out detailed specifications for the products included in the list.

Secondly, strict comparability of products will lower the degree of representativity of a given product in most countries; in order to obtain a sample of products with the same degree of representativity for all countries the number of products has to be increased. The list of products will include more and more products and its extension depends on the number of participating countries; furthermore, it will not be possible to price all selected products included in the list in all participating countries.

This is the case for the ICP list since the beginning, and it is also valid for the EC exercise since 1975. Only in 1970 when the number of countries was confined to six were all products of the list priced by all countries, but this procedure was abandoned in 1975.

The procedure followed by the EC for establishing the list of products and their specifications is based on a close collaboration between the Statistical Offices of the participating countries, not only for the European exercise but also for the African countries. Products with detailed specifications were suggested by countries and then, if available in more than one country, added to the list. The selection was carried out with a specific purpose: the estimation of balanced transitive parities between pairs of countries. The procedures used to obtain these parities are examined in a later paragraph.

WEIGHTING

On the level of basic headings and their aggregations, values expressed in national currency are required for each country. These values have been provided for 1980 according the following rules. The value of GDP and its five main components refer to 1980 estimates available in October 1981; further breakdowns of these values are made on the basis of the most recent available weighting structures depending on the degree of disaggregation requested. A first breakdown of about 60 items is available in the national accounts for the year 1979 (in October 1981). A further disaggregation was established for a more or less remote year for which results of special surveys were available.

Values provided for all 328 basic headings for the year 1980 were mainly extrapolations because final 1980 values will only be available in a later year.

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For these reasons the weights reflect the state of statistical information at a given time and therefore need regular updating.

The value of a basic heading corresponds to the consumption or investment of a set of goods and services defined, if possible, with reference to a product classification. From this set of products only a sample is taken to be priced in order to carry out the estimation of the PPP's.

Within a basic heading more than one product will be selected for pricing but not all products need to be priced by all countries. Nevertheless, it can be said that within a basic heading more than one single parity will be available between pairs of countries and therefore it is necessary to derive an overall parity from these individual parities by some kind of aggregation procedure.

One of the questions arising in this context is whether individual parities within a basic heading should be "weighted" in order to calculate parities on the basic heading level. In the ICP, weights within basic headings were not requested or used (except for headings) whereas the EC did apply product weights in 1970, but not in 1975 nor in 1980. However, an interesting discussion took place during the preparation of the 1980 exercise on this subject of product weights which merits some attention. A first argument against product weights is the availability of data. About half of the participating countries do not have reliable data available within the level of the basic headings. Besides this practical objection it is worthwhile to discuss some conceptual problems related to the provision of product weights.

Two different ways of weighting within a basic heading can be distinguished: a non-exhaustive breakdown, and an exhaustive breakdown. In the first case the weight within a given basic heading may correspond to the relative importance of the selected, well specified, products included in the list. As weights are assigned to individual products they only represent a small part of the total set of products covered by the basic heading. The total weight is relatively low and not exhaustive. According to the practice followed in member countries in the framework of consumer price index calculations, this way of weighting is extended somewhat by taking not only the individual product but also closely connected products, i.e. a subgroup of products for which the selected product is representative. In this case the weight will increase but still it will not be exhaustive. In the case of exhaustive weighting each product will retain a weight equal to the sub-set it represents; the total set is subdivided into sub-sets and for each sub-set a product is selected.

Exhaustive weighting at first glance seems to be preferable because it assures consistency of the data between countries. However, in order to obtain this consistency it is necessary to develop the classification by increasing the number of basic headings beyond the number of 328 already proposed. SOEC has tried to establish a further breakdown, but this work has given very great difficulties because of the lack of clear criteria which can be used for establishing the detailed breakdown, which makes this exercise purely arbitrary. Furthermore, this more detailed classification has another drawback because it does not solve the problems of how to obtain weights but it only postpones it. This can be shown as follows. Let us suppose the original basic heading is subdivided into sub-groups. In these sub-groups it will not be possible to retain one single equivalent product

for all countries because the most representative product will never be the same
in all countries. For this reason a basic heading will always cover more than one
single product for a group of countries. An exhaustive set of weights for each
product was abandoned for this reason. Instead the first type of weighting could
be considered to be the most appropriate in the ICP exercise if any type of
weighting within basic headings is to be used. But in fact these non-exhaustive
weights are only an indication of the degree of representativity in each country
of the selected products. Moreover, as the available price ratios between pairs
of countries do not refer to the same products the weights depend on the pair
of countries concerned.

In 1975 the procedure followed in the EC exercise was to take the non-
weighted geometric average of all available parities between pairs of countries,
which gives in fact equal weight to all available parities. But as was explained
before, the selected products do not have the same meaning for the estimation
of the parities: some are the most representative for the given country, and others
are the most representative for the other countries. This is an argument against
the unweighted geometric average, and in favour of the use of weights within
the basic headings. The procedure followed by the SOEC is very close to the use
of weights for each individual product by indicating the relative importance of
each of the selected products. However, instead of requesting an estimate of
this relative importance it is only necessary for each country to mention the most
representative product, called the "star" product.

PRODUCT SELECTION AND ESTIMATION OF PPPs· FOR BASIC HEADINGS

In the preceding paragraphs a description was given of the different elements
which are of importance for the estimation of PPP's on the level of basic headings:
classification, the basic headings, procedures for product selection, definition of
products and finally the problem of weighting within basic headings. The pro-
cedures to be followed for the estimation of PPP's on the level of basic headings
depend on the conditions imposed upon the comparison. Two conditions should
be underlined, in particular: transitivity and characteristicity. Additivity does not
play a role as values are not used within the basic heading.

Transitivity of results is generally accepted as a necessary condition and the
different methods applied to achieve transitivity will be examined later. On the
level of basic headings the condition of characteristicity is closely related to
product selection, because it depends on the degree of representativity of the
selected products for each country. In this sense this condition of representativity
should be understood as equal characteristicity for all countries. In order to
clarify this it is interesting to examine more in detail the procedures followed by
the ICP as well as by SOEC in the first three phases with respect to product
selection and their consequences for the characteristicity condition.

In the SOEC work for 1980, product lists were established by requesting
participating countries to indicate their most representative products and these
products were added to the list if at least one other country could also price
them. The pricing of the product was done by asking all participating countries
to price as many products of the list as possible. As all countries could find

"their" products on the list it was admitted that the conditions of equal characteristicity would be fulfilled.

However, the tableau of prices or binary parities is not complete because not all countries could price all the products included in the list. In the ICP, the estimation of transitive complete PPP's on the basic heading level was done by using the country product dummy (CPD) method. This method first estimates the missing prices, and then derives transitive PPP's which are calculated as the unweighted geometric averages of all binary parities between pairs of countries. The method used by SOEC in 1975 is based on the table of binary nontransitive parities calculated also as non-weighted geometric averages of all parities available for each pair of countries. To this incomplete table of non-transitive PPP's, the Elteto–Köves–Szulc (EKS) method is applied in order to estimate a complete set of transitive PPP's.

These procedures may have important drawbacks, because they give the same importance to all available prices. These drawbacks are related to product selection and the degree of representativity of the selected products in each of the countries.

Characteristicity of the selected products should be the *same* in the participating countries and this equal characteristicity should be ensured by the product selection and by the procedure followed for calculating the parities.

As the definition of the selected products should be very strict, it will be very difficult to select products which have the same degree of representativity in all countries, because very strictly defined products do certainly not have the same characteristicity in all countries. It can be concluded that if strict definitions of products are maintained, it will be impossible that each selected product will have the same characteristicity in all countries. The 1975 experience has shown further difficulties in achieving equal characteristicity in all countries because the list of products was established by taking into account products which are characteristic in the Community as a whole, i.e. the total list covers all products important for the whole group of countries. This multilateral way of selecting products provides a list which has a "regional characteristicity," i.e. it contains all products with a high degree of representativity in the region as a whole.

However, this "regional characteristicity" *will not provide equal characteristicity* for each country in particular because in the EC two different kinds of countries can be distinguished: "central" countries on the one hand and "peripheral" countries on the other hand. This distinction is made in an economic sense, i.e. for the "central" countries product specifications are very close, whereas in the "peripheral" countries, product specifications are often very different.

A product list for the EC like the one used in 1975 is dominated by products with high characteristicity in the "central" countries and the number of products of peripheral countries is relatively low. Because of the fact that prices and quantities are negatively correlated, the use of a multilateral list with regional characteristicity will overestimate the price level in the peripheral countries and underestimate the price level in the central countries. This means that the list for a group of countries does not ensure equal characteristicity for all countries.

The 1975 comparison carried out by SOEC has shown this shortcoming of the multilateral procedure of product selection and some effort has been spent

on working out possible solutions for this problem. In fact the dilemma was to avoid bias in the estimation of PPP's due to the lack of equal characteristicity without widening the product specifications because the latter can introduce another bias in the results of the comparison.

In order to obtain PPP's between pairs of countries which ensure equal characteristicity for all the participating countries the most appropriate procedure is to consider only products selected for pairs of countries instead of for a whole group of countries.

This first step towards equal characteristicity of PPP's was applied in 1980. The product selection was carried out by taking account of products suggested by each of the participating countries. Prices were collected by all countries in so far as the products could be found. However, for the calculation of binary non-transitive PPP's between pairs of countries not all prices were used. For each country "star" products were indicated by the countries as being the most characteristic for them. For a given pair of countries it was possible to take account of the "star" products for each of them to derive a binary parity. By taking only the "star" products it is possible to ensure equal characteristicity of the products selected for calculating the parities. This new procedure thus takes account in the binary PPP estimate not of all available price ratios but only ratios derived from "star" products, whereas the other parities are left out. By taking the "star" products of the base country h, it is possible to calculate a PPP which is characteristic of the base country compared with country j:

$$_hL_j = \frac{_hP_j}{_hP_h},$$

which can be considered as a Laspeyres type PPP.

Furthermore, it is also possible to take "star" products of country j for estimating the PPP:

$$_hP_j = \frac{_jP_j}{_jP_h},$$

which can be considered as Paasche type PPP.

For a pair of countries it is possible to derive two estimates, one characteristic for country h and one characteristic for country j, characteristicity being defined in terms of selected products. Each of the PPP's provides a biased estimate: one in favour of country j and the other in favour of country h. In order to calculate the best possible unbiased estimate between country h and j, it is then proposed to calculate the Fisher type index as the geometric average of the Laspeyres type and Paasche type PPP's. This procedure is unilateral in the sense that it does not provide characteristicity for the whole group of countries (regional characteristicity) but for each of the pairs of countries involved equal characteristicity is imposed.

The Paasche type PPP can be directly derived from the Laspeyres type PPP's because it is equal to the inverse of the Laspeyres type PPP by permuting the rows and columns of the matrix of Laspeyres type PPP's. The derived matrix of Fisher estimates of non-transitive PPP's should then be transformed into a set of transitive parities, and the procedure followed by the SOEC is the EKS method.

From the previous paragraph it can be concluded that in order to maintain strict definitions for products and to obtain estimates of PPP's between countries with equal characteristicity the unilateral way of product selection and calculation of binary parities is the most appropriate one.

It provides first of all Laspeyres type and Paasche type binary parities on the level of basic headings for each pair of countries. From these two parities a Fisher type parity is then derived for each pair of countries. This Fisher type PPP has equal characteristicity for both countries and it can be considered as an unbiased estimate. The Fisher type indices are not transitive and should therefore be transformed. The EKS method is known as a procedure to provide transitive parities for a group of countries starting from the Fisher indices; the EKS parities are calculated in such a way that the deviations from the original Fisher type indices are minimized. This minimization of distances can be written as follows:

$$\Delta = \sum_r \sum_j (\log {}_s\text{EKS}_r - \log {}_sF_r)^2 = \min$$

${}_s\text{EKS}_r$ is the required transitive parity between country s and r, and ${}_sF_r$ is the given Fisher estimate between country s and r.

From this minimization procedure the following expression for the EKS index can be derived:

$$(1) \qquad {}_h\text{EKS}_j = \left[\prod_{\alpha=1}^K {}_hF_\alpha / {}_jF_\alpha \right]^{1/K}$$

which means that the EKS PPP can be written as the geometric average of all K "indirect" Fisher estimates ${}_h\hat{F}_j = {}_hF_\alpha / {}_jF_\alpha$.

As has been said before the Fisher type PPP is equal to the non-weighted geometric average of the Laspeyres type $({}_hL_j)$ and the Paasche type $({}_hP_j)$ PPP's, and ${}_hP_j = 1 / {}_jL_h$.

It is possible to write equation (1) as function of Laspeyres type PPP's.

$$ {}_h\text{EKS}_j = \left[\prod_{\alpha=1}^K [{}_hL_\alpha / {}_\alpha L_h]^{1/2} \Big/ [{}_jL_\alpha / {}_\alpha L_j] \right]^{1/K} .$$

According to the procedure of product selection followed it is possible to say that the EKS makes it possible to derive balanced transitive PPP's for each pair of countries: the EKS estimate is a way of implicit multilateralization of parities calculated from unilaterally selected products. The estimation of the Laspeyres type parities can be based on one single product or more than one product considered by the country as star products. If there are more than one star products the Laspeyres type parity is an unweighted geometric average of the individual parities valid for the star products.

It is possible to consider the theoretical case where each country has its star product included on the list and all countries collect prices for all selected products. If K countries are participating, K products are selected. However, only a part of the average prices (the star products) is used for the estimation of binary parities. This property of the "star" method for deriving PPP's is not the

same as the normal methods applied which take into account all available average prices. This is the case for the EKS method applied by SOEC in 1975 as well as for the CPD used in the ICP.

The "star" method can be interpreted as a kind of weighting within basic headings, where complete weight is given to the "star" product(s) in each binary comparison and zero weights are given to all other prices, at least in the Laspeyres type PPP's.

In practice it will not be possible to calculate Laspeyres-type PPP's for each pair of countries and this will be the case, in particular, when the number of participating countries is high. A given country may not collect a price for the "star" product(s) of the base country and a Laspeyres-type PPP cannot be estimated. However, this is not an inconvenience, but only indicates that the two countries are economically so remote that an appropriate Laspeyres or Paasche-type PPP cannot be estimated. It would be possible to estimate a PPP by taking all other price ratios available between two countries but it is not certain that this estimate can be considered as having equal characteristicity in both countries. Instead it will be more appropriate to use the EKS method to estimate the missing PPP. As a matter of fact, the estimation of transitive parities of the EKS type is also possible if not all Fisher type PPP's are available. The EKS PPP is then obtained indirectly as the non-weighted (or equally weighted) geometric average of existing PPP estimates of Fisher type available for the remaining countries. It may happen that one round of EKS calculations will not provide a complete table of transitive PPP's and that a second round is necessary (or even more rounds may be required). However, it may happen that for a given country no link is available with the other countries. In this case, even after repeated application of the EKS procedure it is not possible to establish a complete EKS table of PPP's. In this case the country has not provided any price for "star" products of the other countries and none of the other countries has been able to collect prices for the "star" product(s) of that country.

If this is the case the only solution is to group the basic heading together with a similar basic heading. In order to do this a new Laspeyres type estimate is made for the new basic heading by calculating the arithmetic weighted average of the EKS estimates for the original basic headings; as weights it is possible to use the expenditure for each of the basic headings in the base country. The new Laspeyres type PPP's are then made transitive by applying again the EKS procedure.

SOME FURTHER IDEAS

Two different and in most cases conflicting properties are put forward in the preceding paragraph. On the one hand the comparison requires strict definition of the selected products and on the other hand the degree of representativity should be equal for all participating countries.

It will be extremely difficult to select products for a group of countries (a region or on world level) which ensure equal characteristicity for each of them on the basis of a multilateral procedure of selection. By using a multilateral selection procedure only products which have a high degree of representativity

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for the group as a whole are taken into consideration. The list of products will then have regional or world characteristicity and this does not ensure equal characteristicity for each participating country.

For 1970 and 1975, product lists in the EC exercise were established according to a multilateral procedure but the drawbacks were not very important. In 1970 the number of countries was only six and their products were rather similar except for Italy; however, in 1975 with nine countries it became more and more difficult to select products without neglecting products with a high degree of representativity in countries like Denmark and Ireland. In 1980 with 12 countries dissimilarities between participating countries increased and the drawbacks of the product selection based on the most representative products for the whole group conflicted more and more with the properties of equal characteristicity for all countries. In order to solve this the first step was to abandon the multilateral procedure and to follow a bilateral approach. This procedure consists of the selection of one (or more) representative products for each pair of countries and the list of products would cover for each basic heading $K(K-1)/2$ products if K countries participate in the comparison. This is of course an impossible procedure because the number of products becomes too high. For 12 countries, if one single product is selected for each pair of countries, 66 products are required for each basic heading, i.e. more than 20,000 for 328 headings. On the world level this number becomes for 100 countries and 150 basic headings, around 750,000 products.

Instead, in the EC comparison the selection procedure followed was different. For each country one (or more) product(s) was taken with a high degree of representativity. Thus the number of products will be confined to K for each basic heading, one for each country; some of these products may be the same for two or more countries, but it may also happen that a country desires more than one "star" product to be included in the list. This unilateral selection procedure does reduce the number of products included in the list and will nevertheless enable the estimation of parities which fulfill the property of equal characteristicity by following the method described before: the Laspeyres indices allow for the estimation of the Fisher type indices and with the EKS procedure complete transitive parities within the group of countries are obtained.

The second element determining the total effort of each country of pricing the selected products is the question of how many products should be priced. In order to constitute a full matrix of Fisher parities, each country should price all K products. But it has been pointed out in the preceding paragraph that it is neither necessary nor desirable for each country to collect prices for K products because the EKS method allows completion of the parity matrix by indirect estimates for some pairs of countries. This particular property of the EKS method makes it possible to reduce the total price collection. It may even be more efficient to carry out an indirect estimate of the parity between two remote countries instead of making a direct parity estimate based on products which are hardly to be found in one or the other of the two countries.

The unilateral procedure of product selection combined with the EKS method to derive a transitive and complete set of parities for each basic heading can be used to organize price collection by countries in a very flexible way and it will

offer possibilities of reducing the number of products priced in each country. It may be possible for a given group of countries to indicate how to minimize the number of prices collected. This can be illustrated by an example for the EC countries.

It is certainly not possible to find furniture products which are sufficiently well specified in all countries. For Ireland furniture products available are imported from the U.K. or home produced. Furniture imports from other countries do not exist, but some Irish products are available in the U.K. This will allow a reliable Fisher estimate between Ireland and the U.K. but not between Ireland and any other EC country (except if some very simple furniture products are defined using comparability criteria).

However, as the U.K. is linked directly to other EC countries, Ireland can be fitted into the ten member countries with the help of the EKS, which takes into account all available possible "bridges". The directly estimated parity between Ireland and Greece would certainly be less reliable because the common products available will have a very low degree of representativity in both countries. This procedure may be different according to the basic heading concerned, because it depends on the products found in each country. The minimum require-ment is that for each country one Fisher type estimate with another country be available, i.e. two Laspeyres type parities, so that a balanced Fisher parity is obtained.

It is interesting to say some words on the problems related to the world products list or to the linking of regional lists in the light of the preceding ideas of unilateral product selection combined with the EKS method.

In the case of linking regions, this procedure for product selection offers very flexible solutions. If a given group of countries has established its product list it is very easy to fit in other countries or groups of countries. The new countries have to add their "star" products to the list: these should then be priced by at least one country of the group (the group can easily divide the burden between them by each taking a number of specific products). For the joining group it will be necessary to price within each basic heading a sufficient number of products to link itself to at least one country of the original group. Both groups can organize the price collection in such a way to minimize the effort and to divide the effort between them.

This brings us to the question of how to set up a world list of products and how prices should be collected in a world comparison.

Following the idea of unilateral selection of products, the main task of the world list would be to ensure sufficient overlapping of regional lists. If the shortcomings of each regional list are clearly indicated it should than be possible to convince the countries of a group to carry out some additional price collection and this additional work can be easily divided between them depending on availability of the products, resources available, etc. However, it will be necessary to link countries of two different regions on the basis of Laspeyres type estimates for both countries, so that a balanced Fisher estimate can be calculated with equal characteristicity in both countries. It will be possible to determine *a priori* how many links are possible and necessary in order to be able to derive complete

transitive parities for each basic heading for the world comparison. The total number of products included in the world list will be increased, but the total number of prices collected can be kept to a minimum so that the burden of work for each country can be kept as low as possible.

SOME NUMERICAL RESULTS

It is interesting to present some information about the impact on the results of the various procedures for estimating parities on the level of basic heading described above. The data available for 1980 allowed us to carry out some interesting calculations.

The twelve participating countries have provided for 1980 average prices for products included in the SOEC list. It has been possible to derive on the *basic heading level transitive parities* for the twelve countries according to four different methods:

(a) The "star" EKS method, which was adopted by SOEC and the countries as the method to calculate parities on the basic heading level.

(b) The "unweighted no-star" EKS method; according to this method all available binary parities were taken without any weight; this procedure was applied by SOEC and the countries in 1975.

(c) The "weighted" EKS method, which used weights for each product within each basic heading. The weights refer to non-exhaustive indications about the degree of representativity. These indicators were provided by some countries, but others did not provide any product weights. For these countries weights were estimated by SOEC in the following way: "star" products were assumed to represent 80 percent of the total of a basic heading so that 20 percent was left for no-star products. Each "star" product or each no-star product was assumed to have the same relative importance.

(d) The CPD method; the unweighted version was taken for the calculations.

Each of the four methods gives a different *set of transitive parities on the level of basic headings*. In order to calculate the impact of these differences on the level of GDP and private consumption a Geary–Khamis aggregation was applied by using each time the same expenditure data for basic headings but different basic parities.

The application of the "star" method, as well as the use of product weights was not possible for government consumption and gross capital formation. No product weights are available in any country for these two categories of uses. The "star" product method may be used for equipment goods but it has not been possible in 1980, because the necessary information about the degree of representativity of each individual product is not easy to obtain. For these two categories of uses the differences between the four methods are negligible. For this reason they were left out of the table summarizing the overall impact of the four procedures.

As the "star" EKS procedure was chosen for the calculation of official results, the results for the three other procedures are expressed as percentage differences compared with the central method.

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Table 1 provides these differences (in percent) in the parities for GDP and private consumption for the three procedures:
- Weighted EKS
- Unweighted no-star EKS
- Unweighted CPD.

As the differences for government consumption and gross fixed capital formation are very low, the impact on GDP is somewhat below that for private consumption.

For the unweighted CPD and the unweighted no-star EKS the differences are very similar which confirms the fact that the results from both methods are almost identical. For private consumption the maximum distance between two countries is about $7\frac{1}{2}$ percent (the U.K. and Greece), corresponding to 5 percent for GDP. But it is also interesting to note that the impact on countries like Germany, France, the Netherlands, Belgium and Luxembourg is around 1 percent but even for Spain and Portugal the differences are very small whereas for Italy, the difference is rather substantial.

Concerning the weighted EKS, the differences are smaller for all countries and the maximum is now $5\frac{1}{2}$ percent between the U.K. and Italy.

On the level of total private consumption and GDP the differences are relatively small but this is not the case on a more detailed level. Table 2 gives the differences on the level of the eight main groups of objects of private consumption. From these percentages it can be seen that the differences are becoming more important, but again the same countries show the highest percentages: Italy and Greece followed by the U.K. For the weighted EKS Greece has for four groups the highest difference, Italy for three groups and Denmark for one group. The average (absolute) percentages also confirm these conclusions.

The two other methods again give very similar percentages: the unweighted no-star EKS and unweighted CPD have maximum differences for the same countries for each group as can be seen from the following table. The only exception is for group 8 where the differences for the U.K. and Ireland are of the same magnitude.

Group	Maximum	Minimum	Absolute distance EKS[1]	CPD[1]
01	U.K.	Greece	7.4	7.5
02	Greece	Italy	6.9	6.6
03	U.K.	Greece	4.0	5.5
04	Portugal	Belgium	10.9	8.6
05	Belgium	Greece	18.3	19.0
06	Portugal	Greece	14.7	16.3
07	Belgium	Greece	10.2	12.4
08	U.K./Ireland	Italy	16.7	16.0

[1] derived from Table 2.

On the more disaggregated level differences become much more important. It is not possible to show the percentages for all basic headings; instead, in Table 3

TABLE 1

COMPARISON OF PERCENTAGE DIFFERENCES OF THREE ALTERNATIVE METHODS[1]

	Germany	France	Italy	Netherlands	Belgium	Luxembourg	U.K.	Ireland	Denmark	Greece	Spain	Portugal
(a) *Weighted EKS*												
Gross domestic product	0.39	0.27	−2.21	0.16	0.17	0.50	1.39	0.79	−0.37	−1.74	−0.34	0.83
Private consumption	0.59	0.43	−3.32	0.23	0.28	0.81	2.15	1.21	−0.63	−2.43	−0.44	1.19
(b) *Unweighted No-Star EKS*												
Gross domestic product	0.39	0.55	−2.74	0.44	0.69	0.79	1.42	0.96	0.19	−3.68	−0.40	1.06
Private consumption	0.58	0.86	−4.17	0.67	1.08	1.26	2.16	1.45	0.30	−5.27	−0.54	1.50
(c) *Unweighted CPD*												
Gross domestic product	0.22	0.52	−2.78	0.80	0.89	0.82	1.49	1.08	0.79	−3.60	−0.34	0.95
Private consumption	0.42	0.83	−4.27	1.16	1.34	1.24	2.27	1.58	1.17	−5.24	−0.57	1.28

[1] Calculated as $\left(1 - \dfrac{X_i}{X_{\text{star}}}\right)100$

X_i = parity according to one of the three methods ($i = a, b$ or c)
X_{star} = parity according to star EKS method.

TABLE 2

COMPARISON OF PARITIES RESULTING FROM DIFFERENT METHODS: PRIVATE CONSUMPTION (%)

	Germany	France	Italy	Netherlands	Belgium	Luxembourg	U.K.	Ireland	Denmark	Greece	Spain	Portugal
(a) *Weighted EKS*												
01	1.63	1.28	−5.05	0.40	0.65	1.02	2.04	3.54	1.72	−3.66	−0.50	2.25
02	−0.18	0.39	−3.83	−0.09	0.20	0.12	3.35	−0.11	−0.10	1.30	−0.15	−1.11
03	−0.12	−0.07	−0.18	−0.96	−0.22	−0.11	1.46	0.61	0.29	−2.65	−0.60	−0.01
04	1.70	−0.88	−0.61	−3.19	−5.04	1.26	1.41	−0.02	−5.17	7.76	−1.98	8.22
05	−0.53	1.15	−2.34	0.06	5.68	0.54	1.39	−0.55	0.69	−7.65	−1.12	−1.65
06	−0.10	−0.08	0.90	1.94	0.47	0.55	−0.59	0.56	−1.40	−4.37	0.41	2.39
07	−0.48	0.68	−2.67	−1.14	1.07	1.11	2.69	−0.30	−3.00	−4.32	0.09	−0.84
08	1.90	−0.19	−8.49	4.19	1.03	1.88	4.71	1.75	−2.19	−1.40	0.16	−2.0
Average	0.6	0.6	3.0	1.5	1.8	0.8	2.2	0.9	1.8	4.1	0.6	2.3
(b) *Unweighted no-star EKS*												
01	0.58	0.86	−4.17	0.67	1.08	1.26	2.16	1.45	0.30	−5.27	−0.54	1.50
02	0.71	0.65	−4.53	1.21	1.09	1.34	1.13	0.24	0.91	2.39	−0.01	−0.48
03	0.17	0.33	−0.34	−1.14	0.09	−0.12	0.98	−0.28	0.50	−3.01	−0.68	0.57
04	−0.69	1.38	−0.48	−1.73	−4.77	2.08	2.53	1.36	−3.71	−3.19	−0.03	6.09
05	−1.87	0.17	1.40	−0.50	7.85	−1.31	1.86	−1.11	0.03	−10.41	−1.06	−2.06
06	0.61	0.11	−3.19	5.41	1.48	1.02	0.36	0.68	0.42	−8.95	0.56	5.75
07	0.80	1.73	−3.93	0.05	1.86	0.97	1.13	0.00	−3.20	−8.36	−0.12	−2.84
08	0.43	1.61	−11.44	−5.42	1.19	2.95	5.24	4.87	−0.89	0.60	0.06	−4.89
Average	0.7	0.9	3.7	2.0	2.4	1.4	1.9	1.2	1.2	5.3	0.4	3.0
(c) *Unweighted CPD*												
01	0.42	0.83	−4.27	1.16	1.34	1.24	2.27	1.58	1.17	−5.24	−0.57	1.28
02	0.42	1.14	−4.25	1.34	1.51	1.93	0.51	0.42	0.94	2.38	0.35	−0.14
03	0.09	0.06	−0.37	−1.40	−0.01	−0.32	1.63	−0.66	0.45	−3.86	−0.89	0.16
04	−0.51	0.38	−0.64	0.06	−2.20	2.19	2.41	3.36	0.89	−1.09	−2.03	6.37
05	−4.06	0.64	2.04	1.56	10.06	−3.02	1.88	−1.27	−0.51	−8.90	−0.25	−2.71
06	0.74	0.46	−4.31	6.00	1.39	1.73	0.65	0.31	1.00	−10.99	0.04	6.35
07	0.88	1.61	−4.99	−0.23	3.60	0.89	1.58	−0.26	−1.76	−8.81	−0.11	−4.18
08	0.37	2.14	−10.63	−4.70	−2.41	2.28	5.01	5.41	−1.00	0.52	0.05	−5.03
Average	0.9	0.9	3.9	2.1	2.8	1.7	2.0	1.7	1.0	5.2	0.5	3.3

01 = Food, beverages, tobacco
02 = Clothing, footwear
03 = Rents, heating, lighting
04 = Furniture, household products
05 = Health services
06 = Transport, communication
07 = Education, culture and recreation
08 = Other goods and services

TABLE 3
FREQUENCY OF PERCENTAGE DIFFERENCES COMPARED WITH STAR EKS METHOD

%	0–1	1–2	2–3	3–4	4–5	5–10	10–15	15–20	20–25	25–30	30–35	Over 35
(a) Weighted EKS												
Germany	105	44	25	24	10	31	5	2	3	1	0	5
France	115	38	31	20	15	25	9	2	0	0	0	0
Italy	73	26	24	16	20	54	15	17	4	0	1	5
Netherlands	110	40	20	21	12	32	10	4	3	1	0	2
Belgium	110	50	27	18	11	27	8	2	1	0	0	1
Luxembourg	126	49	29	16	10	16	5	3	1	0	0	0
U.K.	92	41	24	20	15	35	12	5	4	0	3	4
Ireland	102	44	26	22	12	25	11	4	1	4	0	4
Denmark	134	38	19	14	15	20	8	4	1	1	1	0
Greece	85	26	14	12	22	34	24	12	9	5	5	7
Spain	102	38	24	25	10	31	10	5	4	2	0	4
Portugal	105	33	23	19	13	37	14	0	3	0	1	7
Total	1,259	467	286	227	165	367	131	60	34	14	11	39
in %	41.1	15.3	9.3	7.4	5.4	12.0	4.3	2.0	1.1	0.5	0.4	1.3
(b) Unweighted no-star EKS												
Germany	89	37	29	24	13	42	11	3	0	3	2	2
France	94	28	27	32	15	39	13	4	3	0	0	0
Italy	69	21	14	14	17	49	33	12	10	5	4	7
Netherlands	98	33	21	19	7	44	18	6	2	1	2	4
Belgium	93	36	29	20	14	38	15	7	1	1	0	1
Luxembourg	104	40	21	24	24	32	6	3	0	1	0	0
U.K.	86	34	24	19	16	44	14	9	4	1	2	2
Ireland	91	45	20	19	16	37	13	,3	2	2	3	4
Denmark	105	38	28	19	19	29	10	2	1	0	1	3
Greece	69	22	14	9	17	42	27	16	12	7	4	16
Spain	84	26	25	30	17	37	13	8	1	4	3	7
Portugal	85	34	23	20	11	38	17	11	1	2	6	7
Total	1067	394	275	249	186	471	190	84	37	27	27	53
in %	34.9	12.9	9.0	8.1	6.1	15.4	6.2	2.7	1.2	0.9	0.9	1.7
(c) Unweighted CPD												
Germany	77	36	26	26	13	45	15	10	1	2	1	3
France	75	42	15	30	16	46	21	8	1	1	0	0
Italy	67	20	15	13	15	48	38	17	7	6	3	6
Netherlands	88	34	21	11	10	49	25	4	5	4	1	3
Belgium	81	28	34	23	10	48	19	7	4	0	1	0
Luxembourg	81	51	23	32	13	41	9	3	1	1	0	0
U.K.	87	31	23	14	13	41	21	11	8	2	2	2
Ireland	87	32	24	24	13	38	22	8	1	0	1	5
Denmark	94	39	31	20	14	38	11	3	3	1	0	1
Greece	66	19	17	7	12	47	28	26	11	6	5	11
Spain	75	23	24	30	18	42	21	5	2	8	1	6
Portugal	77	29	21	12	18	34	21	15	6	9	4	9
Total	955	384	274	242	165	517	251	117	49	41	19	46
in %	31.1	12.5	9.0	7.9	5.4	16.9	8.2	3.8	1.6	1.3	0.6	1.5

a picture has been given of the frequency of differences for all countries and for the three alternative methods.

Again differences are the most important for three countries: Italy, Greece and the United Kingdom. If the total number of cases within each class is taken it is shown that the weighted EKS is the closest to the procedure star EKS, whereas the unweighted no-star EKS and the unweighted CPD are somewhat farther away from the star EKS results. The weighted EKS has $78\frac{1}{2}$ percent of the differences below 5 percent, whereas for the unweighted no-star EKS this is 71 percent and the CPD it is 66 percent.