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The Application of the Concept of Basic Purpose ¹⁾ for Sampling, Replacement, Quality Adjustment and Aggregation

June 2004

Summary

This paper addresses the question of fixity and flexibility of the CPI basket and thus one of the central issues for sampling and aggregation. It then approaches the problems of a more harmonised approach to sampling and replacement and to provide a more consistent basis for the aggregation of the HICP. It elaborates on the application of the notion ‘Basic Purpose’ (BP, also the recently proposed term consumption segment might be used for this). BP is seen as a set of product offers which are purchased by the same broad category of consumers in similar situations and with similar ends in mind. This does not mean that such product offers are essentially equivalent in the sense that they are of entirely the same quality.

The notion BP helps to define what remains fixed in a Lapeyres-type index and what is subject to market changes. The aim is therefore to be redefined more precisely to keep the basket of BPs fixed. The former ‘basket of products’ was ambiguous because it could be interpreted not to allow for any changes at all. This paper draws the conclusions further and generalises the approach and develops rules for sampling as well as for aggregation.

Although this paper is based on the ongoing discussion among the EU it is not meant to prejudge the outcome of this discussion. The aim is rather to give an overview of the present state (in 2003 and 2004) of this discussion and the potential consequences for practical work.

1. The problem

The calculation of any index aims at comparing situations at different points in time. More specifically prices for several (normally several hundred kinds) of products are compared. By doing so, it requires a restriction: Which of the many thousand available product offers (models, varieties) should be selected for the comparison and in case a new variety comes on the market where should one draw the border where another product “begins” (for what is a ‘new’ product or merely a ‘variety’ of an existing one...).

Where the term “fixed basket” is used, it might be misleading if the term “fixed” is understood in a too detailed way: It will normally not be possible to collect the price of a specific apple in the next

¹⁾ The terms have initially been proposed by Martin Ribe and Alexandre Makaronidis. The author is particularly grateful to Alexandra Beisteiner and Martin Ribe for their comments in various discussions – this shall of course not prejudge their views.

month again (because this specific apple will have been sold and eaten), so the price collector will replace it by another apple of the same or similar kind, but normally will not take the price of a banana to replace the price of the apple. Also, for a certain market segment of books fast changes are the rule rather than the exception.

Similarly, last month's shirt is likely to have been sold a month later and will be replaced with a shirt from the current fashion, but normally one would not replace it with a blouse or a pullover. Such replacement issues are also well known for products where technical developments are going on but generally speaking in any market segment where developments and changes occur. This leads to the questions: if product offers and markets are not fixed, what can be regarded as fixed during a certain time period?

2. The convention

BPs are used as intermediate level between single product offers and COICOP class:

- Within the BP the product offers cannot be kept fixed, we speak of different models/varieties of the same product, they fulfil the same BP
- BPs themselves can be kept fixed at least for several years

The scheme below explains further the threefold structure:

Total HICP – divided into COICOP classes

Representativity should be ensured through adequate weights for divisions, groups and classes according to COICOP

The structure has been defined in a regulation and is kept unchanged, weights are kept fixed for at least one year, no substitution is assumed between COICOP classes.

Within a COICOP class – divided into a selection of BPs

Representativity should be ensured through adequate weights and through addition of newly significant goods and services. BPs might also be grouped, but they are the elements to be kept unchanged for several years; new BPs should be added when they become significant (>0.1%). Weights are kept fixed for at least one year, no substitution is assumed between BPs.

Within a BP – selected price observations

Representativity should be ensured through the price collection and selection of replacements Product offers can and should be replaced (potentially entailing QA) whenever necessary in order to take substitution and market changes into account. Weights in the form of importance factors can be used but the Laspeyres principle requires only that they are taken prior to eventual changes.

The approach to this issue of changing markets is to look for market characteristics which remain fixed for a certain time period and can therefore be seen as a classification issue. The comparison problem is thus solved by comparing 'the same' items by their economic function rather than to compare 'the same' items by their specifications. This leads to a classification by economic function which is the basic purpose to the consumers. The classification has to be elaborated in practice but the above mentioned problems and questions indicate that this is one crucial point in index calculation. The lowest stratum of consumption is thus by convention to be defined as basic consumption segment or basic purpose.

The approach taken is that two product offers are considered to belong to the same BP if they are purchased by the same broad category of consumers in similar situations and with similar ends in mind. This does not mean that such product offers are essentially equivalent in the sense that they are of entirely the same quality. The quality of a product offer describes the extent to which it fulfills its basic purpose.

The many thousands of product offers in the universe are thus classified by their basic purpose to the consumers. The price observations are then taken to follow constant BPs appropriately.

3. Note on the understanding of basic consumption segment / basic purpose

The idea behind the convention to use BPs is to reach further harmonisation and to determine the principles of sampling, replacement, quality adjustment (QA) and aggregation. It should be used as guidance for developing sampling and QA rules. Such general rules can be derived even before every BP has been defined in detail.

The definition of a level which is common for sample stratification and for aggregation can help to settle comparability problems. The exact setting of that level remains open for a convention but the convention – possibly on a case by case basis – is necessary in order to achieve comparability. If the level is set 'higher' (resulting in broad product definitions and bigger classes of product offers) a more COLI-type of index will result, if the level is set 'lower' something close to a fixed basket will result. In any case we might derive an impression of how well the sampled product offers cover a BP for sampling purposes.

However, the convention is limited by two borders: If definitions are too tight replacements will be impossible in too many areas and representativity will suffer. In addition it will be quite complicated to cover a relevant market share with tight definitions and traditional price collection. The other limitation is the difficulty of QA procedures if the classes are too large and product definitions are too broad. This space can also be used for a certain amount of flexibility between MS or between product groups as long as the results remain comparable in practice.

At the beginning of the implementation BP should be seen as a tool rather than a definition. The essential insight of the notion of purpose should not be lost by saying precisely how it should be interpreted at the outset. This might only be done as a convention after some discussion. It should then be used a) to help determine strata for sampling, b) for selection of appropriate replacements in these, c) to help decide what allowance should be made for quality change when there has been a sample replacement and d) for the aggregation formula. What matters is that a MS can say how

purpose has been used in particular situations, i.e. defend a particular selection for sampling or quality adjustment.

4. Tentative rules and consequences for Sampling

For many BPs like butter, fresh milk, mineral water, apples, bananas, children's trousers, washing machines, refrigerators, baby napkins etc. this new approach will not likely change traditional sampling procedures significantly. However the use of BP encourages replacements where indicated by market movements. Replacements are to be understood as resulting from sampling in the current period as opposed to initial sampling in the reference period.

Generally it can be said that where the purpose of consumption is used for the sample definition, this will lead to the following consequences:

- The product offers to be selected for price collection should initially be defined by a range of characteristics and not by brand names or types (this follows from the requirement to keep the classification unchanged at least for several years).
- The most straightforward way for describing the changes within the consumption segment is to trace the most sold models in terms of turnover. Alternative rules for 'most similar' would require a measure for similarity which is not available for most areas.
- This does not preclude that a specific interviewer is assigned to a specific variety of the BP but at some level (either at the interviewer's or at the central selection's level) there should be room for potential change due to change within the market segment
- In a more general way of understanding this leads to look for goods and services which are economically similar rather than physically similar. Basic purpose is used to describe the economic function in the market segment.
- The main criteria for the construction of the sample are thus observable consumption segments and not primarily the availability of weights. The BPs/consumption segments can be derived from common product characteristics.
- Where weights are available but the use of BP would not require them, the weights should still be used in form of importance factors and thus differently from traditional weighting.
- Where weights are not available but needed this would either lead to the use of rough estimates or to equal weighting – both are traditional approaches for price indices.

However further problems have to be solved where BPs are used:

5. Further problems and approaches at the lower level structure

The use of weights between BPs is consistent with the approach that substitution is not deemed important at this level. But normally weights might not be available as detailed as necessary. So

only a weight for an elementary expenditure group (EEG) in the universe including several BPs might be one of the results from the national accounts or household budget survey.

The easiest case for the application of BPs occurs for an area where a weight is available and where there is only one relatively important BP in the expenditure of the population.

There might be a very large number of closely related BPs which are all more or less of the same size within such a subgroup. And therefore it might be difficult to select one of these and to attach a weight to it. In such cases, where there are a lot of closely related BPs of similar size an elementary product group (EPG) in the HICP sample as a set of BPs might be constructed.

Existing HICPs might contain either too few weights but in other cases also or too many e.g. where production data are used for weighting. In this case derogations might be necessary in order to postpone changes until the next broader revision of the sample.

Below we use the following abbreviations (more precise definitions are given in the annex)

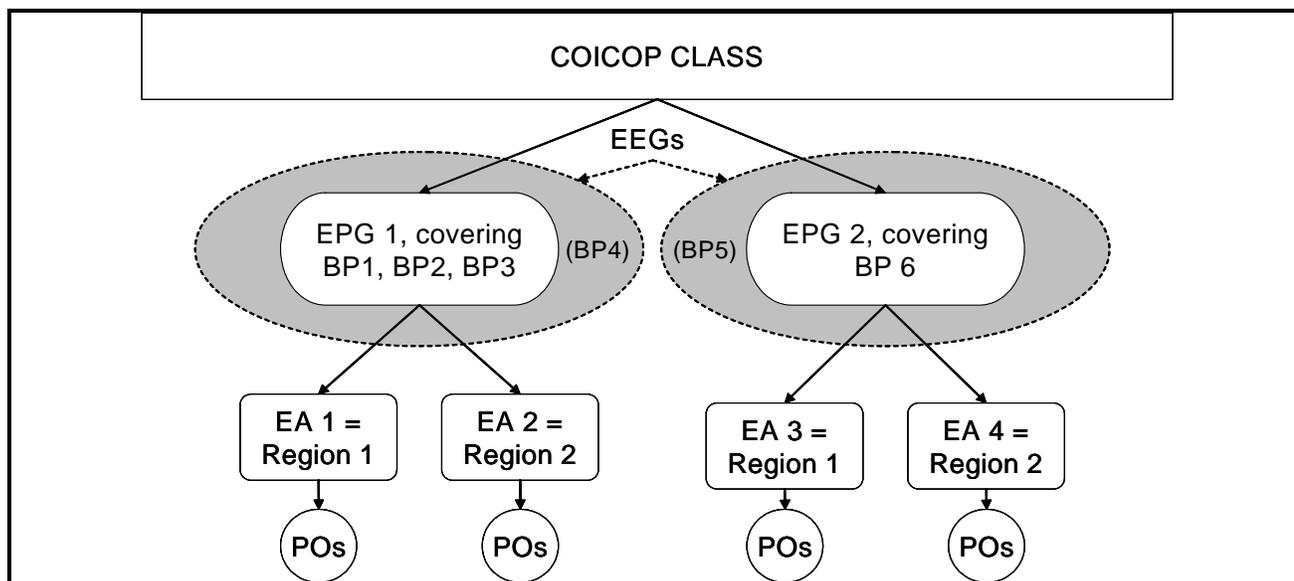
BP	basic purpose or consumption segment as defined above
EEG	elementary expenditure group as derived from weight sources covering one or more BPs
EPG	elementary product group as defined in the HICP sample
EA	elementary aggregate, the lowest level of HICP stratification
POs	product offers, models in a specific region or outlet

Further consequences might be as illustrated in the picture below:

- Where one BP is predominant in an EEG (e.g. washing machines): This predominant BP (BP6 in the picture below) should be taken as EPG for price collection. IN this easier case the EPG in the sample contains exactly one BP and the less important BPs (like very small washing machines, BP5) might be neglected in the price collection.
- Where there are several small BPs in one EEG (e.g. small tools) some of them should be taken for price collection (e.g. tool kits BP1, hammers BP2 and spanners BP3) while screw drivers (BP4) might not be covered by price collection. This seems reasonable especially in cases where there is no clear most sold product.
- One BP should only be allocated in one EPG because by definition substitution is assumed within BP and in index construction typically been done within only EPG.
- EPGs should only be split into EAs for regional stratification, the outlet dimension should rather be used for internal importance factors as the outlet structure might change faster and substitution is more likely between outlets than between products or regions
- Internal weights (importance factors) can be used within EAs for PPS sampling, replacements, QA e.g. where the turnover of brands or outlets is known.

Example of the structure of a COICOP class in two regions

BP4 and BP5 are not included in the price collection; their weight is allocated at EPG1 and at EPG2, respectively. For example in EEG1 the weight might also contain the weights of BP1-BP4 and EEG might contain the weight of BP5 and BP6.



6. How many is ‘sufficient EAs’ and ‘sufficient prices’?

One might argue that the distinction between BPs is a never ending story that therefore the introduction of the notion of market segmentation and BP does not help much in practice. However this can also be solved by reference to existing regulations and by consistent application of the principles.

One question might be how many EAs should be included in a HICP sample. Here the existing legislation requires that newly significant goods and services have to be covered by price collection if they exceed 0.1 percent of total consumption.

If such a good or service is identified as newly significant by any Member State all other Member States have to check whether this is also significant in their country. If all such products which exceed 0.1 percent in weight are explicitly covered with an explicit weight the number of EAs is certainly sufficient in this respect. BPs with a weight of more than 0.1 percent should therefore be covered with an explicit weight.

Where a bundle of closely related BPs is above 0.1 percent but every single BP within is lower than 0.1 percent an appropriate subset should be selected such that the weight of the rest of the BPs is below 0.1 percent.

Where the weight of the EEG is below 0.1 percent an explicit price collection is not necessary, the weight should be distributed for the whole COICOP class.

Sufficient price observations can be assumed where the number of prices is balanced with respect to weights and variation of price movements.

7. Consequences and tentative rules for QA

BP could be used to determine the most important variables for the quality adjustment. This can and should support hedonic regression calculations but also can show where regression might lead to wrong results (wrong in the view of consumer perspective). Where it is necessary to select variables this might be done with the help of BP.

8. Consequences and tentative rules for aggregation

The use of BP would rather lead to the use of the geometric mean within an elementary aggregate because this formulae supports substitution. However, where one can assume that the elasticity of substitution is close to zero also the ratio of mean prices might be used.

Where weights in form of importance factors are included this would lead to:

Where product offers of different basic purposes are put together in one EA: The weighted arithmetic mean of price relatives should be used where the weights relate to turnover and the weighted ratio of arithmetic mean prices should be used where the weights relate to quantities for the different basic purposes. This is consistent with the assumption of zero elasticity of consumption and none-substitution between basic purposes.

Where product offers of the same basic purpose are put together in one EA (importance factors within BP): Weighted unit value indices should be used for homogeneous goods and services (i.e. where no quality differences are assumed) and a weighted geometric average with turnover weights should be used for heterogeneous goods and services.

Annex: Definitions of basic terms

Basic purpose (BP). A BP consists of a set of transactions/product-offers which are purchased by a broad category of consumers for predominant use in similar situations and with similar ends in mind. HFMCE can be exhaustively divided into basic purposes. This division is the same across Member States – although some BPs may be empty of transactions in some MS. BPs exist in the real world and are independent of statistical design. Recently the terms Consumption segment or market segment have been proposed.

Comment: Note that BP is a level in the product hierarchy. Ultimately, BPs have to be determined by convention, where the definition is supposed to act as a guiding principle. It has been proposed that an EU-wide classification down to the level of some 800-1000 BPs should be worked out. By “a broad category of consumers” could be understood a geographical division of the country into regions, cities or similar entities. For some products, e.g. clothing, sex and age would also distinguish the category of consumers.

Elementary product group (EPG) refers to the lowest level of the HICP sample, as designed by the MS, *in the product hierarchy*. It is a result of a statistical design, dividing the expenditure covered by COICOP classes into smaller subgroups. Normally, EPGs as designed do not exhaustively cover a COICOP class. This means that selection and specification of EPGs is a result of a sampling process, albeit usually a purposive one. The term elementary product group is derived from the products which are covered by the price collection.

The term **elementary expenditure group (EEG)** which is derived from the COICOP class, refers to all expenditure incurred for this part of the COICOP class. An EEG contains all BPs also those with very small weight and which are not selected for price collection. The EEG represents the weight for which the EPGs are products for price collection. The COICOP class can thus be divided exhaustively into EEGs.

Elementary aggregates (EA) are also a result of statistical design, whereby an EPG is divided into one or more EAs, usually according to region/city and/or outlet type. This division is often exhaustive (or nearly so) in which case it could be considered as a stratification. Else it would have to be viewed as a result of (cluster) sampling. Each country has designed its HICP so as to have a certain composition of EAs. The EA consists of prices only and within it “reliable expenditure information is not available for weighting purposes”. This does not exclude that importance factors related to the observations due to e.g. region or outlet sizes may be used for internal weighting, where appropriate.

Comment: Stratification by geographical area is preferable to stratification by outlet type. A rule to this end could be considered. This is since a purpose could be defined as referring to a group of consumers living in a certain area. However, these consumers could easily achieve the same purpose by switching between different types of outlets in the area.

Product offer (PO) refers to a specified product in a certain market area. It is typically a specific variety or model in a specific outlet. At a given time it has one and only one price, if it happens to be in the HICP sample we might call it single price observation. Two POs are identical, where all product characteristics are the same.

Comment: There needs to be rules requiring a minimum of such characteristics to be collected by the agency.

Annex: Examples

An Approach to Use Basic Purposes for Cars and TVs

By keeping basic purposes fixed it is on the other hand necessary to **maintain representativity** to fulfil these basic purposes: The models (or items/products/varieties) are not only allowed to vary but should vary in relation to what is representative on the market. This is also a challenge for both sampling and QA procedures.

With the help of ‘purpose’ statisticians can define the (perhaps 3-5) most important variables of a product. It might often be helpful to actually spell out the purpose. The selection of the variables can be tested with hedonic regression, but will often be obvious. However, there is a smaller subjective element included as in all traditional consumer price statistics.

Draft of an operational definition of basic purposes for cars

The basic purpose of a car can be seen as threefold:

- A. A certain capacity/size and
 - B. Transportation on roads
 - C. Luxury and image.
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- A. The capacity or size of the car is perhaps most difficult to measure but nevertheless it is essentially linked to the basic purpose and the use of the car. The important variables in relation to basic purpose are the number of persons who can sit in the car and the luggage space (or weight). These can be linked to variables like weight, length, height etc. but the connection might not be as close as the variables mentioned under B.
 - B. The variables of the second kind should contain the most elementary use of a car – its motor power or speed, perhaps the also the not so common torque. The most common will presumably be the motor power as this is also used in statistics and insurance contracts and is therefore perhaps easier to handle. The motor power is directly linked to the variables which explain the use of the car like speed, acceleration, torque. The other important variable here is the fuel consumption which has a direct impact on the maintenance costs and therefore on the price the consumer is ready to pay for the car.
 - C. Luxury is perhaps the most recent type of purpose element of a car. It can be measured with the help of the extras with which the car is equipped.

Possible consequences for sampling for cars

The three kinds of variables mentioned above can directly be transformed into a stratification. Many statisticians would stratify similar to the following:

- A. small cars for max. 4 persons / medium cars for 5 persons / big cars for 5 persons / sport utility vehicles / family vans 6-7 persons
- B. stronger / less strong engine
- C. standard / superior equipment

This would lead to a starting point of $5 \times 2 \times 2 = 20$ strata, some of which then might be put together or additionally be divided, depending on their size.

Remark: 20 strata for an average weight of some 4% for cars leads to an average weight of 0,2% for every basic purpose. On average this would lead to 500 strata for 100% of the HICP which comes in the same magnitude as the existing “baskets” in the HICPs.

Possible consequences for QA for cars

As a consequence the interesting variables for cars could be reduced to

- A. space for passengers and luggage space,
- B. motor power and fuel consumption,
- C. extras.

Remark: In the case of cars where manufacturers have developed specific brand images QA is obviously easier when replacements are preferably selected within the same manufacturer. This can and should be done particularly in situations where market shares remain constant.

Draft of an operational definition of basic purposes for sampling of TVs

For TVs three uses occur at the first sight: To receive a TV film, to watch a DVD or video cassette and to play computer games. All available models allow all three kinds of use (if the additional equipment is available). This suggests already that there will be a limited number of BPs related to a TV set. It could also be reasonable to allow only one basic purpose for TVs.

The definition for basic purposes includes the consumers perception of the products, the predominant use and the purchase with similar ends in mind and the perhaps more difficult category of consumers. This leads to a categorisation of the available models by their characteristics or even by their price stratification (A) by size and eventually (B) with a distinction of standard vs. luxury. This would result as follows:

- A. Size: Smaller TVs and portables mainly used for children’s rooms or sleeping rooms (e.g. up to 51cm screen size) / Bigger TVs for living rooms / Eventually big luxury TV sets and home cinemas
- B. Standard vs. luxury

Whether one two or three or four strata are constructed will not matter very much but what does matter is that the whole market is (in principle) covered and that the market development within the basic purposes is captured.

Possible consequences for QA for TVs

In any case explicit QA between very small and very big TVs is only feasible with hedonics. For TV sets which are closer together (say 60/66/72cm screen size) explicit estimates should be easier. The relevant variables for watching TV and watching video films might be seen as follows (by importance):

1. Screen size and format and frequency of the picture reproduction
2. Audio quality
3. Other special features

(The use of TVs for video games might possibly require a slightly different order)

Changes in the quality have to be calculated or judged by the price collector or NSI staff according to the list above. An agreement about such a list would already be a big step forward in harmonisation. The order or the variables on the list can be checked regularly by hedonic models. Here it would not be necessary that all MS develop models for their own but checks in one or two MS would be sufficient.