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PRACTICAL ISSUES IN MAINTAINING REPRESENTATIVE PRICE SAMPLES¹

Invited Paper submitted by Statistics Canada*

I. INTRODUCTION

1. One of the many challenges encountered when constructing price indices is maintaining representative (or current) price samples. As the economy is constantly in flux, a fixed sample becomes out-of-date and thus does not accurately reflect the latest buying habits of the population. The quality of the sample also deteriorates as the number of price observations decreases when products disappear from the market. In this paper, we present alternative approaches that are available to index makers in order to maintain the sample of prices as relevant and representative as possible. Because the structures of many countries' CPIs differ, the paper will begin by presenting some of the various aspects of sample design and maintenance.

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2. There are at least four levels of detail for which decisions on sample design can be made. Often, the sampling approach and strategy are different for each of them. There may also be differences in what index makers are aiming to accomplish, which is also examined according to the different levels of detail. The paper describes the options that are available at the different levels of detail and considers how the development of new goods, in their different forms, can be reflected in the samples.

3. The scope of the paper is limited to that part of the index that is based on direct surveying of a fixed sample of prices. As it is focused on practical issues, the paper touches only occasionally on conceptual issues. It does not, except by allusion when describing the structure of the sample, address questions of original sample design.

II. THE ORGANISATION OF SAMPLES

Defining the scope of samples - Basic classes and sub-classes

4. Most statistical agencies organise the construction of their CPI in a similar way. Consumer expenditure that falls within the scope of the CPI is organised according to a classification of products. Let us call the primary element in this classification a “**basic class**”². Basic classes have been defined based on considerations like analytical value, statistical reliability, economic importance and continuity. This corresponds to the lowest level of detail for which the weights are fixed for a pre-determined number of years (we is also called the fixed basket). Indices are often made available to the public down to the level of basic classes.

5. The degree of heterogeneity in price movements varies widely between basic classes. Given that basic classes were not designed explicitly to group products according to similarity of price movements, it may be desirable in certain cases to stratify commodity groups below the basic class level where price movements are presumed to be heterogeneous.

6. Stratification must aim to create groupings, or “sub-classes”, where it is believed that medium-term price change will be as homogeneous as possible, while being as heterogeneous as possible between strata.

7. Since individual price movements in the statistical universe are not known a priori, elements must be grouped together according to characteristics which are believed to be correlated with price movements. For example, sub-classes are often composed of substitute products, or products made with similar inputs. However, it is much harder to speculate on what factors may be determinants of price movements than on what factors may be determinants of the level of prices. Creating sub-classes requires information on market shares, changes in input prices, key product characteristics, market segmentation and so forth. Conclusions can also be drawn based on similar transactions and product price movements. The number of strata appropriate for each basic class must be determined in view of this information.

8. As with basic classes, sub-classes used as strata are mutually exclusive and exhaustive and make up a significant share of total expenditures associated with this basic class. As in defining basic classes, most distinctions will be between products. However, distinctions may be made between different markets, if it is expected that, say, people over a certain age pay differently for the same

products, or if they buy different products. Along the same lines, if there is information on market shares of broad categories of outlets that make up the universe of outlets (i.e. chain stores versus independents) and a belief that price movements may differ systematically across outlet types, then the index maker may create strata to reflect these categories.

9. In all these cases, it should be possible to make an estimate of the relative importance of the different sub-groups, thus adding other dimensions to the index aggregation process. In other words, micro-indices for each sub-class, whether defined on product, outlet type or another stratification variable, will be combined into one index using weights assigned to each stratum according to its importance in value in the same manner as basic class indices and more aggregate indices are weighted together to obtain the all-items index.

10. For most CPIs, the weights at the basic class level are derived from a unified survey of household expenditures. The weights to combine indices for sub-classes are in some cases also available from the same survey of household expenditures or may be derived from other sources, such as sales estimates or miscellaneous market information, or they may have to be the index designer's best guess.

11. Although there are many exceptions, the number of basic classes in a CPI will typically range between 100 to 200, while the number of sub-classes will fall between 500 and 800.

Designing samples: representative and sampled products

Representative products and outlets:

12. For each sub-class, or basic class if no further stratification has taken place, a more or less independent sample is designed. When designing a sample for a product class or sub-class, the index maker usually defines one or more "representative products". This represents the first stage of the sample selection. In most cases, representative products selected are a very small sub-set of possible products in the class. The definition of representative products directs price collectors to a restricted range of products for which prices are observed but attempts to ensure that the price movement of what is selected is representative of the product class or sub-class as a whole.

13. At the first stage of sample selection in the outlet dimension, in the same way as representative products are defined to direct the price collectors to an appropriate set of products to price, the index maker also usually defines "representative outlets" to direct price collectors to the appropriate outlets. In the same way, it is not operationally possible to collect prices from all outlets, so the type of outlet is restricted to one or more that represents the market. Stratification by outlet type, whether explicit or implicit is not widespread and in many cases, only one outlet type will be represented.

14. Selection of the representative outlets directly depends on the choice of representative products as collectors must be able to find the representative products in the selected outlets. In some cases, there is a one-to-one relationship between the outlet and the product, for example, in the case of car dealerships, making the distinction between outlet selection and product selection immaterial.

15. Where there is no one-to-one relationship between product and outlet, the specific outlets chosen in the sample will usually be determined by the managers of the collection staff, taking into consideration workload distribution and transportation costs.

16. Whether the selection of outlets is determined by the selection of the representative products or not, the outlet sample must be determined at this stage to enable the collection process to continue with the pricing of the actual sampled products.

Sampled products

17. Having defined representative products with specifications listing their technical characteristics, and having selected a sample of outlets where such products can be found, the final stage of sampling then takes place. Price collectors are required to select “varieties” of products or, using Ralph Turvey’s terminology, “**sampled products**” and observe their prices over time. There will usually be instructions and guidelines describing the basis of the selection of sampled products beyond the requirement that they satisfy the specification of the representative product. Usually this will include instructions that they must be important sellers in the market; often there will be an implied or explicit instruction that they should be mainstream products, so that they will probably remain on the market for a while. A set of guidelines is also provided for choosing a replacement product in cases when the previous sampled product is temporarily unavailable or disappears from the market.

18. The distinction between a representative product and a sampled product can be rather subtle. It will depend on the approach adopted in the central specification for the representative product is. The specification for the representative product may be very general or tightly defined, thus limiting product selection options in retail outlets to various degrees. Selection may be fairly centralised, with specifications providing relatively strict collection criteria, leaving interviewers little choice on the prices to be recorded. Selection can also be more decentralised, with specifications providing far more general criteria, giving more latitude for interviewers to determine the most representative product varieties in the field.

III. OBJECTIVE OF SAMPLE MAINTENANCE

19. The calculation of a fixed-basket price index calls for monitoring price change of a fixed basket of commodities in a world where consumption patterns change more and less rapidly and commodities flow in and out of the market. As time goes by, the weights used to aggregate the goods and services in a CPI become increasingly irrelevant to the population’s current reality, hence the policy in most statistical agencies to update the reference basket on a regular basis.

20. The period between expenditure weight updates varies widely among countries. Of the 48 countries who have posted information on the IMF web-site³ the most common period for updating the basket is every five years (16 countries). The next most common period is annual (10 countries). The other 22 have different periodicities or did not say, but half of them have updated their basket in the last five years.

21. As with the fixed basket, the sample cannot remain fixed and relevant at the same time. If no sample maintenance takes place, the product sample becomes progressively less representative in three ways:

- 2) sampled products would disappear causing sample attrition
- 3) sampled products may become less representative over time although they still can be found
- 4) new products would appear on the market which may not be well represented by the products in the sample

22. Although CPIs are described as reflecting the change in prices based on the pattern of expenditures on goods and services for a certain year, which is updated with a certain frequency, very little is said about the representativity of samples and weights below the level of detail of the “fixed basket”. Is it reasonable to assume that the surveys that produce the individual goods and service indices are reviewed with at least the same frequency as the basket update? For example, if one of the goods is “bread”, which has a weight that is updated every five years (at the same time as the family expenditure update), should one expect that the survey that produces the bread index be reviewed at least every five years?

23. This would seem to be the minimum expectation of the sample – that it be maintained for the period between basket updates. For countries that update their basket every year this may seem a fairly straightforward exercise, though there are some commodities for which even twelve months is too long a time period in order for the same varieties to be observed. The samples for computers and fashion-based clothing, for example, are likely to have to be overhauled within twelve months. For countries updating approximately every five years, the issue is more complicated. Practically, the challenge of continuing to represent price change for products bought up to five years ago gets progressively more daunting. It raises the question of whether the objective is to maintain the old sample as well as possible, or whether the objective is to ensure that the sample, at the detailed level, reflects more current patterns of expenditure.

24. If the aim is to maintain a sample which is unbiased with respect to the reference period expenditures, then the only relevant loss of representativity as time goes by is due to sample attrition through product disappearance. The loss of representativity due to changes in consumption and the appearance of new goods are irrelevant if the aim is to keep a fixed sample representative of the reference period. In this context, sample maintenance translates into an effort to keep the fixed sample “alive”.

25. If the objective is to keep the sample as representative as possible of the current transactions on the market, then the issue of maintenance becomes more complex. The lines between maintenance and re-sampling become blurred as new patterns of consumption and the appearance of new goods need to be reflected in the sample.

26. At the detailed level of sampled products, changes in the consumption patterns and availability on the market can be very pronounced. The sample will become antiquated long before the basket of goods and services defined at a more aggregate level which is subject to much slower change in patterns. That is the reason why, even within the framework of the fixed-basket concept, price statisticians should attempt to keep weights and samples below the basic class as representative of current spending patterns as possible. This notion is reflected in the very tools that the Canadian

Consumer Prices Program has endowed itself with: the purpose of the monthly linking of price relatives calculated from what are called “matched samples”» is to allow changes in the sample (substitutions, new outlets, deleted outlets or items) to be made as easily as possible and at any time. It should be noted that this feature was not designed just to keep the sample “alive” but to keep it representative of current spending patterns.

27. Whether the aim is to produce a cost of living or a fixed basket index, the infrequency of updating the basket is more a practical constraint than the preferred ideal. So an index maker might decide that as changes at the most detailed level force some reaction, it might be better to try to reflect the current market than try to continue to represent that of up to five years ago. In fact we see that at the most detailed level forced replacements of sampled products usually do reflect current markets. By extension, if maintenance at the most detailed level reflects the latest market conditions, the choice of representative products, and the stratification within the structure of the basic class should also reflect current market conditions as far as possible. The frequency of their review and revision is also a matter of practical constraint.

28. Index makers should therefore balance the ideal of frequent updating against practical constraints and develop a plan to systematically review all samples and weights at the different levels of detail. Of course, not all commodities need to be reviewed with the same frequency. Product developments and market conditions change more rapidly for some commodities than for others and this should be taken into account.

29. As a guide for planning updates to the strata weights, one should consider the impact on the total index of corrections at different levels of detail. As an approximation, the error in the index is the product of the error in the weights of two products and the difference in their price indices. So one needs to trade off the importance of higher level groups, whose indices may not diverge very much, but whose large weights are vulnerable to error, against more detailed commodities, whose weights may not be so large, but whose products might exhibit widely diverse price behaviour. We have traditionally given much attention to the former, with regular expenditure surveys, but not so much formally to the more detailed levels, which are more difficult to observe.

IV. CHANGES THAT CAN BE MADE AT DIFFERENT LEVELS OF DETAIL

30. Maintenance strategies vary according to the level considered – sub-class structure and weighting, definition of representative products, and selection of sampled products. One distinction between the first two and the third is that changes to the design of the sub-classes or representative products are at the discretion of the index maker. With rare exceptions, it will be possible to continue collecting prices according to specifications if no changes are made. Consequently, it is easy to fall into the trap of considering the design as satisfactory though in reality it is becoming outdated. It is only at the sampled product level that the index maker is forced to make changes on an on-going basis. A strategy is needed for the maintenance of the sample at all three levels as they are quite interdependent.

Redesign of the product/outlet stratification

31. There are two kinds of change that can be made at this level, changes in the structure of the sub-classes that comprise a basic class, and changes in the weights used to aggregate the index for

them. If the structure and weights were taken from the same survey that defined the basic class, then updating will only be possible when a new household expenditure survey is conducted. Nevertheless, the list of sub-classes should be reviewed well ahead of the next update to decide whether more or different information is needed from the household expenditure survey to refine the expenditure categories. If the structure and weights can be obtained from some other source, either different quantitative information or judgements based on observing the market, then the potential for more frequent updates exists.

32. The principal aim of redesign of the stratification is to reflect trends in consumption patterns and price movements within a basic class. For example: sportswear, package vacations, cars, may all be basic classes within which the distribution of more homogeneous groups of commodities may vary, and for which sales information may be readily available. It may be clear that the distribution is changing. Sometimes there may be sales figures (or administrative data) to provide evidence, and we do not want to wait five years before updating this information.

33. When a new structure replaces the old, in order to keep the index for the basic class unaffected by the redesign, indices on the old and new structures should be linked at a chosen point of time, usually a particular month. If there is a new sub-class added a starting index needs to be imputed for it which should be the index for the basic class. The values for the new structure should ideally be valued to price levels at the link point, though this can cause some difficulty⁴.

34. The main issue is to ensure we are reflecting true trends in consumer behaviour rather than transitory variations, particularly not variations induced by changes in relative prices, which may be problematic since the new structure is linked into the old one. (Szulc, 1983). We know (Reinsdorf, 1996) that even with data of the highest quality, linking the latest prices to the previous month's quantities produces a sharply upward biased index. This is because, for finely defined products, consumers react drastically to changes in relative prices among apparently similar alternatives. It seems unlikely that expenditures over a whole year might be related to price movements the following year but in some circumstances it may occur. It is more likely to happen, the more narrowly defined the product sub-class is. If for example, the basic class is women's shoes and the sub-classes are dress shoes and sneakers, it is unlikely that changes in the relative quantities bought would have been caused by short-term price changes in the previous year. On the other hand, if the sub-classes are specific models of automobiles, it is quite possible that the previous year's sales volume for a particular model might be unusually high because of aggressive pricing by the manufacturer, which may well be reversed in the current year. Another possible situation is if the expenditures tend to be only made once a year. Package vacations, for example, tend to be marketed only once a year, grouped usually in the same season each year so the comparison between one year and another is really between adjacent periods.

35. Another way of reflecting expenditure shares between groups of products is to allocate the sample size roughly proportional to these sales, instead of using explicit weights to aggregate the indices. The indices derived from these self weighted samples would then follow the usual unweighted micro-index formula, in the case of the Canadian CPI, the geometric mean. One way of looking at the issue of implicit versus explicit weights is in light of the objective of sample maintenance. An index maker should consider which of the two approaches would allow a quicker response to changes in the market. In the Canadian context, a change in explicit weights may require less effort and involve fewer cost than a modification in sample proportions. The former is simply a matter of changing a calculation whereas the latter involves communication of the change to the price collectors and a certain lag time for the required

phasing in and out of the price quotes. These factors explain why explicit weights tend to be favoured over self-weighted samples in the Canadian CPI.

36. If the index maker relies on different sample sizes to effectively weight the subsets, this is done through the mechanism of the sample selection. In these cases, there are no sub-classes per se, only representative products which should be treated as described below.

37. Whatever the approach used to reflect expenditure proportions across products, the index maker usually has to make judgements based on observation and knowledge of the market. As detailed electronic sales records such as scanner data become more easily available, more useful information will likely be at the disposal of index makers in the future. In absence of hard evidence, if more than one representative product is chosen there is a tendency to give them equal weight. Nonetheless, some effort should be put into making some assessment of their relative importance remembering that equal weighting implies a statement on proportions that may be worse than an educated guess. In the words of Ralph Turvey, "it is better to be roughly right than precisely wrong".

Maintaining the list of representative products

38. The tasks involved in keeping the list of representative products up-to-date can range from slight modifications of the descriptions of the representative products or representative outlets to a complete reselection, or, by reassigning the sample sizes, to change their effective weighting.

39. Price surveys for CPI commodities are frequently not independent of each other. In designing a sample both products and outlets have to be considered. Groups of products are inevitably linked together as outlets tend to sell many products and normal practice is to use the same outlet sample for several survey commodities. Fortunately for index makers, the types of outlets change more slowly than the products they sell. It is usually reasonable to redesign the sample of products within an unchanged outlet structure. There are exceptions to this. Car dealerships constitute one such case where there is a one-to-one relationship between the outlet and the product.

40. The main challenge is to review and re-select representative products for the basic class or sub-class. Updating of the products should be done on a regular basis, based on continuous monitoring of trade publications, consumer reports and anecdotes. Because of the ease of accepting the status quo, the index maker should approach this review with a presumption towards change.

41. Although the definition of representative outlets tends to pose fewer problems, this should not be overlooked. If, as often happens, the choice of outlet is limited to mainstream retail outlets in commercial centres, it is possible that other types of outlets, discount stores, speciality stores, catalogue sales, internet sales, may secure a significant share of the market, and display different price change behaviour. Adding or changing the definition of representative outlets should be considered as well.

42. The list of representative products can be changed, or their definition modified. Which happens will depend largely on how restrictively the definitions are written in the first place. A specification may be drafted quite generically, leaving a lot of latitude in the field for the price collectors to choose the sampled product which is most representative. On the other hand, specifications may be designed quite tightly, pointing the price collectors to a particular brand, model number or size of product.

43. Designating quite specific representative products provides a certain guarantee that products with characteristics influencing price movements in a significant way are not omitted from the sample. When representative products are so tightly defined, however, this approach requires that a large number of representative products be designated to ensure that the class or sub-class is properly represented.

44. However, by drafting the specifications more broadly, allowing the sample to cover a broader range of products across outlets, the sample will adjust to changes in the market at a faster rate.

45. The choice between a centralised or decentralised approach is not an absolute one. It is a question of degree. Consumption may vary widely between regions, whether by type of product, brand, size, options or price level (high or low end). In principle, decentralised price selection in retail outlets should improve sample representativity, especially if there is little consistency in consumption patterns between different regions. In practice, certain conditions are more favourable for decentralisation. In other cases, better results may be obtained using a more centralised approach. The table below highlights some of the considerations that should be kept in mind in choosing an approach for product selection.⁵

Conditions favouring decentralised product selection	Conditions favouring centralised product selection
<ul style="list-style-type: none"> • Major regional differences in consumption patterns • Specialised product knowledge not required • Lack of concrete or recent head office information on the more popular product varieties in each region • Good communication between regional operations and head office • Well-trained staff in regions 	<ul style="list-style-type: none"> • Consumption patterns very consistent across the country in terms of various product characteristics • Very homogeneous basic class requiring no diversification (for example, fuel) • Specialised product knowledge required to make appropriate choices • Poor relations with respondents (in-depth interviews could jeopardise the interviewers' access to the retail outlet) • Complete and recent centrally available market information • In the context of a small outlet sample, the selection of the most representative varieties in a given retail outlet may not be representative of the region if product or variety availability varies substantially from outlet to outlet. In such cases, it would be better to determine centrally which varieties should be selected.

46. Generally, the broader the definitions of representative products the quicker and more easily changes can be reflected in the surveys, so this approach would tend to facilitate sample maintenance. The way representative products are defined has other implications, namely on the possibility of finding

replacement products when sampled products disappear and on the need for quality adjustment to make these replacements comparable. This will be discussed in the next section.

Maintaining the price samples

47. Prices are collected for a sample of particular products which must meet the specifications of the representative products. There are usually criteria to assist the selection, most commonly based on their being the high volume seller, or an important seller. However, even if the criteria are met, replacements often have to be made because some price observations are lost.

48. How the replacement variety is compared to the lost variety and integrated into the index – the questions of quality change - is beyond the scope of this paper. However, the choice of replacement is a sampling question, as it can be used to help keep current the sample of prices collected.

49. There are often instructions or guidelines provided to the price collectors regarding the selection of replacement items. There are three clear alternative guidelines: finding the most similar, the most popular, or the most likely to be around in the future. The most similar is a practical solution when one year's vintage of a consumer durable is replaced by the next year's, but it tends to lead to an obsolete sample if consumer preferences are moving away from that kind of sampled product altogether. In contrast, instructions requiring the replacement product to be an important seller in the market tend to lead to a more up-to-date sample. However, since the replacement has to fit within the specification of the representative product, how much leeway is available depends on how tightly that specification is drawn. The tighter the specification, the more straightforward the quality change assessment, since the change is limited, but the greater will be the pressure to review and revise the representative products. On the other hand, the looser the specification, the more challenging will be the problems presented in the analysis of quality change. Finding a replacement that is likely to be around for a good length of time appears to be a compromise between these but it tends to fall short of either option, apart from the challenge it provides to seeing into the future.

50. The approach taken to draft specifications for representative products and replacement instructions will also impact on the rate at which the appearance of new products can be reflected in the index. Depending on the approach taken, new products may not be integrated into the sample unless they happen to constitute the closest substitute available to a sampled product which is no longer available. This issue will be discussed in more detail in the next section of the paper.

51. Although guidelines usually require that the sampled products for which prices are being collected are still representative of the market, often only lip-service is paid to it. The current practice of product selection is often to seek products which are likely to have a long market life with little change in quality—and then retain these items in the sample as long as possible. The risk of bias resulting from changes in quality and the cost of making numerous adjustments for these changes is behind the current tendency of minimising the amount of product substitution.

52. In rare circumstances a product may be replaced in the sample when a price is still available for it. If it is recognised that the markets for some products are changing rapidly, a programme can be developed to replace sampled products, even though they are still available. This can be done in either of two ways: all products can be replaced when they have been in the sample for more than a certain

length of time or the whole sample at some particular time ⁶ as in the case of forced replacements in the US CPI (Lane, 2000). This may ensure that the sample is kept up-to-date.

53. Another possibility is to separate the process of adding new products and removing unrepresentative ones from the sample. One such method is the multi-period overlap method. It may take two forms. In a version pioneered by Ralph Turvey using catalogue sales for computers, (Turvey, 1999) all the price offers are noted and a comparison made between all that are available in successive periods. The advantage of this method is that as certain product types become more popular they will tend to be represented more in the sample as there are more variants of them. The disadvantage is that as the sample size can vary, it can become unwieldy. Another version can be applied to smaller samples selected in stores. In this method new variants that are judged to be popular are added and existing ones remain in the sample until they no longer are significant sellers. This gives the price collector more control over the size of the sample, and ensures that obsolete products that are still nonetheless available do not remain too long in the sample. It requires checking frequently with retailers which can be a burden on them. Nevertheless, this version is to be preferred, as the abnormal price behaviour of varieties at the end of their product life would not affect the index.

54. Outlet replacements are usually treated differently – instead of a quality change assessment being made between the sampled prices from the two outlets the sample is allowed to shrink and then expand. This may be because in practice it takes longer to find a replacement. This can be forestalled by keeping a list of alternative outlets in reserve. In some sampling systems that choose outlets through probability proportional to size an ordered list is produced, which provides the next outlet to be selected if one is lost (Statistics Sweden, 2001). Even if there has to be a gap before finding a replacement outlet, it is better to make explicit imputation for the missing prices so that the prices for the replacement outlet can be compared directly instead of implicitly. Again, what kind of replacements can be made depend on the description of the representative outlet.

V. HOW TO REFLECT NEW GOODS IN THE SAMPLE

55. The preceding sections described the various changes that could be made at different stages in the sample design process to keep the price samples representative of the changing economy. But what changes in the economy do we wish to reflect in the sample?

56. As the economy is in a continuous state of flux, almost everything on which a fixed sample is based is subject to change. There are two broad classes of changes: 1) those that involve only a redistribution of the alternatives; and 2) those that involve the addition of new choices or the disappearance of old ones. We have seen that while reweighting of alternatives is fairly simple, given the information, there are a number of options to consider in dealing with new products and new methods of distribution, that is, new outlets.

57. The phrase ‘new goods’ has been used to cover a number of situations. Following Fixler et al. (1999), let us distinguish three kinds of new goods.

58. There are:

- i) Old consumer items that change – for example, by adding new features or improving performance;
- ii) New consumer items that perform the same function as the old ones but in a better, or novel way;
- iii) Completely new, never-before-seen, consumer items that satisfy a consumer need or want that has never been satisfied before.

59. It has been observed (Nakamura et al., 1996) that practitioners tend to take a pragmatic view of new goods – a new good is one that is included, or considered for inclusion, in an index number basket in the current period for the index that was not included in previous periods. This definition includes goods in all three of these classes.

60. We might map these classes to the different levels of design in our index structure: the first corresponding to changes in the sampled product, the second to changes in the selection of representative products, or possibly to changes in sub-groups, and the third to additions to the basic classes. This is only an approximation, as the classifications both of new goods and of the stages of sample design, are subject to interpretation, but it gives a guide as to where to look to incorporate new goods.⁷

61. Under the present structure of index making, the only way to ensure that the introduction of a new good has an impact on the index at the time of its introduction, is to treat it as a quality change in an existing product. This means that the new good has to satisfy the detailed description of the representative product of which it is a new variety. Unless this has been drawn very liberally not many new goods will pass. Perhaps this would be a good case for pursuing a strategy of defining representative products much less tightly than before. To give an example from Canadian experience, as larger format televisions become more popular, they should be reflected in the CPI. It is not very difficult to compare the quality of televisions of different sizes, particularly as so much hedonic and other research has been done. However, as the specifications for televisions include screen size, a 20” television will not be replaced by a 27” or larger television. The only way to bring larger televisions into the index is to choose them as a representative product, or to define the representative product as televisions, irrespective of screen size, or alternatively to design sub-classes by screen size including large screen televisions and attribute a weight to each. On the other hand, the specification for home computers does not, fortunately, include the speed of the chip, or the amount of RAM or the size of the hard drive. Consequently as better models become available, they can replace older models in the index, and their quality improvement can be compared to the price change.

62. Most new goods can be introduced into the index at the time of some redesign, whether it is for a basic class, for a sub-set of an existing one, or in selecting representative products. It has been noted that expenditures on most new goods are small when they are first introduced on the market. This indicates that getting new products into the index early is more important than estimating the quality improvement when they enter. Sometimes this is not easy. Given the long lead time to bring them in as a new basic class (identify, redesign the expenditure survey, collect the expenditure information, and implement into the index) it is better to bring in as many new goods as possible at lower levels in the classification structure. This can be done either by adding or replacing representative products, or by modifying sub-classes where re-weighting may be done between basket updates.

63. However, even this is not straightforward. Most new goods fail and disappear from the market shortly after their introduction. It is a lot easier to recognise after the fact what should have been brought into the index than it is to forecast it. (In the breakfast cereals case, while apple-cinnamon Cheerios were successful, all the other new cereals introduced were not). However, if we wait too long for a new good to prove its case we will miss its impact. It is like guessing whether the roll of a dice will be six. On any given roll the best guess is no, but some sixes will be rolled. One possible approach to represent new items in the index for a product group that is changing rapidly is to draw an extremely loose specification – say “any electronic portable audio equipment” and keep a sample for it. It will be difficult to keep anything in the sample for long, but whatever is there will show the rapid price drops in this area, and given a reasonable weight, will give some representation to the newest goods.

VI. CONCLUSIONS

64. The objective of sampling for purposes of constructing a CPI is not only to begin with a representative sample, but to keep it representative as products and outlets come and go, as products change and as consumers shift their expenditures between products and outlets. There are several ways of dealing with change to maintain representative price samples. Which approach an index maker will want to use most depends on the overall index and survey design, the classification structure followed, and the degree of centralised control of the survey.

65. Generally, the broader the definition of representative products, the quicker and more easily changes can be reflected in the index. However, a more decentralised approach to product selection puts more responsibility on price collectors and editors who then need to be more highly trained.

66. Factors other than just representativity must be also considered in maintaining price samples. Sample continuity is also an important criterion in product selection because calculation of pure price movement requires a month-to-month comparison of equivalent products. Quality change adjustment methods are used to maintain sample comparability over time if products undergo changes. These adjustment methods are approximate and may themselves introduce bias into calculation of the index. The greater the continuity, the lesser the representativity of the sample and the greater the possible bias caused by delaying the introduction of new goods. The balance between these representativity and continuity criteria is very delicate. It depends in large part on whether the objective of the index maker is maintain a sample which is as representative as possible of the basket reference period, or whether the objective is to yield a measure which is as relevant as possible to the current reality experienced by consumers. The degree to which these different approaches matter will also depend on the product group, because changes of quality and the appearance of new products do not occur at the same pace in all sectors.

67. The optimal solution for sample maintenance may therefore translate into different solutions for different product groups. Whatever combinations of solutions are the best fit, there should be a plan to review each stage of the sample design on a regular basis, even if much of it will remain unchanged. Checks should be applied to prevent too easy approval of the status quo. These regular reviews not only ensure a more representative measure but they also support the credibility of the CPI, which is an essential ingredient of its success.

NOTES

¹ Apart from the references quoted, the authors have also consulted heavily the draft chapters on sampling and quality change for the forthcoming international Consumer Price Index manual. As this is still under preparation no references can be given.

² Terms differ among countries. Unless noted otherwise the Canadian vocabulary is used here.

³ URL is [//dsbb.imf.org/country.htm](http://dsbb.imf.org/country.htm)

⁴ As the weighting information usually pertains to a previous period, so that we are guessing how consumer behaviour may have been modified since then we may do better sometimes not to adjust for price changes between the weighting period and the link period. This is an empirical matter, depending on how relative expenditures at that detailed level react to relative price movements.

⁵ From Allard-Saulnier (1999).

⁶ The BLS plans this as a programme of ‘directed replacement’ for some products undergoing rapid technological change.

⁷ As this is meant to be a practical guide we will not discuss the theoretical approach to new goods. However, it should be recognised that our practice ignores completely one aspect of the introduction of goods in the second or third category – the improvement due to their introduction. This can be calculated, under certain assumptions, by estimating a reservation price for the new good – that is, the price at which its demand in the preceding period was just zero. This has been estimated from regressions on competing goods (Hausman, 1997), for breakfast cereals and cellular phones and would seem to be applicable to the second category of new goods, where the new good is a variant on existing ones. It is less easy to see how it could be done for completely new goods, as we would not know what it is substituting for. In any case, there are practical difficulties in doing this analysis in current production.

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