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INTEGRATING INTER-AREA AND INTERNATIONAL PRICE COMPARISONS WITH CONSUMER PRICE INDEX COMPILATION

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Abstract

The views expressed in this paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy.

The best available inter-area and international price comparisons for consumer goods and services use data from the Consumer Price Indices (CPIs) compiled by national statistical offices (NSOs). Yet serving public and private multinational institutions' need for these indices is rarely a priority for NSO management, particularly when it involves competition for the budgetary resources devoted to the national CPI. This article examines an approach for integrating place to place price indices with normal CPI compilation by enabling improved quality adjustment of the CPI at the same time it facilitates international comparisons. It depends on the wide implementation of an international standard, characteristics-extended product classification that could greatly reduce the burden on NSOs of participating in the cooperative production of international price indices.

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I. INTRODUCTION

The best available inter-area and international price comparisons for consumer goods and services use data from the national statistical offices (NSOs) compiling Consumer Price Indices (CPIs). In recent critical reviews of the International Comparisons Project (ICP) by Castles (1997) and OECD-EUROSTAT Purchasing Power Parities (PPPs) by Ryten (1998), the accuracy and reliability of international comparisons has been assessed as less than adequate. Castles notes at length the difficulties encountered in comparing like goods from country to country, and Ryten argues for the need to secure greater support from NSOs in compiling the ICP.² Yet serving public and private multinational institutions' need for these indices is rarely a priority for NSO management, particularly when it involves competition for the budgetary resources devoted to the national CPI.

This article examines an approach for integrating place-to-place price indices with normal CPI compilation by enabling improved quality adjustment of the intertemporal CPI at the same time it facilitates international comparisons. It depends on the wide implementation of an international standard, characteristics-extended product classification that could greatly reduce the burden on NSOs of participating in the ICP.

International and inter-area price indices are conceptually the same as the more familiar temporal price indices—they merely compare prices from locality to locality rather than time period to time period. Since, with the exception of some differences in scope, both draw from the same set of prices and their associated specific goods and services, much of our initial comments are generic to both the inter-area and intertemporal price index compilation contexts. We review the stylized facts of the existing situation in order to set a context for the chief recommendation of this paper, that international product classification standards be extended for selected detailed product groups to include a standard set of characteristics that would be measured for each item classified into those groups.

² Prasada Rao (this seminar) also notes the scope differences between household consumption PPPs and CPIs, which are the same as those between the household consumption deflator in the national accounts and the CPI. Like that paper, the focus of this paper is on the intersection of CPI and national accounts individual consumption expenditure coverage of expenditure on goods and services. We exclude from the national accounts individual consumption aggregate any items of consumption expenditure on behalf of individuals that is undertaken by nonprofit institutions serving households and by the general government. We also exclude good and service items produced for own consumption, with the exception of the housing services homeowners consume from their own dwellings, which are in scope for a number of national CPIs. Beyond this, a number of detail differences remain between the coverage of the CPI and national accounts individual consumption of households in their own behalf. These differences are often idiosyncratic to individual countries. As noted by Prasada Rao, the coverage of individual consumption lying outside the CPI expenditure aggregate would have to rely on imputations and additional sources besides the national CPI programs of countries participating in a PPP exercise.

II. CONSTRUCTING PRICE INDICES WHEN PRODUCT ASSORTMENTS VARY

A. Comparing like with like—product specifications must be sufficiently “narrow” in any price index

We begin this article with an attempt to clarify the terms “narrow” and “broad” specification, at least as seen by the authors. These terms are widely used in the practice of price statistics to refer to the mode of identifying the most detailed items in a price index whose prices are to be recorded and compared from period to period. In general, price statisticians go about identifying a “unique” item to be priced through a narrowing process beginning with a product classification group and ending with a detailed description(s) of the item(s) selected to represent that group. Such a description might include model number, country of manufacture, material, dimensions, features, terms of sale, and so on, as appropriate to the item group.

The test in determining the level of detail sought in a product description is essentially a “law of one price” rule. If all possible items in the narrow class defined by the description would be sold at the same price on the same date in the same locality, the description is sufficient. This test often is not amenable to empirical confirmation, but could be considered at least the thought experiment guiding the statistical office analyst and price collector in arriving at a product description for a specific item that is to be “repriced” in several localities or time periods. In this sense, all detailed item descriptions or specifications must be sufficiently “narrow.” By the same token, any attempt to add still more description to the item specification would not be helpful to a price index maker, since the added description would merely indicate a subclass of the specification with an identical price. In this sense, it is efficient to have item descriptions sufficiently “broad.”

In principle, then, the optimum item specification is both sufficiently narrow and efficiently broad, but it is almost always narrower than the detailed item group to be represented by a sample of such specifications. The jargon of price statistics sometimes obfuscates this point by using the term “specification” also to refer to the highest level of product detail that will be represented by a sample of detailed products. Item groups that are “broad” or loosely defined are termed “broad specifications” when, in the language of this paper, they are just broad item groups. There is no meaning to the notion of a valid “broad” versus “narrow” specification in our use of the term. There is only a specification that may be correctly, too broadly, or too narrowly defined in characterizing a specific item in an item group whose broadness is, in turn, characterized by the range of specifications it contains.

B. The problem of different assortments of product types between situations compared

Consider a hypothetical situation in which all available varieties in a given time period and locality are covered by an enumerated set of specifications for an item group. Suppose that for one of these specifications a price is missing in one locality or time period but present in the other, and thus a price relative between the two situations cannot be computed. The standard approach in such a case is to impute the average price relative of the specifications

that *have* been priced in both localities or time periods. The average will have a weighting scheme, with common alternatives such as equally weighted, weighted according to probability of selection, or weighted according to a criterion of similarity with the missing item. In this approach to varying product assortment, which we will call the “instantiation approach,” there is never a direct comparison of the price of one variety with that of another, different variety, straightforwardly following the “comparison of like with like” principle of index numbers. Rather, there is an assumption that the price relative of the specification with the missing price is the same as the average relative of the specifications in the item group.

An alternative approach is to go ahead and make a direct comparison between the price observed for an item in whatever situation it is observed, with the price of a dissimilar item(s) in the other situation(s) in which the item in question is not observed, after adjustment for the difference in characteristics between the two. We will call this the “characteristics approach,” following familiar terminology. In the now extensive hedonic regression literature, the conventional method for incorporating product characteristics information into the comparison of dissimilar items in price indices involves estimating a statistical model relating measured prices to the measured characteristics of the associated products. This class of comparisons, when extended to cover judgmental coefficients supplied by statistical office analysts or cost differentials supplied by producers—also ultimately on the basis of the difference in characteristics—is known as the class of “quality adjustment methods.”

III. TWO APPROACHES TO NARROW SPECIFICATION OF PRODUCTS AND DIFFERING ASSORTMENT

A. The “instantiation” approach

How this approach works

Product specification

The instantiation approach requires only a sufficient description of the product that it is uniquely defined in the “law of one price” sense, and so that it can be recognized in a range of localities and time periods wherever and whenever it is available for the subsequent recording of its price. In some countries, a national set of detailed product specifications is determined by the NSO, generally on the basis of a commodity study determining items considered to be volume sellers and having wide availability. Alternatively, many countries use a judgmental selection process for product varieties within a detailed product group that is undertaken by the price collector in the field.

In both of these cases, NSOs often find it sufficient to supply a text description of the detailed items. In other countries, such as the United States, product or “price-determining” characteristics are determined beforehand by a commodity study, and these characteristics are recorded and coded during the process of determining product specifications, e.g.,

selecting varieties for subsequent pricing.³ This notwithstanding, the instantiation approach does not require the recording and coding of characteristics information as part of the process of selecting product varieties to price in the index, but merely sufficient information to identify a given assortment of varieties from place to place or time to time, and, as a result, characteristics information generally is not recorded and coded. Since the instantiation approach is often broadly satisfactory in the time series context characterizing the national CPI, the characteristics data are, often at best, only recorded for those commodity groups in which available variety assortments have begun to change at a moderate to rapid pace.

Constructing a price index when the product assortment differs

As noted above, price index construction when detailed specifications are produced with the instantiation methodology follows the standard approach of making comparisons between a pair of localities or time periods using only those product specifications within an item group for which there are price observations in both localities or time periods compared. By implication, specifications for which there are missing price observations in one of the situations being compared are imputed by the average relative of the item group, or, in some cases, a smaller reference group within the item group. The instantiation approach is the primary method used in price index construction, both intertemporal and inter-area price indices, but it is not without problems.

Problems with adhering to narrow product specifications under the instantiation approach

Overlap is critical

Overlap in the coverage of price observations across product specifications from period to period or place to place is critical to the instantiation approach. Confidence in the accuracy of the resulting item index is undermined when this core set of priced specifications covers only a small fraction of the expenditure represented in the item group, say, less than 50 percent.

Overlap is often insufficient, particularly in place-to-place comparisons

By implication, the instantiation approach runs into problems when products must be characterized with extremely narrow specifications. Under very narrow product specifications, prices may be observed for these specifications in very few places or across very few time periods, severely limiting overlap. Practitioners often try to offset the shrinkage of overlap by loosening the product specification, effectively making comparable items that were considered different products under the tighter specification. Unless the original specifications were inefficiently tight to begin with, this practice tends to compromise the integrity of the resulting index.

³ This methodology is referred to in the jargon of some NSOs as “disaggregation.” Disaggregation can be performed purposively or by using statistical probability selection methods.

The problem of narrow overlap is important in interarea price indices when the good is complex, subject to rapidly evolving technology, with differences in market penetration of varieties in different areas, and/or the weather and sociodemographic characteristics of the purchasing population are different between areas, explaining a difference in the tastes of the population for the available assortment. One approach to managing the overlap problem in the interarea context is the “chaining” approach of, for example, Hill (1999), that is supported by Prasada Rao (this seminar). Under this approach, a direct comparison between two areas or countries may only be possible through intervening bilateral comparisons with “third” areas or countries, such that each link in the comparison chain maintains a satisfactory coverage overlap of product varieties.

B. The “characteristics” approach

How this approach works

Product specification

As noted above, the characteristics approach begins with a market study by an NSO analyst to determine a set of price determining characteristics. These product characteristics, such as size, features, nature of the sale transaction, type of outlet, and so on, are determined in detail according to the available information about the impact of the detailed characteristic on price at a point in time or over a specified reference period, such as a year. The information may be available from industry and marketing sources, or it may be necessary to seek direct anecdotal information from small-sample “hothouse” or “focus group” studies. The market study may, if there are sufficient data available, utilize a regression analysis of the effect of various characteristics on price in order to determine a parsimonious set of price-determining characteristics with the highest explanatory power. The market study determines what measures of the characteristics the price collector will seek in specifying the product, but generally not the levels or values of those measures, which will be determined in the field by the collector and recorded at the time of collection (see Armknecht and Weyback, 1989).

The methodology the collector uses to determine product specifications may or may not follow a stepwise selection process, according to a particular ordering of characteristics that is determined by the market study. At each stage of selection, characteristic by characteristic, the selection process is purposive (e.g., select the volume seller) or random (as in probability sampling). This stepwise, so-called “disaggregation” methodology is not strictly necessary in order to record the characteristics information on a variety. The variety may be purposively selected without using any characteristics information and the values of product characteristics recorded after selection. On the other hand, without disaggregation the recording of characteristics is not intrinsic to the process of determining the specification, and the value of determining and recording characteristics will depend on their perceived usefulness in handling prospective quality change in the item priced.

Constructing a price index when the product assortment differs

For practical purposes, all characteristics-based comparisons of dissimilar items take place when an old variety is “replaced” by a new one. If the old variety is replaced by more than

one new variety, variations on the theme described in this section would be needed—the most conventional approach is to select one new variety, as similar as possible with the old one, to replace it when it disappears. The same would apply for two or more old varieties being replaced by fewer new ones. The most similar are directly compared and the rest are imputed as in the instantiation approach.

The standard characteristics-based index methodology requires price and characteristics observations of a sufficiently wide variety of detailed commodities or specifications in the item group to estimate a regression model of price on characteristics. Such models, which typically characterize the relationship between price or the log of price and the associated product characteristics as a linear function, were first called “hedonic” models by Court (1939) and the name has stuck. Models may be run independently for each area or period compared. Alternatively, data from the two periods or areas may be pooled and the assumption made that all model parameters except the intercept are the same between the two situations. This approach, favored by a number of studies, is called the time-dummy approach for intertemporal applications and the country-product-dummy approach (Summers, 1973) for place to place comparisons. Finally, as an extension of the constant parameters assumption, the model may be run for an earlier period and the estimated parameters used in the current quality adjustment situation. Indeed many “hedonic” analysts seek stable model parameters over time as a confirmation of their model specifications, despite the fact that this is often an unreasonable expectation in view of the inevitable omitted variables, and the fact that a parsimonious model that closely fits the data of a given area or period can be used without apology to quality adjust a price index. Koksiki, Moulton, and Zieschang (1999) provide a methodology for producing exact, characteristics adjusted economic index number comparisons between areas (or time periods) that allows hedonic equation parameters (and even the form of the equation) to differ among the situations compared.

Whatever the method of estimation of the characteristics parameters in the regression model, they are used to impute a price for a missing detailed item in a given area or period. This is done by adjusting the price of a donor item so that it represents the same characteristics package, under the assumptions of the hedonic regression model.⁴ Interestingly enough, then, at the end of the day the characteristics approach follows the same overarching principle of index number construction, that comparisons of detailed items must be “like with like,” interpreted as “having the same measured characteristics.” The characteristics approach just makes use of additional information, on characteristics of products, in order to to achieve this objective.

⁴ This procedure is also applicable to service products. See Armknecht and Ginsburg, 1992, pp. 133-5.

How the characteristics approach compares with instantiation

Overlap is not critical but sample size is

Because characteristics information can be used to adjust comparisons of different varieties within an item group, provided a statistical model has been estimated, overlap between the detailed specifications of the item varieties is not required at all in order to produce a “like with like” price comparison under the characteristics approach. This is the considerable advantage of having characteristics information on hand when variety overlap is slim, as in comparisons between areas with different climates and levels of economic achievement whose inhabitants consequently consume different types of detailed items with item group. On the other hand, the variety samples within item group must be sufficient to identify and robustly estimate the parameters of the marginal impact of characteristics on price of the “hedonic” statistical model. This is a potential problem with the use of characteristics information when it is necessary to estimate models within given time periods, or within areas and countries, where samples of priced specifications may be small. However, the problem lessens if the detailed data can be pooled, and a version of the characteristics-country-dummy model considered across multiple areas or a pooled time-series-characteristics model considered across two or more time periods.

Users must accept a type of statistical model

All hedonic quality adjustments that use characteristics information as just described to produce price comparisons between different assortments of item specifications are predicated on the validity of the regression model on which the procedure rests. This should, again, not be a major issue for most users, but it sometimes is a problem for survey methodologists partial to “model free” estimation.

How detailed do characteristics have to be in practice?

Armknrecht and Weyback (1989) provided an early analysis answering this question by assessing the degree of explanatory power each measured characteristic has for price. They found that, from the large variety of characteristics variables collected in the US CPI on apparel items, only a few explained the largest share of the variation in price. There is no substitute for detailed and careful studies such as this one in laying out a core set of characteristics information for each product class. Fortunately, a huge volume of such work has been undertaken over the last ten to fifteen years and could be exploited to determine the core or parsimonious set of essential characteristics needed for various types of goods and services.

IV. OBTAINING INTERNATIONALLY COMPARABLE PRODUCT CHARACTERISTICS

A. Why the characteristics approach should be a part of the package of measures for improving the International Comparisons Project

Sample overlaps may be limited for some item groups in almost any bilateral comparison

Although chaining with the instantiation approach could be applied at the item group level, it is most likely to be applied at the country all items level. In either case, there will be item groups for which there is very low overlap and for which a characteristics-based quality adjustment methodology will be needed. These may be similar to, but not the same as, the item groups for which assortments are rapidly changing over time within country. Household electronics and communications equipment and services are examples of the later. However, as noted earlier, inter-area differences in assortment that are driven by persistent differences in background conditions such as weather and cultural preferences will not necessarily be those item groups subject to rapid assortment change within area or country.

Price databases with characteristics information in them are easier to query for the international specifications determined for the ICP under the instantiation approach

Other than running full-text searches on descriptions of product specifications, there is no way of efficiently querying a price database for a specific set of international product specifications unless (1) the specifications are defined on a set of coded internationally-determined characteristics defining the varieties in the item group, and (2) NSOs adopt at least a core set of the international standard characteristics for their product specifications. Searching for and locating internationally preset ICP product specifications is possibly the most burdensome aspect of NSO participation in the current ICP, a burden that could be significantly relieved by the efficient price database design made possible by coded characteristics information. Note that this advantage holds whether the instantiation or characteristics approaches are used to handle differing product assortments from place to place.

Price databases with characteristics information in them promote good index quality adjustment and sample management practices for national CPIs

There almost certainly is support across the majority of NSOs for the eventual implementation of characteristics-based hedonic methods for selected commodity groups in their national CPIs. It is these same characteristics data that could be used for international comparisons. Even for those item groups whose assortments are stable over time but geographically variable, characteristics information assists in managing the sample in the same way it does for those groups whose assortment is changing rapidly, by making product specification changes easier for respondents to report and easier for the NSO to detect.

B. The classification extensions needed to obtain the national and international advantages of the characteristics approach to product specification and index construction

In order to have ease of cooperation with the ICP in addition to having the benefits of a well-structured, characteristics-extended price database for the CPI, NSOs interests are ultimately served by implementing product and characteristics classification schemes consistent with an internationally agreed standard. It is thus incumbent on international standards-making committees such as the Expert Group on Economic and Social Classifications to begin consideration of characteristics extensions to the existing product and consumer expenditure classification structures:

The Central Product Classification, version 1.0 (CPC)

The Classification of Individual Consumption by Purpose (COICOP)

The extension of these international product classification systems to include a core set of standard characteristics for each ultimate category of the classification could be greatly assisted, as noted above, by recourse to the huge hedonic regression literature. The international discussion group most deeply involved in hedonic analysis on consumer products is the Ottawa “City” Group on Price Statistics. Its recommendations might be sought as the Expert Group on Classifications went about establishing standard characteristics extensions to international product classification standards. For determining characteristics extensions of areas of product classifications specific to services, consultation with the Voorburg “City” Group on Service Statistics.

Countries whose regional systems already implement derivations of international standards, such as the Australia-New Zealand Standard Product Classification and the EUROSTAT CPA and PRODCOM, could find these extensions immediately useful in organizing price collection activity for the CPI. Countries with a wealth of experience in the collection and use of coded detailed product specifications such as the United States, among others, could first benefit from concurring their national product classifications with an international standard, and second, use this concordance to share their experience in the implementation and use of characteristics-extended product definitions for the CPI with the international community. We discuss this further under The Way Forward below.

C. Why it’s so hard to implement the simple requirement

As with the implementation of any basic international classification structure, agreement must be achieved on a standard and on an implementation plan. Notwithstanding the negotiation of points of view and practical requirements of the parties to an agreed standard, implementation becomes a challenge if there is expenditure of resources involved. The latter requires careful consideration during the design phase of the characteristics extensions to international standard product classifications making the new standard backward compatible with existing national standards in order to minimize implementation costs. As this is a

process that could be expected to take a period of some months to reach agreement and a period of years to achieve wide implementation, there is no time like the present to start.

V. THE WAY FORWARD: TOWARD A STANDARD CHARACTERISTICS-EXTENDED PRODUCT CLASSIFICATION

As noted above, a logical point of departure would be an agenda item on the next meeting of the Expert Group on Economic and Social Classifications, with a view toward commissioning a technical subgroup to formulate a proposal for characteristics extensions to international product coding standards. As also noted, such an extension need not start from scratch. The work of the subcommittee might proceed as follows, with a justifying principle for each step stated in italics:

- Inventory currently implemented national price collection “checklists” that capture coded product characteristics information—consideration should also be given to emerging commercial product coding standards in this exercise; *there is no need to “reinvent the wheel.”*
- Develop concordances between the national and international standard product classifications for these selected characteristics-extended national product classifications; *use of the new characteristics extensions should be as easy as possible for countries that have already implemented coded price collection checklists in order to ensure their participation in the development and establishment of the new standard.*
- Inventory the characteristics items by detailed international product code across national classifications and develop, as a first approximation, a list of characteristics comprising the union of the items measured on the national checklists; *use of the new characteristics extensions should be as easy as possible for countries already using coded price collection checklists to ensure their participation in the development and implementation of the new standard.*
- Streamline these “union” characteristics lists to develop an international standard that maps broadly to current national standards wherever logical and feasible; *the new standard should represent an improvement over existing systems while being backward compatible with them.*

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