Towards a New Approach for Linking Countries at the Detailed Heading Level In a Way to Eliminate Systematic Quality Differences Associated with Income

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Introduction

In carrying out purchasing power studies from the expenditure or output side, it is important to compare prices of goods and services that are alike across countries. In full benchmark or more limited comparisons, holding quality of items constant across countries is a formidable task. Studies have been carried out by Ahmad (1980) to get a handle on how many items need to be priced to adequately represent the major expenditure headings. It would appear from Ahmad's work that it is possible to approximate the parity for an aggregate like clothing with fewer comparisons than are usually carried out in benchmark work. This is why an effort like the Bruno initiative could become a cost-effective approach to obtaining more up-to--date purchasing power comparisons for a wider range of countries of interest to the Bank.

However, there remains another important area for research that has received less attention and that is the quality problem. Critics of benchmark comparisons argue that the potato is a potato rule, while defensible for some purposes, often means that the price of an item in an affluent country may include much more in the way of retailing services (costs) than in poorer countries. Further, some have argued that even the quality of a commodity may be higher in more affluent countries. Most of these observations have been qualitative in nature, suggesting the direction of bias (to lower the parities of low-income countries), but have not really provided quantitative estimates. (An exception would be the types of quality adjustments that have been tried by the Group II countries in Europe).

The present paper proposes one possible way to make a quantitative judgement about whether there are biases of the sort described above that tend to understate the PPPs of low income countries and unduly raise their real per capita incomes. In addition, the method of testing for bias also offers a way to correct for any bias. If this approach is as attractive as the author claims, it would be especially valuable in an effort like the Bruno initiative that would be using limited price data from a range of countries. The approach suggested here is a form of chaining, and the paper begins with a discussion in Part I of linking countries in the context of international price comparisons. Part II of the paper sets out the proposed method and Part III provides some empirical applications to some price data sets for the ESCAP countries in 1985 and also from the ILO collections. Part IV concludes.

Part I: Chaining in International Comparisons

It is easy to despair of comparing prices of even a fairly homogeneous item like an onion in a rural open air market in Kenya with a supermarket in the U.S. Is it really necessary or desirable to make such a direct comparison?1 Isn't there some way to chain or link the comparisons between countries so that the disparity of amenities associated with the purchase are somehow muted? Because there are similarities between temporal and spatial price comparisons, it is natural to think of chain indexes as a possible approach to dealing with quality issues. However, with temporal indexes there is a natural sequence created by the passage of the seasons and the years. Unfortunately, there is no natural sequence of countries and any attempt at bridging countries is fairly sensitive to the order in which countries are linked.(2)

In much of the ICP work it has been convenient to use one country as a link between regions; however, this too, can be a slippery slope. In the report on Phase V for example, when Japan was used to link the ESCAP and OECD countries, the results were very much affected by the fact that relative prices in Japan were not typical of ESCAP. The result is that estimates for several of the ESCAP countries differed by over 25% depending on whether the linking through Japan was done at the GDP level or at the level of C, I, and G.(3)

When one turns to comparisons of individual item prices at the detailed heading level, still less work has been done on the problem of linking. An important exception to this generalization is the technique that has evolved at Eurostat to which we now turn.

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1 The problem is intentionally a bit overstated. In fact the comparison is between the quantity weighted price of an onion in all markets in both countries.

2 This comment strictly applies to linking involving expenditures such as are reported in Kravis, Heston and Summers (1978). However, if linking is done at the item level within a basic heading, then there are implicit weights associated with the items compared.

3 In the World Report, a country like Pakistan was linked to OECD by taking its quantity relative to Japan for each level of aggregation from the ESCAP comparison, times the Japan quantity (in $ from the OECD comparison) to put Pakistan in $ as in Table 1 of the Report (United Nations, 1994). If one adds up C, I, and G from this Table and compares it to the GDP total, the former exceeds the latter by 29%.

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a. Item Selection in Eurostat

Comparing prices at the basic heading level typically involves a form of linking or chaining because it may not always be possible to directly compare the prices between each pair of countries for a particular heading of expenditure. Any comparison of items at

the basic heading level faces three problems (at least), first of comparing 'like with like', second of choosing the level of aggregation for comparison, and third, choosing the method from moving from the item to the detailed heading or higher level of comparison. In many instances the method of comparison and the level of aggregation may be a determining factor in the choice of items to compare. In this discussion we begin at the detailed heading level and look at individual item price comparisons with special reference to Eurostat.

The basic heading level is typically defined as the level below which there are no expenditure weights. In fact, there are implicit weights involved in any method of item selection below the basic heading level. In the early comparisons between the EU countries both the method of price collection, the use of item price weights and the selection of items have been carried out in different ways. In some comparisons price collection was even carried out by Eurostat based surveys somewhat like what was done in the ECIEL comparisons for Latin America.(4) However, typically the country statistical offices have been involved in the EU comparisons. What follows is my understanding of recent methods and their possible applications in the world comparisons.

Within a basic heading Eurostat attempts to make the best possible binary matching of items between each pair of countries. If there are a number of suggested specifications for a heading (perhaps based on previous comparisons and discussions with country price experts) countries will indicate which are important (termed star "*" items) as well as items that are available and commonly consumed. Where possible items are specified as to brand and model. Items that are not widely available in the country are not to be included in the comparisons by the country, though where model matching is easily possible, there is some tendency for countries to provide prices for available, but not widely consumed, items.

In the Eurostat method, where some there are * items, the binary of country A with B will include only * items in A, with the comparison of B with A will include only * items in B. In Table 1, * items have been created for A and B for illustration. In this case, the A/B comparisons would be items 1 and 8 only (2/12 x 4/18).5 and the B/A comparison would include only items 2 (35/6). Other information, including the prices for item 5 would not be included in either binary, because it is not a * item in either country.(5) This procedure has been criticized by Ferrari and Riani(1994) because of this selective use of prices in each binary. It is not the purpose of this paper to go further into the Eurostat approach. However, one aspect of the Eurostat approach, namely selective comparisons, is at the heart of what is proposed here.

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4 In most Latin American comparisons the item list was reduced to a common denominator that required each country to provide a price (or in a few cases an estimate of what a price would be) for every item, a computationally convenient requirement. Further, most price collection was carried out by a team visiting the various countries, rather than the now more typical practice of country statistical offices providing prices; the former practice had the advantage of providing a fairly uniform list of items for which prices were collected. A major, but less obvious, disadvantage was that country statistical

offices were never involved in the price collection so there was little knowledge or continuity in the pricing exercise in the participating Latin American countries.

5 Another way to make this point is to note that in Table 2 above, the binary comparison between A and B is identical to that between B and A. This is not necessarily the case in the Eurostat approach

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tables 1 and 2 here

Part II: The Proposed Method

Normally the price Tableau has many missing items because there is great diversity in what are commonly consumed items in different countries. The derived price ratios grouped by each of the 6 possible binary combinations are given in rows 5-10. The next step in the usual EKS procedure is to form the matrix of direct and indirect parities as is done in Table 2.

There is a presumption that it is harder to hold the quality of item comparisons constant between countries at very different levels of income. This is especially true for certain services where outlet and quality are particularly difficult to hold constant. For this reason, the proposal below is primarily based upon a type of chaining that builds up from lower to higher income countries within a region or other country groupings. The proposal seems compatible with either an EKS or a CPD framework as described in the ICP Handbook (United Nations, 1992, pp. 54-60). In this paper the EKS approach has been used for illustration. It would appear that the CPD approach could be developed in a parallel fashion but this has not been attempted here.

Binary comparisons at the basic heading level are quite straightforward. Consider countries A and B in the example in Table 1 above, now ignoring the *item possibility. The parity between A and B for the category is taken as the geometric mean of the price ratios for the matching items (l), (2), (5), and (8), which in the example, is 5.01 = (6 x 5.83 x 4 x 4.5)1/4. As noted no item weights are given, and again, since the *item Eurostat convention is not being followed, the binary comparison of B/A will be equal to 1/(A/B).

The price tableau in the illustration has a number of items for which countries have not provided prices, which is the usual situation. A desirable property of the geometric mean is that the ratio of the geometric means of two series is equal to the geometric mean of the product of the ratios of the two series. But this only holds when the price tableau is complete. This leads us to a discussion of the Elteto-Koves-Szulc (EKS) method that allows estimation of transitive multilateral parities based on all possible binary comparisons.

When the price tableau is complete, we have noted that the direct binary parity between B and A is equal to the indirect binary derived through third countries like C or D However, this is not the case when the price tableau is incomplete, as can be seen from a comparison of the direct and indirect parities given in Table 2 above. Considering (B/A),

the direct ratio, it can be seen that it does not equal the indirect ratio, (B/A)^ = (C/A)/ (C/B) in either row of Table 2.6 Or put another way, transitivity is lost.

The EKS method permits transitivity to be restored by taking into account the indirect and direct comparisons by the formula in (1):

(1) ppjk = [(ppji/ppki)]1/n = [pp2jk x (ppjk/ppki)]1/n, where ppii = 1.

The term "pp" is used to denote a parity at the basic heading level. In EKS the direct parities (ppji, where i=j) and (ppki, where i=k), are each counted, while each indirect parity is counted once. In the above example with 4 countries, the EKS calculation of the (C/A) parity from the geometric means is: C/A = [(C/A) x (C/A) x {(C/D) x (D/A)} x ((C/B) x (B/A)}]1/4, or C/A = [10.206 x 10.206 x 10.125 x 10.129]1/4 = 10.670.

An advantage of the EKS method is that it produces transitivity and makes use of all the price information available, including both direct price comparisons between each pair of countries, as well as all indirect price relationships between each pair of countries and the remaining countries.

In the example given above, suppose that countries are in order of per capita GDP with A being a very high income country and D a very poor country. If one thought the quality of goods were likely to be very different between countries A and D, one might consider excluding both direct and indirect comparisons between the two countries in the EKS estimates. One would still be able to obtain an EKS parity between A and D, but it would only be based upon indirect comparisons between the two countries.

Is this a sensible procedure? It is argued here that we can obtain a reading on this question by estimating EKS parities including all countries, and EKS parities that simply excludes direct comparisons between more economically distant countries, linking them through intermediate indirect comparisons. If there is a systematic improvement of quality of products and services as one moves from low to high income countries, then one ought to expect that the parities normalized upon the poorest country, would be lower using all countries, than by linking countries. Or put another way, using all countries would lead to a smaller range of the real quantity comparisons than that produced by the linking feature.

Before discussing empirical results, it should be noted that this is a conjecture that might be true for some basic headings and not for others. If there were a systematic quality effect, it indeed would be surprising if had the same quantitative effect across all basic headings. Rather one might expect it to be stronger for some headings and not for others.

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6 That is, the direct value of (B/A) is 5.01, while (B/A)^ is 10.206 (C/A)/ 2.021 (C/B) = 5.05 through C in row 5 of Table 2, and (10.129/1.668) = 5.267 through country C.

Part III Some Illustrative Estimates

The estimates provided below are based upon the detailed price data from the 1985 ESCAP comparisons. Some estimates have also been made based upon the ILO sample of food prices in over 200 national and subnational locations around the world. However, these latter estimates, while appearing to support the patterns reported below, are not far enough along for presentation.

The approach used here is illustrated in Table 3 below, which is simply a reworking of Table 2 above. For illustration, assume that countries A and D are considered to be of such different economic structure that one is unsure that quality is being held constant in the price comparisons. Our procedure then would be to simply exclude all direct price comparisons from the matrix used to make the EKS estimates as has been done in Table 3 below. In addition all indirect comparisons based on the direct A and D comparisons are also excluded.

table 3 here

Because the countries' direct and indirect comparisons between B and C were not changed, their EKS estimate remains the same, while they change for all of the other cases. When one moves to actual applications, one is faced with the choice of the size of the country groupings. In the illustrations below, the prices for the ll ESCAP countries in the 1985 benchmark are used. First the countries were put into three groups with some overlap as follows. The bottom 3 countries, Bangladesh, Nepal and India, were compared directly with each other and the other two members of the lower group, Pakistan and Sri Lanka. Pakistan and Sri Lanka were in turn in the middle group and were compared with each other and with the Philippines, Thailand, Iran and Korea. Finally, Iran and Korea were compared with each other and the other two members of the high income group, Hong Kong and Japan.

The results of this exercise are reported in Table 4 for several basic headings where the 11 ESCAP countries are ordered by per capita GDP from low to high. For each heading, the ratio of the usual EKS estimate to the modified EKS estimate is presented. The Philippines has been taken as the numeraire so its ratio is 1.0. If there were a systematic quality effect across countries, then we would expect this ratio to be lower for the low income countries and to rise with income. That is for a country like Bangladesh, the exclusion of direct comparisons with high income countries would raise its modified EKS parity (the denominator of the ratio in Table 4), so we would expect the ratio to be less than 1, while the opposite would be the case for Japan. The results are suggestive of a systematic difference between the two EKS estimates. What is surprising, however, is that the results appear less strong for apparel headings where one might have thought quality differences in items and outlets would be most difficult to hold constant. And the largest effect is for fruits where the ICP specifications are thought to be quite clear, though outlets can vary greatly.

table 4 here

These results certainly suggest that further examination of possible systematic quality variations across countries is warranted. One other variation in method is reported in Table 5. The experiment in Table 4 divided the ESCAP countries into a lower and higher income group, each of which overlapped with income adjacent countries in a middle group. What would happen if one more broke down the countries into more groups. This

exercise is reported in Table 5, where for the heading of poultry the ratio of Table 4 has been presented for both a 3 group and 5 group breakdown of the countries. The results show a pattern that is similar to that for Table 4 for the 5 group case, but is much less pronounced for the 3 group case. This would suggest that, as in many linking cases, the result. may be sensitive to how countries are grouped. The ESCAP sample is too small to really examine this question thoroughly. In future work with the ILO food sample, it will be possible to look at this question for a much larger number of countries.

table 5 here

Conclusion

The research reported here has suggested a method by which one might modify to usual basic heading parities obtained by EKS to allow for possible systematic quality differences across countries related to income. The preliminary results suggest that such modified EKS may in fact provide a way to link countries at the basic heading level in a way that avoids comparisons between countries at great economic distance from each other. It should also be possible to modify the CPD method in a similar fashion, but this has not been examined yet. Problems that remain to be examined are how sensitive are these modified estimates to the groupings of countries used, and whether these quality effects vary across broad expenditure groups.

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