

**INITIAL COMMENTS ON THEODORE BRETON'S PAPER**  
**“EVIDENCE THAT CAPITAL FORMATION IS OVER-ESTIMATED IN ICP 2011”**

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**I. Introduction**

For some time Theodore Breton (Universidad EAFIT, Columbia) has claimed that the ICP underestimates the PPPs for construction for low- and middle-income countries and so over estimates the gross fixed capital formation for those countries. Initially, Breton was using data from the 2005 ICP but over the past year or so he has used 2011 ICP data and has come to the same conclusion using both data sets.

Breton has supplied his spreadsheets based on 2011 ICP data to the ICP Global Unit and the following comments are based largely on an analysis of the methods he has used in these spreadsheets.

**II. 2011 ICP methods**

The ICP estimation for construction was complex because it involved the need to cater for different methods being used to estimate construction in different regions. The EU-OECD used a model-based approach, the Commonwealth of Independent States used a cross between models and inputs and the other regions all used an input approach, which involved collecting prices for materials, labor and equipment hire and weighting together the resultant PPPs. Ten EU-OECD countries collected input prices in addition to pricing the models to provide a link between the EU-OECD and the ICP regions (i.e. those coordinated by the ICP Global Office). The methodology involved several stages—within region estimation, linking regions, and the CAR aggregation to impose fixity.

Three basic headings are defined for construction (residential construction, non-residential construction and civil engineering). For the input approach, prices were collected for about 50 products including materials, labor and equipment. PPPs were computed for each of these three categories in the ICP regions using the CPD, which is a multilateral computation. Importantly, it uses regression techniques to take account of missing prices because not every product was priced by every participating country. Within each region the three sub-basic heading PPPs (materials, labor and equipment) were weighted to each construction basic heading using resource weights. The resource weights differed within each construction basic heading, as did the range of products that were considered relevant for each of them.

The computation of the aggregated construction PPP (residential, non-residential and civil engineering basic headings) in each region was the same as that used for other basic heading aggregations (i.e. comparisons between each pair of countries of each product priced by both countries). Their geometric mean created the Fisher index matrix of all bilateral comparisons. The

GEKS method (geometric means of the direct and indirect PPPs) makes them transitive and base country invariant.

The 10 EU-OECD countries were considered as a “special region” for linking purposes and their “regional” PPPs were calculated in a similar manner to that described above.

The key point is that the ICP method is multilateral at every stage and produces robust results that are transitive so that the results for any pair of countries can be directly compared. It is also robust in smoothing out the variability from the bilateral comparisons.

### **III. Breton’s methods**

Breton uses two different methods to estimate “prices” for the 2011. The first is an input-based method, in which he estimates “prices” for each of labor, materials and equipment hire and then weights them together using weights for each in a similar manner to that used in the ICP. However, his methods used to estimate the “prices” for each of these components differ significantly from those used in the ICP. His second method is to estimate “prices” for materials and then “gross up” to a total “price” by dividing by the materials share in inputs (i.e. if the materials input share is 60%, his total “price” for the country is 1.67 times  $(=1.00/0.60)$  the materials “price”).

#### **A. The details**

Breton has not used the estimation procedures (CPD and EKS) that are used in the ICP. He has deleted some products and then adjusted each price to \$US using exchange rates. The next step was to calculate the average price for the 10 EU-OECD countries that reported input prices for linking purposes by taking an arithmetic average of the \$US price for each material and labor product, with no adjustment for missing prices. PLIs for equipment for each country are as published by the ICP 2011 but the average PLI for the 10 EU-OECD countries is an arithmetic average of those countries’ PLIs. It is difficult to make a judgement on what all these average prices for the 10 EU-OECD countries actually mean because of the effect of some missing prices for materials and labor and using an arithmetic average. It is virtually certain that this method would produce significantly different results from those in the ICP, particularly because of using an arithmetic average rather than a geometric mean. However, it is important to note that the ICP methods have been developed and reviewed over the past five decades and are certainly more robust than using simple averages. Breton then calculates the ratio of each country’s \$US price for each product to the EU-OECD \$US average price for each material and labor product and equipment hire, which means each country’s PLI for each product is expressed on the base of the 10 EU-OECD countries that reported input prices for construction. The result in each case is some type of price level index (PLI) relative to the USA rather than a PPP. These PLIs are then averaged, via an arithmetic mean and with no allowances for missing values, for each country’s material and labor product ratios to produce material and labor sub-heading PLIs. They are combined with the equipment PLIs by weighting each country’s three sub-heading PLIs by the corresponding resource mixes.

Breton’s “grossed-up input” PLI is obtained by dividing the materials sub-heading PLI by the material resource mix share for each country. An assumption underlying this procedure is that the total

construction PLI is based entirely on the relationships between materials PLIs; in other words differences in wages across countries are not taken into account.

## **B. The problems**

Breton's calculation procedures differ significantly from those used in the ICP. In particular, his first step is to derive PLIs rather than PPPs and all his "price" ratios ignore gaps in the price matrix and are estimated as arithmetic means rather than geometric means. Arithmetic mean can severely bias calculations built on ratios, like PPPs. The ICP uses the country-product-dummy (CPD) regression methodology to take account of missing prices. Not using the CPD or any other gap-filling techniques would distort the estimates for countries based on the different product gaps in each country. It would also affect the estimates produced for the 10 EU-OECD countries used to link the EU-OECD region to the ICP regions and may be at least part of the reason that Breton's PLIs for low- and middle-income countries are so much higher than those in the ICP. The ICP uses the CPD and EKS methods to estimate basic heading level PPPs that are based on matching PPPs that are common to each pair of countries in the comparison.

Finally, Breton uses prices and weights from the "non-residential buildings" basic heading and then compares the results to total construction, which consists of residential buildings, non-residential buildings and civil engineering, each of which have different resource mixes, products selected and expenditure shares.

## **IV. Conclusions**

It is impossible to determine why Breton's estimates of PPPs for low- and middle-income countries are so much higher than those in the ICP. However, it is likely that his simplistic method of estimating the PLIs for the 10 EU-OECD countries could lead to some distorted linking factors which are used to link most high-income countries to the low- and middle-income countries. In addition, he does not apply fixity, which could have a significant effect on the linking process given that only 10 EU-OECD countries are used in the link and fixity is applied to the whole region. More generally, his unsophisticated methods are guaranteed to produce different results from the ICP's but they by no means invalidate the ICP results for construction.

An additional interesting issue is that Breton's GDP per capita estimates are based on exchange rates rather than PPPs, which seems to be an odd method for him to classify countries when their PPP-based estimates of GDP per capita are readily available from the ICP.

One final point is that construction is one of the so-called "comparison-resistant" components of the ICP. The methods used to estimate the ICP's construction PPPs are far from ideal (current best-practice is the model-based approach used by the EU and OECD). While the ICP's input methods have some strong assumptions underlying them, they are at least based on robust compilation methods (CPD and EKS). Breton's estimates are very different from the ICP's but his compilation methods are simplistic. As a result, the differences do not necessarily indicate major problems with the ICP's construction PPPs.