

Calculating Approximate PPPs Using the Price Factor Method

Global Office



Operational Material

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CALCULATING APPROXIMATE PPPS USING THE PRICE FACTOR METHOD (PFM)

1. Pros and cons of the Price Factor Method (PFM)

The Standard Method, which requires countries to price specified products, is generally accepted as the most accurate way to calculate PPPs for equipment goods and the alternative Price Factor Method described here is certainly inferior. However, the Standard Method proved difficult for many countries because the SPD/PSs referred to items that were not commonly used in their countries or because purchases of specific types of equipment goods were sporadic so that it was difficult to get a realistic price for a piece of equipment that may not have been purchased in a recent year. It is also expensive to collect prices for equipment goods because national statistical offices do not usually have the necessary expertise in-house. Some have to hire equipment experts to identify the products specified in the SPD/PS or find close substitutes if what was specified in the SPD/PS was not available in their countries. In some cases, outside experts also had to be consulted to determine the price. The method described here is a “fall-back” solution for countries that do not have the financial resources or expertise to use the Standard Method. It is referred to as the Price Factor Method (PFM) because it involves the decomposition of the price of machinery and equipment into its component “price factors”. As the countries using the PFM import almost all of their equipment goods the PFM starts with the ex-factory price of an equipment good in the exporting country and follows it through to its final price when it is installed and ready to use on the importing country.

One advantage of the PFM is that (approximate) PPPs are obtained using information that is already available in many national statistical offices. Countries that have an input-output or supply and use table – even if it not very recent – will have estimates of the margins and other costs that are required by the PFM. This is also the case for countries that use a commodity flow method for estimating gross fixed capital formation. For these reasons PFM is an attractive alternative for countries with limited resources.

2. From ex-factory prices to installed, ready for use, prices

Using the Standard Method, PPPs are obtained from the ratios of the prices of particular types of equipment goods *installed and ready for use* at the producing establishments in each country. For an imported equipment good, this price can be broken down into the ex-factory price of the good and a series of costs, or “margins” that the purchaser incurs to bring it from where it was produced to where it will be used in production. These margins are shown in Table 1 below. They consist essentially of transport and trade margins, customs duties and other taxes and, except for transport equipment, installation costs.

Table 1. Components of the price of an imported equipment good when it is installed and ready for use in the importing country	
	Ex-factory price in exporting country
<i>plus</i>	<i>Surcharge less discount for country or region</i>
<i>plus</i>	<i>Product taxes less subsidies in exporting country</i>
<i>plus</i>	<i>Trade margin in exporting country</i>
<i>plus</i>	<i>Transport within the exporting country</i>
<i>plus</i>	<i>Wharfage (fee for using the wharf) in exporting country</i>
<i>plus</i>	<i>Fee for customs documentation in exporting country</i>
equals	F.o.b. (Free on Board) price in exporting country
<i>plus</i>	<i>International freight</i>
<i>plus</i>	<i>Insurance costs</i>
equals	C.i.f.(cost, insurance, freight)price in importing country
<i>plus</i>	<i>Fee for customs documentation in importing country</i>
<i>plus</i>	<i>Customs duty in importing country</i>
<i>plus</i>	<i>Wharfage (fee for using the wharf) in importing country</i>
<i>plus</i>	<i>Product taxes less subsidies in importing country</i>
<i>plus</i>	<i>Trade margins in importing country</i>
<i>plus</i>	<i>Transport within importing country</i>
<i>plus</i>	<i>Installation costs at the purchaser's establishment</i>
equals	Installed, ready-to-use price in importing country

Consider two countries, *A* and *B*, which import a particular kind of equipment good from the same producer. If all the margins incurred by countries *A* and *B* are expressed in a common currency – say US dollars - then:

$$\frac{P_A}{P_B} = \frac{XR_{A/US} (F + a_1 + a_2 + \dots + a_n)}{XR_{B/US} (F + b_1 + b_2 + \dots + b_n)} \dots\dots\dots (1),$$

where:

P_A and P_B are the installed, ready to use prices of the machine in countries *A* and *B*, both expressed in their national currencies;

$XR_{A/US}$ and $XR_{B/US}$ are the number of units of *A*'s and *B*'s currency that can be purchased for one US dollar;

F is the ex-factory price of the machine in US dollars;

a_1, \dots are the n margins in US dollars incurred by the importer in country A both in the exporting country and in country A itself; and

b_1, \dots are the n margins in US dollars incurred by the importer in country B both in the exporting country and in country B itself.

Since $\frac{P_A}{P_B}$ is the bilateral *purchasing power parity* for the machine in question, with B as the base country, and since $XR_{A/US} / XR_{B/US}$ is the exchange rate between countries A and B. Equation (1) can be written as

$$PPP_{A/B} = \frac{XR_{A/B}(F + a_1 + a_2 + \dots + a_n)}{(F + b_1 + b_2 + \dots + b_n)} \dots \dots \dots (2),$$

where:

$PPP_{A/B}$ is the bilateral PPP using B as the base country; and

$XR_{A/B}$ is the exchange rate between countries A and B, specifically the number of units of currency A that can be purchased by one unit of currency B.

If the a 's and b 's are converted to ratios of the ex-factory price and are denoted by α 's and β 's, equation (2) can be written as

$$PPP_{A/B} = \frac{XR_{A/B}(F + F \sum_{i=1}^n \alpha_i)}{F + F \sum_{i=1}^n \beta_i} \dots \dots \dots (3),$$

or:

$$PPP_{A/B} = XR_{A/B} \left(\frac{1 + \sum_{i=1}^n \alpha_i}{1 + \sum_{i=1}^n \beta_i} \right) \dots \dots \dots (4).$$

The term in brackets in (4) can be seen as an *adjustment factor* required in order for the exchange rate between countries A and B to equal the PPP. It is one plus the sum of the margins paid in one country divided by one plus the sum of the margins paid in the other. These margins are the various items listed in Table 1 expressed as ratios of the ex-factory price.

3. Practical application

Data limitations require three modifications to the formulation of the “ideal” PFM given in (4) above.

Ex-factory prices are not available

The adjustment factor in equation (4) requires knowledge of the ex-factory price of the piece of equipment in the exporting country. In practice however, statistical offices in importing countries do not have information on ex-factory prices - nor will they usually have any information on the costs or margins incurred in the exporting country up to the point where the goods are delivered to the point from which they are being exported.

In practice therefore, it will be necessary to convert the costs or margins to ratios of some other price that is likely to be similar in the countries concerned even if it is not identical. The best choice would be the f.o.b. price in the exporting country but most countries record their imports at c.i.f. values, that is including freight and insurance costs to bring the goods to the port of entry. **It is here suggested that the c.i.f. values of imported machinery and equipment are converted to an approximate f.o.b. basis using the ratio of total international insurance and freight charges to total merchandise imports.**

Moving from PPPs for specific types of equipment goods to averages for all equipment goods

The discussion above has dealt with a specific equipment good imported from a specific producer in an exporting country. However it is here proposed that exchange rates be adjusted to approximate PPPs for two broad groups of equipment goods imported from all sources. The two groups are Metal Products and Equipment (15.01.10.0) and Transport Equipment (15.01.20.0). **This means that the various margins used for the adjustment factor in equation (4) will not be the costs that are incurred for importing a specific type of equipment and machinery from a particular country but averages for all of the two types of equipment goods from whatever country they are imported.** For example, the transport margins must be the average margins charged on transporting Metal Products and Equipment as a whole and Transport Equipment as a whole from the port of arrival to the place where they are to be used; the customs margin must be the average rate charged on imported Metal Products and Equipment as a whole and on imported Transport Equipment as a whole.

Some margins can be ignored.

Several of the margins listed in Table 1 may be zero or small relative to the initial ex-factory price and can be ignored. In addition, statisticians in the importing countries will not be able to estimate the costs that are incurred in the exporting country. **The costs and margins that are likely to be relatively large and which countries could reasonably be expected to report are as follows.**

1. Customs duties
2. Non-deductible VAT and other taxes on products

3. **Transport costs in the importing country**
4. **Wholesale and retail trade margins in the importing country**
5. **Installation costs**

Countries are also required to provide the c.i.f. values of imports of the two *Groups* of equipment goods, the c.i.f. value of total merchandise imports and the insurance and freight costs of total merchandise imports. Annex 1 contains a reporting form to collect these 8 items for the two *Groups* of equipment goods – *Metal Products and Equipment* and *Transport Equipment*.

4. Calculating the adjustment factor

The information collected on the reporting form in Annex 1 can be used by the Regional

Coordinators to calculate an approximate version of the adjustment factor $\left(\frac{1 + \sum_{i=1}^n \alpha_i}{1 + \sum_{i=1}^n \beta_i} \right)$ and

multiply it by the exchange rate to get an approximate PPP. The four steps are as follows:

Step 1: The reported c.i.f. value of imports of each of the two *Groups* of equipment goods is converted to an approximate f.o.b. value using the ratio of total international insurance and freight to the c.i.f. value of total merchandise imports. This f.o.b. value is used as the closest practical approximation to the ex-factory values which should, in principle, be used as the basis for calculating the ratios in the adjustment factor.

Step 2: Each of the following items is calculated as a ratio of the (approximate) f.o.b. value of imported equipment goods. :

- customs duties;
- non-deductible value added taxes and other taxes on products;
- transport costs in the importing country;
- retail and wholesale trade margins in the importing country;
- installation costs.

The calculations are made separately for *Metal Products and Machinery* and *Transport Equipment*.

These ratios are summed for each country to obtain $1 + \sum_{i=1}^n \alpha_i$ for country A; $1 + \sum_{i=1}^n \beta_i$ for country B; and so on for all the countries in the region for which the PFM is being used.

Step 3: The exchange rates between each pair of countries are then multiplied by the relevant adjustment factor to obtain pairs of bilateral PPPs for *Metal Products and Machinery* and *Transport Equipment*.

Step 4: These bilateral PPPs are made transitive by the EKS procedure.

Box 1 is a worked example showing the calculations for steps 1, 2 and 3 of the adjustment procedure for two countries. As only two countries are involved in this example, Step 4 is not required although when the PFM is used by more than two countries their PPPs obtained by the PFM will have to be made transitive by the EKS procedure.

Box 1. Worked Example for Imported <i>Metal Products and Machinery</i>		
	Country A - all values in national currency	Country B - all values in national currency
C.i.f. value of imports of <i>Metal Products And Machinery</i>	3 000	1 6000
Customs duties	250	800
Non-deductible value added taxes and other taxes on products	300	1000
Transport costs	80	300
Retail and wholesale trade margins	160	800
Installation costs	120	580
C.i.f. value of all merchandise imports	75 000	34 0000
Insurance and freight on all merchandise imports	800	3 000
Units of local currency per US Dollar	35	75
 <u>Step 1</u>		
Convert c.i.f. value of imports of <i>Metal Products and Machinery</i> to approximate f.o.b. values		
Country A: $3\ 000 \times (1 - (800/75\ 000)) = 2\ 968$		
Country B: $16\ 000 \times (1 - (3\ 000/340\ 000)) = 15\ 859$		
 <u>Step 2</u>		
Calculate total of margins as ratios of approximate f.o.b. values		
Country A: $(250 + 300 + 160 + 80 + 120)/2\ 968 = 0.307$.		
Country B: $(800 + 1000 + 800 + 300 + 580) = 0.219$		
 <u>Step 3</u>		
Adjust exchange rates to approximate bilateral PPPs		
Country A: Exchange rate A/B = $35/75 = 0.467$. Therefore PPP:A/B = $0.467 \times (1+0.307)/(1+0.219) = 0.500$		
Country B: Exchange rate B/A = $75/35 = 2.143$. Therefore PPP:B/A = $2.143 \times (1+0.219)/(1+0.307) = 2.000$		

In this worked example, the margins shown in the first part of the worksheet are generally higher in country A than in country B. As a result, the PPP for country A is higher than its exchange rate while the PPP for country B is lower than its exchange rate. If the exchange rates had been used instead of the PPPs, the volume of equipment goods in country A would have been over-estimated while the volume of equipment goods in country B would have been under-estimated.

Annex 1. Reporting Form for the Price Factor Method (PFM)

The reporting form for countries to implement the PFM asks for only the costs and margins that are likely to be relatively large and which countries could reasonably be expected to report.

Reporting form for Price Factor Method (PFM)			
Country _____		Currency unit _____	Year _____
Line no.	Description	Metal products and equipment (Group 15.01.10.0)	Transport equipment (Group 15.01.20.0)
1	C.i.f. value of imports of equipment goods		
2	Customs duties		
3	Non-deductible VAT and other taxes on products: <i>either</i> amount <i>or</i> percentage of line 1	_____ _____ %	_____ _____ %
4	Transport costs in the importing country <i>either</i> amount <i>or</i> percentage of line 1	_____ _____ %	_____ _____ %
5	Wholesale and retail trade margins in the importing country <i>either</i> amount <i>or</i> percentage of line 1	_____ _____ %	_____ _____ %
6	Installation costs <i>either</i> amount <i>or</i> percentage of line 1	_____ _____ %	_____ _____ %
7	Memorandum items Total imports of goods in c.i.f. values Total insurance and freight on all imports of goods, including those provided by residents as well as non-residents.	_____ _____	
Reporting form completed by: _____			
Position: _____			
e-mail address: _____			
Telephone: _____			
Postal address: _____			

Explanatory notes

Line 1. C.i.f. value of imports of equipment goods

The c.i.f. price (i.e. cost, insurance and freight) is the price of a good delivered at the frontier of the importing country, including any insurance and freight charges incurred to that point but before the payment of any customs duties or other taxes on imports or trade and transport margins within the importing country. C.i.f. is the standard method for valuing merchandise imports so that the c.i.f. value of imported equipment goods can be obtained directly from the regular statistics on international merchandise trade.

The imports to be included here are those that form part of Gross Fixed Capital Formation (GFCF). Goods that form part of GFCF in equipment goods can be identified using either the SITC (*Standard International Trade Classification*) or the HS (*Harmonised System*) classifications of merchandise trade. A few goods, such as motor vehicles and personal computers are imported both for capital formation and for final consumption by government or households. Imports for final consumption should be excluded. Countries that use some version of the commodity flow method for estimating GFCF will already have a key for assigning codes to GFCF or final consumption.

Note that no breakdown is called for beyond the *Group* level of the *ICP Expenditure Classification*. This reporting form asks only for figures in respect of total *Metal Products and Machinery* and total *Transport Equipment*.

Line 2. Customs duties

The amount shown here should be customs duties *due* on imports although amounts *actually paid* will usually be a good approximation and can be reported here. There are two ways in which this item can be estimated – either from records of customs duties collected or by applying the rates of customs duties to the c.i.f. values of imports:

- Most customs authorities classify their receipts according to the *Harmonised System*. The amounts collected on equipment goods can therefore be obtained by identifying the relevant HS codes. As noted above it is necessary to distinguish duties collected on goods for GFCF from those collected on goods for final consumption expenditure. The main problem here will affect motor vehicles, computers, hand-tools and metal furniture.
- If a single rate of customs duty is charged for all imports of investment goods, this item can easily be estimated by applying that rate to the value of imports shown in the line 1. If different rates apply to different types of equipment goods or to imports from different countries, it will be necessary to calculate a weighted average of these rates using the c.i.f. values of the relevant imports as weights.

Line 3. Non-deductible value added taxes and other taxes on products

The amount shown here is the total amount of value added taxes, sales taxes or other product taxes paid by the final purchaser of the imported item of equipment goods. In some countries VAT and other product taxes are reimbursed or not charged on goods for GFCF. In such cases there will be no entry in this item.

Line 4. Transport costs in the importing country

These are the costs of transporting equipment goods from where they enter the country to the establishment of the purchaser. Many countries may have information on transport costs from an input-output or supply and use table. Other countries use some form of the commodity flow method to estimate GFCF in equipment goods. Use of this approach requires estimates of transport costs for equipment goods. Other countries will need to estimate the average distance over which imported equipment goods are carried from their point of arrival to the main industrial centres. They will also need estimates of freight rates per ton-kilometre and the tonnage of equipment goods transported.

Line 5. Retail and wholesale trade margins in the importing country

No distinction is made between wholesale and retail margins.

Trade margins are the gross output of retail and wholesale enterprises. Imported goods are usually traded by large corporate enterprises which will keep standard accounting records. Input-output and supply and use tables are another possible source for some countries.

Line 6. Installation costs

There are usually no installation costs for *Transport Equipment*.

For *Metal Products and Machinery* the costs of installation should include all costs of putting the item in place, connecting it to the power source, calibrating and running in the equipment good so that it is functioning correctly. Countries that use some form of the *commodity flow method* to estimate GFCF in equipment goods will already have estimates of these costs.

Line 7. C.i.f. value of imports of goods and international insurance and freight on all imports of goods.

This memorandum item asks for the c.i.f. value of **total** imports of goods and **total** costs of international freight and insurance. The first item should be readily available from merchandise trade statistics.

The balance of payments will give the value of insurance and transport services provided by non-resident insurance and transport companies. In many countries all, or mostly all, international freight and insurance is provided by non-resident companies. In some countries however, it will be necessary to estimate insurance and freight services provided by resident companies. In the SNA Supply and Use Table, total international insurance and freight is one of the adjustment items in the supply matrix.