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## **Calculating Construction PPPs**

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## Introduction

The World Bank, through its International Comparison Program (ICP), is responsible for the production of Purchasing Power Parities (PPPs) for both national GDP and for sub-components of GDP for around 200 countries. PPPs are alternatives to market exchange rates and are intended to reflect price level differences across countries more accurately. One of the sub-components of GDP is Construction, part of Gross Fixed Capital Formation.

Construction is described in the report of the ICP 2005 results as ‘comparison resistant’. It is difficult to identify a range of comparable and representative construction products/ projects and virtually impossible to observe purchaser prices in a national average location at the same time in all countries. Designing the data collection, collecting the price data and processing it involves specialist skills and knowledge.

At the April 2011 TAG meeting it was decided:

- to base construction PPP calculations on simple combinations of three groups of inputs (materials, labour and equipment) rather than allocating each input to model projects or weighting each input in any other way;
- that each basic heading will have three PPPs – one each for the three inputs;
- to base weights for the three inputs on resource mixes for each heading provided by countries or, if countries could not provide that, on default resource mixes for groups of countries, determined centrally;
- to ask countries to indicate ‘importance’ or ‘representativity’ for each material in each basic heading; and
- to ask for percentage additions for professional fees for each basic heading (in addition to contractors’ mark-ups).

The minutes of the meeting also noted that “It may be necessary to adjust for different levels of labor productivity”.

Since April 2011, a revised survey form<sup>1</sup> and an initial note on default resource mixes have been prepared. There have been a number of regional workshops reviewing progress on the construction survey – one of the authors has attended workshops in Bangkok, Cambodia and Tunis. The indications are that countries generally are able to complete the survey form although, in all cases, the data needs to be thoroughly checked and adjusted. Alternative units are used in virtually all countries and these need to be converted to standard units<sup>2</sup>. There have been a few countries unable to provide resource mixes but fewer than feared so far. It is crucial that unit prices are comparable and that specifications are equivalent and, to do that, each form needs to be examined carefully; in addition, resource mixes need to be collected and the default values reviewed.

This note describes test exercises undertaken to calculate construction PPPs. It is based on thirteen completed survey forms (five from Eurostat and the remainder from the author’s contacts). These

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<sup>1</sup> The survey form is largely as used in the pilot survey (collecting prices for 38 materials, 5 types of construction equipment and 7 types of labour, and percentage resource mixes and contractors’ mark-ups); in addition respondents are now asked to indicate the importance of each material in each basic heading and provide appropriate percentage additions for professional fees in each basic heading. Additional notes for guidance on the use of the form have also been prepared and circulated to countries.

<sup>2</sup> The survey form uses metric units but a number of countries use imperial or national units for some material prices; similarly, bricks or blocks can be priced in thousands or in m2 or m3 and various other units are used for different materials.

have all been through an initial validation exercise; ideally, they should be subject to at least one more round. Expenditure weights for basic headings have been taken from available published sources and, in some cases, are rather out-of-date (see Table 1, below).

**Table 1: EXPENDITURE WEIGHTS FOR BASIC HEADINGS**

	Residential	Non-residential	Civil engineering
Australia	33	23	44
China	37	36	27
Denmark	52	26	22
Finland	38	42	20
Hong Kong	36	41	23
Hungary	28	39	33
Indonesia	11	40	49
Malaysia	28	35	37
Netherlands	46	30	24
Portugal	50	23	27
Singapore	31	47	23
UK	40	47	13
USA	42	48	10
Range	11 - 52	23 - 48	10 – 49
Median	38	39	24

The note is in four parts, including this introduction; the next section describes the calculation method; and the third section summarises and comments on the results. A final section draws some conclusions from the exercise.

## The test exercises

### Resource weighted method

The calculation method described here used geometric means rather than ICP tools to aggregate data. Price data from the survey forms was assembled as follows:

- percentages for mark-ups and professional fees were added to each important resource price in each basic heading;
- price relatives (PPPs) were calculated for each item in each basic heading;
- the geometric mean was calculated for each group of resources in each basic heading, producing Resource PPPs;
- the Resource PPPs in each basic heading were combined using resource mixes, producing Basic Heading PPPs; and
- Basic Heading PPPs were combined into All Construction PPPs, using expenditure weights.

The intention is that the application of resource weights to resource price levels will account for productivity. Table 2 illustrates the thirteen PPPs that were calculated (the figures are for Australia, with the USA = 1.00).

**Table 2: RESOURCE, BASIC HEADING AND ALL CONSTRUCTION PPPs**

Resources	Basic headings			
	Residential	Non-residential	Civil engineering	
Materials	1.94	1.64	1.43	
Equipment hire	0.98	0.94	0.95	
Labour	1.28	1.23	1.24	All construction
All construction	1.57	1.41	1.15	1.35

## Summary of results

Table 3, overleaf, summarises the resource, basic heading and all construction PPPs and places them alongside construction PPPs from ICP 2005 and average exchange rates for 2005. The base is USA = 100. The calculated PPPs and the ICP 2005 PPPs are not directly comparable, they are for different periods of time and the six years from 2005 to 2011 have been particularly turbulent in terms of construction prices. It should also be remembered that there were some doubts about the 2005 construction results and the 2011 data still needs more checking and validation.

There are sufficient similarities, however, across the different sets of data to provide some reassurance. The resource based method also provides additional information on resource price levels that will assist data checking.

Table 4, below, compares Basic Heading and All Construction PPPs for the Eurostat/ OECD countries with preliminary 2011 PPPs received from OECD. All of this data is, of course, subject to change. The table also includes average 2011 exchange rates and PPPs are relative to USA = 100. Again, the two data sets are not directly comparable, the data needs to be scaled to the same group of countries.

**Table 4: SUMMARY OF CONSTRUCTION PPPs FOR OECD COUNTRIES**

Country	Basic Heading or All Construction PPP	Resource based calculation method	OECD 2011 Preliminary construction PPPs	Average 2011 exchange rates
Australia	Residential	1.57	1.33	0.940
	Non-residential	1.41	1.68	
	Civil engineering	1.15	1.45	
	All construction	1.35	1.49	
Denmark	Residential	6.34	7.89	5.196
	Non-residential	5.95	8.69	
	Civil engineering	7.60	5.55	
	All construction	6.52	7.57	
Finland	Residential	0.79	0.91	0.697
	Non-residential	0.79	1.01	
	Civil engineering	0.76	0.72	
	All construction	0.79	0.90	
Hungary	Residential	106.0	105.6	183.112
	Non-residential	114.0	155.3	
	Civil engineering	128.0	142.2	
	All construction	116.0	133.2	
Netherlands	Residential	0.90	0.91	0.697
	Non-residential	0.91	1.05	
	Civil engineering	0.68	0.71	
	All construction	0.85	0.90	
Portugal	Residential	0.49	0.46	0.697
	Non-residential	0.47	0.54	
	Civil engineering	0.53	0.43	
	All construction	0.49	0.48	
UK	Residential	0.65	0.56	0.623
	Non-residential	0.60	0.88	
	Civil engineering	0.56	0.79	
	All construction	0.61	0.72	

The calculated all construction PPPs are typically lower than the OECD PPPs but generally within 15%. There is wider variation among basic heading PPPs.

The table on page 5 compares All Construction Price Level Indicators (PLIs) for the eight countries.

**Table 3: SUMMARY OF CONSTRUCTION PPPs**

					ICP 2005 construction PPPs	Average 2005 exchange rates
Country	Basic Heading	Residential	Non- residential	Civil engineering		
Australia	Materials	1.94	1.64	1.43	1.39	1.31
	Equipment	0.98	0.94	0.95		
	Labour	1.28	1.23	1.24		
	Basic heading	1.57	1.41	1.15		
	All construction	1.35				
China	Materials	2.87	2.81	3.57	1.93	8.19
	Equipment	1.69	1.61	1.61		
	Labour	0.26	0.25	0.25		
	Basic heading	2.43	2.41	2.51		
	All construction	2.45				
Denmark	Materials	8.21	7.58	8.79	9.16	5.99
	Equipment	3.11	2.97	2.97		
	Labour	9.06	8.64	8.64		
	Basic heading	6.34	5.95	7.60		
	All construction	6.52				
Finland	Materials	0.87	0.87	0.85	0.92	0.80
	Equipment	0.55	0.55	0.52		
	Labour	0.72	0.72	0.68		
	Basic heading	0.79	0.79	0.76		
	All construction	0.79				
Hong Kong	Materials	5.77	5.58	6.35	4.15	7.78
	Equipment	2.49	2.40	2.53		
	Labour	2.22	2.14	2.26		
	Basic heading	4.43	4.39	4.57		
	All construction	4.45				
Hungary	Materials	138.0	132.0	155.0	148.62	199.47
	Equipment	75.6	72.2	72.1		
	Labour	49.1	46.9	46.9		
	Basic heading	106.0	114.0	128.0		
	All construction	116.0				
Indonesia	Materials	5,030.0	4,710.0	5,440.0	2,551.52	9,704.7
	Equipment	1,080.0	1,040.0	1,010.0		
	Labour	375.0	3,61.0	351.0		
	Basic heading	3,540.0	3,140.0	4,230.0		
	All construction	3,720.0				
Malaysia	Materials	1.73	1.68	1.78	0.91	3.79
	Equipment	0.53	0.52	0.50		
	Labour	0.23	0.23	0.22		
	Basic heading	1.18	1.14	1.22		
	All construction	1.18				
Netherlands	Materials	0.97	0.98	0.93	1.12	0.80
	Equipment	0.59	0.59	0.53		
	Labour	0.81	0.81	0.74		
	Basic heading	0.90	0.91	0.68		
	All construction	0.85				
Portugal	Materials	0.71	0.71	0.86	0.53	0.80
	Equipment	0.11	0.10	0.10		
	Labour	0.17	0.16	0.16		
	Basic heading	0.49	0.47	0.53		
	All construction	0.49				
Singapore	Materials	1.13	1.08	1.16	0.62	1.66
	Equipment	na	na	na		
	Labour	0.31	0.30	0.30		
	Basic heading	0.94	0.91	0.95		
	All construction	0.93				
UK	Materials	0.74	0.72	0.76	0.77	0.55
	Equipment	0.42	0.40	0.39		
	Labour	0.58	0.55	0.54		
	Basic heading	0.65	0.60	0.56		
	All construction	0.61				

**Table 5: ALL CONSTRUCTION PLIs FOR OECD COUNTRIES**

Country	Resource based calculation method	OECD 2011 Preliminary construction PLIs
Australia	144	159
Denmark	125	146
Finland	113	129
Hungary	64	73
Netherlands	124	129
Portugal	71	69
UK	99	116

Bearing in mind the recent and current volatility of construction prices, both sets of data are credible.

## Conclusions

### On the survey

An important, if obvious, conclusion is that reliable PPPs require good quality construction price data. This calls for:

- A well designed survey form and supporting material. This part of the ICP 2011 survey appears to be going well. A number of countries have commented that it is more straightforward to complete than the 2005 form.
- Reliable and cooperative respondents. Survey respondents are not only required to complete the survey form but also to respond to validation and other queries on a number of occasions over an extended period of time.
- Sufficient time spent checking and normalising data. All the data used for the test exercises has been examined to ensure that they are complete and comparable across countries. In virtually all cases the examination has involved exchanges with respondents.
- Opportunities to discuss the survey and the data. The workshops attended have been excellent opportunities to discuss the survey, although the attendees at workshops tend to be statisticians rather than construction experts.
- At least two rounds of price validation. The data used in the test exercises has typically been through a single validation round that has been largely about normalising data. At least one further validation round could help to improve data quality.
- Ideally, access to other construction price data to inform the validation. It has been helpful at workshops, and when reviewing survey forms, to have available for reference construction price books or other published construction price data.

As survey data becomes available, it is important that resource mixes and percentage additions are collated and analysed by region and by type of country so that country data can be reviewed and compared with initial estimated resource mix values.

### On the method and the results

It is difficult to conclude too much at this stage from the results presented in this paper. The test exercise, however, demonstrates that the method outlined at the TAG in April 2011 is workable and produces plausible results. The method needs refining, the test data needs further checking and validation and the OECD data used is provisional. It is also worth emphasising that, while collecting reliable and comparable construction price data is always difficult, in recent years construction prices have been particularly volatile and variability in price levels has been more pronounced both within and between countries.