

The UK's Construction Price Indices Experience and Perspectives.

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Outline

- Background
- History of the UK Construction Price indices
- The new UK Construction Output Price Index:
 - Methods
 - Implementation
 - Future developments
- Lessons learnt

Background

What is construction?

- Includes a wide variety of activities:
 - Construction of dwellings (houses, apartments, etc)
 - Construction of non-residential buildings
 - Civil engineering works (roads, bridges, dams etc)
 - Repair, maintenance and renovations
- In the UK, it accounts for around 6% of GDP
- Key short-term indicator feeding into GDP calculations, alongside Index of Production and Index of Services

Why are construction price indices important?

- Price indices fundamental to assess real change output
- Use for deflation of components of national accounts (construction output and gross fixed capital formation)
- Adjustment of constructions contracts
- Indexation for insurance purposes

Measuring construction prices is tricky!

- Diverse sector and we need to measure prices at constant quality – for construction is virtually impossible, as very rare to have same projects
- International and intranational comparisons hard because of different construction standards and requirements
- Data sources may be limited
- Require lot of technical knowledge

History of the UK Construction Price indices

Construction Statistics in the UK

- ONS in charge of Construction statistics (output/volume) since 2010
- The Department for Business, Energy and Industrial Strategy (BEIS) has historically been responsible for producing Construction price indices
 - Adjustment of constructions contracts
 - Indexation for insurance purposes
 - Use for deflation of components of national accounts (construction output and gross fixed capital formation)

Construction Price and Cost Indices (CPCI)

- Suite of indices produced by BCIS (Building Cost Information Service) for the Department for Business, Innovation and Skills (BIS)
- Produced by BCIS – Building Cost Information Service of the Royal Institution of Chartered Surveyors
- RICS professional body that accredits professionals within the land, property, construction, and infrastructure
- It included:
 - Output Price Indices (OPIs)
 - Tender Price Indices (TPIs)
 - Price Adjustment Formulae Indices (PAFI) /Resource Cost Indices (RCIs)
- Breakdowns available for:
 - New construction
 - Repair and maintenance
 - Public
- Further breakdowns by housing vs non-housing (commercial, industrial and infrastructure)

Bills of quantities & schedules of prices

- Traditional construction procurement route for UK public sector projects
- Project designed and detailed bills of quantities (BoQ) prepared. These are detailed list of all the materials, labour etc required for the building projects
- Tenders invited based on BoQ. Bidders provide a schedule of prices

PPP Bills of quantity - example

Box 11.3: An example of a major component and its elementary components

Item specification		Unit	Quantity	Unit Price (national currency)	Total Price (national currency)
3.	Masonry				
3.1	Ground floor double-skin external wall:				
	➤ 20 cm sand-lime brickwork + 11 cm facing brickwork, inclusive of pointing and acid cleaning	m ²	257	17	4369
	➤ Plastering	m ²	257	8	2056
3.2	Upper floors double skin external wall:				
	➤ 11 cm sand lime brickwork + 10 cm facing brickwork, inclusive of pointing and acid cleaning	m ²	413	18	7434
	➤ Plastering	m ²	413	8	3304
3.3	Gable ends, 11 cm facing bricks, inclusive of pointing and acid cleaning	m ²	625	18	11250
3.4	Fair-finish 7 cm plaster block work	m ²	585	7	4095
Total					32508

Tender Price Indices (TPIs)

- Based on Tender prices receipted in a quarter
- Tenderers provide a schedule of prices based on detailed Bills of Quantities produced by commissioning body
- The schedule of prices are re-priced at base prices. This allows to construct a Paasche price index (quantities at time t)
- Main use in estimating, cost-checking and fee negotiation on construction projects
- Basis for the Output Price Indices (OPI)

Output Price Indices (OPIs)

- Required as deflator in National Accounts
- Construction output in each quarter rarely related to contracts awarded/receipted in that quarter
- Use set of weights to combine previous quarters' TPIs by sector
- Sector OPIs combined to create higher level aggregates
- Breakdowns published for new work, Repair and Maintenance and all work

Sector OPI

Sector OPIs derived as an harmonic mean of TPIs

$$x = \sum_{n=7}^n w(n) \times NO(n)$$

$$OPI = x / \sum_{n=7}^n \frac{w(n) \times NO(n)}{TPI(n)}$$

NO(n)=value of new orders at time n

TPI(n)=TPI at time n

W(n)= weights

Weights applied to new orders	Period										
	n	n-1	n-2	n-3	n-4	n-5	n-6	n-7	n-8	n-9	n-10
Public housing	0.07	0.14	0.18	0.20	0.17	0.13	0.08	0.03			
Private housing	0.07	0.13	0.17	0.19	0.17	0.13	0.09	0.06			
Infrastructure	0.07	0.11	0.13	0.13	0.13	0.12	0.10	0.08	0.06	0.04	0.02
Public non-housing	0.08	0.16	0.20	0.20	0.17	0.12	0.07	0.03			
Private industrial	0.16	0.28	0.27	0.17	0.09	0.05					
Private commercial	0.12	0.20	0.21	0.19	0.14	0.09	0.05				

Price Adjustment Formulae Indices (PAFI)

- Series of 42 input price indices including specific materials, labour and plant indices
- Use of PPI, SPPI and Average weekly earnings
- The indices represent the underlying movement in factory gate prices and nationally agreed wage awards. They are not intended to represent the effect that national or local market pressures have on prices from subcontractors, merchants and so forth
- Main use for contract indexation

Resource Cost Indices (RCI)

- Weighted averages of PAFI indices
- Separate indices available for housing; non-housing; infrastructure; and repair and maintenance (housing and non-housing)
- Breakdowns by materials; labour; plant; electrical work; mechanical work and building work also available
- Main use for contract indexation

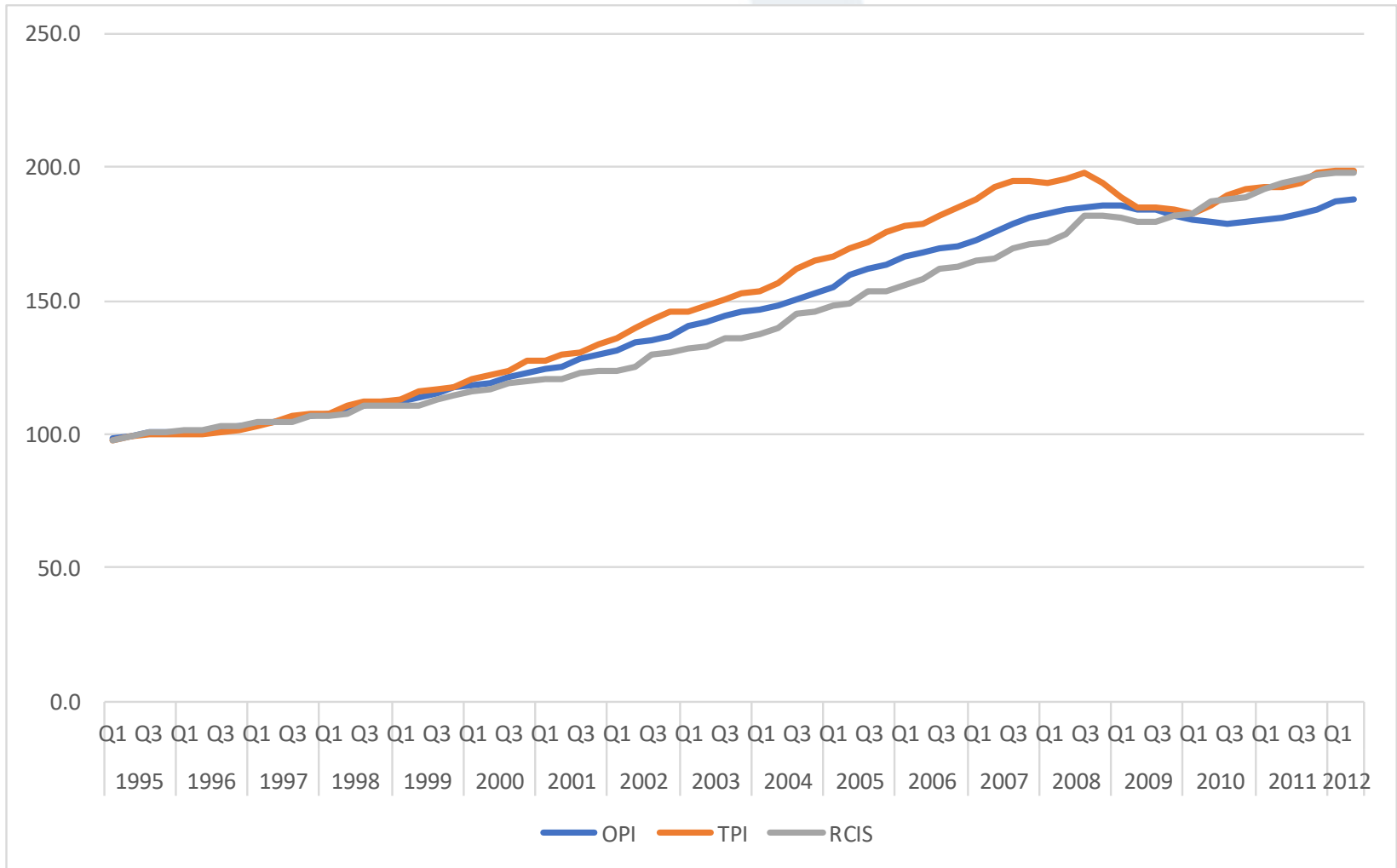
Issues

- CPCI been subject of a number of reviews over the last 10 years
- [Langdon report in 2010](#) quote research by Yu and Ive:
 - Limited information on Mechanical and Electrical service items, often lumped together in BoQ
 - Use of base rates makes it difficult to capture new elements and proprietary items
 - BoQ procurement route diminishing in importance
 - Limited coverage of private sector housing and commercial

Construction Breakdown

Private Commercial ONW	New Work	19%
Private Housing	New Work	17%
Private Housing	R&M	13%
Infrastructure	New Work	11%
Private Other Work	R&M	8%
Public ONW	New Work	8%
Infrastructure	R&M	6%
Public Housing	R&M	6%
Public Housing	New Work	4%
Public Other Work	R&M	4%
Private Industrial ONW	New Work	3%

Comparison of CPCI – all work



New methodology and 2014 consultation

- Consultation in 2014 on new methodology
 - Proposal to move to a basket-type approach to produce an input price index
 - Use the new input indicator as a basis for an output indicator
- Publication of indices on new methodology due in December 2014 but issues with quality
 - Construction output lost National Statistics status due to deflators
- Transfer of responsibility to ONS in March 2015

Methodology development

- Interim solution while longer term methodology developed
- Use of already existing ONS data sources
- Interim methodology very close to final methodology
- Interim methodology used for 2015-2017
- Since Q3 2017, final methodology applied

The new UK Construction Output Price Index

Project-cost approach

- A selection of types of construction projects has been chosen
- Input costs for each type of projects are obtained by weighting together costs for materials, labour and plants
- A mark-up to account for profits is applied to the input cost
- The result is considered a proxy for output prices

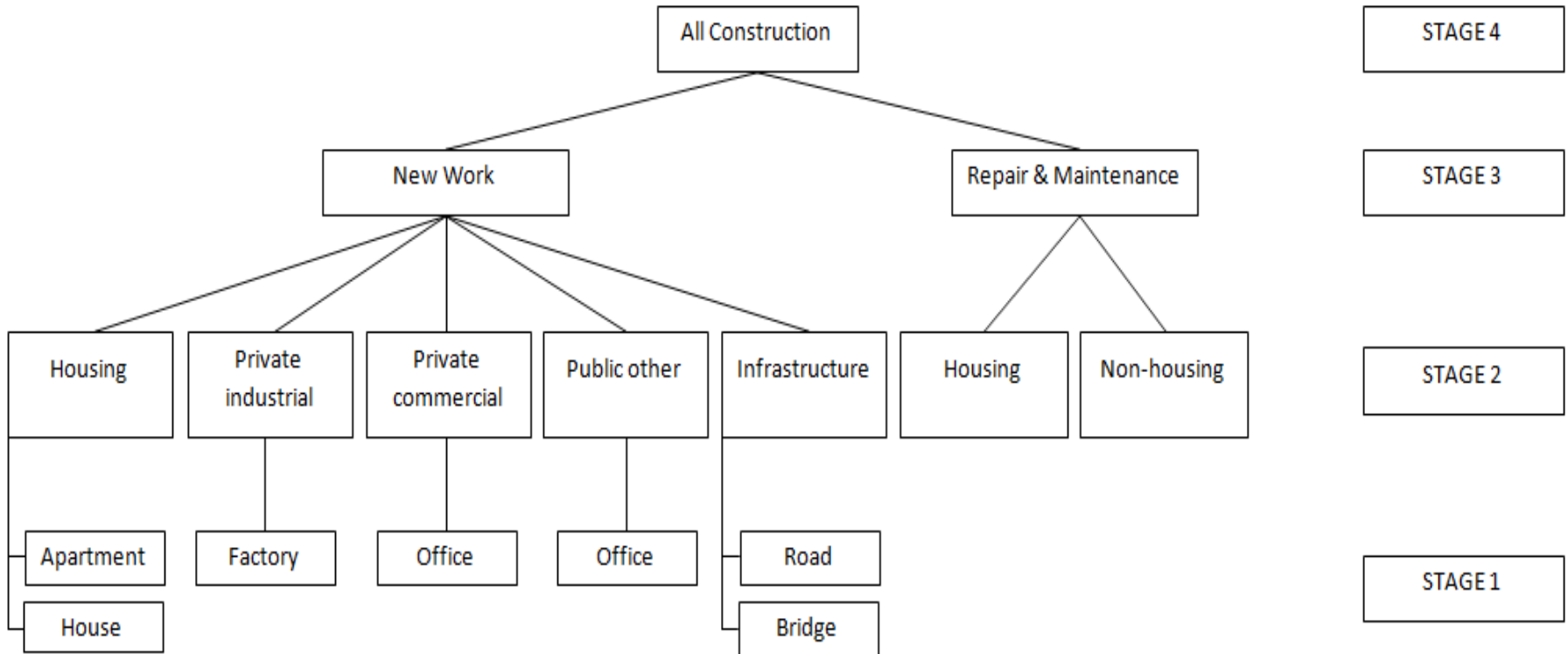
Basic methodology:

Material costs (PPI)

Labour costs (AWE) × *Mark – up for profit margin* = *Output price*

Plant costs (SPPI)

Construction output price index structure



New work - projects

- Projects chosen from Purchasing Power Parities standard construction projects as representative of UK industry

Type of work	Bill of quantity
Housing	Detached house and apartment
Infrastructure	Roads and bridges
Public Other	New office building
Private Industrial	Factory building
Private Commercial	New office building

New work - Materials

- PPPs bills of quantities define the materials and weights to use to create the materials input costs
- Low-level producer Price Indices linked to PPPs BoQ
- PPIs for single materials are weighted together using PPPs BoQ
- Weights not updated on a regular basis
- Produce a materials index for each type of project

Repair and maintenance - materials

- Not covered specifically in PPPs manual, no BoQ available, no model projects available to price
- Materials selected using information from the Annual Purchases survey
 - Collects data on business' expenditure on energy, services, goods and materials
 - Materials breakdown required
- Purchases returns linked to construction monthly survey to identify sector (housing vs non-housing)

Labour

New work

- ONS Average Weekly Earnings for construction excluding bonuses
- Average Weekly Earnings (AWE) measure of average weekly earnings per employee.
- It is based on the Monthly Wages and Salaries Survey (MWSS), which samples around 8,500 employers in Great Britain

Repair and Maintenance

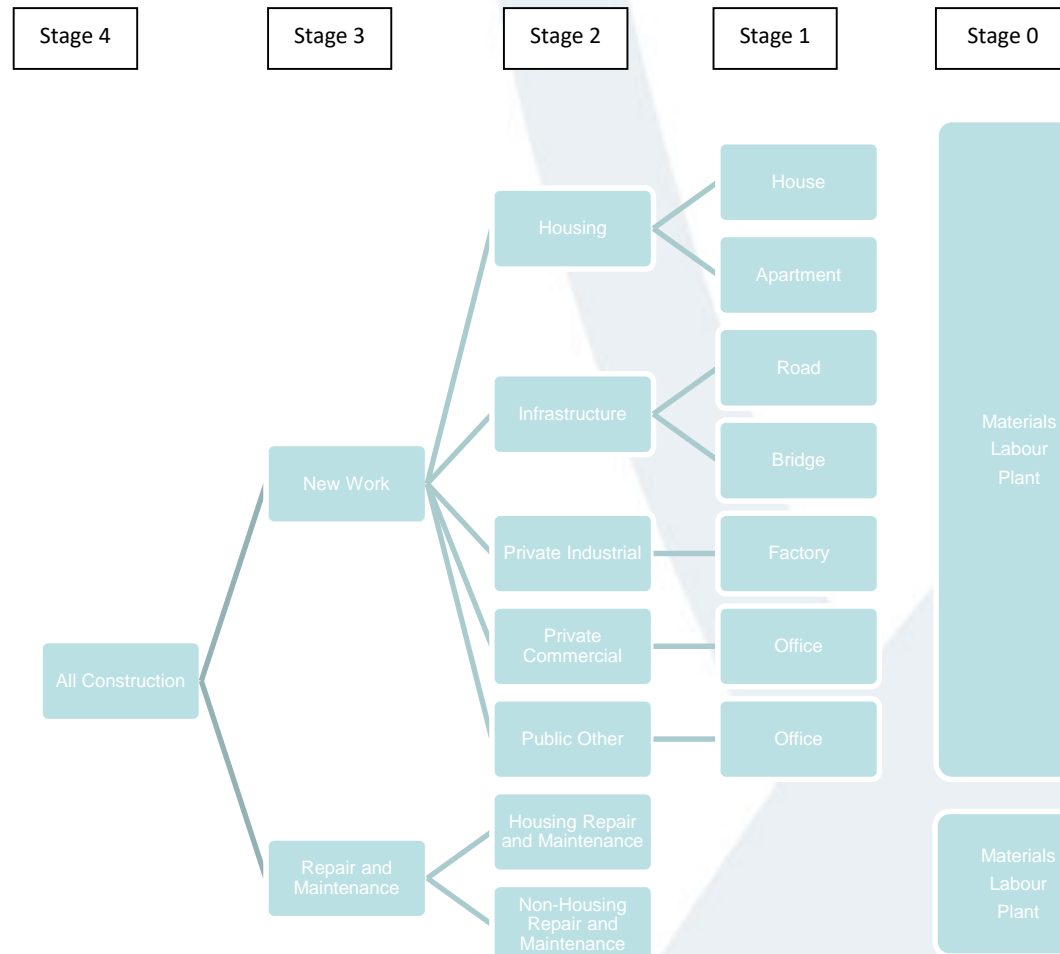
- “Services for the regular repair of the dwelling” CPI – combination of hourly rates for plumbers, electricians, carpenters and decorators
- Use CPI weights to obtain a labour index

Plant



- SPPI for construction plant hire
- Change in price received by UK plant hire companies when providing plant without an operator to other UK companies and government
- Quarterly figure
- Same SPPI index used throughout the index structure

Index and weights structure



Stage 1 weights

- Need to combine materials, labour and plant indices
- Data used to weight the individual labour, materials and plant components for a construction business comes from the Annual Business Survey (ABS) using 2015 data.

Component	Annual Business Survey Question
Labour	Total employment costs
Materials	Goods and materials used in the running of your business (including raw materials, stationery, components and consumables)
Plant	Amounts payable for hiring, leasing or renting plant, machinery and vehicles

- Labour, material and plant ratios calculated for each business in each sector
- Median ratios used

Stage 1 weights

Index	%		
	Labour	Materials	Plant
Housing	44.3	50.2	5.5
Infrastructure	47.5	40.4	12.1
Other Work	54.5	39.9	5.7
Housing R&M	60.6	35.8	3.6
Non Housing R&M	24.8	69	6.2

Source: Office for National Statistics

- Housing weights used for both detached house and apartment block
- Infrastructure weight used for both road and bridge indices
- Other work weights used to price the factory and office project models

Stage 2 weights – new work only

- Two representative projects have been used for both housing and infrastructure.
- The resulting indices having been weighted together using weights estimated from data provided by Barbour ABI.
- The weights are fixed :
 - Housing – Detached house (65%) and Apartment building (35%)
 - Infrastructure – Road (90%) and Bridge (10%)

Stage 3 weights

- Weights derived from ONS's Output in the Construction Industry release. Weights are updated annually as data becomes available.

- 2017 weights were

Component	Weight into stage 3 (parts per 1,000)
Housing	357
Private industrial	46
Private commercial	299
Public other	113
Infrastructure	185
Housing repair and maintenance	528
Non-housing repair and maintenance	472

Source: Office for National Statistics

Stage 4 weights

- Used to produce an overall Construction OPI
- Not directly used by National Accounts
- Weights obtained by ONS's Output in the Construction Industry release

Stage 3 index	Weight into stage 4 (parts per 1,000)	Stage 4 index
New work	655	All construction
Repair and maintenance	345	

Mark-up for profit margin/1

- Mark up represents difference between price charged by company and its marginal cost
- Based on gross profit as focus on direct costs of goods and not indirect fixed costs

$$M = \frac{AVG \text{ Gross Profit}}{(AVG \text{ Turnover} - AVG \text{ Gross Profit})}$$

- Data from 715 firms obtained from FAME dataset from Bureau Van Dijk

Mark up for profit margin/2

- Annual mark up figures from FAME database

Table 7: Annual mark-up figures, based on gross profit

Year	Mark-up (%)
2011	13.321
2012	12.879
2013	12.307
2014	10.741
2015	11.092

Source: Office for National
Statistics

- Cubic spline applied to derive quarterly series
- Linear interpolation applied to obtain monthly series

Main improvements between interim and current methodology

- Mark up
- Plant element in the R&M sector
- Use of Purchases to design R&M materials list
- Improved matching of PPIs to BoQ and R&M materials list
- Improved method to derive stage 1 weights
- Changes to AWE to better account for small businesses

OPI dissemination

- Monthly series are published on the quarterly Construction Output Price Index (OPI) statistical bulletin
- Reference tables with time series
- Quality and Methodology Information (QMI) document
- Monthly deliveries to National Accounts (Construction team)

Production systems

- Interim and final solution developed via a set of spreadsheets
- These use PPI, SPPI, AWE and CPI data
- They cover almost the whole OPI production, including:
 - AWE forecasting
 - SPPI monthly interpolation
 - Index weighting
 - Re-referencing
 - Markup monthly interpolation
 - Mark-up application
- They exclude:
 - SPPI forecast for latest quarter (in CSDB)
 - Annual mark-up calculation and quarterly interpolation
 - Weights calculations

Production system developments

- Between December 2017 and March 2018, spreadsheets for NA deliveries redeveloped in Python system
- Local system that will require migration to new Data Access Platform
- Cut down production process to a few minutes
- System currently being expanded to cover OPI publication requirements

Future development

- Construction OPI methodology considered now “final”
- Working alongside construction output team to re-gain “National Statistics” status after de-designation in 2014
- Some work around refinements in the mark up calculation and data source
- Lot on development though on data sources, particularly PPI and SPPI



Developments – sources

- Large programme of development on Business Prices (PPI/SPPI). This includes:
 - New classification (CPA 2.1)
 - Introduction of chainlinking
 - New sample designs
 - New sampling frame and weights for SPPI
 - SPPI move from B2B to B2All
 - Services Export Price Index
 - Improve SPPI timeliness
- Chainlinking expected to have the larger impact on construction

Redevelopment: lessons learnt

Put users and experts at centre of development

- Absolutely key to involve users and technical experts
- Understand requirements and use of the indices
- Technical knowledge absolutely critical to develop an index
 - Range of construction activities
 - Construction techniques
 - Types of organisations involved in construction activities (e.g. public vs private)
 - Administrative arrangements for government authorisation of construction projects (e.g. BOQ required?)

What ONS did...

- Decision to focus on deflator use of the index
Development work carried out very closely with the Construction output team— new methodology completely aligned with NA requirements
- Wider engagement outside ONS to get input into the project
 - Construction Statistics Steering Group
 - Other government departments
 - Industry experts
 - Academics
 - Consultative Committee for Construction Industry Statistics
 - Eurostat

Communicate change clearly and timely

- Substantial methodological change
- Wider users need to be informed
- Widespread use in contract indexation – users do not like to see change!

What ONS did...

- Updates on development at meetings with various stakeholders
- Publication of detailed methodological papers to communicate expected changes and impact

Try to re-use existing data where possible...

- New data collections are expensive
- New data collection represent an additional burden to respondents and increase compliance costs
- New methodology should look at maximising secondary use of existing data sources

What ONS did...

- New methodology completely reliant on existing and long established ONS data sources
- Complemented by a small number of privately owned datasets
- No increase in any compliance cost!

...but treat existing sources with caution

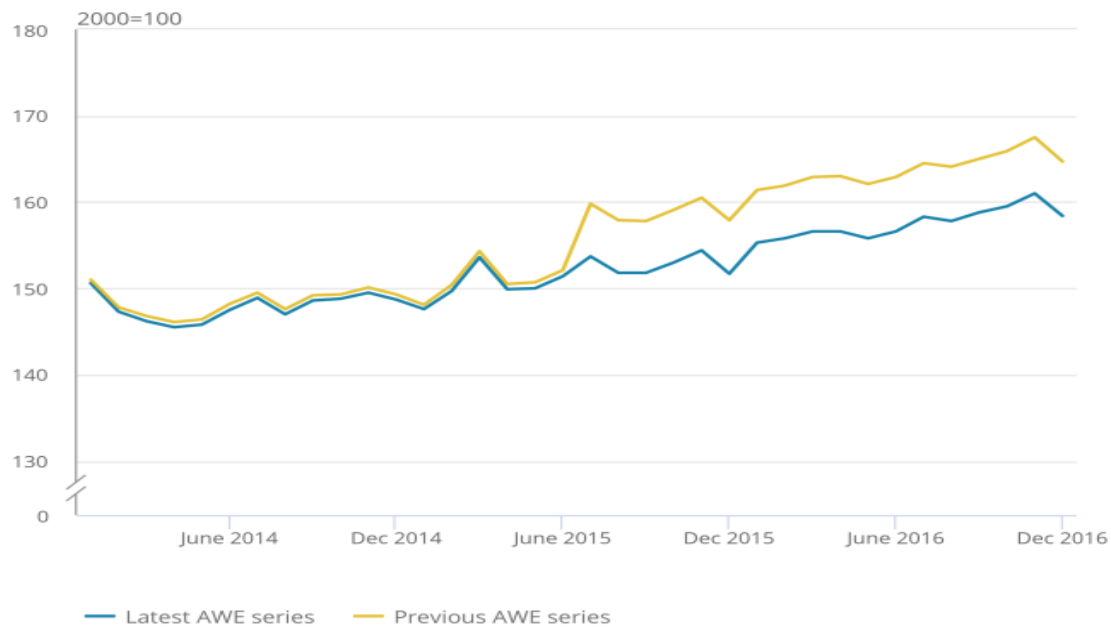
- Different definitions
- Data originally collected for different purposes and methods optimised accordingly
 - Sample designs are optimised for the primary use of the data sources
 - Timeliness dictated by primary requirements

A couple of real examples/1...

- AWE data changed methodology to better capture small businesses. This had a large impact on the construction earning index used for new work

Figure 4: Average Weekly Earnings index (AWE) for construction excluding bonuses, non-seasonally adjusted

Great Britain, January 2014 to December 2016



Source: Office for National Statistics

A couple of real examples/2...

- PPI sample allocated to minimise error around PPI headline indicator
- PPI sample sizes for different products reflect weight (and variability) of that products category within manufacturing output – not in terms of weight as a construction input!
- Small sample sizes for some of the PPI used for construction materials
- Some PPI already had to be replaced

What ONS is doing now..

- Improve engagement with areas responsible for different data sources, to ensure Construction OPI requirements are understood
- PPI and SPPI sample re-developed ensuring construction needs can be met (e.g. minimum sample sizes)

Contacts

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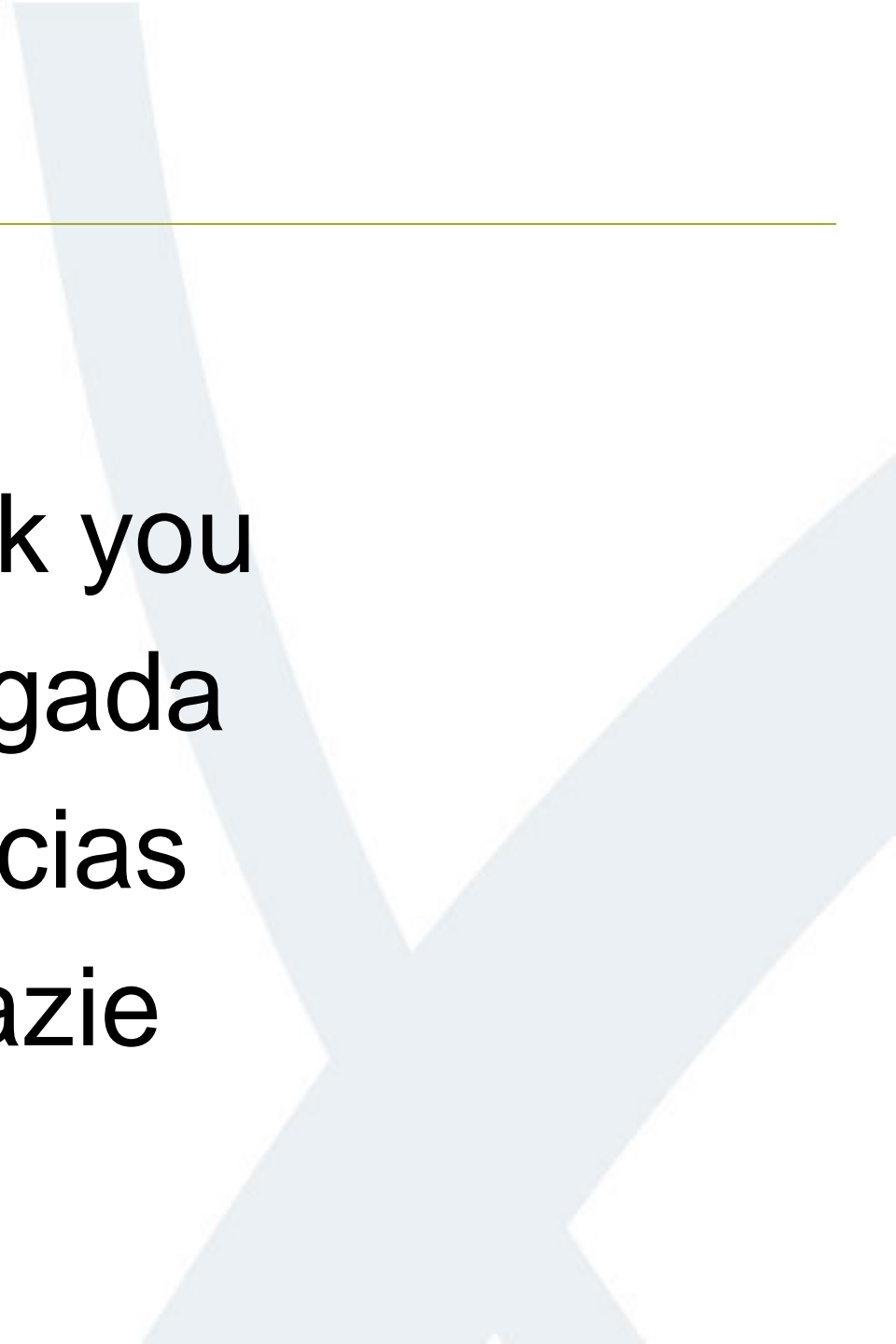
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Thank you
Obrigada
Gracias
Grazie



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UK construction industry

- Larger businesses (over 100 employees) account for almost 40% of turnover and represent 0.3% of businesses
- Relatively high contribution of small businesses (less than 10 employees). Over 90% of businesses accounting for around 32% of industry turnover
- Specific characteristic of the construction sector – e.g. in Retail, small businesses represent only 13% of turnover, with large businesses accounting for 74% of industry turnover

Construction Breakdown

Public Housing	Private Housing	Infrastructure	Other Work
<ul style="list-style-type: none"> •Local authority housing schemes •Married quarters for services and police •Old people's homes •Orphanages •Provision of roads and services within housing sites 	<ul style="list-style-type: none"> •Privately owned buildings for residential use <ul style="list-style-type: none"> ○Houses ○Flats ○Bungalows ○Cottages ○Vicarages • Provision of services to new developments 	<ul style="list-style-type: none"> •Water •Sewerage •Electricity •Gas •Communications •Air Transport •Railways •Harbours •Roads 	<ul style="list-style-type: none"> <u>Industrial</u> <ul style="list-style-type: none"> •Factories •Warehouses •Oil •Steelworks •Coal <u>Public Other / Private Commercial</u> <ul style="list-style-type: none"> •Schools and colleges •Universities •Health •Offices •Entertainment •Garages •Shops •Agriculture •Everything else!

Monthly mark-up figure

Figure 2: Monthly mark-up figures, construction industry

Great Britain, January 2012 to June 2017

Figure 2: Monthly mark-up figures, construction industry

Great Britain, January 2012 to June 2017

