



Department
for Business
Innovation & Skills

**Construction Price and Cost Indices:
Methodological Changes**

**Government Response to the
Consultation**

NOVEMBER 2014

Contents

Executive Summary	3
Introduction	4
Government Response	5
Annex A – Summary of Responses	7
Annex B – ONS Proposed Methods	13
Annex C – List of Respondents	23

Executive Summary

Between 7th July and 28th July 2014, BIS invited views on proposals for a new methodology for calculating construction price and cost indices¹. The consultation set out proposals for new input cost indices to replace the tender price indices currently provided, and for the methodology to be used to convert these input cost indices to output price indices. This updated methodology will produce indices which better reflect real changes in the price of construction work. We also asked for comments about the preferred length for the time series to be published for the new series.

We received eight responses to the consultation. Four were broadly favourable to the proposals, and the other four raised a number of issues. A summary of the issues raised, and our response/actions to address those issues, is included in this response at Annex A.

Following the consultation, BIS and its contractor AECOM² have worked with the Office for National Statistics (ONS) to further develop the new methodology for converting the input cost indices to output price indices. We have also taken advice from the ONS National Accounts Methodology Committee. The methodology involves the calculation of markup factors to adjust the input cost indices for supplier's profit margin, productivity and overheads. The markup is subsequently applied to the cost of materials, products, equipment hire and labour included within the input cost indices to derive an output price index. This approach is based on the assumption that the output price contractors charge to clients reflects a markup over the cost faced by contractors.

Documents providing more detail on the new methodologies will be published next week on the BIS website³. ONS will be publishing a note⁴ about the changes to construction output on 20th November.

¹ [Methodological Changes to Construction Price and Cost Indices: User Consultation](#)

² [AECOM website](#)

³ [BIS Construction Price and Cost Indices webpage](#)

⁴ [ONS website](#)

Introduction

On 7th July BIS launched a consultation on changes to the methodologies for the calculation on input cost indices and output price indices for construction. This was in response to concerns that the tender price methodology used was becoming increasingly outdated, due to changes in the way construction work is procured. Few construction projects are now available for inclusion in the tender price calculations, which relied upon bills of quantity⁵. Thus, the updated methodology will produce indices which better reflect real changes in the price of construction work.

The existing construction price and cost indices are published by BIS, and produced under contract by AECOM. They are used by ONS to deflate the National Statistics on construction output and new orders, as well as by the industry and other analysts.

Prior to the consultation, on 19th June 2014, BIS and AECOM published an article outlining the proposed new methodologies⁶ and ONS published an article on how they use the indices⁷. On the same day, ONS hosted a seminar in London at which ONS and AECOM presented the same information and answered questions. AECOM and ONS then repeated their presentations at a meeting of the Consultative Committee on Construction Industry Statistics (CCCIS). Information on attendees of both the seminar and the CCCIS meeting were included in the consultation document in Annex C. The minutes of the CCCIS meeting are available on the BIS website⁸.

The consultation closed on 28th July. We received eight responses from a range of stakeholders. A list of respondents can be found in Annex C:

Respondent type	Number
Government organisations	4
Professional body	1
Individuals	3

Methodological documents will be published on the BIS website next week which will provide more detail, in response to requests by consultation respondents. Summaries of the other issues raised, and the responses or actions taken to address those issues, are provided in Annex A.

⁵ [BIS article on Tender Price Indices](#)

⁶ [BIS article on improvements to construction price and cost indices](#)

⁷ [ONS article on how they use the construction price indices](#)

⁸ [CCCIS minutes](#)

Government response

Views on the proposed method for compiling input cost indices

Respondents were generally supportive of the proposed methodology for compiling input cost indices, although several respondents asked for more detail on elements such as the sampling and data collection methods for the basket of goods. Next week, BIS will publish a more detailed methodology document to answer these questions. Input cost indices calculated using the new methodology will be published for the first time in December 2014, as part of the regular quarterly National Statistics on Construction Price and Cost Indices⁹. These will replace the existing tender price and resource cost indices.

Updating of the basket of goods for the input cost indices

Some respondents felt that quarterly updating was unnecessarily frequent. Others were unclear whether this referred to updating which goods were included in the basket or the prices. BIS and AECOM have decided that the basket of goods will be updated annually, to reflect any changes in the types of materials being used. This is in line with the practice for other price indices such as the Consumer Price Index. Purchasers' prices for each item in the basket will be updated quarterly.

Conversion of input cost indices to output price indices

Some respondents expressed a preference for the output price indices to be directly measured using a survey rather than derived by applying a factor to the input cost indices. However, it is likely that this would suffer from the same issues of falling sample sizes that are currently affecting the existing Tender Price Indices.

ONS provided proposals for three different methods for the calculation of a market indicator. Method 1 calculates a single, time varying markup for the construction industry as a whole. Method 2 uses sub-sector level estimates of labour share and productivity to calculate sub-sector markups. Method 3 separately models the effects of competitiveness and spare capacity in construction sub-sectors, to obtain sub-sector markups. Following discussion, we have decided to introduce Method 1. Methods 2 and 3 were rejected, due to issues relating to the availability of the required data. All three methods proposed by ONS can be found in Annex B, in a paper provided as part of the ONS consultation response. AECOM have worked closely with ONS to develop a series of markup factors which will be applied to the input cost indices to derive output price indices. The markup factors estimate the effects of suppliers' profit margins, productivity and overheads,

⁹ [BIS Construction Price and Cost Indices](#)

identified in OECD guidance¹⁰ as the difference between input cost indices and output price indices.

Next week, BIS will publish more detailed methodology descriptions. BIS will publish Output price indices using the new methodology for the first time in December 2014, as part of the regular quarterly National Statistics on Construction Price and Cost Indices. These will replace the existing output price indices.

Length of time series

Respondents felt that as long a time series as possible would be preferable. AECOM hold historic input cost data back to 2005 on a consistent basis, and so the time series will be available back to 2005.

In December 2014, ONS will release the monthly construction output publication, covering the period up to October 2014. In line with national accounts revisions periods, this publication will take on board the new price series from January 2013.

When ONS publish Quarterly National Accounts consistent with Blue Book 2015 on June 30th 2015, they will then incorporate the whole series. ONS will also create a link between the old price indices and new, to ensure consistency.

Next steps

BIS will publish detailed methodological guidance on the new Input Cost Indices and Output Price Indices next week.

ONS will publish a note on the changes on construction output on 20th November. The note will also explain how New Orders will be deflated in future.

BIS will publish the first set of price and cost indices on the new basis on 12th December. ONS will use the new indices in the National Statistics on Output in the Construction Industry, also to be published on 12th December.

¹⁰ [OECD \(2002\) Construction Price Indices Sources and Methods](#)

Annex A – Summary of Responses

Introduction

Following receipt of the responses to the recent consultation exercise, regarding the proposed methodological improvements to the construction PCI, we provide below our comments to the issues raised. In summary, from the eight responses received: four appear to be broadly favourable, and four raise a number of issues. We have provided here a summary of the issues raised by each respondent and our response/actions to address those issues. Additionally, we have drafted methodology documents outlining our approach to the input cost indices and the output price series.

Office for National Statistics

Many of the comments raised by the ONS will be addressed through the provision of a comprehensive methodology document for the input cost indices, including:

- Periodicity of updating the basket of goods
- Sample and data collection methods for the basket of goods
- Use of arithmetic vs. geometric mean
- The use of an un-weighted approach vs. weighted approaches
- The inclusion of transport, energy and other costs in the input cost series

ONS provided proposals for three different methods for the calculation of a market indicator. Method 1 calculates a single, time varying markup for the construction industry as a whole. Method 2 uses sub-sector level estimates of labour share and productivity to calculate sub-sector markups. Method 3 separately models the effects of competitiveness and spare capacity in construction sub-sectors, to obtain sub-sector markups. We have reviewed the appropriateness of the alternative suggestions for a market indicator, and agree that Method 1 seems the most appropriate. We are currently constructing a time-series of OPIs based on the preferred ONS methodology.

The full paper provided by ONS, including the three suggested methods, is available in Annex B.

Bank of England

The Bank of England (BoE) suggest that output prices should be measured directly using a survey source, however we believe that this approach would result in similar sampling issues that affect the current series. This also suggests a project focused methodology which is something that we are keen to move away from. Our approach is concerned with measuring cost/price movement at an industry/sector level rather than at a project level (where aggregation issues exist).

The BoE were consulted about the ONS proposed methodology and are content with it.

We have historic input cost data back to 2005 available on a consistent basis electronically and so can provide OPIs back to 2005.

Building Cost Information Service

Again, many of the comments raised by the Building Cost Information Service (BCIS) will be addressed through the provision of a comprehensive methodology document for the indices.

Specific responses to BCIS comments are as follows:

BCIS 1.1: It is stated that the input costs are cost to contractor. Clarification is required as to whether this is referring to the purchasing contractor or the main contractor because the market adjustment will be affected as a result.

Response: The input costs are the cost to the purchaser irrespective of where they are in the supply chain.

BCIS 1.2: Generally, from the documentation provided, it is unclear what the indices intend to represent or how the changes will address the current issues around sample sizes and coverage. It is also not immediately obvious how the proposals will represent different procurement routes or how the new methodology will improve the alignment with National Accounts/SIC codes.

Response: The input cost indices will not represent different procurement routes as they are industry/sector specific and not project specific.

BCIS 1.3: It is unclear how all sectors of the construction industry are to be represented by this new methodology. Inputs for housing, non-housing and civil engineering/infrastructure are mentioned, which would imply that the same inputs are used for all sectors including repair and maintenance, which would in turn imply that the only differentiator between the sectors is the split between labour, plant and materials.

Response: Different baskets of inputs are used to represent the sub-sectors.

BCIS 1.4: The document 'Improvement to the Construction Price Indices and impacts' refers to the collection of costs for different types of labour but the source referenced is a single index used for all labour across all sectors. Further explanation is required.

Response: The labour cost element is a single index.

BCIS 1.5: The proposal seems to imply that the materials inputs to each of the three sectors are un-weighted; however this section of the documentation is not clearly defined. This seems contrary to the compilation of all other indices of this type, so details of the research carried out to produce this proposal are required.

Response: We will provide a methodology document to outline the approach adopted.

BCIS 1.6: In relation to the suggestion of the basket of goods being reviewed and updated on a quarterly basis; if this is referring to re-pricing, it appears sufficient based on the information currently provided around the new methodology. If it is referring to reviewing the contents of the list, further details of how a review would be carried out are required.

Response: Prices will be updated quarterly; the content of the basket will be reviewed annually.

BCIS 1.7: Given that the input cost indices will presumably be used to calculate both tender price and output price indices, any sudden short-term change in weights would presumably have a detrimental effect on one or other of the aforementioned as the mix implied by current tenders would be different to that of current output. This would imply that short term updates to weightings would be counterproductive.

Response: We are not providing TPIs.

BCIS 1.8: Applying weights to the sector input indices to calculate an 'all construction index' is described as using 'appropriate expenditure weights'. However, it is not clear how the weights will be produced.

Response: The all construction index is estimated using expenditure weights, a full description of the approach will be provided in a methodology document.

BCIS 2.1: In order to answer this question fully, a comprehensive list of the inputs and details of how they were chosen would need to be made available as well as clarification of the sampling techniques adopted. It would also be beneficial to understand how the different inputs have been assigned to the sectors and how the results have been validated to ensure the results are representative. The methodology detailing the calculation of input cost indices also requires further clarification especially around how and at what stage of the process the inputs are weighted.

Response: Further details of the approach will be provided in a methodology document.

BCIS 2.2: ONS also require Tender Price Indices (TPI), i.e. prices agreed at the commit to construct, to deflate new orders, and Output Price Indices, i.e. prices paid when the work is carried out, to deflate output.

Response: We are not providing TPIs. The ONS will, in their article to be published on 14th November, explain how New Orders will be deflated in future.

BCIS 2.3: Tender prices from most procurement processes represent forecast input costs to the main contractor and their profit and overheads reflecting the current market conditions. From the documentation made available, it is not clear how this has been considered.

Response: This is considered within the markup factor.

BCIS 2.4: Output prices from lump sum tenders reflect forecast input costs from previous periods, and profit and overheads reflecting market conditions from previous periods. Output prices on target cost contracts reflect current input costs, and profit and overheads reflecting market conditions from previous periods. Other procurement routes will also differ. Again, it is not clear how this has been considered.

Response: The OPIs will not represent different contract/procurement types, as they are industry/sector specific.

BCIS 3.1: The OECD guidance does not differentiate between Output Prices and Tender Prices but refers to both as 'output prices'.

Response: We are providing OPIs and not TPIs.

BCIS 3.2: Input prices to main contractor plus their profit margins and overheads and productivity gains to the whole supply chain should equal output prices subject to the procurement route, see 2.3 and 2.4 above.

Response: See response to 2.3 and 2.4 above;

BCIS 3.3: If input prices are to the purchasing sub-contractor then various levels of profit and overhead will need to be applied, depending on the length of the supply chain.

Response: We are not measuring supply chain impacts.

BCIS 4.1: Market conditions for the whole supply chain would need to be considered, i.e. all levels of contractor and sub-contractor within the industry. The effects of the different procurement route methods would also somehow need to be considered.

Response: The indices are industry/sector specific and not contract/procurement/project specific.

BCIS 4.2: Additional details about how the market conditions factor would be applied would be useful to gain a fuller understanding of this area of the proposal.

Response: Further details of the approach will be provided in a methodology document.

BCIS 4.3: If there was a movement towards offsite construction, the labour component of the market conditions measure would change and distort the results.

Response: A movement to off-site construction would remove that element from the scope of the construction industry, and hence would not be appropriate to be measured by construction price and cost indices.

BCIS 4.4: Productivity changes are likely to occur over the short-term reflecting demand changes as well as in the long-term. It is not clear how either will be included in the proposed methodology.

Response: Following comments received during the consultation exercise, we have revised the composition of the markup indicator which now includes a productivity measure.

BCIS 4.5: Any indirect method requires research and validation.

Response: We have undertaken extensive research to update the methodology for both input costs and output prices over the past calendar year, given various studies that have drawn into question the reliability of the current approach. We have evaluated numerous alternative approaches and methodologies, presented at four stakeholder meetings/presentations, and contributed to the recent consultation exercise to assess fitness for purpose.

BCIS 4.6: If the proposed market factor was shown to reflect short-term changes in the relationship between input costs and output prices, there is no apparent mechanism to ensure against 'drift' in the medium to long-term.

Response: The methodology, and its appropriateness to be designated a national statistic, will be kept under review;

BCIS 4.7: It is not clear how regional market factors would be produced given that there is no proposal for a regional input cost index. Regional new orders are more volatile than national new orders and there has been no consideration thus far about overlapping markets between regions.

Response: Our approach includes for regionalisation at both input cost and output price stages. At input cost, via the AWE series, we expect most regional variations will be captured by earnings differentials rather than differences in materials and plant costs.

In addition, at output price, we are using statistics that include a regional element that will allow for the estimation of regional factors.

Infrastructure UK (HM Treasury)

The respondent provided broad agreement regarding the approach as proposed. However, following the consultation exercise, we have revised the composition of the market indicator to address various concerns raised.

The respondent requested a longer time series, if possible. AECOM have historic input cost data back to 2005 available on a consistent basis electronically, and have provided the longest possible time series that the data will allow.

Education Funding Agency

The respondent provided broad agreement regarding the approach as proposed.

Anonymous Respondent A

The respondent provided broad agreement regarding the approach as proposed. BIS can confirm that a comprehensive methodology document will be provided.

Anonymous Respondent B

Some of the comments raised by respondent B will be addressed through the provision of a comprehensive methodology document for the input cost indices, including:

- Periodicity of updating the basket of goods
- Sample and data collection methods for the basket of goods
- Use of arithmetic vs. geometric mean
- The use of an un-weighted approach vs. weighted approaches

The respondent also suggested that output prices should be measured directly (although does not provide a suggestion for how this might be done given the declining use of Bills of Quantity). However, BIS believes that this approach would result in similar sampling issues that affect the current series. This also suggests a construction project focused methodology which is an approach that, in agreement with ONS, BIS wish to move away from. Our approach is concerned with measuring cost/price movement at an industry/sector level rather than a project level (where aggregation issues exist).

AECOM have undertaken extensive research to update the methodology for both input costs and output prices over the past calendar year, given various studies that have drawn into question the reliability of the current approach¹¹¹²¹³. AECOM and ONS have evaluated numerous alternative approaches and methodologies, presented at four stakeholder meetings/presentations, and contributed to the recent consultation exercise to assess fitness for purpose.

¹¹ [Davis Langdon Report](#)

¹² [BIS response to Davis Langdon report](#)

¹³ [Results of consultation on the uses of construction price and cost indices](#)

The respondent questioned the use of the market indicator, and requested greater clarity on this. BIS can confirm that the market indicator as proposed is to be used as an adjustment factor to the input cost series, and is not independent of input costs. Following the outcome of the consultation exercise, we are modifying our approach to the estimation of the market indicator to address various concerns raised.

Anonymous Respondent C

The respondent provided broad agreement regarding the approach as proposed, although noted some concerns regarding the conversion of input costs to output prices. Following the consultation exercise, the composition of the market indicator has been revised to address the various concerns raised.

Annex B – ONS proposed methods

Suggested methods for producing construction output price indices (July 2014)

Andrew Banks, Office for National Statistics

Introduction

This note sets out a selection of methods that could be used to produce construction output price indices. These represent the prices that contractors will charge their clients for undertaking a given piece of construction work. In all methods, we estimate the output price index by applying an adjustment factor (or a 'markup' term) to construction input prices. These represent all of the resource costs faced by the contractor such as materials and labour, which will clearly be key determinants of output prices.

We start with a basic framework that attempts to model a time varying markup ratio for the entire construction industry. Subsequent sections then set out how this methodology could be expanded to derive sub industry markup terms.

Basic theory

OECD guidance (<http://www.oecd.org/industry/business-stats/2372435.pdf>) indicates that the difference between the output price index and the input price index can be attributed to three elements: profit margins, productivity and overheads. Rather than modelling these three elements separately, we attempt to derive a markup term that should fully encapsulate these elements.

First, all construction firms are assumed to operate under monopolistic competition; hence the output price contractors charge to clients reflects a markup over the cost faced by contractors, as shown in (1).

$$P_t = A_t \cdot C_t \quad (1)$$

P_t is the output price charged by contractors to clients, C_t is the input cost faced by a contractor, and A_t is some markup ratio applied by the contractor.

(1) can be expressed in a log-linear form:

$$p_t = a_t + c_t \quad (2)$$

where logarithms of variables are denoted by lower case letters.

Basic economic theory tells us that in a steady state, this markup should be inversely related to the price elasticity of demand in the market; if demand is more responsive to price movements then the markup on costs will be lower.

The most important determinant of price elasticity is the availability of substitutes, or in the case of the construction industry, the number of firms able to bid for a construction contract. Macallan (2008) notes that the markup *“is likely to be lower for business which face greater competition: in more competitive markets businesses are more likely to undercut the prices charged by their rivals and that limits their ability to set price above marginal cost”*.

A wealth of literature supports this notion; for example Martins (1996) shows that average markups are lowest in industries that supply homogenous products and have a greater concentration of firms, i.e. highly competitive industries.

As well as varying by industry and sub industry, an argument can be made for the markup varying over time, along with the business cycle. However there is debate over the relationship between the markup, costs and output prices. Phelps and Winter (1970) suggest that markups are procyclical (they increase as the level of demand increases). Their model assumes that firms can charge a higher markup in one period and reap higher profits, but will suffer lower profits in future periods as customers subsequently switch to competitors. This tradeoff suggests that firms will charge a higher price when current demand is higher than future demand, hence a procyclical relationship.

However this result depends on the relative ‘stickiness’ of output and input prices. These are likely to both respond to the business cycle in the same direction, but may do so at different speeds and timings. Macallan (2008) takes an example of an increase in demand: *“If prices adjust slowly but wages are flexible, then the markup will fall: in order to supply the extra output demanded businesses must employ more labour; that necessitates higher wages, raising marginal costs; and since prices respond more slowly than wages, costs rise faster than prices, reducing the markup. Theory cannot predict whether wages or prices will respond quickest to a change in excess demand and so cannot say how the markup will respond to that change.”*

An alternative set of models exists which suggest a countercyclical relationship for markups, built on the strategic interaction of firms through the business cycle. Rotemberg and Woodford (1992) suggest businesses can engage in implicit collusion and reneging; firms can reduce their price to undercut competitors and obtain a temporary rise in profit that will be offset by lower profits in the future when other firms follow suit. For this reason, firms are more likely to undercut at times when future demand is lower than current demand, hence an inverse relationship between current demand and the markup.

In light of empirical evidence by Macallan (2008) which suggests pro-cyclical of markups in the aggregate UK economy, we assume this also applies to the UK construction industry. Further information on how this can be independently modeled is set out in Section V.

Method 1: Applying a single time varying markup to the entire construction industry and its sub industries

This section sets out the basic framework for modelling the markup in the entire construction industry. As a starting point, this single markup could be applied to each sub industry cost price index to produce a sub industry output price index.

This initial approach presents a practical application to a theoretical factor demand relationship discussed by Ellis (2006) and Macallan (2008). Under a constant returns to scale (CRS), constant elasticity of substitution (CES) production function, they show that the markup for a given unit of output can be expressed as follows

$$A_t = \frac{\varepsilon_{YL_t} \left(\frac{1-\sigma}{\sigma}\right)}{S_t} \quad (3)$$

$$a_t = \left(\frac{1-\sigma}{\sigma}\right) \ln(\varepsilon_{YL_t}) + \ln\left(\frac{1}{S_t}\right)$$

This relates the markup to “*the elasticity of output with respect to labour input, ε_{YL} (reflecting how much extra output can be produced when the business hires an additional unit of labour), divided by the labour share, s (the amount of nominal GDP that accrues to workers in the form of compensation). This relationship will hold in the economy as a whole, as well as for an individual business.*”

In this case, σ is equal to the elasticity of substitution between capital and labour. By assuming $\sigma = 0.4$, which is consistent with the findings of Barnes (2008), we can obtain equation (4):

$$A_t = \frac{\varepsilon_{YL_t}^{1.5}}{S_t} \quad (4)$$

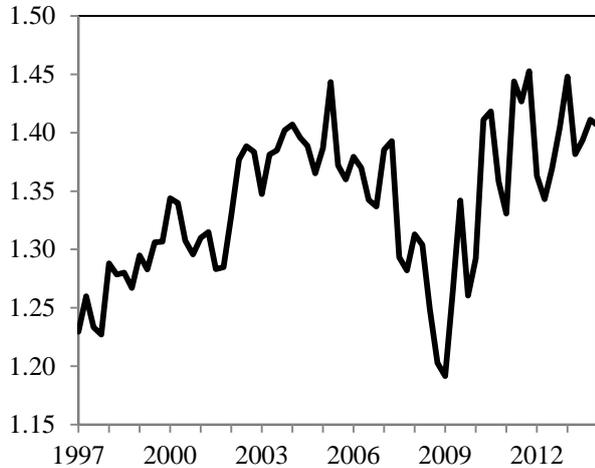
$$a_t = 1.5 \cdot \ln(\varepsilon_{YL_t}) + \ln\left(\frac{1}{S_t}\right)$$

All variables in (4) can be easily accessed from ONS published data. For example, the labour share for the construction industry can be derived as follows:

$$S_t = \frac{\text{Construction employment}_t \cdot \text{Average construction earnings}_t}{\text{Construction GVA in current prices}_t} \quad (5)$$

This is presented in Figure 1, and clearly shows a procyclical trend.

Fig 1. The inverted construction labour share (nominal construction GVA divided by employee compensation in the construction industry)



To introduce ε_{YL} to the model, Ellis (2006) states that the elasticity of output with respect to labour input could be considered to be the deviation of labour productivity relative to a trend level of labour productivity, noting: “the expression offers a simple intuition for change in the markup. When labour productivity is above trend, the markup is rising (conditional on the labour share). When it is below trend, the markup is falling. And the harder it is to swap between capital and labour in production (the lower σ is), the bigger any change in the markup will be.”

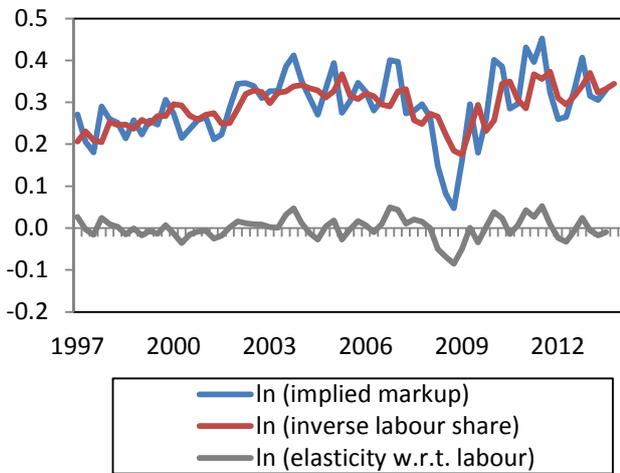
Again, the former can be easily estimated using ONS data as follows:

$$\text{Labour productivity}_t = \frac{\text{Construction GVA (current prices)}_t}{\text{Construction employment}_t} \quad (6)$$

There are numerous methods of estimating the trend level of productivity in a given industry; ranging from the simplest methods (linear line through the data) to more complex methods (such as applying a multivariate filter). We derive a rate of trend productivity by applying a Hodrick-Prescott filter that assumes $\lambda = 1600$.

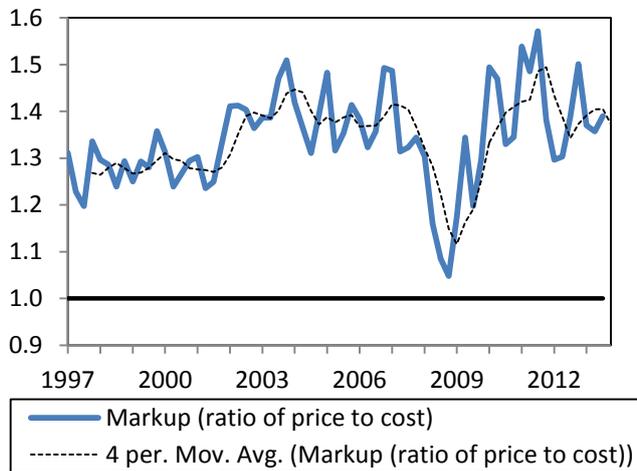
The natural log of the inverse labour share, elasticity of output with respect to labour and the implied construction industry markup is shown in Figure 2, while Figure 3 shows the implied construction industry markup ratio obtained from these components.

Fig 2. The inverse labour share, elasticity of output with respect to labour, and an implied markup for construction (logarithmic scale)



Using this methodology, the construction industry is estimated to have experienced growth in the markup ratio up until the economic downturn, when the ratio fell sharply to just above 1.0 (the point at which construction firms would break even, assuming costs are entirely passed through). The markup ratio recovered in 2010 and 2011 but has since fallen back.

Fig 3. Implied markup for the construction industry (ratio of price to cost, A_t)



To illustrate the impact of the markup of the output price index, Figures 4 and 5 apply estimates of A_t to the current ‘all construction’ cost index supplied by the Department for Business, Innovation and Skills (BIS), by substituting A_t into (2).

Fig 4. Implied output price for the construction industry (2010=100)

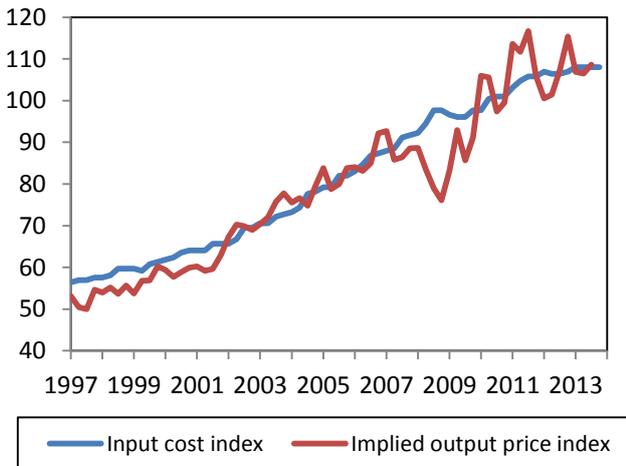
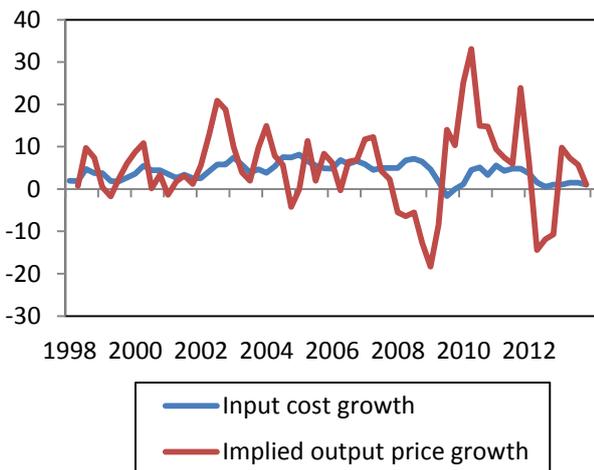


Fig 5. Implied output price inflation for the construction industry (quarter on previous year, %)



This basic framework can be applied to all thirteen construction sub industries (e.g. private house building, infrastructure etc.). To do this, each sub industry level input price index (shown here as C_{nt}) is multiplied by the markup in the total construction industry (A_t), to obtain a sub industry specific output price index (P_{nt}).

$$P_{nt} = A_t \cdot C_{nt} \quad (7)$$

$n \in [1, \dots, 13]$

However this method will not fully capture differences in market structure and capacity level at a sub industry level. Sections IV and V focus on expanding the basic framework to estimate sub industry markup terms.

Method 2: Applying sector level labour share and productivity estimates

In theory, the simplest method of estimating a sub industry output price is to apply sub industry level data to the basic framework in (3). This will result in a sub industry markup term (A_{nt}) that can be applied to sub industry input cost indices as follows:

$$P_{nt} = A_{nt} \cdot C_{nt} \quad (8)$$

$$n \in [1, \dots, 13]$$

However in practice this is not straightforward, as data need to be sourced for GVA, average earnings and employment at a sub industry level to obtain estimates of the labour share and productivity. While GVA data are readily available from the ‘output in the construction industry’ ONS release, earnings and employment data need to be subjected to two conversion processes to present them on a consistent basis.

First, employment and earnings data can only be obtained on a Standard Industrial Classification (SIC) basis, which could be considered as the ‘trade of a firm’. For example on a SIC2007, 2-digit basis data are classified as follows: construction of buildings (industry 41), civil engineering (industry 42) and specialized construction activities (industry 43). These are clearly different categories compared with the thirteen sub industries in the construction output release, which can be considered as the ‘type of work’ undertaken.

As a result both employment and earnings would need to be converted from a SIC basis to a ‘type of work’ basis. This could be undertaken by apportioning weights to the SIC series, using data on the value of work done by trade of firm and type of work, which is presented in Table 2.8 of the annual ‘Construction Statistics’ ONS publication.

Second, employment and employee compensation data are only available prior to 2008 on a SIC2003 basis. This would mean that in addition to the conversion process set out above, the data would need to undergo a SIC2003 to SIC2007 conversion. While both processes should be relatively straightforward, this would add to the practical difficulties of estimating output prices on a regular basis.

Finally, sub industry level data are available on a less timely basis compared with earnings and employment data for the entire construction industry that are obtained from the ONS monthly labour market statistics. For this reason, sub industry employment and earnings data will need to be forecast at the tail end of the data. Lower level employment and earnings data are likely to exhibit greater levels of volatility, so a smoothing process should also be considered.

While there are practical difficulties in implementing this method, it is likely to be theoretically superior compared with the method set out in (7).

Method 3: Separately modelling the effect of spare capacity in construction sub industries

The method set out in Section IV could be considered to be the optimal approach to measuring sub industry output price indices. However, in light of the practical difficulties that would occur in undertaking this, this section sets out a third method that separately models the effects of competitiveness and spare capacity in construction sub industries to obtain a sub industry markup term. This method is much simpler to undertake in practice, but also utilizes more timely data so does not need to be forecast at the tail.

To separately model the effect of spare capacity in each sub industry, we can refine (2) as follows:

$$\begin{aligned} P_{nt} &= I_{nt} \cdot C_{nt} & (9) \\ p_{nt} &= i_{nt} + c_{nt} \\ n &\in [1, \dots, 13] \end{aligned}$$

The sub industry specific markup term (I_{nt}) replaces the construction industry markup (A_t), where (I_{nt}) can be defined as follows:

$$\begin{aligned} I_{nt} &= A_t^{(1-\delta_n)} \cdot B_{nt}^{\delta_n} & (10) \\ i_{nt} &= (1 - \delta_n) \cdot a_t + \delta_n \cdot b_{nt} \end{aligned}$$

where the refinement on (4) is the introduction of an industry specific capacity term, (b_{nt} , which represents the level of spare capacity in each sub industry relative the level of spare capacity in the total construction industry). This affects the markup by a constant, δ_n (reflecting the impact of additional spare capacity on the markup).

In summary, this assumes that the markup in a given sub industry is influenced to some extent by the implied markup in the entire construction industry (derived in Section III), as well as the level of additional spare capacity experienced in the sub industry relative to the total construction industry.

The industry specific spare capacity term (b_{nt}) can equate to the output gap in a given sub industry relative to the output gap in the entire construction industry. Both output gap series have been estimated using output relative to HP-filtered output (again this assumes $\lambda = 1600$).

To apply these estimates of spare capacity to the markup, we need to define the industry specific constant term, δ_n . We assume that 1 percentage point change in additional spare capacity in the sub-industry results in a +0.013 absolute change in the markup. This is consistent with the findings of Macallan (2008) at the whole economy level.

Taking the example of new private house building, Figure 6 shows the implied markup in this sub industry against the markup estimated for the entire construction industry. This shows that the private house building sub industry is estimated to have experienced a sharper fall in the markup during the downturn, and a slightly stronger pickup in the most recent period.

Fig 6. Implied markup in the private house building sub industry against the markup for the entire construction industry (ratio of price to cost)

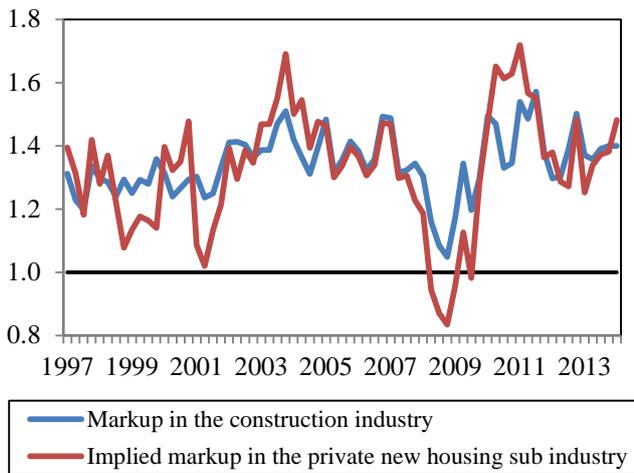
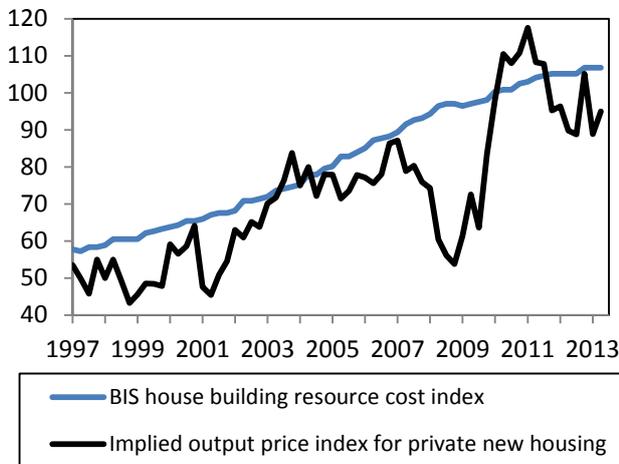


Figure 7 applies estimates of the private house building markup to the current house building resource cost index supplied by the Department for Business, Innovation and Skills (BIS), by substituting I_{nt} into (9).

Fig 7. Private house building output price index under the following assumptions ($\delta_n = +0.013$), 2010=100



REFERENCES

Barnes, S, Price, S and Barriel, M, “The elasticity of substitution: evidence from a UK firm-level data set,” *Bank of England Working Paper no. 348*, Apr. 2008.

Ellis, C, “Elasticities, markups and technical progress: evidence from a state-space approach,” *Bank of England Working Paper no. 300*, Jul. 2006.

Macallan, C, “The cyclicity of markups and profit margins for the United Kingdom: some new evidence,” *Bank of England Working Paper No. 351*, Aug. 2008.

Martins, J, "Markup pricing. Market structure and the business cycle," *OECD Economic Studies No. 27*, 1996.

Phelps, E S and Winter, SG, "Optimal price policy under atomistic competition," *Microeconomic foundations of employment and inflation theory*, 1970.

Rotemberg, J and Woodford, M, "Oligopolistic pricing and the effects of aggregate demand on economic activity," *Journal of Political Economy*, 1992.

Annex C – List of Respondents

Bank of England
Building Cost Information Service
Education Funding Agency
HM Treasury
Office for National Statistics

3 responses from individuals

© Crown copyright 2014

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. Visit www.nationalarchives.gov.uk/doc/open-government-licence, write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or email: psi@nationalarchives.gsi.gov.uk.

This publication available from www.gov.uk/bis

Any enquiries regarding this publication should be sent to:

Department for Business, Innovation and Skills
1 Victoria Street
London SW1H 0ET
Tel: 020 7215 5000

If you require this publication in an alternative format, email enquiries@bis.gsi.gov.uk, or call 020 7215 5000.

BIS/14/1200