

**dti**



## **Review of early estimates of construction output for GDP in 2003**

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### **Introduction**

The Department of Trade and Industry (DTI) is responsible for the main official information on the output of the construction industry in Great Britain, which is both published quarterly by DTI and is supplied to the Office for National Statistics (ONS) to inform their releases on quarterly National Accounts. DTI publish a National Statistics release on quarterly construction output in the first week of the third month following the end of the quarter, and these figures are supplied to ONS for their *Quarterly National Accounts First Release*, published towards the end of the third month (Month 3 or M3).

DTI also supply ONS with estimates of construction output for their estimates of GDP published in the first and second months following the end of the quarter, known as the Month 1 (M1) and Month 2 (M2) estimates. In the first two quarters of 2003, these estimates did not accurately predict the figures published by DTI at M3, leading in the second quarter to a revision to GDP growth from 0.3% to 0.6%. Following the publication of the *Quarterly National Accounts First Release* for Q2 2003, ONS and DTI announced that they would be carrying out a joint review in two phases; firstly to identify the causes of the revisions; and then to identify options for improving the early estimation of construction output. This paper completes the first phase of the review.

### **Summary of Conclusions**

The main conclusion of this part of the review is that it was the unforeseen fall in construction output in Q1 2003 that largely contributed to the revision in the estimate of both Q1 and Q2 construction output. This was both because of the effect it had on the estimation models, and because it caused DTI to be more cautious in forecasting a return to positive growth in Q2 2003 than might otherwise have been the case. This downward revision in the estimate of Q1 construction between M2 and M3 was not apparent in the Q1 GDP figures because of an upward revision in the services sector.

The following recommendations are made:

1. Work should continue on the development of the Activity Balances model and to improve the understanding of the relationship between early survey data and that available at M3;
2. Research should be undertaken to explain the unexpected fall in Q1 2003;
3. Further work should be undertaken to identify other methods of producing accurate early estimates of construction output, such as a small monthly survey.

### **Background**

Construction is responsible for about 5.4% of national GDP, and is one of the largest economy sectors not included in the ONS monthly collections of data which result in the Index of Production and the Index of Services. DTI produces official information on construction, and so provides ONS with information for inclusion in the estimates

of GDP published at M1, M2 and M3. However, DTI do not have full survey information available at M1 and M2, and so supply ONS with estimates produced using economic models and accessing incomplete survey returns. These estimates are produced specifically for ONS. DTI do not provide them to other users.

### **The Month 1 estimate**

The Month 1 estimate of GDP, *Gross Domestic Product – preliminary estimate First Release*, is published by ONS at the end of the first month following the relevant quarter, and so DTI have to provide information on construction to ONS within two weeks of the end of the quarter. At this stage, DTI typically have received no more than 5% of survey returns, and so uses economic models to provide ONS with the M1 estimate.

The first model uses the results from a monthly survey of construction orders and contracts (also published by DTI as a National Statistic). The second model, introduced in autumn 2002 following the recommendations of an interdepartmental working group, uses monthly information on activity balances. More detailed descriptions of the models used are provided in annex A.

### **The Month 2 estimate**

The Month 2 estimate, *UK Output, Income and Expenditure First Release*, is published by ONS at the end of the second month following the relevant quarter, and DTI provide information within the first week of that month. This estimate was historically produced by rerunning the orders model described above, with revised orders information. Over the last few quarters DTI has accessed early survey returns to supplement the model, and it is hoped to place increasing reliance on early survey returns as a picture of their relationship to final survey returns is established. More information on the results of early survey returns is provided in annex B.

### **The Month 3 estimate**

The DTI publish a quarterly National Statistics release *Output and Employment in the Construction Industry*, which reports on the output of the industry during the latest quarter, including an analysis by region, sector and subsector. The information from this release is provided to ONS for inclusion in their *Quarterly National Accounts First Release*. The information from this release is compiled by combining three sources of information:

- a quarterly survey of construction companies, covering 12,000 of the 168,000 VAT-registered construction companies in Great Britain and stratified by employment;
- a quarterly census of 236 public sector Direct Labour Organisations (DLO), mostly local authority maintenance teams;
- an estimate of the output of self-employed construction workers and companies not registered for VAT, known as the unrecorded estimate.

This release is published by DTI just over two months after the end of the relevant quarter, on the first Friday of March, June, September and December each year.

## The 2003 estimates

The estimates provided to ONS at M1 and M2 in the first and second quarters of 2003 were subject to greater than usual revision at M3 when the full survey results became available. The table below gives the estimates provided to ONS – this may differ slightly from those published in the various GDP releases, as adjustments are made for Northern Ireland and definitional differences between the DTI information and National Accounts requirements. The effect on GDP is the estimated result on GDP growth of the construction estimate.

	Month 1		Month 2		Month 3		Revision M1-M3
	DTI estimate	Effect on GDP	DTI estimate	Effect on GDP	DTI estimate	Effect on GDP	
<b>Q1 2003</b>	3.1	0.2	3.1	0.2	-2.6	-0.1	-0.30
<b>Q2 2003</b>	-0.4	0.0	0.9	0.1	5.3	0.3	0.30
<b>Q3 2003</b>	1.2	0.1	2.5	0.1	1.9	0.1	0.04

The construction-related GDP revisions at Q1 and Q2 2003 were the largest ever. The revisions at Q2, which were published in conjunction with revisions to manufacturing and services, as well as the rebasing of GDP figures from 1995 prices to 2000 prices, caused much comment.

### Revision to Q1 2003

The M3 estimate of construction change in Q1 was a fall of  $-2.6\%$ . This was a surprise fall, following over two years of continuous industry growth, and was not foreseen at the M1 or M2 stages. On its own, the revision to the estimate for construction output revised GDP growth down by  $-0.3\%$ , although off-setting revisions elsewhere, notably in the service sector, resulted in an overall revision to GDP growth of just  $-0.1\%$  (from  $0.2\%$  to  $0.1\%$ ).

The M1 estimate of Q1 growth was  $3.1\%$ , following strong orders growth over the previous year, and output growth of  $2.1\%$  in Q4 2002. When early survey returns were considered at M2, they showed a fall of  $7.7\%$ . However this was discounted because:

- The relationship between early and final survey returns was still to be established. This was only the second quarter for which early returns had been considered, and performance in Q4 2002 was not strong, giving change of  $-0.4\%$  compared to a final M3 change of  $+2.1\%$ ;
- The response rate by strata at M2 does not show the same pattern as that at M3 – the middle strata are faster to respond than both the smallest and largest firms and it seemed probable that the later returning large firms, responsible for  $50\%$  of industry output although forming just  $2\%$  of firms on the DTI Register, would show stronger growth (see Annex B for response rates);
- Given strong orders figures over the past year and continued output growth over the past two years, a large fall seemed unlikely.

However, when M3 information was produced for the DTI release on 6th June 2003, it became obvious that the higher strata had not shown the growth expected once the

returns were in. The following table shows the change at M3 in each component of total output – for an explanation of the strata see Annex B:

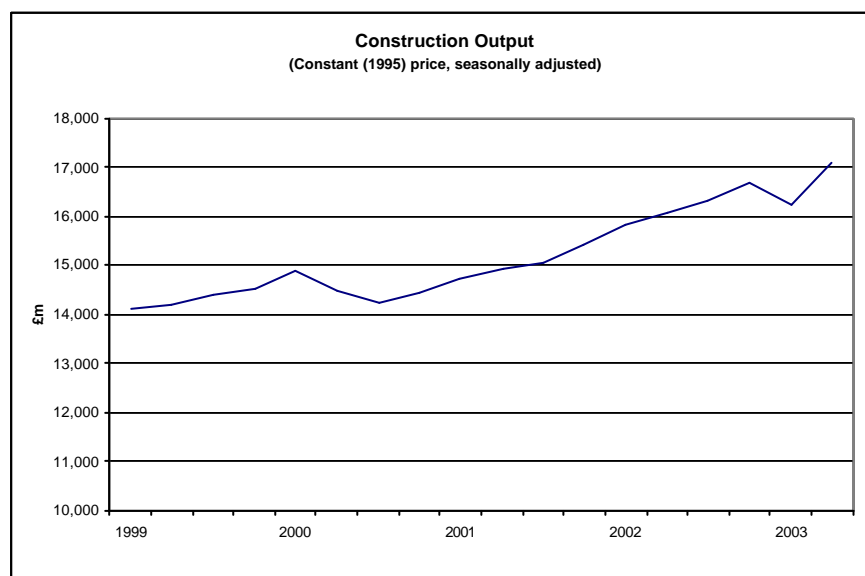
**Change between Q4 2002 and Q1 2003 by component, current prices**

Component		Share of total in Q1	% Change
Recorded output	Strata 0-5	30%	+2.5
	Strata 6-13	51%	-7.5
Total Recorded Output		81%	-4.3
Unrecorded Output		16%	-10.4
Direct Labour Organisations		3%	+10.8
Total			-4.9

**Revision to Q2 2003**

Following the surprise fall in Q1 2003, the M1 estimate for Q2 2003 was that construction output would fall again, by -0.4%. This was reported as “unchanged” given the extremely provisional nature of the estimate. This was largely based on the New Orders model. The Activity Balances model showed a rise of 0.9%, which seemed high given the fall in the previous quarter. The Activity Balances model was also run with an adjustment to remove the fall at Q1, and gave a rise of 4.4% for the second quarter. This seemed at the time to be even less likely.

When early survey returns were considered at M2, they again showed a rise of 4.5%. This still seemed too large an increase, however it did now seem likely that there would be a rise at Q2, and so the M2 estimate supplied to ONS was a rise of 0.9%. However when M3 information was produced for the DTI release on 5th September, it became clear that the industry had more than just recovered from the Q1 fall, it had returned to its previous trend with a rise of 5.3%. The following graph shows construction output over the past few years:



This change in the estimate was partially responsible for a revision to GDP of 0.3%.

## **Conclusions**

Consideration of the recent performance of the construction industry in Great Britain suggests that it was the Q1 output figure which was the outlier, not Q2. However, a small upwards revision to the much larger services sector of the economy balanced the downwards movement of the construction estimate between M1 and M3, and minimised the overall effect on GDP to a revision of growth from 0.2% to 0.1%.

The M1 estimate for construction in the second quarter was then far too low, as no one anticipated that the industry would recover as quickly as it did, and the inaccuracy of the Q1 M1 and M2 estimates caused more cautious estimates to be made. Publication of the revisions to construction coincided with the publications of revisions to other important economic series, including to historic GDP figures, generating widespread concern about the quality of economic data used for policy purposes.

In both quarters, the early survey data used at M2 reported the correct direction of change, although it sometimes over-estimates the level. This was also shown when the third quarter estimates were made, and suggests that although there is still great variation between M2 and M3 results, this data will become increasingly useful as it is better understood.

## **Recommendations**

- Work should continue on the development of the Activity Balances model and to improve the understanding of the relationship between early survey data and that available at M3;
- Research should be undertaken to explain the unexpected fall in Q1 2003;
- Further work should be undertaken to identify other possible methods of producing accurate early estimates of construction output, such as a small monthly survey.

**The Month 1 estimate**

The Month 1 estimate is used by ONS to inform the GDP figures published in the *Gross Domestic Product – preliminary estimate First Release*. DTI are required to provide this estimate usually within the first week following the end of the quarter, at which point very few survey forms have been returned. Because of this, the Month 1 estimate is model based. The detailed figures are those used before the rebasing to 2000 prices, and will have to be reworked before the next Month 1 estimate.

The Orders model has been used for several years and uses information from the DTI Monthly Inquiry of Contracts and New Orders (results of which are published monthly as a National Statistic) to model New Work output. At the time at which ONS request the data, two months of the relevant quarter are available, and the third is estimated from previous trends. For each of the 6 new work sectors, a series known as composite orders is calculated using the weighted sum of orders placed over the last few quarters, excluding orders over £150 million.

The weights and number of quarters used varies between sectors to reflect the different size and type of work carried out – for example infrastructure contracts tend to take longer than other types of work – and are calculated using information on duration and work flow from the DTI’s monthly new orders inquiry and quarterly survey of projects in progress. The weights used for each sector are:

<b>Sector</b>	<b>Composite Orders</b>
Public Housing	$0.24*q(t) + 0.24*q(t-1) + 0.19*q(t-2) + 0.14*q(t-3) + 0.1*q(t-4) + 0.06*q(t-5) + 0.02*q(t-6) + 0.01*q(t-7)$
Private Housing	$0.21*q(t) + 0.18*q(t-1) + 0.16*q(t-2) + 0.14*q(t-3) + 0.1*q(t-4) + 0.1*q(t-5) + 0.06*q(t-6) + 0.03*q(t-7) + 0.02*q(t-8)$
Infrastructure	$0.17*q(t) + 0.23*q(t-1) + 0.19*q(t-2) + 0.14*q(t-3) + 0.11*q(t-4) + 0.08*q(t-5) + 0.04*q(t-6) + 0.02*q(t-7) + 0.01*q(t-8) + 0.01*q(t-9)$
Public Non-housing	$0.12*q(t) + 0.21*q(t-1) + 0.19*q(t-2) + 0.17*q(t-3) + 0.15*q(t-4) + 0.11*q(t-5) + 0.04*q(t-6) + 0.01*q(t-7)$
Private Industrial	$0.26*q(t) + 0.3*q(t-1) + 0.19*q(t-2) + 0.12*q(t-3) + 0.07*q(t-4) + 0.03*q(t-5) + 0.01*q(t-6) + 0.01*q(t-7) + 0.01*q(t-8)$
Private Commercial	$0.15*q(t) + 0.26*q(t-1) + 0.22*q(t-2) + 0.16*q(t-3) + 0.09*q(t-4) + 0.07*q(t-5) + 0.02*q(t-6) + 0.02*q(t-7) + 0.01*q(t-8)$

where  $q$  is the quarterly orders total for the  $t^{\text{th}}$  period, and  $t$  is the relevant quarter.

A series of sector-specific equations are then applied to the composite orders figures for the reference quarter to estimate New Work output in that sector for the quarter. These equations have been calculated by regressing composite orders against actual output in the Long Term (since 1983) and the Short Term (since 1990), and are reworked regularly. The equations used are given below:

Sector	Long Term	Short Term
Public Housing	-4.339 + 1.0849y	13.035 + 1.0825y
Private Housing	538.236 + 0.6532y	953.282 + 0.3502y
Infrastructure	-267.812 + 1.5629y	119.374 + 1.2019y
Public Non-housing	-77.156 + 1.2221y	215.288 + 0.9490y
Private Industrial	37.637 + 1.0914y	109.554 + 1.0496y
Private Commercial	12.6274 + 1.0876y	-47.788 + 1.2321y

where y is the composite orders total for the relevant sector.

The values produced by both models are well below actual output levels, so the growth over the previous quarter estimate is taken, and applied to previous actual output to produce a sector estimate. These are then summed to produce a New Work estimate.

Orders figures are not available for Repair and Maintenance (R&M) output, and hence each sector (public housing, private housing, public non-housing and private non-housing) is extrapolated from previous output trends. These sectors are summed to produce a Repair and Maintenance estimate. The New Work and R&M estimates are combined to produce an estimate of total construction output.

### The Activity Balances Model

The Activity Balances model was developed by Experian on behalf of DTI following the recommendations of an interdepartmental working group in 2002. It uses the results of a monthly survey of activity balances within the construction industry to estimate the performance of the whole industry (rather than by sector as the DTI model does). Details are given below – adjustments are made to data for Q1 1998 and Q1 2000 to smooth out spikes in the output series:

Ordinary Least Squares

QUARTERLY data for 38 periods from 1991Q3 to 2000Q4

Date: 10 JUL 2002

dlog(otot)

$$\begin{aligned}
 = & 0.01682 * \text{spike}(98,1) - 0.03713 * \text{spike}(98,1)[-1] \\
 & (2.35815) \qquad \qquad \qquad (-5.27479) \\
 & + 0.01973 * \text{spike}(100,1) - 0.02879 * \text{spike}(100,1)[-1] \\
 & (2.80353) \qquad \qquad \qquad (-4.09570) \\
 & + 0.00023 * \text{CFR} + 0.00688 \\
 & (4.99657) \qquad \qquad \qquad (4.52983)
 \end{aligned}$$

Sum Sq 0.0015 Std Err 0.0069 LHS Mean 0.0017  
R Sq 0.7322 R Bar Sq 0.6903 F 5, 32 17.4942  
D.W.( 1) 1.9906 D.W.( 4) 2.1178

Chow test of stability for break after 1997Q4  
12 observations from end of sample  
F( 2, 30): 0.6070 ( based on three regressions )

Where:

OTOT	All work, 1995 prices, seasonally adjusted
Spike(yy,q)	a dummy variable for year “yy” quarter “q”
CFR	The seasonally adjusted CFR (Construction Forecasting and Research, now part of Experian) all work output balance for the first two months of the quarter and the last month of the previous quarter.

During the development of this model, several other possible input variables were analysed, including economic data, materials deliveries, rainfall data and other work or activity measures. These did not prove successful, although activity data from the Construction Confederation also showed a good relationship. However the CFR data were preferred because they are timelier and are available monthly. Experian continue to experiment with other input series as they become available – for example recent work has looked at temperature and hours of sunshine.

**The Month 2 estimate**

The Month 2 estimate is supplied to ONS at the beginning of the second month following the reference quarter, for inclusion in the *UK Output, Income and Expenditure First Release*. Originally it was based on the DTI model rerun to include complete quarterly orders data. However, following the recommendations of an interdepartmental working group in 2002, work was carried out to make it possible to access early returns to the DTI Quarterly Inquiry of Construction Activity. At the same time, working practices were changed within DTI to ensure that as many returns as possible had been validated by the time the Month 2 estimate was due, rather than simply focusing on the DTI publication deadline a month later.

The results of these early survey returns have been used since the estimate for Q4 2002. They have been of varying accuracy and DTI are still building up an understanding of how the information received at this stage compares to that received by a month later. In addition, the Quarterly Inquiry is the source of around 81% of output, and hence any changes to the unrecorded estimate (16%) or the estimate of Direct Labour Organisation output (3%) will not be picked up at M2 stage. However, for the last two quarters this information has been used to increase the estimate of growth made at Month 1.

**Response Rates at M2 and M3 in Q1 and Q2 2003 by Strata**

Strata	Employment	Month 2 Q1 2003	Month 3 Q1 2003	Month 2 Q2 2003	Month 3 Q2 2003
SG0	1	0.53	0.75	0.29	0.56
SG1	2-3	0.52	0.77	0.29	0.62
SG2	4-7	0.51	0.76	0.28	0.65
SG3	8-13	0.50	0.74	0.31	0.69
SG4	14-24	0.51	0.75	0.30	0.66
SG5	25-34	0.48	0.76	0.33	0.68
SG6	35-59	0.52	0.75	0.33	0.68
SG7	60-79	0.45	0.70	0.30	0.66
SG8	80-114	0.47	0.74	0.26	0.70
SG9	115-299	0.39	0.67	0.25	0.62
SG10	300-599	0.38	0.65	0.25	0.67
SG11	600-1,199	0.36	0.65	0.14	0.60
SG12&13	1,200 +	0.40	0.58	0.24	0.70
Total		0.50	0.75	0.30	0.66

**Notes**

1. This table shows the percentage of responses returned and validated at the relevant stage
2. SG stands for Size Group. Size Groups 6 and above are sampled at 1 in 1
3. Size Groups 12 and 13 are combined here because of their small size – in 2002 there were just 57 firms in these two strata. This also means that a few returns can make a large difference to their response rate.