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Sources of Revisions to Labour Productivity Statistics

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Summary

This note breaks down the source of revisions to ONS labour productivity statistics between revisions to output and revisions to labour input estimates. In terms of annual growth rates, labour productivity growth can be thought of as growth of output *minus* growth of labour input.

At the whole economy level, ONS standard revisions analysis shows that productivity growth has tended to be revised down by some 0.2-0.3 percentage points (pps) for the period 2004Q1 to 2008Q4. The analysis in this note shows that this is mainly due to downward revisions to output growth; revisions to labour input growth have been nil on average or very small upward adjustments. Unsurprisingly, revisions to output and labour input growth are strongly correlated. Additionally, there is some evidence that the size of revisions to output growth have increased over the period reviewed.

At the sectoral level, revisions to growth of manufacturing labour productivity have been positive on average (1.2 pps for the preferred measure of output per hour). Two-thirds of this reflects downward revisions to growth of labour input, with the remaining third due to upward revisions to growth of manufacturing output. Unlike the whole economy estimates, there is no evidence that the size of revisions have changed over time. But the correlation between revisions to growth of output and labour input is much weaker than at the whole economy level.

For services, productivity growth has tended to be revised down by 0.7 pps, most of which reflects downward revisions to output growth; labour input growth being revised upwards slightly on average.

Growth of unit labour costs (ULCs) can be thought of as growth of labour costs per hour *minus* growth of output per hour. At the whole economy level, revisions to growth of labour cost per hour can be significant but have tended to net out over time, so the average revision to ULC growth is equal to the average revision to growth of output per hour with the sign reversed.

The pattern of revisions changes over time, and the results in this note are sensitive to the length of time over which revisions are analysed.

Introduction

Labour productivity is defined as output per unit of labour input. Labour Productivity estimates are obtained by dividing measures of output by some measure of labour input i.e. number of workers, number of filled jobs or number of hours worked. The Office for National Statistics (ONS) publishes Labour Productivity Statistics on a quarterly basis, for the UK whole economy and at section and sub-section levels. These productivity estimates are derived statistics as their source inputs (output and labour input) are obtained from other ONS statistics. Revisions to productivity estimates therefore reflect revisions to either or a combination of its component output and labour input measures. Revisions could also be a result of changes to the methodologies used in estimating output, labour input or labour productivity itself. Revisions published in the Labour Productivity bulletin (Table R1) show the changes in the growth rates of the productivity estimates i.e. year on year and quarter on quarter changes, between the current publication and the last published estimates. The bulletin also contains an analysis of average revisions to high level estimates in the revisions triangles. These

triangles show historic revisions to productivity estimates from first release onwards and form the basis of our analysis of revisions to Labour Productivity estimates.

This paper will evaluate and explain these sources of revisions and their effects on productivity estimates.

Revisions to Output

Quarterly National Accounts are published approximately ninety days after the end of the period to which they relate. Owing to availability of more data for previous periods, revisions are usually permitted up to the first quarter of the previous calendar year. For instance, revisions to data for the first quarter of 2010 can be implemented in subsequent publications up to the fourth quarter 2011 release. These revisions are usually applied at a quarterly balancing round, prior to the publication of the quarterly accounts. As well as the quarterly balancing, an annual Supply and Use balancing is carried out to ensure consistency and coherence of national accounts components and to obtain a single estimate of GDP. More details of sources of GDP estimates and their revisions can be found in Walker et al (2012). In brief, the sources of revisions to quarterly output estimates include:

- Quarterly balancing, where quarterly sources for the expenditure and income components of GDP are more complete, and together with the output component lead to revisions at the balancing round.
- Annual Supply and Use balancing as mentioned above.
- Revisions to annual GDP estimates could also lead to revisions to the quarterly paths.
- Changes to methods and data sources.
- Changes to international standards and frameworks could also affect previously published estimates, as new standards are applied retrospectively.

Revisions to Labour Inputs

Labour input measures used in productivity estimation include the number of workers, filled jobs and hours worked. The Labour Force Survey is the source of data on the number of workers in the UK, and this is used in productivity estimation at the whole economy level. The number of filled jobs, also known as productivity jobs is derived from two principal sources, the Labour Force Survey and Workforce Jobs from the Short Term Employment Survey (STES). The third measure of labour input, hours worked or productivity hours is the product of estimates of average hours (derived from the LFS) and productivity jobs. While the LFS is considered the preferred source of whole economy headcount figure (number of workers), Workforce Jobs provides a more reliable industry breakdown of labour input.

Revisions to Labour Force Survey

The Labour Force Survey is a quarterly household survey which provides information about employment in the UK. The LFS also provides an estimate of average hours worked within the economy for the survey period. There are two principal sources of revision to LFS data; reweighting the survey estimates to match population estimates and changes to seasonal adjustment methods.

- Reweighting to population estimates: The LFS survey is weighted to whole economy estimates using mid-year population estimates (MYEs) for UK and the regions and sub-national population projections. Mid-year population estimates are published annually, and population projections are

made based on the latest published estimates. Periodically, mid-year estimates for previous years are also revised. For instance, in May 2011, ONS published revised estimates for mid-2002 to mid-2008 population estimates for UK, England and Wales, Scotland and Northern Ireland. The availability of new population data replacing projected estimates and revisions to previous estimates affect the aggregate and regional number of workers, jobs and hours used in calculating productivity estimates for the whole economy and the regions.

- Seasonal Adjustment: This applies to the Actual Weekly Hours Worked data published from the LFS on a whole economy level and by gender. When calendar effects distort the seasonal trends of this series, adjustments are made to the parameters used in adjusting the data to account for these seasonal factors. These adjustments and the revisions they create are however of minimal impact to the productivity hours used in labour productivity. This is because the labour productivity branch calculates a slightly different estimate of hours, including workers with second jobs, which are excluded in the published average hours from the LFS. Secondly, within the productivity system, seasonal adjustment is applied to productivity hours, which is a product of average hours and productivity jobs. As such, the seasonal adjustment differs from that used by the LFS for its Average Weekly Hours.

Revisions to Work Force Jobs

Workforce jobs (WFJ) is a quarterly measure of the number of jobs in the United Kingdom (UK) by industry, and is the main source of the industry distribution of labour input for Output per job productivity estimates. WFJ combines data from a range of surveys and administrative sources comprising employee jobs (EJ) from employer surveys, self-employed jobs (SEJ) from the LFS, and government supported trainees (GST) and Her Majesty's Forces (HMF) obtained from administrative sources. ONS publishes annual articles on Revisions to Workforce Jobs outlining the sources and effects of WFJ revisions within the year. Due to the composite nature of WFJ estimates, the sources of revisions vary from year to year. However, a regular source of revision to WFJ is the annual benchmarking of GB quarterly employee jobs series to the latest Business Register Employment Survey (BRES), formerly the Annual Business Inquiry (ABI1).

In estimating Output per job, the industry breakdown of productivity jobs is scaled to the total UK jobs from the LFS. As such, revisions to WFJ estimates affect the industry spilt of jobs in the economy, rather than the total number of jobs.

Analysis of Revisions to Labour Productivity Estimates

For each quarterly Labour Productivity publication, revisions triangles are published to show a historic trend of revisions to certain productivity estimates over time. The revisions triangles also include an analysis of revisions to year on year growth rates, between first estimates and their value after three years, for a 20 quarter period up to the latest quarter for which a three year revision history is available. Where 20 quarters of data are not published in the revisions triangles, historic data have been used to complete the tables to 20 quarters. The three year revisions comparison table also provides a statistical test for the significance of the revisions over the period covered. These tables currently show no statistical significance caused by revisions to the productivity estimates over the period assessed. Revisions triangles are published along with the Labour Productivity statistical bulletin on a quarterly basis.

Further light can be shed on revisions by decomposing the published revisions to year on year growth of the quarterly productivity estimates into their output and labour input components. Using source data for the same publication as each first estimate, we have been able to breakdown the revisions to first estimates three years after publication into their output and labour input components. This was achieved by recording the growth of labour input for each first estimate and for the same period three years later, and computing output growth as the residual.

Points to note:

- This analysis was conducted before productivity estimates for 2012Q1 were finalised, so the published revisions used in this analysis relate to data for 2004Q1 to 2008Q4, that is, the 20 quarters ending three years before the last published estimates.
- Analysis of revisions over a three year period after first publication is standard ONS practice and designed to allow sufficient time for revisions to take effect. However, this is not to say that ONS estimates are not subject to revision more than three years after initial publication, and the results in this note would differ if a different revision were used.
- Equally, the analysis of three-year revisions on a rolling period of five years or 20 quarters is standard ONS practice. Again, the results in this note are sensitive to this parameter.

Whole Economy Output per Job

Labour productivity is computed as output divided by labour input. As such, productivity estimates increase when output is revised upwards or labour input is revised downwards and decrease if the reverse was the case. Changes to output and labour input offset each other if they move in the same direction. In the analysis below, revisions to growth in labour productivity are broken down into components due to revisions to labour input and output growth.

On the whole economy level, Table 1 shows revisions to year on year growth of Output per job estimates. The revisions estimates are the difference between the value of first publications and their value three years later. This analysis attempts to break down these revisions into their output and labour input sources, i.e. revisions due to changes in growth of output and/or changes to growth of labour input. The average revisions for the 20 quarters in the table shows that between the three year period, Output per job has on average been revised downwards by 0.3pps, driven largely by downwards revisions to output (-0.2pps) and marginal upwards revisions to growth of jobs (0.1pps). The average absolute revisions, i.e. revisions irrespective of their sign shows that on average, quarterly revisions to growth of output (0.6pps) are six times larger than the revisions to jobs (0.1pps).

Table 1: Revisions to growth of whole economy output per job (OPJ) – between first publication and estimates three years later

Period	Revisions to growth of OPJ (pps)	Revisions to growth of Productivity Jobs (pps)	Revisions to growth of Output (pps)
2004 Q1	0.1%	0.4%	0.5%
2004 Q2	0.1%	0.2%	0.3%
2004 Q3	-0.2%	0.1%	-0.1%
2004 Q4	-0.4%	0.1%	-0.3%
2005Q1	-0.2%	0.4%	0.2%
2005 Q2	0.4%	0.2%	0.6%
2005 Q3	0.3%	0.0%	0.3%
2005 Q4	0.3%	0.0%	0.3%
2006 Q1	0.9%	0.0%	0.9%
2006 Q2	0.1%	0.1%	0.2%
2006 Q3	-0.3%	0.1%	-0.2%
2006 Q4	-0.1%	0.1%	0.0%
2007 Q1	-0.5%	0.0%	-0.5%
2007 Q2	-0.4%	0.1%	-0.3%
2007 Q3	-0.2%	0.0%	-0.2%
2007 Q4	-0.3%	0.2%	-0.1%
2008 Q1	-0.1%	0.1%	0.0%
2008 Q2	-0.7%	-0.2%	-0.9%
2008 Q3	-2.2%	-0.3%	-2.5%
2008 Q4	-2.8%	-0.3%	-3.1%
Mean revisions	-0.3%	0.1%	-0.2%
Mean absolute revisions	0.5%	0.1%	0.6%

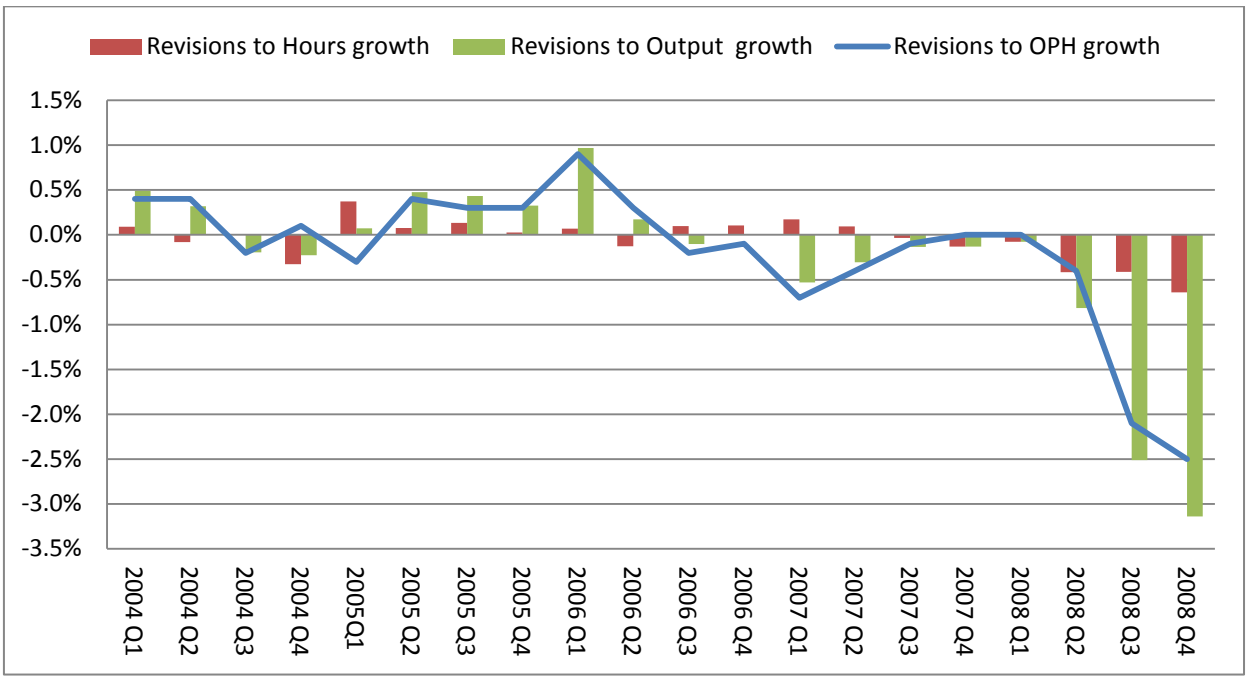
Whole Economy Output per Hour

For revisions to growth in whole economy Output per Hour, Table 2 shows that on average, the driver of quarterly revisions for the 20 quarters to Q4 2008 is similar to that of Output per job for the same period. Revisions to growth in output (-0.2pps) is on average the main driver of revisions to growth in Output per hour, combined with a nil average revision to productivity hours for the period. Figure 1 shows that quarterly revisions to Output per hour were driven by changes to growth in output in all but three quarters of the 20 quarters reviewed.

Table 2: Revisions to YoY growth of whole economy output per hour

2004Q1 to 2008Q4	Output per hour (pps)	Hours (pps)	Output (pps)
Mean revisions	-0.2%	0.0%	-0.2%
Mean absolute revisions	0.5%	0.2%	0.6%

Figure 1: Revisions to YoY growth of whole economy output per hour – between first publication and estimates three years later



Manufacturing Sector

In the manufacturing sector, the picture of revisions to productivity estimates differs from that observed at the whole economy level. While whole economy revisions to output per job and output per hour for the 20 quarters to Q4 2008 were on average driven by revisions to growth in outputs, Table 3 shows that for the manufacturing sector, changes to labour inputs i.e. jobs and hours, were on average the main drivers of revisions to output per job and output per hour for the same period. Table 3 also shows that unlike whole economy trends for both output per job and per hour, on average and in absolute terms, the size of revisions to growth in output are lower (0.6pps each) than revisions to growth of labour inputs (1.0pps and 1.2pps respectively).

Table 3: Revisions to YoY growth of manufacturing output per Job and output per hour

	Manufacturing output per job			Manufacturing output per hour		
2004Q1 to 2008Q4	Output per job (pps)	Jobs (pps)	Output (pps)	Output per hour (pps)	Hours (pps)	Output (pps)
Mean revisions	0.9%	-0.6%	0.4%	1.2%	-0.8%	0.4%
Mean absolute revisions	1.4%	1.0%	0.6%	1.6%	1.2%	0.6%

Figure 2: Revisions to Manufacturing Output per Job – between first publication and estimates three years later

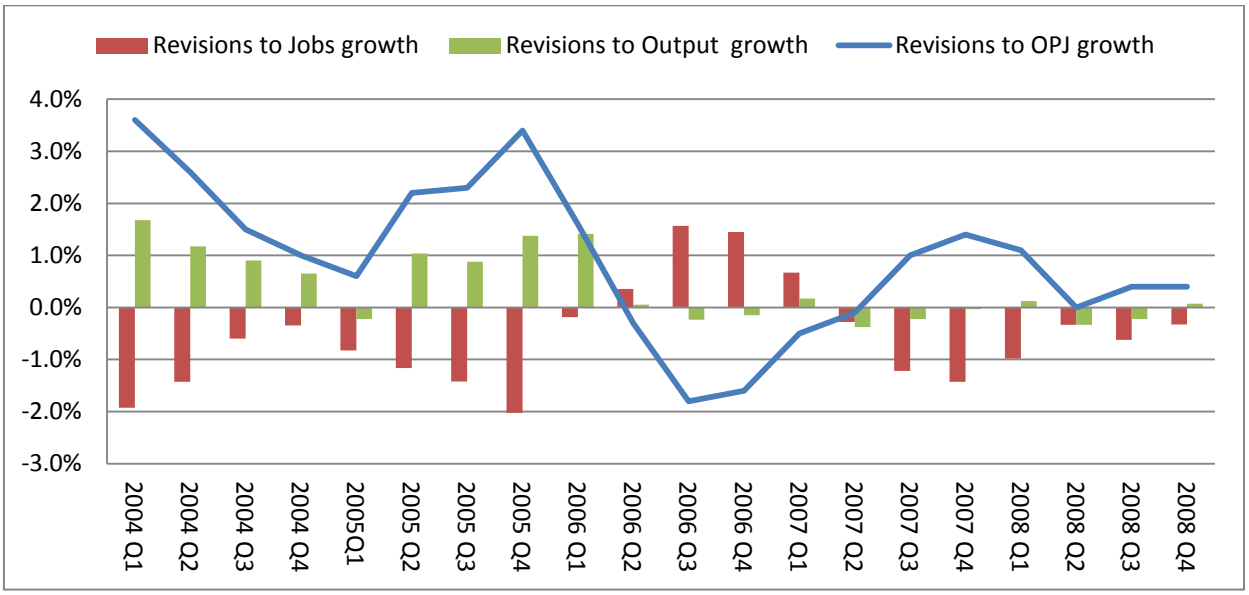
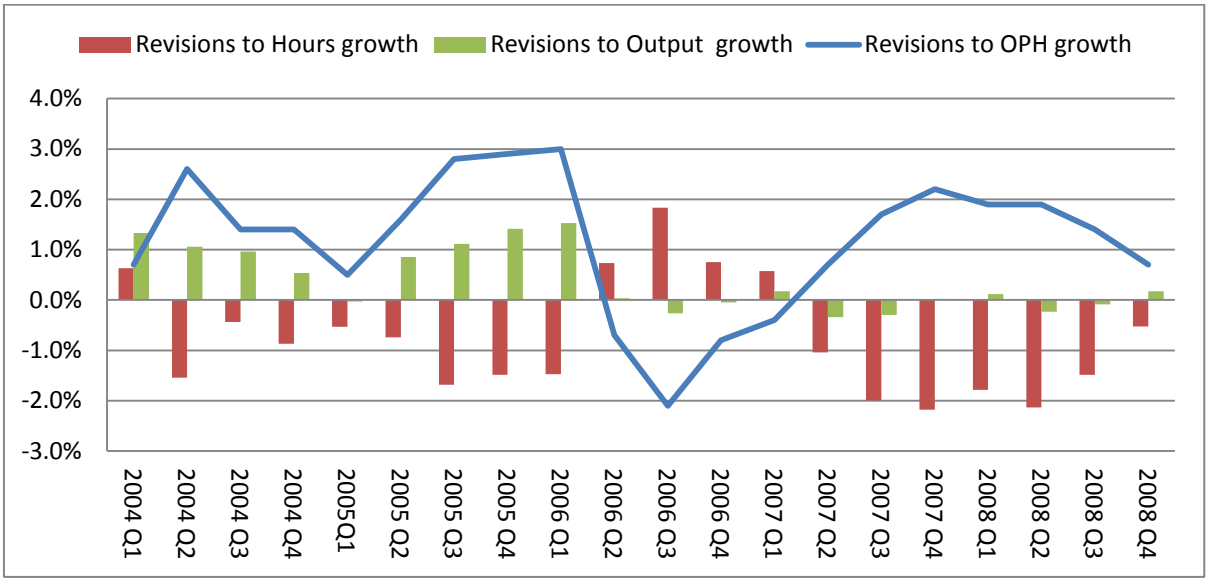


Figure 3: Revisions to Manufacturing Output per Hour – between first publication and estimates three years later



Services Sector

Table 4 shows that the drivers of revisions to service sector output per job and per hour are dissimilar to those observed in manufacturing and mirrors what is observed for the whole economy. On average, the downwards revisions to service sector output per job and per hour (-0.7pps each) were driven largely by downwards revisions to growth of output (-0.6pps each) than growth in labour input (0.1pps and 0.2pps respectively). Within the period reviewed, there were on average larger absolute changes to growth of output than labour input.

Looking at the increasingly large revisions to growth of output for whole economy output per job, per hour and per worker in 2008, the data suggests that these changes in output are largely accounted for by changes in output in the service sector rather than manufacturing. This might not be unrelated to the fact that Labour productivity for some service sections use experimental GVA data from the Index of Services (IOS), which are still under development and not yet National Statistics. The experimental series used in estimating labour productivity are published in the background notes of the Labour Productivity statistical bulletin. ONS has published a plan towards moving these experimental statistics to National Statistics status.

Table 4: Revisions to YoY growth of services output per job and output per hour

	Services output per job			Services output per hour		
2004Q1 to 2008Q4	Output per job (pps)	Jobs (pps)	Output (pps)	Output per hour (pps)	Hours (pps)	Output (pps)
Mean revisions	-0.7%	0.1%	-0.6%	-0.7%	0.2%	-0.6%
Mean absolute revisions	0.8%	0.2%	0.8%	0.8%	0.3%	0.8%

Figure 4: Revisions to Services Output per Job – between first publication and estimates three years later

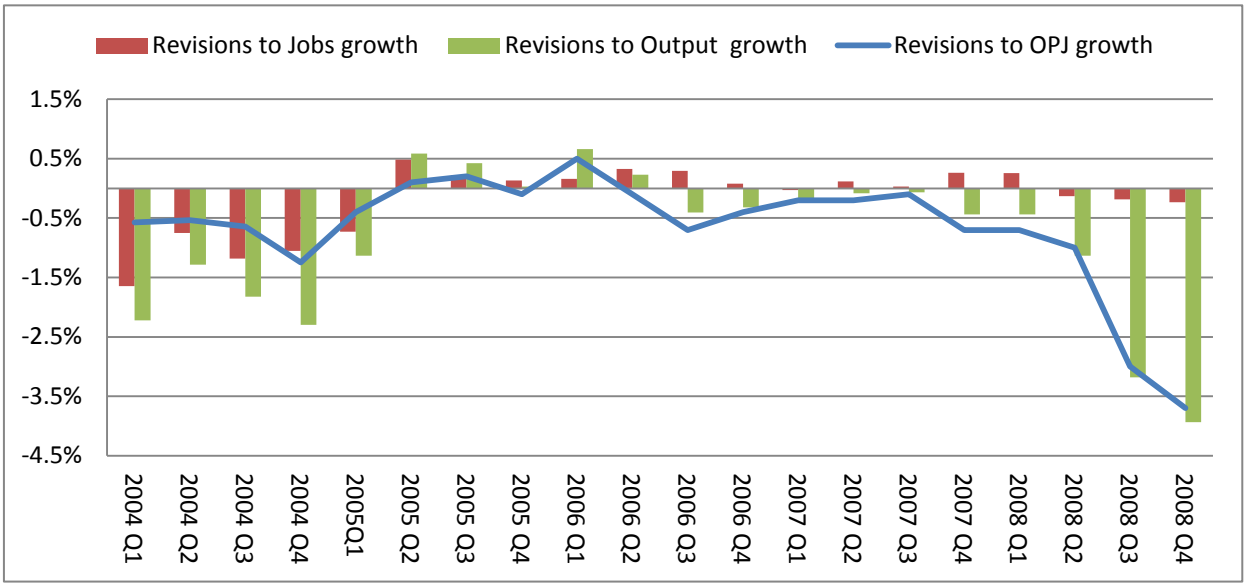
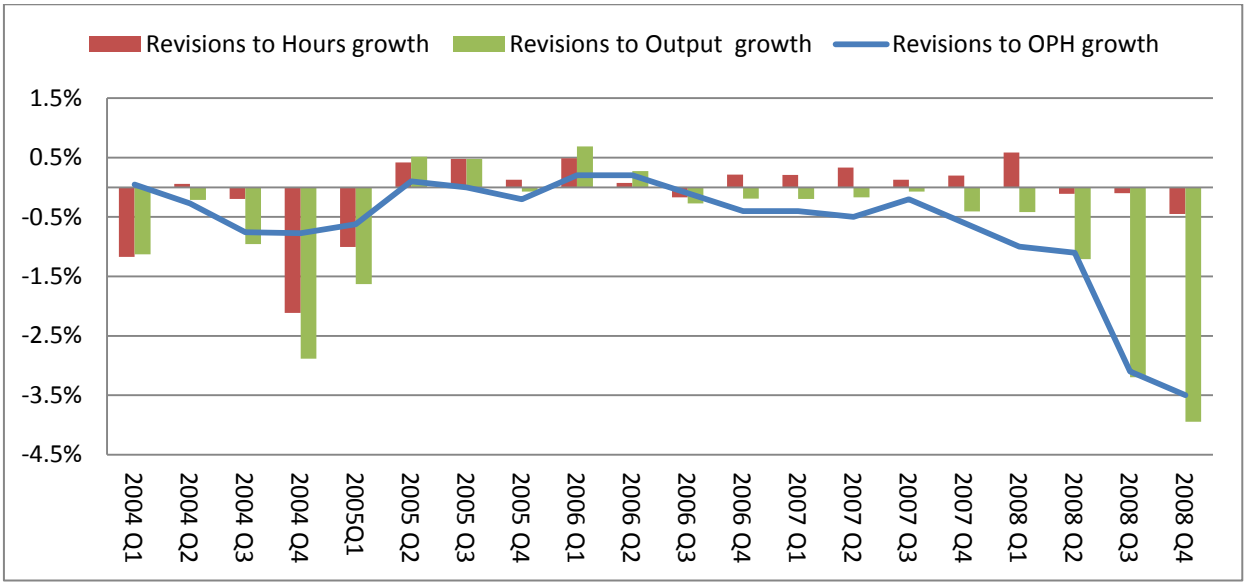


Figure 5: Revisions to Services Output per hour – between first publication and estimates three years later



Whole economy unit labour costs

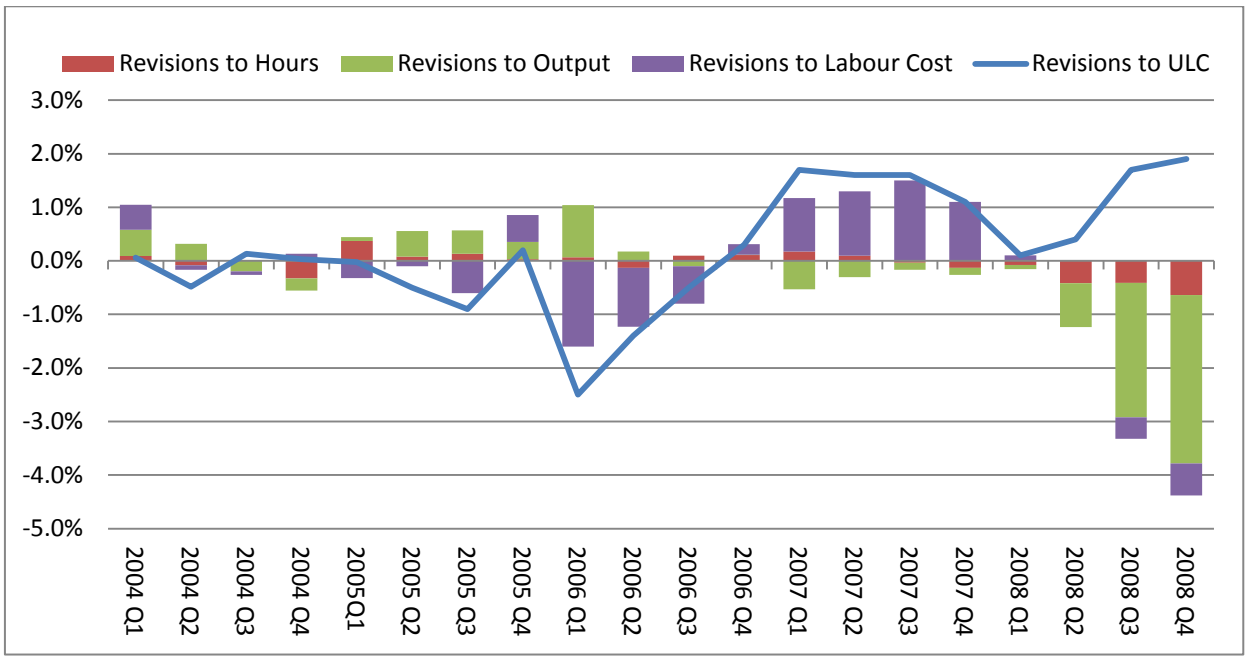
Unit Labour Cost (ULC) is the cost of labour per unit of output. ULC is derived by dividing total labour costs by total output. Revisions to growth of UCL therefore depend on changes to labour input (in this case productivity hours), changes to output and changes to labour costs. Growth of UCL is revised upwards, if labour costs or labour inputs are revised upwards, or output is revised downwards. Table 5 shows that for the 20 quarters, growth of ULC has on average been revised upwards by 0.2pps. This upwards revision was driven by a downward revision to growth of output (-0.2pps), while revisions to growth of productivity hours and labour costs for the period were nil.

Figure 6 shows that pre 2008, revisions to ULC were largely driven by revisions to growth of labour cost, however, large downward revisions to growth of output without matching upward revisions to growth of productivity hours and labour costs were the key drivers of revisions to ULC in 2008. Figure 6 depicts the productivity puzzle of the recession, where in 2008 growth in output were largely revised downwards, without resulting declines to growth in labour input (hours worked) and labour costs in similar proportions to output.

Table 5: Revisions to YoY growth of whole economy ULCs

2004Q1 to 2008Q4	ULCs (pps)	Hours (pps)	Output (pps)	Labour Costs per hour (pps)
Mean revisions	0.2%	0.0%	-0.2%	0.0%
Mean absolute revisions	0.9%	0.2%	0.6%	0.6%

Figure 6: Revisions to Whole Economy Unit Labour Costs – between first publication and estimates three years later



Conclusions

Labour Productivity estimates are derived statistics obtained from dividing an output measure using gross value (GVA) by some measure of labour input –number of workers, jobs or hours worked. Revisions to Labour Productivity estimates reflect revisions to either or both output and labour input. From the analysis in this paper, for the 20 quarters between Q1 2004 and Q4 2008, revisions to growth of whole economy output per job, output per worker and output per hour are on average driven by revisions to growth in output. Below the whole economy, revisions to growth of output per job and per hour in the manufacturing sector are largely driven by downwards revisions to growth in labour input. In the service sector on the other hand, revisions are driven by downwards revisions to growth of output. Also, the huge revisions in output growth for 2008 are seen to be largely due to changes in output in the service sector of the economy. Revisions to growth of Unit Labour Costs were on average driven by downward revisions to growth of output, without offsetting changes to growth of labour input (hours worked) and labour costs.

References and Useful Links

ONS (2011), Labour Force Survey: reweighting to 2010 population estimates

http://www.ons.gov.uk/ons/rel/lms/labour-market-statistics/lms-may-2011/reweighting-article.pdf

Labour Market Trends, August 2004, Vol 112, No8

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-112--no--8/labour-market-trends.pdf

Labour Market Trends, November 2004, Vol 112, No11

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-112--no--11/labour-market-trends.pdf

Labour Market Trends, February 2005, Vol 113, No2

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-113--no--2/labour-market-trends.pdf

Labour Market Trends, May 2005, Vol 113, No5

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-113--no--5/labour-market-trends.pdf

Labour Market Trends, November 2005, Vol 113, No11

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-113--no--11/labour-market-trends.pdf

Labour Market Trends, February 2006, Vol 114, No2

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-114--no--2/labour-market-trends.pdf

Labour Market Trends, June 2006, Vol 114, No6

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-114--no--6/labour-market-trends.pdf

Labour Market Trends, August 2006, Vol 114, No8

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-114--no--8/labour-market-trends.pdf

Labour Market Trends, November 2006, Vol 114, No11

http://www.ons.gov.uk/ons/rel/lms/labour-market-trends--discontinued-/volume-114--no--11/labour-market-trends.pdf

Labour Productivity Revisions Triangles

http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-254821

Labour Productivity Quality and Methodology Information

http://www.ons.gov.uk/ons/guide-method/method-quality/quality/quality-information/economic-statistics/index.html

National Accounts Revisions Policy

http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/revisions/economic-statistics/national-accounts-revisions-policy.pdf

ONS, (2012), Revisions to Workforce Jobs – March 2012

http://www.ons.gov.uk/ons/guide-method/method-quality/specific/labour-market/articles-and-reports/revisions-to-workforce-jobs-march-2012.pdf

Phillips C., (2012), Reconciliation of estimates of jobs: March 2012, ONS

http://www.ons.gov.uk/ons/rel/lms/labour-market-statistics/march-2012/comparison-of-estimates-of-jobs.html

Quarterly National Accounts Statistical Bulletin – 4th Quarter 2011

http://www.ons.gov.uk/ons/rel/naa2/quarterly-national-accounts/q4-2011/stb---quarterly-national-accounts-gdp-q4-2011.html

UK National Accounts – a short guide

http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/national-accounts/methodology-and-articles/uk-national-accounts---a-short-guide.pdf

Walker G., Walton A and Georghiades (2012), Why is GDP revised?

http://www.ons.gov.uk/ons/rel/naa1-rd/national-accounts-articles/why-is-gdp-revised-/index.html