ARTICLE

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Discontinuity analysis affecting the 2006 ABI employee estimates

SUMMARY

Three changes to Annual Business Inquiry/1 were introduced to the 2006 survey which resulted in a discontinuity when comparing with previous years. This also affected Workforce Jobs (WFJ) estimates for employment as these figures are benchmarked against the ABI for certain sectors of the economy.

An impact assessment to measure the discontinuity has been completed. The main proposal, for users requiring a consistent time series, is to amend the back series for ABI/1 onto the new method. This can be done using link factors produced from the 2006 ABI/1 estimates on both the 'old' and 'new' methodology.

The overall discontinuity was estimated at 417,000 employees in a downward direction. The retail, real estate, education and health sectors were the industries affected the greatest.

The discontinuity for WFJ benchmarking is estimated to be 203,000 jobs in a downward direction. This is lower than the overall discontinuity because WFJ is not benchmarked to the ABI for all industries, and also because the change in reference date does not impact on WFJ due to benchmarking against the third quarter (September) estimates as opposed to the fourth quarter (December).

Background

In 2006, three improvements were introduced to the way employment estimates are formed from the Annual Business Inquiry (ABI). Two of these relate to the first phase of the transition to the Business Register Employment Survey (BRES), which will replace the ABI/1 in 2009 and bring various benefits to users. The 2006 ABI/1 represents an improvement to the detailed industry and regional employment estimates. The third change is a methodological improvement to the apportionment of the lower level estimates.

The three changes introduced were as follows:

- change in reference date from December to September
- use of Business Register Survey data within the ABI/1 results
- change to the minimum domain methodology

Further information on these changes can be found in the link: www.nomisweb.co.uk/articles/news/files/ABI%202006%20discontinuities.doc

At the time it was not possible to untangle the impact of the first two changes. Only a high level estimate could be produced, using an average of the revisions made to Workforce Jobs (WFJ) as part of the benchmarking process over past years.

Further analysis has now been concluded and the purpose of this paper is to provide information on the overall discontinuity

caused by these three methodological changes.

Methodology

In order to identify the impact of the discontinuity, the results were re-run as close as possible to the old methodology wherever possible. It was not possible to re-estimate exactly on the old methods since the relevant data were not available. Each of the three changes were reviewed and removed separately in order to determine not just the overall impact, but also the impact of each change individually.

The order used to recreate the 2006 ABI/1 results on the 'old' methodology was to first remove the change in the minimum domain methodology, next the change in source data, and finally the change in the reference date. The order used to remove the discontinuity could potentially impact on the estimates of each of the contribution of each of the changes.

Change in the minimum domain methodology

The level at which the regional apportionment methodology was calculated was reviewed and improved for certain sectors. This change did not impact on the total number of employees but did affect the estimates at the detailed regional and industrial levels.

The results were processed on the previous regional apportionment methodology to identify the impact of the change. An assessment was published alongside the 2006 estimates, when they

were initially released via the Nomis website (this is a service provided by ONS giving access to the most detailed and up to date labour market statistics – www.nomisweb.co.uk).

Change in the source data

Prior to the 2006 change, if a business was selected for both the Short Term Employment Survey (STES) and ABI/1, then the ABI/1 questionnaire was suppressed and the STES return from the business used in the results. This was the case for most large (greater than 250 employees) businesses, although there were some smaller businesses included. This overlap control was changed in 2006 to allow the use of Business Register Survey (BRS) data returns within the ABI/1 results. This meant that for most large businesses BRS returns were used in place of STES. There are no definitional differences between surveys or, in theory, timing/reference date differences. The reason for the difference is mainly because STES is dispatched after BRS. Also STES collects turnover information (used for the short-term output indicators), and so businesses tend to wait until the turnover information is available before completing the employment section. This timing difference between the two surveys can lead to sizeable differences in the employment returns from the same businesses.

Where BRS data were used in the changed ABI results estimation process, they were matched to returns from STES. For successful matches, which was achieved for the majority of the larger businesses, the STES returns were taken into ABI to take the estimation process closer to the methodology used prior to the changes.

Change in the reference date

Prior to 2006, ABI/1 asked for employment on a set date in December. This was changed to a date in September for 2006.

To re-create figures at a December reference date non-seasonally adjusted WFJ employee estimates were used. WFJ collects and produces quarterly estimates from STES based on a set reference date. The reference date in September matches that of the ABI/1's changed (current) methodology and the reference date in December matched that of the ABI/1 under the previous method.

Using the WFJ estimates, a scaling factor was calculated at an industry level using the 2006 Q3 and 2006 Q4 estimates. These industry level factors were then applied to the relevant 2006 ABI/1 industry estimates

to simulate the results on a December reference date.

Assumptions

When re-creating the results using the old methodology, several assumptions were made. These assumptions were:

- for cases where BRS returns were included in the ABI/1 results processing, because there was not a match with the STES sample, it was assumed the BRS return would match that which the ABI/1 return would have produced
- STES data validation would match ABI/1 validation. All STES data had been through validation procedures prior to inclusion in results. During ABI/1 construction extra validation by the ABI/1 team might have revised the figures. It was assumed this was not the case
- it was assumed that the general movement at industry level in the WFJ employee estimates between quarters was replicated across all the ABI/1 returns and aggregates

Analysis

This section reviews the results of reproducing the 2006 ABI estimates with the discontinuities removed. Analysis

was undertaken at various levels with the summary of the results presented in the remainder of the article. Analysis was undertaken at the whole economy level and at 2-digit and 4-digit Standard Industrial Classification (SIC) levels. Regional results were produced and analysed at Government Office Region (GOR) and Local Authority level both by 2-digit SIC.

High level results

- the overall discontinuity introduced by the three changes to the ABI/1 is estimated to be 417,000 employees in a downward direction
- the introduction of the new methodology for Minimum Domains does not impact on the total number of employees
- the impact of the change in source data is estimated to be 190,000 employees in a downward direction
- the impact of the change in reference date is estimated to be 227,000 employees in a downward direction

Table 1 shows the estimates for the 2006 ABI at different stages of removing the total discontinuity.

Figure 1 shows the published ABI employee figures from 2000 onwards together with estimates for 2006 with and without the total discontinuity removed.

Table 1
2006 employee estimates from the ABI with each discontinuity removed

Versions of Results	Number of Employees Estimate	Difference compared to the 'Published' Estimate
Published Estimate	26,335,000	
Removal of Minimum Domain methodology change	26,119,000	0
Removal of Minimum Domain methodology change & Source Data change	26,545,000	-190,000
Removal of Minimum Domain methodology change, Source Data change & Reference Date change	26,772,000	-417,000

Source: ABI/1

Figure 1

ABI/1 Time Series 2000–2006 including the impact of the discontinuity

Source: ABI/1

Table 2
Impact of the discontinuity at sector level

Sector	Published Estimates	Estimates with discontinuity removed	Difference	Percentage difference
Agriculture, hunting & forestry	255,000	236,000	19,000	7.5
Fishing	7,000	7,000	0	0.0
Mining & quarrying	57,000	61,000	-4,000	-7.0
Manufacturing	2,869,000	2,861,000	8,000	0.3
Electricity, gas & water supply	101,000	110,000	-9,000	-8.9
Construction	1,259,000	1,257,000	2,000	0.2
Wholesale & retail trade	4,393,000	4,616,000	-223,000	-5.1
Hotels & restaurants	1,781,000	1,783,000	-2,000	-0.1
Transport, storage & communication	1,559,000	1,594,000	-35,000	-2.2
Financial intermediation	1,046,000	1,056,000	-10,000	-1.0
Real estate, renting & business activities	4,542,000	4,631,000	-89,000	-2.0
Public Admin	1,469,000	1,423,000	46,000	3.1
Education	2,411,000	2,477,000	-66,000	-2.7
Health	3,214,000	3,272,000	-58,000	-1.8
Other	1,393,000	1,390,000	3,000	0.2
Total	26,355,000	26,772,000	-417,000	-1.6

Source: ABI/1

The published series identifies the published figures on the number of employees from the ABI/1. The 'discontinuity carried forward' line highlights the figure for 2006, removing the methodological changes made. The 'discontinuity applied back' line provides an indication of the employee estimates for the back series using the new methodology. The recommended option, to have ABI/1 employee estimates on a consistent basis across the discontinuity, would be to amend the back series onto the new methodology. To do this a linking factor can be calculated, taking the published 2006 estimate divided by the estimate with the discontinuity removed for the required domain. This factor can then be applied to the relevant domain for previous periods. There are no plans for ONS to release a revised set of back data for ABI/1 estimates on this basis.

Industrial results

There were certain sectors of the economy that were affected to a greater degree than others. Also, each of the changes introduced had differing impacts on certain industries. The manufacturing sector was not affected to the same degree as the service sector. The overall discontinuity for the manufacturing sector was estimated to be 8,000 employees in an upward direction while for the service sector it is estimated to be 432,000 employees in a downward direction. The change in minimum domain did not impact at sector level for Great Britain as a whole. However, there was an impact at the more detailed industry level when analysing the overall discontinuity at the 2-digit and 4-digit SIC level. **Table 2** identifies the impact of the changes at the sector level. **Figure 2** shows the impact the changes in source data and reference date had on each sector.

The biggest impact was in highly seasonal industries, such as retail (division 52). This is due to the increase in the number of employees in the build up to the Christmas period. The change in reference date has the greatest impact but the change in source data (as detailed in the section on Methodology) also has an impact.

Breaking the sectors down into 2-digit industries (divisions) shows the largest difference was in retail (division 52) with an estimated discontinuity of -207,000. The main reason for this was the change in reference date, which accounted for approximately two-thirds of the whole discontinuity. Other divisions where

Figure 2
Estimated discontinuity and impact of each change at Sector level

Source: ABI/1

Figure 3
Estimated discontinuity at Government Office Region (GOR) level

Source: ABI/1

the changes introduced caused a large discontinuity were real estate (division 70 with –66,000), public administration (division 75 with 46,000), education (division 80 with –66,000) and health (division 85 with –58,000). The cause of the discontinuity varies between sectors.

There were certain divisions where the discontinuity was found to be small, but with sizeable impacts for the different changes that offset each other. An example of this was in ‘Other business activities’ (division 74). The overall discontinuity for this 2-digit SIC was estimated to be –26,000. However, the change in the minimum domain method accounted for an upward discontinuity of 47,000 and the changes in source data and the reference date an estimated downward discontinuity of 37,000 each.

Regional results

The changes made to the ABI also have an impact at regional as well as industry level. Analysis at Government Office Region (GOR) level shows that the area most affected was the South East of England with an estimated discontinuity of 86,000 in a downward direction. This is 2.3 per cent of

the total estimated number of employees. The West Midlands was also impacted to a similar degree with 2.1 per cent, a discontinuity of 52,000 in a downward direction. The change in the minimum domain methodology had minimal impact at the overall GOR level, with the only noticeable impact being in London and the South East. The main reasons for the discontinuity were the changes in source data and reference date.

The impact at the overall GOR level and the contributions of each of the changes is shown in **Figure 3**.

Similar analysis was undertaken at the Local Authority (LA) level. There are 408 Local Authority districts throughout GB. Of these, 50 LAs showed a discontinuity of greater than 5 per cent with the largest being Castle Morpeth (15 per cent increase in employees due to the changes implemented) and Woking (17 per cent decrease).

Detailed ABI/1 estimates

Estimates for the ABI/1, including and excluding the discontinuity together with scaling factors to remove the discontinuity, can be found on the Nomis website at www.nomisweb.co.uk.

Impact on Workforce Jobs

WFJ estimates are benchmarked to the ABI/1 so the methodological changes have had an impact on these estimates. However, the overall level of discontinuity is not the same. The reference date change is not an issue as it is a matter of benchmarking to a different quarter. Also WFJ do not benchmark against the public sector component of the ABI/1.

The total discontinuity for WFJ was less than for the ABI/1 and was estimated to be 203,000 jobs in a downward direction.

ONS will reproduce estimates adjusting for the discontinuity at the same time WFJ statistics are published on a new industrial classification (SIC 2007), in June 2010, to avoid another release of revisions. The discontinuity will be removed from the employee jobs series by amending back series (pre 2006 Q3) like the recommended option for ABI/1 (see the ‘discontinuity applied back’ line in Figure 1). The difference will be wedged back to 1996 Q1, which is the start of the lowest level WFJ employee jobs series.

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