FEATURE

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Planned methodological changes to the Index of Production

SUMMARY

In January 2008, as part of a wider reprioritisation of the Office for National Statistics' (ONS) business, the sample size for the Monthly Production Inquiry (MPI) will be reduced by 17 per cent. Of itself, the reduced sample size would lead to lower-quality estimates of the change in production output as published in the Index of Production (IoP) First Release. However, ONS will introduce a number of methodological changes in March 2008, including a reoptimisation of the MPI sample. These changes will maintain, and in some cases improve, the quality of the aggregate IoP indices. At the same time, the level of detail published for the IoP will be reduced, providing greater focus on the aggregate series. This article sets out the reasons for the methodological changes and their impact on the levels of detail which ONS will publish.

The Index of Production (IoP) is a monthly measure of the change in the volume of production of the manufacturing, mining and quarrying, and energy supply industries, which together represents around 18 per cent of the UK economy.

The IoP is published as an Office for National Statistics (ONS) First Release around 26 working days after the end of the reference month. The release presents indices of output for mining and quarrying, the oil and gas extraction industry, and seven broad industries within the manufacturing sector.

The IoP has three primary uses:

- as a short-term economic indicator in its own right. For example, HM Treasury and the Bank of England use the IoP to monitor short-term changes in industrial activity
- as a component of the production or output measure of gross domestic product (GDP). GDP measures the sum of the value added created through the production of goods and services within the economy. In this context, the IoP can be seen as a proxy for the short-term change in real value added of the production industries, and
- as a requirement for the Statistical Offices of the European Community (Eurostat). Information on production and current price sales are provided to Eurostat. These are used with data from other countries to create monthly indices for the whole of the European Union

Walton (2005) describes the current methodology used to compile the IoP.

Methods changes in detail

In March 2008, when the IoP estimates for January 2008 are published, a number of methodological changes will be introduced into the compilation methods used to construct the indices. These changes will offset the impact on the quality of the estimates following the reduction in the Monthly Production Inquiry (MPI) sample size planned for January 2008. This section outlines each of the changes. A separate article, planned for publication in *Economic & Labour Market Review* (ELMR) later in 2008, will assess the impact of each of these changes on the aggregate indices.

New aggregation structure

The current IoP is calculated for some 232 detailed industries. Historically, this level of detail was seen as necessary to provide a full understanding of the dynamics of the production sector. ONS reported on some analysis of the quality of the estimates at this level of detail in an earlier article in ELMR (Youll *et al* 2007). Broadly, the reason for the relatively poor quality of the detailed production industry estimates is the small sample sizes used in their estimation. The 17 per cent cut in the MPI sample in January 2008 will impact further on the quality of these detailed series. ONS has therefore considered the impact of this change on the level at which the IoP is compiled, and the levels of detail which it is appropriate to publish, given current

user needs for short-term indicators of the sector.

Appendix **Table A1** sets out the aggregation structure which will be used from March 2008 for the IoP. This structure is designed to improve the robustness of estimation at the aggregate two-digit level of the Standard Industrial Classification (SIC) and above. For example, in the current compilation system for the IoP, seasonal adjustment takes place at the most detailed level, for 223 series. At this level, the extent of sampling error (Youll *et al* 2007) can dominate the seasonal signal in the series. Better aggregate estimates can be achieved by seasonally adjusting at higher levels of aggregation. Similarly, the accuracy of the estimates themselves can be much improved by aggregating to a level at which sample sizes are sufficiently large to allow robust estimation.

This new industry structure is consistent with ONS longer-term plans for the introduction of a monthly short-term measure of the activity of the whole economy. This will include levels of detail for the manufacturing and services sectors appropriate to their relative contributions to economic output. The development of this whole economy indicator is planned as part of the wider re-engineering of the National Accounts which will take place during 2008 and 2009.

The introduction of the new industry structure in March 2008 will mean that the IoP estimates published currently for more detailed aggregates, say at the four-digit level of the SIC, will no longer be available. There will be similar, parallel, changes in the levels of detail which are published currently for estimates of turnover for the engineering sector based on the MPI itself.

Auxiliary variable

Estimates of the level of manufacturing turnover used within the IoP are calculated from the MPI sample using a 'combined ratio estimator'. Essentially this estimator scales, or 'weights', the turnover data collected in the MPI sample to a population total using information from ONS's Inter-Departmental Business Register. Part of the estimation process involves a scaling based on the level of what is called 'auxiliary' information from the register. Currently this scaling uses information on the level of employment of each business in the sample. The accuracy of this scaling can be improved by instead using turnover, with a consequent improvement in the accuracy of the overall estimation (that is, estimates will have a lower standard error). The

reason turnover is a more effective auxiliary variable follows from the fact that there is a closer correlation between businesses' reported monthly turnover and their registered turnover than there is with their registered employment.

Deflation

The IoP is a 'real' measure of changes in output, that is, it is adjusted for changes in prices, or deflated. The deflator used for the IoP is a composite, based on price changes of sales to the domestic market and, separately, export sales.

In March 2008 there will be some improvements to the approach used to calculate the deflator used for domestic sales. The current method is to take the weighted arithmetic mean of price indices for up to five products within an industry. The new method will use up to 20 products within an industry. This more detailed approach will improve the relevance of the price indices to the turnover of the industries being deflated.

The method used to calculate export deflators will remain largely unchanged.

Lagged deflators

The current IoP methodology adjusts the price deflators for 'timing effects' in some industries. For example, the sales price of goods which have been warehoused for some time may differ significantly from their 'price' (or production cost) at the time the goods were created. The current methodology attempts to adjust for such effects, and to calculate the effective price of goods at the time of production, rather than at the time of sale. ONS has studied the validity and relevance of lagging deflators in this way in the IoP and decided that the potential improvements in quality which might arise from lagging prices is outweighed by the difficulty in accurately measuring these effects. For example, a separate survey is required to evaluate the extent to which these lags occur, the most recent being in 1995. Furthermore, changes in the structure of the UK economy over the last 30 years have meant that there are many fewer industries with long time lags between order and delivery. The impact of lagging deflators on the IoP growth rates is also very small, and in most cases does not lead to changes in published growth rates. On the balance of evidence, therefore, ONS has decided to discontinue the lagging of deflators from March 2008.

Inventory adjustment

The IoP is designed as a measure of changes

in output. Output can be calculated as turnover less the change in inventories during the period being considered. The current methodology for the IoP therefore includes estimates of the change in inventories, calculated from a separate, quarterly, survey. The quarterly estimates of change in inventories are used to create a monthly series, by a method of temporal disaggregation called 'splining'.

The impact of the inventory adjustment on detailed IoP industries is generally quite small. However, economic theory suggests that, on average over time, this adjustment should lead to less volatile series, since the output or activity of businesses should, according to economic theory, be more stable than invoiced sales. Analysis in ONS of the impact of the inventory adjustment on the detailed IoP series indicates that this is not generally the case in practice, and that the inventory-adjusted series are very often more volatile than the unadjusted turnover series. This may be because the inventories estimates are derived from a separate sample survey, and so the degree of correlation between the turnover and inventories estimates is often quite small. Furthermore, the net impact on the aggregate IoP of these adjustments is generally very small.

As a result, ONS will drop inventory adjustments based on the quarterly inventories inquiry from March 2008. Instead, the IoP will take on adjustments for changes in inventories from the Annual Business Inquiry (ABI). The estimates of changes in inventories from this survey are more accurate than those based on the quarterly inquiry, and therefore provide a more robust basis for adjusting MPI turnover to an 'output' concept. As a result, in future, the IoP will be brought in line with estimates of the change in gross value added (GVA) from the annual National Accounts supply-use tables, which are based primarily on the ABI. The IoP will therefore remain conceptually a measure of the change in output, rather than sales. However, at the end of the series, changes in turnover will be used as a proxy for changes in output, until estimates based on supply-use tables are available.

Smoothing

For 13 industries, the production indices are smoothed to reduce the volatility of the series. Smoothing is a method for identifying the underlying movements in output, separately from the movements in recorded turnover, or inventory-adjusted turnover. For example, the production of an

aircraft will take place over a considerable period of time, whereas the sale will appear in only one period. Ideally, the work in progress associated with the production activity should be captured. In practice though, it is difficult for businesses to provide this information to ONS in the short term, and so estimates based on turnover are smoothed as a means of estimating the actual flow of activity over time. Following an analysis of the impact of smoothing on the aggregate IoP, from March 2008 this will be reduced to just five industries. Appendix **Table A2** sets out descriptions of the five industries that will be smoothed.

Merchanted goods

The IoP is adjusted currently for goods bought for resale, or 'merchanted goods' in 22 industries. The idea here is that some manufacturing businesses buy a proportion of their goods solely for the purpose of resale, without adding further value. In March 2008, this adjustment will be dropped from the IoP methodology, because analysis has shown that the adjustments have very little impact on the overall IoP. Further, the quality of the data on the extent of 'merchanting' is also an issue. As noted earlier, it is therefore planned in future to bring the IoP in line with annual estimates of the change in GVA from the National Accounts supply-use tables. This will provide a more direct basis for accounting for the impact of merchanted goods which may affect the short-term estimates.

Alignment of seasonally adjusted and non-seasonally adjusted series

Currently, each year, at the time of the release of the December estimates, the average level of the seasonally adjusted IoP is brought into line with that of the non-seasonally adjusted IoP. This ensures consistency in the annual growth rates (for example, 2006 compared with 2007). While consistency may be desirable from some perspectives, it will produce a less accurate measure of the seasonally adjusted change. This is particularly the case when seasonality is changing over time. In general, it is accepted that the best measure of the annual change is that based on the seasonally adjusted, rather than non-seasonally adjusted, series.

Therefore, from March 2008, ONS will no longer align the seasonally adjusted to the non-seasonally adjusted series in this way. Users of the IoP therefore need to be aware of the difference in the annual average of the seasonally adjusted and non-seasonally adjusted series. This new approach should considerably reduce the revisions which this alignment has caused over all months of the year, in the December and January releases.
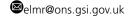
Availability of historical series

The changes described in this article will, as noted earlier, impact on the published level of detail. They will also affect the historical period for which published estimates are available. From March 2008, series will be made available back to January 1998 for each 'industry' in the new industry structure described above. Series at the two-digit (division) level of the SIC will be available back to 1978. Quarterly and annual data for the higher level aggregates (SIC subsections, sections and above) will be available back to 1948, with monthly data available from 1968. Series based on four-digit SICs will no longer be available.

Further developments

This article describes methodological changes that will be introduced for the IoP in March 2008. A further article, planned to coincide with the release of the estimates based on these new methods, will be published in ELMR later in 2008, and will present an assessment of the impact of these changes on the IoP.

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Youll R, Parkin N and Hunt C (2007) 'Measures of accuracy for the Index of Production', *Economic & Labour Market Review* 1(8), pp 24–8 and at www.statistics.gov.uk/cci/article.asp?id=1842

APPENDIX A

Table A1
New IoP industry structure

New industry aggregate			Current industry structure SIC		
Code	Description	SICs	Class	Subsection	Section
1	Mining of coal and lignite; extraction of peat	10	10101 10102 10103		
2	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying	11	11102 11105 11107 11202 11203	CA	
3	Mining of uranium and thorium ores; mining of metal ores; other mining and quarrying	12–14	1200 1300 1410 1421 1422 1430 1490	CB	C
4	Production, processing and preserving of meat and meat products	15.1	1511 1512 1513		
5	Processing and preserving of fish and fish products, fruit and vegetables	15.2–15.3	1520 1531 1532 1533		
6	Manufacture of vegetable and animal oils and fats	15.4	1541 1542 1543		
7	Manufacture of dairy products	15.5	1551 1552		
8	Manufacture of grain mill products, starches and starch products	15.6	1561 1562		
9	Manufacture of prepared animal feeds	15.7	1571 1572		
10	Manufacture of bread, fresh pastry goods, cakes, rusks, biscuits and preserved pastry goods and cakes	15.81–15.82	1581 1582	DA	
11	Manufacture of sugar, cocoa, chocolate and sugar confectionery	15.83–15.84	1583 1584		D
12	Manufacture of macaroni, noodles, couscous, similar farinaceous products, condiments, seasonings and other food products not elsewhere classified; processing of tea and coffee	15.85–15.89	1585 1586 1587 1589		
13	Manufacture of wines, cider, other fruit wines and beer	15.93, 15.94, 15.96	1593 1594 1596		
14	Manufacture of malt and distilled potable alcoholic beverages; production of ethyl alcohol from fermented materials	15.97, 15.99	1597 1599		
		15.98	1598		
16	Manufacture of tobacco products	16	1600		
17	Preparation and spinning of textile fibres; textile weaving; finishing of textiles	17.1–17.3	1710 1720 1730		
18	Manufacture of made-up textile articles, except apparel; manufacture of other textiles, knitted and crocheted fabrics, knitted and crocheted articles	17.4–17.7	1740 1751 1752 1753 1754 1760 1771 1772	DB	

Table A1- *continued*
New IoP industry structure

New industry aggregate			Current industry structure SIC		
Code	Description	SICs	Class	Subsection	Section
19	Manufacture of wearing apparel, dressing and dyeing of fur	18	1821 1822 1823 1824 1830	DB	
20	Manufacture of leather and leather products	19	1910 1920 1930	DC	
21	Manufacture of wood and wood products	20	2010 2020 2030 2040 2051 2052	DD	
22	Manufacture of pulp, paper and paperboard	21.1	2110		
23	Manufacture of articles of paper and paperboard	21.2	2121 2122 2123 2124 2125		
24	Publishing of books	22.11	2211		
25	Publishing of newspapers	22.12	2212	DE	
26	Publishing of journals and periodicals	22.13	2213		
27	Publishing of sound recordings; other publishing	22.19	2219		
28	Printing and service activities related to printing; reproduction of recorded media	22.2–22.3	2221 2222 2223 2224 2225 2239		D
29	Manufacture of coke, refined petroleum products and nuclear fuel	23	2310 23201 23209 2330	DF	
30	Manufacture of industrial gases, dyes and pigments	24.11–24.12	2411 2412		
31	Manufacture of other inorganic basic chemicals and other organic basic chemicals	24.13–24.14	2413 2414		
32	Manufacture of fertilisers, nitrogen compounds, plastics in primary forms, synthetic rubber in primary forms, pesticides and other agro-chemical products	24.15, 24.16, 24.17, 24.2	2415 2416 2417 2420		
33	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	24.3	2430		
34	Manufacture of pharmaceuticals, medicinal chemicals and botanical products	24.4	2441 2442	DG	
35	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	24.5	2451 2452		
36	Manufacture of other chemical products and man-made fibres	24.6–24.7	2461 2462 2463 2464 2465 2466 2470		
37	Manufacture of rubber products	25.1	2511 2512 2513	DH	

Table A1- *continued*
New IoP industry structure

New industry aggregate			Current industry structure SIC		
Code	Description	SICs	Class	Subsection	Section
38	Manufacture of plastic products	25.2	2521 2522 2523 2524	DH	
39	Manufacture of glass and glass products	26.1	2611 2612 2613 2614 2615	DI	
40	Manufacture of non-refractory ceramic goods other than for construction purposes, refractory ceramic products and ceramic tiles and flags	26.2–26.3	2621 2622 2626 2629 2630		
41	Manufacture of bricks, tiles and construction products, in baked clay; manufacture of cement, lime and plaster	26.4–26.5	2640 2650		
42	Manufacture of articles of concrete, plaster and cement; cutting, shaping and finishing of stone; manufacture of other non-metallic mineral products	26.6–26.8	2661 2662 2663 2669 2670 2681 2682		
43	Manufacture of basic metals	27	2710 2722 2731 2732 2721 2733 2739 2741 2742 2743 2744 2745 2751 2752 2753 2754	DJ	D
44	Manufacture of structural metal products	28.1	2811 2812		
45	Manufacture of tanks, reservoirs, containers of metal, central heating radiators, boilers and steam generators, except central heating hot water boilers	28.2–28.3	2821 2822 2830		
46	Forging, pressing, stamping and roll forming of metal; powder metallurgy; treatment and coating of metals; general mechanical engineering	28.4–28.5	2840 2851 2852		
47	Manufacture of cutlery, tools and general hardware	28.6	2861 2862 2863		
48	Manufacture of other fabricated metal products	28.7	2871 2872 2873 2874 2875		
49	Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines	29.1	2911 2912 2913 2914	DK	

Table A1- *continued*
New IoP industry structure

New industry aggregate			Current industry structure SIC		
Code	Description	SICs	Class	Subsection	Section
50	Manufacture of other general purpose machinery	29.2	2921 2922 2923 2924	DK	
51	Manufacture of agricultural and forestry machinery	29.3	2931 2932		
52	Manufacture of machine tools	29.4	2940		
53	Manufacture of other special purpose machinery	29.5	2951 2952 2953 2954 2955 2956		
54	Manufacture of weapons and ammunition	29.6	2960		
55	Manufacture of domestic appliances not elsewhere classified	29.7	2971 2972		
56	Manufacture of office machinery and computers	30	3001 3002	DL	D
57	Manufacture of electric motors, generators and transformers	31.1	3110		
58	Manufacture of electricity distribution and control apparatus; manufacture of insulated wire and cable	31.2–31.3	3120 3130		
59	Manufacture of accumulators, primary cells, primary batteries, lighting equipment, electric lamps and electrical equipment not elsewhere classified	31.4–31.6	3140 3150 3161 3162		
60	Manufacture of electronic valves and tubes and other electronic components	32.1	3210		
61	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy	32.2	3220		
62	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods	32.3	3230		
63	Manufacture of medical and surgical equipment and orthopaedic appliances	33.1	3310		
64	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes	33.2–33.3	3320 3330		
65	Manufacture of optical instruments and photographic equipment;	33.4–33.5	3340 3350		
66	Manufacture of motor vehicles	34.1	3410	DM	
67	Manufacture of bodies (coachwork) for motor vehicles, trailers and semi-trailers, parts and accessories for motor vehicles and their engines	34.2–34.3	3420 3430		
68	Building and repairing of ships and boats	35.1	3511 3512		
69	Manufacture of railway and tramway locomotives and rolling stock	35.2	3520		
70	Manufacture of aircraft and spacecraft	35.3	3530		
71	Manufacture of motorcycles, bicycles and other transport equipment not elsewhere classified	35.4–35.5	3541 3542 3543 3550		
72	Manufacture of furniture	36.1	3611 3612 3613 3614 3615	DN	
73	Manufacture of jewellery, related articles and musical instruments	36.2–36.3	3620 3630		
74	Manufacture of sports goods, games and toys	36.4–36.5	3640 3650		

Table A1- *continued*
New IoP industry structure

| New industry aggregate | | | Current industry structure SIC | | |
Code	Description	SICs	Class	Subsection	Section
75	Miscellaneous manufacturing not elsewhere classified	36.6	3661 3662 3663	DN	D
76	Recycling	37	3700		
77	Production and distribution of electricity	40.1	4010		
78	Manufacture of gas; distribution of gaseous fuels through mains	40.2	4020	E	E
79	Collection, purification and distribution of water	41	4100		

Source: Office for National Statistics

Table A2
Smoothed industries in the IoP

New industry aggregate (SICs)	Industry description
16	Manufacture of tobacco products
23.3	Processing of nuclear fuel
35.1	Building and repairing of ships and boats
35.2	Manufacture of railway and tramway locomotives and rolling stock
35.3	Manufacture of aircraft and spacecraft

Source: Office for National Statistics