A Guide to the Index of Production

1. Introduction

The monthly United Kingdom (UK) Index of Production (IoP) provides a timely indicator of growth in the output of production industries at constant prices. The IoP is a key economic indicator and one of the earliest short-term measures of economic activity and shares exactly the same industry coverage as the corresponding quarterly series within UK Gross Domestic Product (GDP).

The main output is a seasonally adjusted estimate of total production and broad sector groupings of mining & quarrying, manufacturing, energy and water supply & sewerage. In general, seasonally adjusted output estimates are available down to the National Accounts Supply Use Table (SUT) level. Output estimates are calculated by taking value estimates and adjusting them to remove the impact of price changes, or by using direct volume estimates. The total IoP estimate and various breakdowns are widely used in private and public sector institutions, particularly the Bank of England and Her Majesty's Treasury, to assist in informed policy and decision making.

2. Conceptual Basis

IoP is an estimate of the UK production industry's Gross Value Added (GVA). GVA is defined as 'total outputs minus total inputs'. To produce this on a constant price basis, both inputs and outputs should be deflated, which is known as double deflation.

In practice, it is difficult and considered too burdensome to ask respondents to supply data on inputs, therefore the majority of industries in IoP measure output as a proxy for GVA. In general, the ratio between total output and total input remains fairly constant, thus measuring output is a valid proxy of GVA. The main exception to this rule is electricity data where we have data on both inputs and outputs and can therefore produce a GVA index.

3. Defining Production

The industries included in the Index of Production are as defined by the United Kingdom Standard Industrial Classification (UKSIC) 2007, sectors B to E inclusive.

Businesses within MBS are classified according to a Standard Industrial Classification (SIC) based on their predominating business activity. The SIC 2007 classification was introduced in the August 2011 release in October 2011 and represents the first major revision of the classification structure since 1992.

The geographical coverage includes all businesses whose primary output resides within the United Kingdom. This includes England, Scotland, Wales and Northern Ireland but excludes the Isle of Man, Channel Islands and the Falkland Islands.

The table contained in Annex A shows the levels at which production statistics are released. The industry groups and subgroups are defined, as well as the proportion of production represented by each group.

4. Data Sources

The majority of data used to compile the manufacturing sector, and thus the Index of Production, is collected via the Monthly Business Survey (MBS). The data collected is sales turnover excluding Value Added Tax (VAT). This data is then deflated using Producer Price Indices (PPI) [see section 9]. Within the manufacturing sector we also receive direct volume data from:

> Department of Energy and Climate Change (DECC) for fuel industries;
> Iron and Steel Statistics Bureau (ISSB) for steel industries.

The mining & quarrying sector is mainly comprised of data from DECC, including volume of oil & gas extraction and coal extraction.

The majority of data used to produce the energy sector index is also from DECC and includes energy and gas supply output.

A comprehensive list of the IoP source data can be found in the GDP(O) source catalogue, under 3. Methods in the link below:

https://www.ons.gov.uk/economy/economicoutputandproductivity/output/methodologies/indexofproductioniop

5. Scope and Coverage of MBS

In January 2010, The Monthly Business Survey replaced the Monthly Production Inquiry (MPI) and the Monthly Inquiry into the Distribution and Services Sector (MIDSS). The MBS brings together for the first time short term turnover information for the production and services sector.

The MBS covers businesses which are engaged in production activity in the UK (England, Scotland, Wales and Northern Ireland) and the provision of services in Great Britain (England, Scotland and Wales). Neither include the Isle of Man, Falkland Islands or the Channel Islands.

6. Sampling and Data Collection

6.1 Sampling

The Inter-Departmental Business Register (IDBR)[1] is used as the sampling frame for the MBS. A stratified random sample is used to ensure small and large businesses are represented according to the production and services sectors' population structures. The MBS sample of approximately 33,000 businesses is drawn from a total number of 1.6 million businesses within the UK (production) and Great Britain (services) industries.

[1] http://www.ons.gov.uk/ons/about-ons/products-and-services/idbr/index.html

Turnover data are collected from a sample of approximately 6,000 production businesses across the UK and 27,000 service providers across Great Britain. The sample, which represents the whole production sector (with the exception of agriculture, forestry, fishing, as well as electricity & gas suppliers) and the whole services sector (with the exception of financial service providers), includes all large businesses and a representative sample of smaller businesses. Collectively, all of these businesses cover approximately 95 per cent of these sectors in terms of turnover.

Band one	0 – 4		
Band two	5 –9		5 – 19
Band three	10 – 49	20 – 99	20 – 149
Band four	50+ 100+		150+
Band five	Bands two and three with turnover of greater than £60 million.		

Band one	0 – 9		
Band two	10 –49		10 – 99
Band three	50 – 149	50 – 249	100 – 249
Band four	250+		
Band five	Bands two and three with turnover of greater than £60 million.		

A random sample is taken from bands one, two and three, while bands four and five are fully enumerated. The employment threshold that corresponds to each band differs slightly depending on the concentration of businesses within the industry.

6.2 Questionnaire

Production businesses are asked to provide total turnover exclusive of VAT and the proportion of this which is generated from goods exported outside the UK.

Businesses producing alcohol and tobacco are also asked to provide the value of excise duty.

Businesses producing potable water are asked to provide the volume in megalitres.

Service providers are asked to provide total turnover exclusive of VAT and, in some industries, the value of their commission or grants.

Most businesses are able to report data for the requested calendar month although some provide data for a similar accounting period. The questionnaire asks respondents to indicate the dates to which the reported turnover data relates i.e. accounting period or calendar month.

In addition, each quarter, a sub-sample of 20,000 businesses are asked to provide information on employment including divisions of male and female, and full and part time employees. These data are then used in the Workforce jobs section of the UK Labour Market statistical bulletin.[2]

6.3 Mode of collection

For the majority of the sample (33,000) data are collected using telephone data entry (TDE). Respondents are sent a paper TDE letter specifying the questions and instructions on how to return their data through the TDE system.

Approximately ten percent reply to the survey by a mode other than TDE.

[2] http://www.ons.gov.uk/ons/rel/lms/labour-market-statistics/index.html

7. Editing, Validation and Imputation

7.1 Editing and Validation

The MBS uses an editing and validation approach known as selective editing. Selective editing is an internationally recognised method that uses a data based approach to assess the influence of business estimates on the aggregate outputs.

The selective editing approach means that the editing process should be more efficient and effective since it will only edit potential errors that have a significant impact on final outputs

Under selective editing, key variables on the questionnaire are defined and scores derived. The scores compare returned values with expected values, where the expected values are generally estimated using past data or other available information related to the variable, for example, from administrative sources. The scores from ‘key’ variables are then combined to derive an overall score for every return. This derived, single score for the business’ return is then tested against a methodologically set threshold. If the score is higher than the defined threshold then the individual returns will fail and be flagged for manual editing. Thresholds have been derived and set to ensure minimum bias is introduced from not editing values that may have once been edited under the previous system. Thus selective editing will not result in an adverse impact on output quality.

Prior to passing through selective editing, individual returns are subject to a number of user defined checks, including exports exceeding total turnover, turnover being zero or impossible dates.

7.2 Imputation

Each month MBS achieves a response of approximately 78 per cent, providing approximately 88 per cent of turnover. Ratio imputation is used to provide estimates for non-responders.

The basic method is to impute for the current response Yt using the response from the previous period Y t-1 and a growth factor (or imputation link) R.

8. Estimation

Estimation is the process of approximating characteristics of a population, in this case production turnover in the UK and services turnover in Great Britain, when information is available only for a sample of the population.

In order to provide estimates of the full production and services sectors, combined or separate ratio estimation is used. Ratio estimation is used when the ratio of the study variable over an auxiliary variable, such as turnover in the business register, is roughly constant and the variance of the study variable can be assumed to be proportional to the auxiliary variable. The estimate is then given by the product of the estimate of the ratio by the population total of the auxiliary variable.

9. Deflation

The value estimates collected by the MBS reflect both price and volume changes. To remove the direct effects of price changes, value data are deflated to produce IoP volume measures. SUT Industries are broken down by product and deflators are applied prior to aggregation back to SUT Industry level.

In the majority of cases, the deflators used are a combination of a home deflator and an export deflator. Home deflators are Producer Price Indices (PPI) and export deflators are Export Price Indices (EPI). These deflators are weighted together using the proportion of export sales as a weight.

The volume series received from other government departments do not require deflating.

10. Indexing

Index numbers provide a measure of the average level of prices, quantities or other measured characteristics relative to their level for a defined reference period or location. It is usually expressed as a percentage. Estimates of production output are published in index form rather than in monetary form.

10.1 Reference Period

The reference period is the year for which the index is scaled to equal 100. IoP indices are currently published in index form with a reference year of 2013 equal to 100.

To keep IoP consistent with the UK National Accounts, the reference year is updated each year when weights are available from the Blue Book[3]. The change to the reference year is a simple calculation and does not impact on the movements of the series.

[3] http://www.ons.gov.uk/ons/guide-method/method-quality/general-methodology/index-numbers/index.html

10.2 Chain Volume Measures

The chain volume measures of IoP are annually re-weighted chained (Laspeyres weights) indices referenced to current price values, currently in 2013. A Laspeyres index is a fixed base index whose index numbers are weighted arithmetic means of price (or other) relatives, using value (or equivalent).

For each year, the values for each SUT in current prices and previous year prices are calculated. These values are then aggregated using weights for each SUT industry derived from fully balanced National Accounts SUT.

Each year the series is re-referenced and comparability with previous years is achieved by chain-linking the series together to form a continuous time series. An average of the values for October, November and December is used to provide the link factor.

Chain-linking starts at the lowest possible level of aggregation. For IoP, this means that aggregation begins at the SUT level. These estimates are used to create a chain-linked estimate for all businesses for each SUT. Higher level chain linked aggregates are derived in a similar way.

The chain-linking method used is consistent with the standard National Accounts method.

11. Seasonal Adjustment

IoP indices are seasonally adjusted by estimating and removing systematic effects due to the time of year and the arrangement of the calendar from the non-seasonally adjusted estimates. Seasonal adjustment is performed each month using the standard, widely used software package X-13-ARIMA-SEATS. The annual seasonal adjustment review is also performed using X-13-ARIMA-SEATS.

The seasonally adjusted estimates have corrections for trading days effects (the number of each day of the week in a month) and Easter effects, which are caused by the date of Easter moving between March and April. Prior corrections are applied as necessary. Corrections are estimated and applied where there is a statistically significant effect.

12. Revisions Policy

The IoP adheres to the National Accounts constraining policy. This means that each release of IoP data is constrained to only take on revisions from a pre announced date. This helps ensure the IoP is consistent with the wider Gross Domestic Product estimate.

13. Links with GDP

IoP indices are consistent with those used in the production of the output measure of GDP. Currently based on 2013 GVA weights, the production sector represents 14.6% of the total UK economy.

For the preliminary release of GDP, which is released around 24 days after the end of the reference period, IoP provides a forecast for the third month of the quarter. This forecast is produced using Arima models and analysing early returns to the Monthly Business Survey and early estimates from DECC.

14. Confidentiality and Disclosure

The Index of Production is compliant with the National Statistics Code of Practice, Principle 5, Practice1, which states:

‘Ensure that official statistics do not reveal the identity of an individual or organisation, or any private information relating to them, taking into account other relevant sources of information.'

All necessary steps are taken to protect the confidentiality of data collected from respondents. This includes statistical disclosure controls to ensure that individual respondents are not identified in the published statistics.

When data are shared with other bodies, for example Eurostat and the Scottish Government, it is done so under legislation and using secure electronic file transfer methods.

15. Dissemination

Statistics covering IoP estimates are disseminated monthly through:

The Index of Production Statistical Bulletin:
http://www.ons.gov.uk/ons/rel/iop/index-of-production/index.html

The Index of Production Statistical Bulletin presents the key messages within the data, a detailed sector summary focusing on the four main aggregates: mining & quarrying; manufacturing; energy and water supply & sewerage.

Time series data are available for users to download. This can be found at
http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?dataset=diop

Index of Production publication dates can be found on the UK National Statistics Publication hub release calendar.
https://www.gov.uk/government/statistics/announcements

16. Reliability of Estimates

There are two possible types of error in estimates of manufacturing turnover, sampling error and non sampling error.

Sampling error occurs because a sample, rather than the entire population, is surveyed. It is the difference between the true value for the population and the estimated value. One way of measuring this difference is through standard errors.

Non sampling error arises from inaccuracies in coverage, collecting, recording and processing of the data. The most significant of these errors are: misreporting of data items; deficiencies in coverage; non-response and processing errors. Every effort is made to minimise reporting error by the careful design of questionnaires, building and maintaining the sampling frame, intensive training and supervision of editing and validation staff and efficient data processing procedures.

Annex A – Published Statistics

Weight	SIC	Description
1000		**All Production Industries**
120.4	**B**	**Mining and quarrying**
0.9	5	Mining of coal and lignite
96.2	6	Extraction of crude petroleum and natural gas
23.4	7+8+9	Other mining and quarrying plus mining support
700.4	**C**	**Manufacturing**
114.2	**CA**	**Food products, beverages and tobacco**
86.3	10	Manufacture of food products
16.0	10.1	Processing and preserving of meat and meat products
12.4	10.2-3	Processing and preserving of fish, fruit and vegetables
1.2	10.4	Vegetables, animal oils and fats
5.0	10.5	Dairy products
5.3	10.6	Grain mill products, starches and starch products
16.8	10.7	Bakery and farinaceous products
26.0	10.8	Other food products
3.7	10.9	Prepared animal feeds
23.1	11	Manufacture of beverages
17.6	11.01-6	Alcoholic beverages
5.6	11.07	Soft drinks, minerals and bottled water
4.8	12	Tobacco products
25.4	**CB**	**Textiles, wearing apparel and leather products**
12.1	13	Textiles
10.4	14	Wearing apparel
2.9	15	Leather and related products
51.0	**CC**	**Wood, paper products and printing**
10.9	16	Wood and wood products except furniture
18.5	17	Paper and paper products
21.5	18	Printing and reproduction of recorded media
9.2	**CD**	**Coke and refined petroleum products**
9.2	19	Coke and refined petroleum products
39.8	**CE**	**Chemicals and chemical products**
39.8	20	Chemicals and chemical products
5.0	20A	Industrial gases, inorganics and fertilizers
8.8	20B	Petrochemicals
3.5	20C	Dyestuffs and agro-chemicals
6.0	20.3	Paints, varnishes and similar coatings
9.4	20.4	Soap, detergents and cleaning products
7.1	20.5	Other chemical products
58.7	**CF**	**Basic pharmaceutical products and preps**
58.7	21	Basic pharmaceutical products and preparations

55.0	**CG**	**Rubber, plastic products & other non metallic mineral products**
36.1	22	Rubber and plastic products
18.9	23	Other non-metallic mineral products
10.3	23OTHER	Glass, refractory, clay and stone products
8.6	23.5-6	Cement, lime, plaster and articles of concrete
83.1	**CH**	**Manufacture of basic metals and metal products**
15.1	24	Basic metals
7.2	24.1-3	Basic iron and steel
7.8	24.4-5	Other basic metals and casting
68.0	25	Fabricated metal products except machinery & equipment
59.4	25OTHER	Fabricated metal products excl weapons and ammunition
8.6	25.4	Weapons and ammunition
36.2	**CI**	**Computer, electronic and optical products**
36.2	26	Computer, electronic and optical products
20.9	**CJ**	**Manufacture of electrical equipment**
20.9	27	Manufacture of electrical equipment
50.6	**CK**	**Manufacture of machinery and equipment n.e.c**
50.6	28	Machinery and equipment n.e.c
92.0	**CL**	**Manufacture of transport equipment**
50.8	29	Motor vehicles, trailers and semi-trailers
41.2	30	Other transport equipment
6.2	30.1	Building of ships and boats
29.6	30.3	Air and spacecraft and related machinery
5.4	30OTHER	Other transport equipment
64.4	**CM**	**Other manufacturing and repair**
15.9	31	Manufacture of furniture
21.0	32	Other manufacturing
27.5	33	Repair and installation of machinery and equipment
1.9	33.15	Repair and maintenance of ships and boats
8.4	33.16	Repair and maintenance of aircraft and spacecraft
17.2	33OTHER	Rest of repair; installation
104.5	**D**	**Electricity, gas, steam and air conditioning supply**
104.5	35	Electricity, gas, steam and air conditioning supply
73.9	35.1	Electric power generation, transmission and distribution
30.6	35.2-3	Manufacture of gas and distribution of fuel
74.7	**E**	**Water supply, sewerage and waste management**
22.0	36	Water collection, treatment and supply
20.6	37	Sewerage
31.5	38	Waste collection, treatment and disposal activities
0.7	39	Remediation and other waste activities