

Article

Producer Price Index standard errors: 2016

This article presents the calculated standard errors of the month-on-month and annual growth rates for PPI during the period January 2016 to December 2016.



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1 . Abstract

The Producer Price Index (PPI), produced by the Office for National Statistics (ONS), provides a measure of inflation for the UK manufacturing sector. It is constructed from a monthly survey which measures the price changes of goods bought and sold by UK manufacturers. Output PPI measures changes in the price of goods produced by UK manufacturers. The output price (also known as the factory gate price) reflects the total price received by the manufacturer for a particular product. It includes costs such as labour, raw materials and energy, as well as interest on loans, site and building maintenance or rent. This article presents standard errors for output PPI during the period January 2016 to December 2016, for both 12-month and month-on-month growth rates. These growth rates are calculated for all manufacturing (Gross Sector Output (GSO) including duty) and for Standard Industrial Classification (SIC) divisions. Index values and 95% confidence intervals corresponding to the period January 2016 to December 2016 are also calculated for all manufacturing (GSO including duty).

2 . Standard errors

If the Producer Price Index (PPI) was based on a census of every business in the UK, where every survey was returned correctly and on time, then the true values of price movements would be known. However, since the PPI is based on a sample of UK businesses, this means that population price movements are estimated and are subject to sampling variability. Sampling variability means that if a different set of businesses had been sampled, then a different estimate would have resulted. The extent to which these estimates would differ, as a result of taking different samples, cannot be measured directly but can be approximated using a standard error (calculated as the square root of the variance of the estimate). Standard errors are used to show the spread of price movements and are one way of assessing the accuracy of a price index. The lower the standard error for a given price index, the more confident one can be that the estimated index is close to the true value for the price index had all UK businesses been included.

3 . Confidence intervals

A confidence interval is an estimated range of values which lie around a sample estimate. This range identifies the likely values for the population value, defined by a specified probability. Confidence intervals for this publication are produced at the 95% level. This means that if 100 samples were taken, then the population value would fall between the upper and lower bounds 95 times.

4 . 12-month growth

Table 1 presents 12-month growth rates along with standard errors for the all manufacturing Producer Price Index (PPI) (Gross Sector Output including duty) and Standard Industrial Classification (SIC) divisional level PPIs. The standard errors have been calculated for each division by creating standard errors for each 12-month growth rate covering the period January 2016 to December 2016 and then taking the arithmetic mean of the 12 individual standard errors.

Table 1: 12-month growth rates with standard errors, January 2016 to December 2016, UK

SIC Division	Division Description	12 month growth, 12 month average, January 2016 to December 2016 (percentages)	Standard error of the 12 month growth, January 2016 to December 2016 (percentage points)
All Manufacturing		0.1	0.2
10	Food products	-0.6	0.5
11	Beverages	0.7	1.2
12	Tobacco	4.8	1.0
13	Textiles	-0.5	0.6
14	Wearing apparel	1.2	2.3
15	Leather and related products	0.5	3.1
16	Wood, products of wood and cork, except furniture; articles of straw and plaiting materials	0.4	0.6
17	Paper and paper products	0.7	0.4
18	Printing and recording services, printed matter	0.5	0.9
19	Coke and refined petroleum products	3.0	0.0
20	Chemicals and chemical products	-1.0	0.7
21	Basic pharmaceutical products and preparations	3.4	1.3
22	Rubber and plastic products	1.6	0.9
23	Other non-metallic mineral products	1.6	0.7
24	Basic metals	10.3	2.2
25	Fabricated metal products, except machinery and equipment	1.1	0.5
26	Computer, electronic and optical products	1.2	0.7
27	Electrical equipment	-0.1	0.7
28	Machinery and equipment NEC	2.0	0.5
29	Motor vehicles, trailers and semi trailers	2.2	1.4
30	Other transport equipment	3.2	1.8
31	Furniture	1.3	0.5
32	Other manufactured goods NEC	2.3	0.9
33	Repair and installation services of machinery and equipment	5.4	1.1

Source: Office for National Statistics

Notes:

1. Standard errors of all SIC divisions are calculated as the arithmetic mean of the standard errors for each 12-month growth covering the period January 2016 to December 2016.
2. The 12-month growth rates may not match those published in the PPI monthly bulletin due to the revisions policy in place for PPI. Please see PPI Quality and Methodology (QMI) for further information.
3. For division 19 "Coke and refined petroleum products", the standard error has been set to zero, rather than being calculated from the source data. Imputed values were used in the calculation of index values used to calculate the 12-month growth rates. This is because prices for this division are collected on behalf of ONS by the Department for Business, Energy and Industrial Strategy (BEIS) and are shared with us at an aggregate level only. As a result, we do not hold the individual prices required to calculate a standard error for this division. The survey issued by BEIS to collect prices for this division covers around 98% of all turnover for coke and refined petroleum products. As a result of this high coverage, any sampling error is likely to be minimal and therefore close to zero.

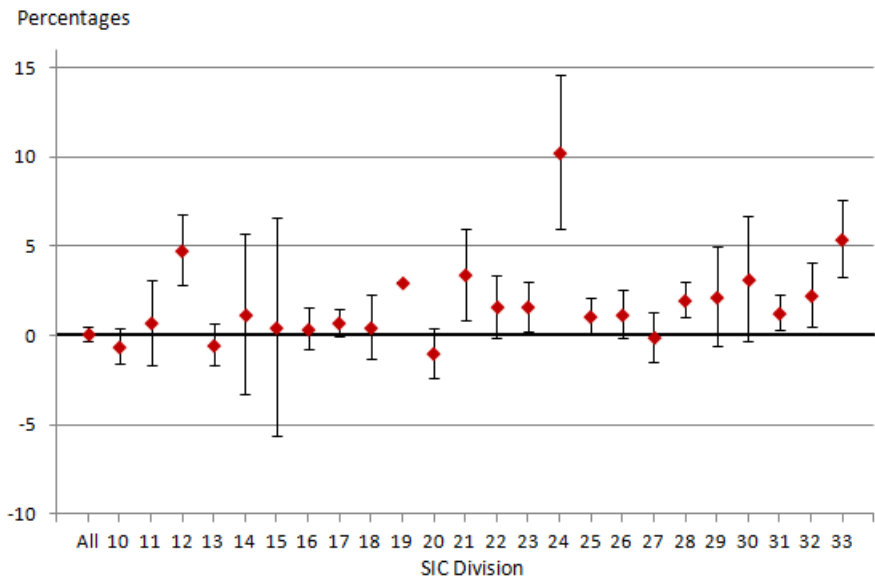
The unweighted mean standard error of the 12-month growth for all divisions was 1.0. Divisions with the largest standard error values of 12-month growth include divisions: 15 "Leather and related products"; 14 "Wearing apparel"; and 24 "Basic metals". These divisions had 12-month growth standard errors of 3.1, 2.3 and 2.2 respectively. Divisions 15 and 24 also had a high standard error for the month-on-month growth (Table 2). This was due to the variation of prices of items included in these divisions which had a significant impact on the growth rates calculated month-on-month as well as the same month a year prior.

Others divisions that also had a standard error noticeably higher than the mean for all divisions include: 30 "Other transport equipment"; 29 "Motor vehicles, trailers and semi trailers"; and 21 "Basic pharmaceutical products and preparations". These divisions had 12-month growth standard errors of 1.8, 1.4 and 1.3 respectively. Despite having above-average standard errors for the 12-month growth, these divisions had relatively low standard errors for the month-on-month growth. This contrasts with the 3 divisions with the highest standard errors (that is, divisions 15, 14 and 24), which also had large standard errors for month-on-month growth. This suggests that there is relatively little variation in the price relatives between months but a larger amount of variation between years.

Figure 1 shows the 12-month growth rates for each SIC division with 95% confidence intervals calculated as ± 1.96 standard errors. This chart highlights the divisions, as described above, with the largest standard errors. It can be seen that the confidence intervals for some divisions do not overlap with zero, meaning that the direction of the price movements measured by the PPI are statistically significant. For the aforementioned divisions, they are significant for one of two reasons. It is either as a result of a large growth rate as seen for Division 12 "Tobacco Products", Division 24 "Basic Metals" and Division 33 "Repair and installation services of machinery and equipment", or it is as a result of a low standard error as seen for Division 25 "Fabricated Metal Products except Machinery", Division 29 "Motor Vehicles" and Division 31 "Furniture".

Figure 1: 12-month growth rates by SIC Division with 95% confidence interval

January 2016 to December 2016, UK



5 . Month-on-month growth

Table 2 presents month-on-month growth rates along with standard errors for the all manufacturing Producer Price Index (PPI) (Gross Sector Output including duty) and the Standard Industrial Classification (SIC) divisional level PPIs. The standard errors have been calculated for each division by calculating standard errors for each month-on-month growth rate over the period January 2016 to December 2016 and then taking an arithmetic mean of the 12 individual standard errors.

Table 2: Month-on-month growth rates with standard errors, January 2016 to December 2016, UK

SIC Division	Division Description	Month-on-month growth rate, 12 month average, (Jan 2016 to Dec 2016) (percentages)	Standard error of the month-on-month growth, 12 month average, January 2016 to December 2016 (percentage points)
All Manufacturing		0.1	0.1
10	Food products	0.2	0.1
11	Beverages	0.0	0.3
12	Tobacco	0.4	0.2
13	Textiles	-0.1	0.2
14	Wearing apparel	0.2	0.3
15	Leather and related products	0.2	0.8
16	Wood, products of wood and cork, except furniture; articles of straw and plaiting materials	0.2	0.2
17	Paper and paper products	0.0	0.1
18	Printing and recording services, printed matter	0.2	0.2
19	Coke and refined petroleum products	1.8	0.0
20	Chemicals and chemical products	0.4	0.2
21	Basic pharmaceutical products and preparations	0.4	0.3
22	Rubber and plastic products	0.1	0.2
23	Other non-metallic mineral products	0.2	0.2
24	Basic metals	1.9	0.6
25	Fabricated metal products, except machinery and equipment	0.2	0.1
26	Computer, electronic and optical products	0.1	0.2
27	Electrical equipment	0.1	0.2
28	Machinery and equipment NEC	0.2	0.1
29	Motor vehicles, trailers and semi trailers	0.2	0.2
30	Other transport equipment	0.3	0.3
31	Furniture	0.2	0.1
32	Other manufactured goods NEC	0.1	0.2
33	Repair and installation services of machinery and equipment	0.5	0.2

Notes:

1. Standard errors of all divisions are calculated as the arithmetic mean of the standard errors for each month-on-month growth covering the period January 2016 to December 2016.
2. The month-on-month growth rates may not match those published in the PPI monthly bulletin due to the revisions policy in place for PPI. Please see PPI Quality and Methodology (QMI) for further information.
3. For division 19 “Coke and refined petroleum products”, the standard error has been set to zero, rather than being calculated from the source data. Imputed values were used in the calculation of index values used to calculate the 12-month growth rates. This is because prices for this division are collected on behalf of ONS by the Department for Business, Energy and Industrial Strategy (BEIS) and are shared with us at an aggregate level only. As a result, we do not hold the individual prices required to calculate a standard error for this division. The survey issued by BEIS to collect prices for this division covers around 98% of all turnover for coke and refined petroleum products. As a result of this high coverage, any sampling error is likely to be minimal and therefore close to zero.

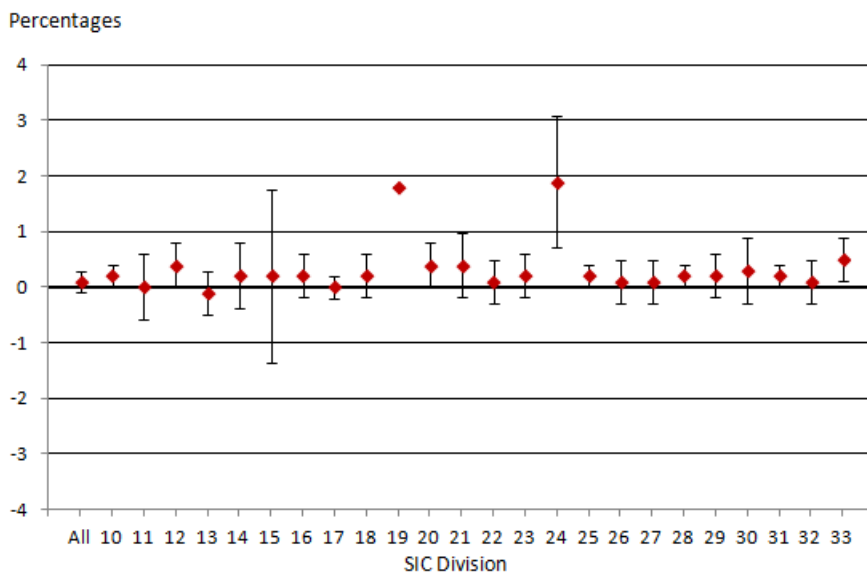
Divisions with the largest standard error of month-on-month growth were division 15 “Leather and related products” and 24 “Basic metals” which had standard errors of 0.8 and 0.6 respectively. The volatile price movements in Division 15 are largely due to the fact that the growth is calculated from a relatively small sample of items therefore price movements within this sample will have a significant impact on the growth rates. In addition to this, it is also worth noting that the two indices feeding into division 15 show quite different price movements over the past 12 months; “Tanned and dressed leather” decreased by 1.7% in the year to December 2016 whereas “Footwear” increased by 2.8% over the same period. This variation in the direction of growth rates will also impact the standard error.

The unweighted mean standard error for the month-on-month growth for all divisions was 0.2. The standard error value of the month-on-month growth of division 24 “Basic metals” was 0.6, which is three times the mean value. This is likely to be as a result of the fact that the underlying price data for this division is collected from a single published source; therefore this restricts the variety of items that can be collected which can cause variation in the results.

Figure 2 shows the month-on-month growth rates for each SIC division with 95% confidence intervals calculated as ± 1.96 standard errors. This chart highlights the divisions, as described above, with the largest standard errors. It can be seen for Division 24 “Basic Metals” and Division 33 “Repair and installation services of machinery and equipment”, the confidence intervals do not overlap with zero, meaning that the direction of the growth rate reported for these divisions are statistically significant. For division 24 this is mainly due to the large growth over the period January 2016 to December 2016, while for division 33 this is mainly due to a narrow confidence interval. The reason there are relatively few divisions where the direction of growth is significant is because month-on-month growth tends to be smaller and more volatile.

Figure 2: Month-on-month growth rates by SIC Division with 95% confidence interval

January 2016 to December 2016, UK



6 . Aggregate PPI

This section includes summary information of standard errors for growth rates of the top level Producer Price Index (PPI) (Gross Sector Output (GSO) including duty). The month-on-month growth rates along with associated 95% confidence intervals are plotted for each consecutive month between the period January 2016 and December 2016. Table 3 shows the monthly growth rates of all manufacturing and an estimate of the standard errors for these periods.

Table 3: All Manufacturing growth rates with standard errors, January 2016 to December 2016, UK

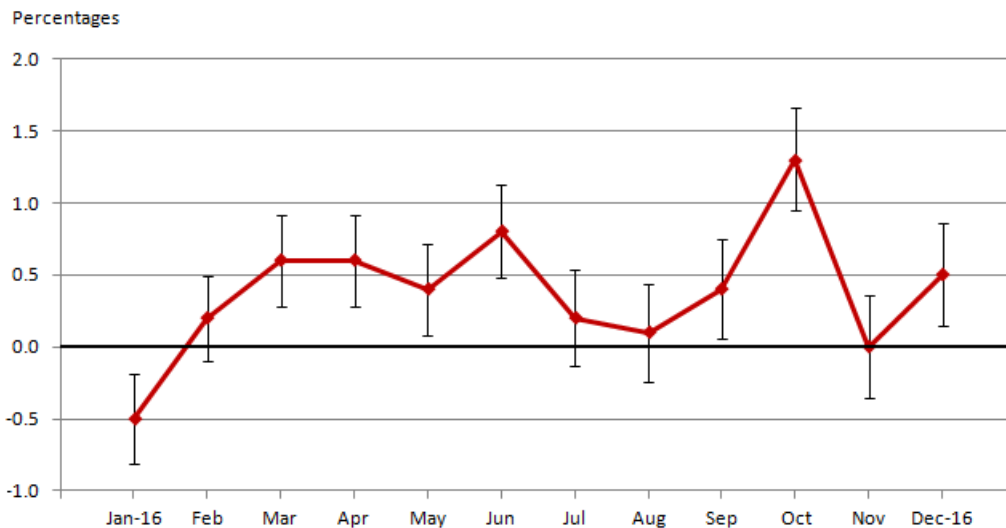
2016	Month-on-month growth, December 2016 (percentages)	Month-on-month standard error, (percentage points)
January	-0.4	0.2
February	0.2	0.2
March	4.7	0.2
April	-0.4	0.2
May	0.9	0.2
June	-0.6	0.2
July	-0.2	0.2
August	0.4	0.2
September	-0.3	0.2
October	-2.8	0.2
November	-2.5	0.2
December	2.9	0.2

Source: Office for National Statistics

Standard errors remained constant throughout the period January 2016 to December 2016. This is reflected in the confidence intervals which can be seen in Figure 3. Figure 3 shows the growth rates for all manufacturing (GSO including duty) along with their corresponding 95% confidence intervals for the period January 2016 to December 2016. For the aggregate PPI, it can be seen that the direction of growth rate for every month between the period January 2016 to December 2016 (excluding February, July, August and November) is statistically significant. This is because the confidence intervals for these months overlap with zero, meaning that the direction of the growth rates reported for these divisions are significant.

Figure 3: All Manufacturing (GSO including duty) growth rates with 95% confidence interval

January 2016 to December 2016, UK



Overall, standard errors for both month-on-month and 12-month growth rates were relatively similar for most Standard Industrial Classification (SIC) divisions with the exception of a few divisions.

Divisions 14 "Wearing Apparel", 15 "Leather and related products", and 24 "Basic metals" had the highest standard error values for 12-month growth. Furthermore, divisions 15 and 24 also had the largest standard error values for month-on-month growth. This resulted from varying price movements seen within these divisions between consecutive months as well as the same month a year prior.

Standard errors for monthly growth rates of all manufacturing (Gross Sector Output (GSO) including duty) remained constant throughout the period January 2016 to December 2016.

7 . Quality and Methodology

1. Standard errors have been published previously for PPI in three articles: [Measuring the quality of the producer price index, measuring the quality of the producer price index - an update](#) and [Analysis of Producer Price Indices using Standard Errors](#)
2. The producer price index is published monthly in a [Statistical Bulletin](#).
3. A [Quality and Methodology \(QMI\)](#) paper for the PPI describes the intended uses of the statistics, their general quality and the methods used to produce them.
4. The methods used to calculate standard errors presented here can be found in [Survey Methodology Bulletin No.62, pages 62 to 80](#)
5. Details of the policy governing the release of new data are available by visiting <https://www.statisticsauthority.gov.uk/monitoring-and-assessment/code-of-practice/> or from the Media Relations Office email: media.relations@ons.gsi.gov.uk

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