

# Comparing ONS UK economic growth data with diffusion indices: 2012 to 2025

Comparing ONS short-term UK economic data and S&P Global Purchasing Managers' Index surveys (PMI). These are official statistics in development.

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# 1 . Main points

- Moderate positive correlations have been observed between the Purchasing Managers' Index (PMI) diffusion index and the three-month on three-month Gross Domestic Product (GDP) growth rates, both before (0.34) and after (0.31) the coronavirus (COVID-19) pandemic.
- Correlations between the Monthly Business Survey (MBS) diffusion index and three-month movements in GDP strengthen from 0.21 for the pre-pandemic period, of 2012 to 2019, to 0.53 for the post-pandemic period of 2022 to 2025, with improvements across all sectors.
- No statistically significant correlations were observed between PMI diffusion indices and month-on-month GDP growth rates or month-on-month MBS diffusion indices.

## 2 . Overview of diffusion indices and movements in GDP

This article updates [previous Office for National Statistics \(ONS\) analysis](#) comparing official estimates of Gross Domestic Product (GDP) with a selection of diffusion indices. The UK economy has since experienced the coronavirus (COVID-19) pandemic and an energy price shock. There has been user interest in whether the relationships between diffusion indices and movements in GDP have changed over time, including by sector. We also construct an improved Monthly Business Survey (MBS) diffusion index to understand how these compare with movements in GDP.

Understanding how these correlations might change over time is important for the quality assurance of ONS statistics, including these new insights from the MBS. Examining these changes can improve users' understanding of how diffusion indices relate to GDP growth. The ONS is well placed to examine this because it has access to firm-level data from the MBS, which is a major component of monthly GDP estimates.

This article covers the period from 2012 to 2025, with MBS data being provisional for 2025. It focuses on two questions.

- How closely do diffusion indices track movements in official ONS measures of GDP, and does this differ across sectors?
- To what extent has the correlation between these diffusion indices and movements in GDP changed before and after the COVID-19 pandemic?

We are grateful for our S&P Global colleagues for their feedback on this article and our continued engagement.

## 3 . Diffusion indices

One feature of diffusion indices is that these can only be a proxy of the "extensive" margin or the "breadth" of change – that is, the proportion of firms that have reported a change. They do not capture the "intensive" margin of change, which would capture how much there has been a change – the "depth" of change. Even when a diffusion index is based on the same underlying figures that feed into official estimates of output, these would not necessarily track perfectly the movements in monthly Gross Domestic Product (GDP).

The Purchasing Managers' Index (PMI) is an example of a diffusion index, which summarises firm-level responses to business surveys on whether economic activity has increased or decreased on the month. PMIs are published before official estimates of GDP and are widely used by economists, policymakers and financial markets to get a timely picture of economic activity.

We construct a PMI-style diffusion index using firm-level Monthly Business Survey (MBS) data as part of improving our understanding of the signals in these diffusion indices. The data we compare in this article are:

- published monthly PMI data
- derived three-month on three-month diffusion index based on the ONS Monthly Business Survey (and Construction Output Survey), which capture changes in turnover from one month to the next at the firm level; for the purposes of this article, these diffusion indices are referred to as "Monthly Business Survey diffusion indices"
- Published three-month on three-month GDP growth rates, using the latest estimates available at the time the analysis was conducted; at the sector level, Gross Value Added (GVA) growth is used, representing the equivalent measure of output (the ONS also publishes quarterly and annual GDP)

To make a like-for-like comparison, we constructed a diffusion index from the MBS using a methodology that mirrors the PMIs. The same broad approach was taken in our [previous article comparing estimates of UK output and diffusion indices](#). Methodological improvements in this update include broader industry coverage, trimming of outlier responses, and applying industry deflators to better align the indices with volume estimates of output (for more information see [Section 8: Data sources and quality](#)).

We look at the correlations with the movements in monthly GDP. As explained in [our GDP insights blog published on 12 September 2025](#), three-month on three-month GDP is our lead measure of economic growth for monthly GDP estimates. As such, this publication focuses on correlations between PMI diffusion indices, three-month on three-month MBS diffusion indices and three-month on three-month GDP growth rates. Other periodicities are available in our [accompanying dataset](#).

## 4 . Correlations between the movements in GDP and diffusion indices

To compare the trends of Gross Domestic Product (GDP) and diffusion indices, we standardise each series, which ensures all series are in comparable units. For presentation purposes, the standardisation has transformed the data by subtracting the series mean and dividing by the series standard deviation for each observation. This means each standardised series has a mean of zero and standard deviation of one.

However, the large movements during the coronavirus (COVID-19) pandemic affect these time series' properties, particularly in GDP. For instance, it is not possible to infer the relative volatility between these time series, as the standardisation process is such that it is only showing the periods of relative volatility within each time series. The series may not always move together, even when they indicate a similar underlying economic trend. Caution should be taken when drawing conclusions from visual comparisons alone.

Figure 1 shows how the three-monthly movements in GDP track with the Purchasing Managers' Index (PMI) and Monthly Business Survey (MBS) diffusion indices, including for the manufacturing, services, and construction sectors. Co-movements are generally more apparent at the whole-economy level rather than individual sectors. The pandemic period is associated with large movements across all indicators and sectors. For the composite measures, GDP, PMI and the MBS diffusion index all point to a large fall in output during early 2020, with the trough of each series below five standard deviations of their respective 2012 to 2025 means.

Figure 1 also captures how you would not necessarily expect co-movements in GDP and these diffusion indices. PMI and MBS indices are only reflecting the extensive margin of change, whereas movements in GDP are also picking up the intensive change.

### **Figure 1: Standardised diffusion indices and three-month on three-month GDP track reasonably well for the whole economy (composite) and across sectors**

Three-month on three-month GDP growth, and three-month on three-month Monthly Business Survey (MBS) diffusion index and Purchasing Managers' Index (PMI), seasonally adjusted at constant prices, 2012 to 2025

Notes:

1. The MBS diffusion index is deflated using industry-level deflators. The PMI similarly captures changes in volumes of output.
2. Three-month on three-month GDP data are consistent with the GDP monthly estimate, UK: April 2026, released in June 2026. This does not account for revisions from the July 2026 publication, which has revisions back to January 2024.
3. 2025 MBS data are provisional.
4. All series have been standardised with mean of zero and standard deviation of one, for comparability.
5. Comparisons of other periodicities are included in our [accompanying dataset](#).
6. Further detail can be found in [Section 8: Data sources and quality](#).
7. MBS data used in this analysis are different to the data used in the compilation of the Index of Services, Manufacturing and Construction because of different processing steps.
8. In the case of the construction sector, the MBS diffusion index reflects responses to the Construction Output Survey.

GDP includes industries not captured by the PMI and MBS diffusion indices, including the non-market and retail sectors. For example, our Monthly Business Survey (MBS) is used for 43.3% of the monthly services gross value added (GVA) by industry weight. The [GDP data source catalogue](#) shows that the MBS is just one of the many sources used to compile GDP. As such, movements in GDP will also reflect information that is not covered by the MBS.

Another feature is the differences between the MBS and PMI diffusion indices, where likely explanations include the different survey size and coverage, sample composition of businesses and respondent behaviour to these surveys. Comparisons of the various data sources can be found in [Section 8: Data Sources and Quality](#).

A final reflection is that we have shown the latest vintage of GDP at the time of analysis, not the first estimates. Given that early estimates of GDP can be revised, reflecting the trade-off between timeliness and accuracy, these correlations might also change by vintage of GDP. Our [published revision triangle dataset](#) shows how estimates of movements in GDP have changed in real time. Future research might look at how these correlations might change as we produce more mature estimates of GDP, particularly for the post-pandemic period.

## Correlations of three-month on three-month measures

These relationships are statistically validated by testing correlations. We use detrended cross-correlation analysis (DCCA) to derive correlation coefficients between the three data sources, which are comparable to results from the 2019 publication.

DCCA is a methodology initially proposed in G.F. Zebende's 2011 [DCCA cross-correlation coefficient: Quantifying level of cross-correlation article](#) to estimate correlations between data series that may have underlying trends and that could bias conventional correlation analysis. The method estimates correlations by removing trends in the data over a number of overlapping boxes, with the length of each box being determined by the scale "S". DCCA produces a unique correlation coefficient for each scale measured, meaning that it produces a profile of correlation coefficients for each combination of series. In line with other measures of correlation, a coefficient of 1 indicates perfect positive correlation, a coefficient of negative 1 indicates perfect negative correlation and a coefficient of 0 indicates no correlation between the series being assessed.

To estimate whether the correlations represent a statistically significant positive relationship, rather than coincidental co-movement, we estimate a one-sided 95% confidence interval to assess the coefficients against. Any value above the confidence interval is considered a statistically significant positive relationship. More detail on how this interval is calculated is provided in [Section 8: Data Sources and Quality](#).

As the DCCA model is sensitive to large movements in the pandemic period, the data have been split into the pre-pandemic period and post-pandemic period. For these purposes, the pre-pandemic period is defined as January 2012 to February 2020, and the post-pandemic period as January 2022 to December 2025.

Table 1 shows the highest correlation coefficients observed between these three series in the pre-pandemic period, while Table 2 shows the corresponding correlation coefficients for the post-pandemic period.

The PMI diffusion indices are moderately correlated with three-month on three-month GDP growth rates in the pre-pandemic (0.34) and post-pandemic (0.31) period, with variation between sectors. The strongest relationship observed is between GDP growth rates and the MBS diffusion index in the post-pandemic period, which might be indicative of potential for a real-time coincident indicator. The weakest relationship is between PMI and MBS diffusion indices in the post-pandemic period.

Table 1: Pre-pandemic correlations show weak to moderate values in the highest correlations observed between the diffusion indices and the three-month on three-month GDP measure, with notable sector-level differences. Highest observed detrended cross-correlation analysis (DCCA) coefficients for three-month on three-month GDP growths, three-month on three-month Monthly Business Survey (MBS) diffusion index and monthly Purchasing Managers' Index (PMI), seasonally adjusted at constant prices, January 2012 to February 2020

|                                    | <b>Composite</b> | <b>Manufacturing</b> | <b>Services</b> | <b>Construction</b> |
|------------------------------------|------------------|----------------------|-----------------|---------------------|
| <b>PMI and GDP</b>                 | 0.34*            | 0.31*                | 0.17            | 0.03                |
| <b>MBS diffusion index and GDP</b> | 0.21             | 0.30*                | 0.12            | 0.27*               |
| <b>MBS diffusion index and PMI</b> | 0.23             | 0.23                 | 0.27*           | 0.38*               |

Source: Office for National Statistics and S&P Global

#### Notes

1. The MBS diffusion index is deflated using industry-level deflators. The PMI similarly captures changes in volumes of output.
2. Three-month on three-month GDP data are consistent with the GDP monthly estimate, UK: April 2026, released in June 2026. This does not account for revisions from the July 2026 publication, which has revisions back to January 2024.
3. 2025 MBS data are provisional.
4. All series have been standardised with mean of zero and standard deviation of one, for comparability.
5. Comparisons of other periodicities are included in our accompanying dataset.
6. Further detail can be found in Section 8: Data sources and quality.
7. MBS data used in this analysis are different to the data used in the compilation of the Index of Services, Manufacturing and Construction because of different processing steps.
8. In the case of the construction sector, the MBS diffusion index reflects responses to the Construction Output Survey.
9. [\*] indicates correlations that were found to be statistically significant compared with a 95% confidence interval.
10. In line with other ONS outputs, the pre-pandemic end month is February 2020. For the purposes of this analysis, we define the post-pandemic period as starting in January 2022.

Table 2: Post-pandemic correlations show notable divergences in the highest correlations observed between the three source combinations

Highest observed detrended cross-correlation analysis (DCCA) coefficients for three-month on three-month GDP growths, three-month on three-month Monthly Business Survey (MBS) diffusion index and monthly Purchasing Managers' Index (PMI), seasonally adjusted at constant prices, January 2022 to December 2025

|                                    | <b>Composite</b> | <b>Manufacturing</b> | <b>Services</b> | <b>Construction</b> |
|------------------------------------|------------------|----------------------|-----------------|---------------------|
| <b>PMI and GDP</b>                 | 0.31*            | -0.09                | 0.41*           | 0.36*               |
| <b>MBS diffusion index and GDP</b> | 0.53*            | 0.50*                | 0.56*           | 0.41*               |
| <b>MBS diffusion index and PMI</b> | 0.06             | 0.23                 | 0.05            | 0.19                |

Source: Office for National Statistics and S&P Global

## Notes

1. The MBS diffusion index is deflated using industry-level deflators. The PMI similarly captures changes in volumes of output.
2. Three-month on three-month GDP data are consistent with the GDP monthly estimate, UK: April 2026, released in June 2026. This does not account for revisions from the July 2026 publication, which has revisions back to January 2024.
3. 2025 MBS data are provisional.
4. All series have been standardised with mean of zero and standard deviation of one, for comparability.
5. Comparisons of other periodicities are included in our accompanying dataset.
6. Further detail can be found in Section 8: Data sources and quality.
7. MBS data used in this analysis are different to the data used in the compilation of the Index of Services, Manufacturing and Construction because of different processing steps.
8. In the case of the construction sector, the MBS diffusion index reflects responses to the Construction Output Survey.
9. [\*] indicates correlations that were found to be statistically significant compared with a 95% confidence interval.
10. In line with other ONS outputs, the pre-pandemic end month is February 2020. For the purposes of this analysis, we define the post-pandemic period as starting in January 2022.

In our [accompanying dataset](#), we also show correlations when monthly PMI is compared with month-on-month GDP growth and our month-on-month MBS diffusion index. No statistically significant results were observed when all measures were in month-on-month periodicities.

## Summary of correlations between GDP growth and PMI

Figure 2 shows the DCCA results when PMI diffusion indices are compared with official measures of GDP growth, for the pre-pandemic and post-pandemic samples. The x-axis reflects the scale over which the correlation is assessed. For example, the left panel of Figure 2 shows the correlation between three-month on three-month GDP growth and the PMI in the pre-pandemic period, across scales. For example, a scale of 4 shows that we are assessing how the two series move together over a rolling window of four months. Likewise, a scale of 5 captures how these series move together over a rolling window of five months, and so on. The right panel of Figure 2 shows the same correlations over these rolling windows in the post-pandemic period.

In line with best practice, the minimum scale length is determined as  $S(\min) = P + 3$ , where  $P$  is the order of the polynomial used for detrending. In this analysis we use a polynomial of order 1. The largest scale length is determined as  $S(\max) = N/5$ , where  $N$  is the length of the series.

**Figure 2: Correlations between three-month on three-month GDP growth and month-on-month PMI diffusion indices show moderate to weak correlations, both before and after the pandemic period**

Detrended cross-correlation analysis (DCCA) coefficients for three-month on three-month GDP growths and month-on-month Purchasing Managers' Index (PMI), February 2012 to February 2020 and January 2022 to December 2025

Notes:

1. MBS diffusion index is deflated using industry-level deflators. The PMI similarly captures changes in volumes of output.
2. Monthly GDP data are consistent with the GDP monthly estimate, UK: April 2026 released in June 2026. This does not account for revisions from the July 2026 publication, which has revisions back to January 2024.
3. 2025 MBS data are provisional.
4. All series have been standardised with mean of zero and standard deviation of one, for comparability.
5. Comparisons of other periodicities are included in our accompanying dataset.
6. Further detail can be found in Section 8: Data sources and quality.
7. MBS data used in this analysis are different to the data used in the compilation of the Index of Services, Manufacturing and Construction because of different processing steps.
8. In the case of the construction sector, the MBS diffusion index reflects responses to the Construction Output Survey.
9. Statistical significance is assessed by a one-sided 95% confidence interval.
10. In line with other ONS outputs, the pre-pandemic end month is February 2020. For the purposes of this analysis, we define the post-pandemic period as starting in January 2022.

Figure 2 shows that the monthly PMI composite diffusion index and three-month on three-month GDP growth are most closely related over medium-term time scales, with correlations exceeding the 95% confidence interval in 5- to 18-month windows for the pre-pandemic period. The highest correlation coefficient observed was 0.34 at 13-month time scales, which indicates that these two tend to move in the same direction over the medium term. At time scales of less than 6 months, the series correlation is no stronger than that observed between unrelated white noise series.

The manufacturing sector shows a similar pattern to the whole economy in the pre-pandemic period, being statistically significant at timescales between 5 and 16 months and showing a peak correlation coefficient of 0.31 at 12-month time scales. Correlations between PMI diffusion indices and three-month on three-month GDP growth rates for the construction and services sectors showed weak, statistically insignificant correlations across all time scales.

In the post-pandemic period, the manufacturing PMI showed weak correlation with three-month on three-month GDP growth, across all time scales. In the services sector, statistically significant correlations were observed between the monthly PMI diffusion index and three-month on three-month GDP growth in timescales of five to nine months, with correlations increasing as the scales widened. Moderate correlations in the range 0.29 to 0.41 in this period are observed for medium-term timescales. Similar trends were observed in the construction sector. The composite measure showed some evidence of correlation at longer time scales. Since the post-pandemic sample reflects a shorter time series, caution should be taken when interpreting these results.

## Summary of correlations between GDP growth and the MBS diffusion index

When MBS diffusion indices are compared instead with official three-month on three-month GDP growth rates, we observe weak correlation in the pre-pandemic period, but stronger correlation in the post-pandemic period. Figure 3 shows that in the pre-pandemic period, weak statistically significant correlations were observed over both short- and medium-term trends in the manufacturing and construction sectors, with both becoming statistically insignificant at time scales of a year or longer.

Figure 3 demonstrates moderate to strong correlations in all three sectors in the post-pandemic period. For the manufacturing and services sectors, we see correlation coefficients of 0.42 to 0.56, with correlations increasing as the time scales are widened. The profiles imply that the correlations improve over longer time scales, such that co-movements strengthen over longer-term time horizons.

For the construction sector, correlation coefficients in the post-pandemic period start at 0.41, indicating that short-term fluctuations tend to move together. However, correlations deteriorate over longer-time scales, implying that co-movements weaken over longer-term time horizons.

### **Figure 3: Three-month on three-month MBS diffusion indices show moderate correlation with three-month on three-month GDP growth rates before the pandemic, but stronger correlation in all sectors after the pandemic**

Detrended cross-correlation analysis (DCCA) coefficients for three-month on three-month GDP growths and three-month on three-month Monthly Business Survey (MBS) diffusion indices, February 2012 to February 2020 and January 2022 to December 2025

#### **Notes:**

1. MBS diffusion index is deflated using industry-level deflators. The PMI similarly captures changes in volumes of output.
2. Monthly GDP data are consistent with the GDP monthly estimate, UK: April 2026, released in June 2026. This does not account for revisions from the July 2026 publication, which has revisions back to January 2024.
3. 2025 MBS data are provisional.
4. All series have been standardised with mean of zero and standard deviation of one, for comparability.
5. Comparisons of other periodicities are included in our accompanying dataset.
6. Further detail can be found in Section 8: Data sources and quality.
7. MBS data used in this analysis are different to the data used in the compilation of the Index of Services, Manufacturing and Construction because of different processing steps.
8. In the case of the construction sector, the MBS diffusion index reflects responses to the Construction Output Survey.
9. Statistical significance is assessed by a one-sided 95% confidence interval.
10. In line with standard practice, the pre-pandemic end month is February 2020. For the purposes of this analysis, we define the post-pandemic period as starting in January 2022.

Correlations between MBS diffusion indices and three-month on three-month GDP growth are stronger in the post-pandemic sample than in the pre-pandemic sample. However, the post-pandemic period covers a shorter time span, so caution should be exercised when comparing the strength of correlations across the two periods.

### **Summary of correlations between PMI and the MBS diffusion index**

Figure 4 shows that pre-pandemic correlations between the PMI and MBS diffusion indices were generally weak and varied across industries. In the pre-pandemic period, correlations between the services diffusion indices peaked at 0.27 and were insignificant at time scales wider than seven months, and correlations between the composite diffusion indices peaked at 0.23 and were insignificant at time scales wider than five months. These results imply that the series share similar short-term fluctuations only. These relationships did not persist in the post-pandemic period, where no sectors were found to have statistically significant positive correlations over any time scales tested.

### **Figure 4: Correlations between three-month on three-month MBS diffusion indices and month-on-month PMI diffusion indices show generally weak correlations, especially after the pandemic period**

Detrended cross-correlation analysis (DCCA) coefficients for three-month on three-month Monthly Business Survey (MBS) and month-on-month Purchasing Manager's Index (PMI) diffusion indices, February 2012 to February 2020 and January 2022 to December 2025

**Notes:**

1. MBS diffusion index is deflated using industry-level deflators. The PMI similarly captures changes in volumes of output.
2. Monthly GDP data are consistent with the GDP monthly estimate, UK: April 2026, released in June 2026. This does not account for revisions from the July 2026 publication, which has revisions back to January 2024.
3. 2025 MBS data are provisional.
4. All series have been standardised with mean of zero and standard deviation of one, for comparability.
5. Comparisons of other periodicities are included in our accompanying dataset.
6. Further detail can be found in Section 8: Data sources and quality.
7. MBS data used in this analysis are different to the data used in the compilation of the Index of Services, Manufacturing and Construction because of different processing steps.
8. In the case of the construction sector, the MBS diffusion index reflects responses to the Construction Output Survey.
9. Statistical significance is assessed by a one-sided 95% confidence interval.
10. In line with standard practice, the pre-pandemic end month is February 2020. For the purposes of this analysis, we define the post-pandemic period as starting in January 2022.

The persistence of weak correlations between the PMI and MBS diffusion indices, even after aligning methodology and industry coverage, suggests that differences between the measures are unlikely to be explained solely by methodological factors. Further work would be needed to understand the extent to which other factors, such as differences in sample composition, timing, or responses to economic shocks, contribute to these differences.

## 5 . Future developments

The availability of increasingly timely and high-frequency information presents further opportunities for informing Gross Domestic Product (GDP) in real time. Every week we publish our [real-time indicators dashboard](#), which uses innovative surveys, methods and data sources. The full commentary is also published in our monthly [Economic activity and social change in the UK, real-time indicators bulletin](#). Future work could use information from [our flash Value Added Tax \(VAT\) turnover diffusion index](#) in improving the production of early estimates of GDP. We will explore the feasibility of producing a real-time MBS diffusion index in the future, subject to our wider prioritisation efforts.

We have also developed for the first time a turnover diffusion index using responses to [the Business Insights and Conditions Survey \(BICS\)](#). The BICS collects qualitative information on whether a firms' turnover has increased, decreased, or remained the same, compared with the previous month. The non-seasonally adjusted BICS diffusion indices for the services, manufacturing and construction sectors can be accessed in our [accompanying dataset](#). We will review the potential of the analysis in this article to inform how we look at the suite of real-time indicators.

We continue to review how we can improve the trade-off between the timeliness and accuracy in early estimates of GDP, including by looking at some of these diffusion indices. There is scope to further exploit the richness of Office for National Statistics (ONS) microdata to better understand coherence across different data sources. For example, directly linking Monthly Business Survey (MBS) and BICS microdata would allow us to assess consistency in firm-level responses between a statutory, quantitative survey (MBS), and a timelier, voluntary, qualitative survey (BICS). Such analysis could help identify differences in how respondents interpret qualitative questions in surveys, such as the BICS, and improve the interpretation and calibration of diffusion indices. Firm-level analysis also allows us to understand how responses vary by firm characteristic, such as firm size and industry, as such, variation can often be masked when only observing aggregate indicators.

A longer BICS longitudinal panel will allow for robust seasonal adjustment and the development of seasonally adjusted BICS diffusion indices. Further work could explore its predictive power for GDP, particularly at times of economic uncertainty.

Future work could also explore the regional dimension of these indicators to better understand variation in economic growth across the devolved nations. For example, comparing regional Purchasing Managers' Index data with regional gross value added (GVA) estimates.

## 6 . Diffusion indices and correlations data

[Selected diffusion indices and detrended cross-correlations analysis by sector. UK](#)

Dataset | Released 30 July 2026

Detrended cross-correlation analysis of seasonally adjusted UK Monthly Business Survey (MBS) diffusion indices in constant prices, with the Purchasing Managers' Index and ONS official estimates (2012 to 2025). Dataset also includes selected non-seasonally adjusted and current price MBS and Business Insights and Conditions Survey diffusion indices. These are official statistics in development.

## 7 . Glossary

### Diffusion index

A diffusion index is an aggregate measure that tracks the breadth of economic change across businesses, rather than the magnitude.

## Gross Domestic Product (GDP)

GDP is the main measure of UK economic growth based on the value of goods and services produced during a given period.

### Composite

The term "composite" is used for the Purchasing Managers' Index (PMI) and Monthly Business Survey (MBS) diffusion indices because they combine sectors. The GDP series represents headline whole-economy GDP growth and includes additional industries not covered by the composite diffusion indices, including the retail and public sector.

### Seasonal adjustment

A widely used technique for removing seasonal or calendar effects from time series data.

### Volume estimates

The volume estimates are calculated by taking the value estimates and adjusting to remove the impact of price changes.

## 8 . Data sources and quality

### Summary of data sources

In this section, we summarise the difference between Gross Domestic Product (GDP), Monthly Business Survey (MBS) and Purchasing Managers' Index (PMI).

### Gross domestic product (GDP)

- Source: Office for National Statistics (ONS).
- Frequency: Monthly (output measure), quarterly and annual estimates are also available.
- Coverage: UK, whole economy and by sector (manufacturing, services, construction).
- Sample size: 42,000 businesses surveyed in the MBS, as well as other sources for full coverage.
- Measures: Total economic output based on the monetary value of goods and services produced.
- Prices: Current price and volume estimates of output growth.
- Units: Combined from multiple survey and administrative data sources to produce official estimates of output (in levels, British pounds).
- Timeliness: Monthly GDP estimates are published with a lag (around 40 days) after the reference period.
- Revisions: Subject to revision as more complete data become available as explained in [our National Accounts Revisions Policy](#); estimates up to 2023 have been balanced as part of the supply-use process and rely on annual sources (estimates for 2024 and 2025 rely primarily on the MBS).

### Monthly Business Survey (MBS)

- Source: Office for National Statistics (ONS).
- Frequency: Monthly.
- Coverage: UK manufacturing, services and construction sectors.
- Sample size: Approximately 42,000 businesses are sampled each month; on average, around 29,000 businesses provided MBS returns in consecutive months when mapped to the PMI industry coverage.
- Measures: Businesses are asked to report the monetary value of turnover for the latest month (British pounds).
- Units: Source data collected as turnover values (British pounds), which are used to derive diffusion indices of business activity.
- Method: Survey responses used to estimate response balances, which are aggregated to produce diffusion indices of business activity.
- Timeliness: Published with a lag (around 40 days) after the reference period.
- Revisions: For every release, subject to revision for the latest 12 months to incorporate late and revised survey responses.

## **Purchasing Managers' Index (PMI)**

- Source: S&P Global.
- Frequency: Monthly.
- Coverage: UK manufacturing, services and construction sectors.
- Sample size: Panel of around 2,000 companies.
- Measures: Businesses are asked whether output has increased, decreased or stayed the same compared with the previous month.
- Units: Diffusion index (0 to 100) based on the balance of responses indicating increased, unchanged or decreased activity.
- Method: Survey responses aggregated into a diffusion index using response balances.
- Timeliness: Published shortly after the end of the reference period.
- Revisions: Not revised after publication.

## **Methodology for constructing diffusion indices**

For this analysis, our diffusion indices are comparable with the Purchasing Managers' Index (PMI) and constructed using a subset of Monthly Business Survey (MBS) data. All diffusion indices and GDP growth rates are standardised to enable direct comparison.

The construction of our MBS diffusion index involves the following four steps:

## Step 1

The MBS data are first adjusted to align as closely as possible with PMI sector coverage. These diffusion indices, notably, do not account for non-market output or retail. We exclude businesses with Standard Industrial Classification (SIC) that are not included in PMI surveys. This mainly affects the services sector. It should also be noted that industries that are not included in the MBS are also not included in the diffusion index.

The ONS MBS coverage (SIC07) is:

- Services: 45000 to 97000 (excluding 47000 to 49200; 50000 to 51220; 64000 to 66300; 68100 to 68209; 70100; 81100; 81300; 84000 to 84300; 85100 to 85310; 87000 to 88000; 92000; 94000 to 94990; 96040 to 97000)
- Manufacturing: 10100 to 33200 (excluding 19100 to 19209 and 24100 to 24340)
- Construction: 41200 to 43000

The PMI coverage (SIC07) is:

- Services: 49100 to 64999; 68100 to 82990; 90000 to 96090
- Manufacturing: 10100 to 33200; 38300 to 38320; 58100 to 58190; 59200
- Construction: 41000 to 43999

## Step 2

Turnover values from the MBS are first converted into volume measures by applying deflators from our [ONS industry deflators dataset](#). We divide each firm's reported turnover by the relevant industry deflator, so that changes in turnover reflect changes in real activity rather than changes in prices. This also aligns the MBS more closely with the PMI, which asks firms about changes in output rather than turnover.

The resulting volume measures are then linked at the firm level across the periods being compared. A business is only included in a diffusion index calculation where it has a valid MBS return in both the current and comparison period. Because this approach requires businesses to be observed in more than one period, not all MBS returns can be used in the linked dataset. This reflects the MBS sample design, sample refresh and response patterns, rather than necessarily indicating businesses entering or leaving the market. Internal analysis suggests that linking has a limited effect on the movement of the resulting diffusion indices. Therefore, removing businesses without repeat observations is unlikely to materially affect the interpretation of the correlation analysis.

For the three-month on three-month diffusion index, we compare the sum of the turnover across the latest three months against the three-months before, consistent with how quarterly GDP is constructed. The three-month on three-month growth rate in period "t" for each firm is therefore calculated as:

$$\frac{\sum_{t-2}^t \text{Turnover}_t}{\sum_{t-5}^{t-3} \text{Turnover}_t}$$

Diffusion indices and correlations based on month-on-month percentage changes are included in our [accompanying dataset](#).

For each month and sector, we trim the top and bottom 1% of turnover growth rates to remove outliers.

### Step 3

The percentage change in volume compared with the preceding period is calculated and is compared with a user-defined threshold value. The purpose of this threshold value is to capture that the PMI are not sensitive to small changes in business activity and so will likely report no change in output even if it has slightly increased or decreased.

The diffusion index is then calculated using the following formula:

$$I = (100 \times P_U) + (50 \times P_S) + (0 \times P_D)$$

where "I" is the value of the index, "P" is the percentage of businesses and the subscripts "U", "S" and "D" represent the possible directions of business activity compared with the previous month of "up", "same" and "down", defined using the user-defined threshold value.

A business is classified as experiencing:

- increased activity if the percentage change in turnover exceeds the threshold
- unchanged activity if it lies within the threshold band
- decreased activity if it falls below the threshold

By multiplying each by the appropriate weighting factor, this gives a diffusion index where:

- a value above 50 indicates an expansion of business activity
- a value of 50 indicates no change
- a value below 50 indicates contraction of business activity

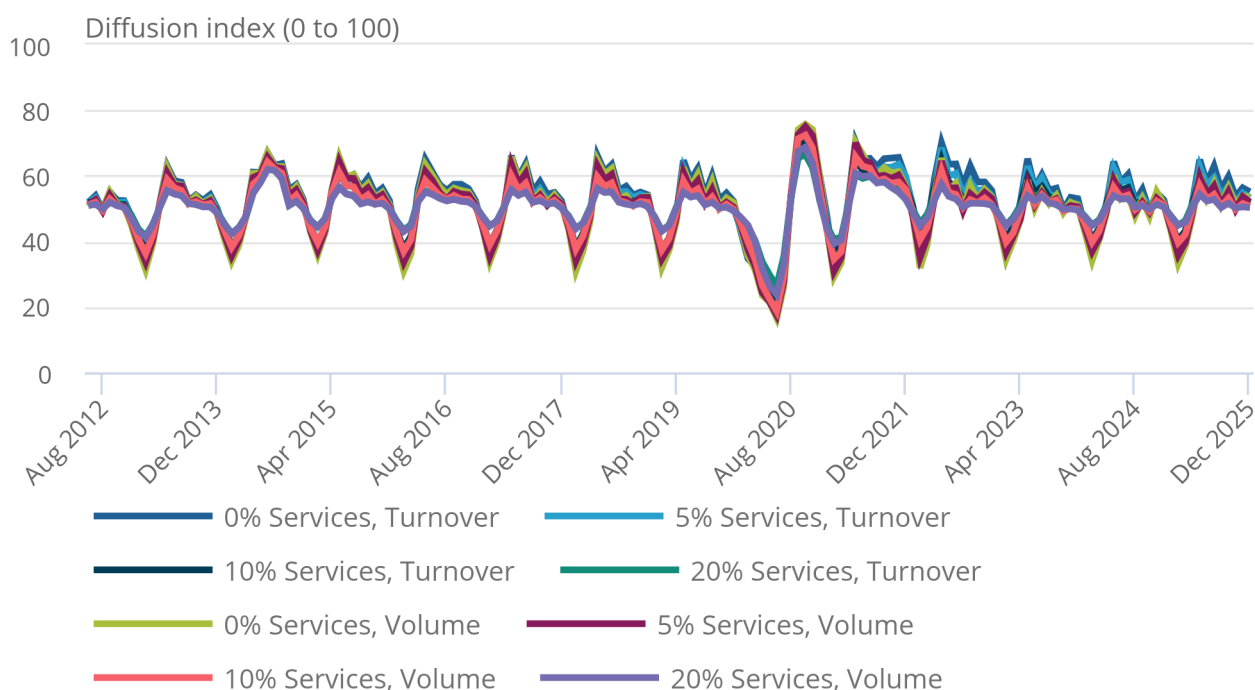
A plus or minus 5% threshold has been chosen for the analysis in this article. Comparisons using alternative threshold levels (Figure 5) show that this choice has little effect on the overall pattern of the MBS diffusion indices. These comparisons are based on non-seasonally adjusted series and are included as examples. Higher thresholds preserve the shape of the series but classify more businesses as having "no change", which moderates the series towards the no-change value (50).

**Figure 5: Using alternative thresholds has little effect on the non-seasonally adjusted MBS diffusion index**

Comparison of alternative threshold levels on the non-seasonally adjusted three-month on three-month Services Monthly Business Survey (MBS) diffusion index

### Figure 5: Using alternative thresholds has little effect on the non-seasonally adjusted MBS diffusion index

Comparison of alternative threshold levels on the non-seasonally adjusted three-month on three-month Services Monthly Business Survey (MBS) diffusion index



Source: The Monthly Business Survey from the Office for National Statistics

**Notes:**

1. These reflect non-seasonally adjusted, non-standardised, diffusion indices.
2. Volume indices are constructed by deflating at the firm level, using industry-level deflators with 2023 as the base year.
3. 2025 MBS data are provisional.
4. MBS data used in this analysis are different to the data used in the compilation of the Index of Services, Manufacturing and Construction, because of different processing steps.

A fictional example of how diffusion indices operate can be found in [Section 5 of our previous article on comparing estimates of UK output and diffusion indices](#).

## Step 4

Following this, our MBS diffusion index is seasonally adjusted at the sector level, where appropriate, using X13 ARIMA-SEATS software. This corresponds to the level of seasonal adjustment applied to the PMI diffusion index.

For comparison purposes, MBS diffusion index, PMI diffusion index, and GDP growth are transformed into standardised units. This is done by calculating the mean and standard deviation for each series and then subtracting the mean from each value in the series before dividing by the standard deviation.

$$(X - \mu) /$$

It should be noted that as this process sets the mean of each series to zero, rather than the no-change values of 50 for the diffusion indices and 0 for the index growths, values just above and below 0 on the shifted series cannot necessarily be simply interpreted as a prediction of growth or contraction.

We also create a composite MBS diffusion index by weighting the three individual sectors by their shares to overall GDP.

## Methodology for measuring correlation between time series

We measure the relationship between time series using detrended cross-correlation analysis (DCCA), consistent with the approach used in our [previous article comparing estimates of UK output and diffusion indices](#). This ensures a consistent methodological framework for analysing the relationship between these series.

This approach is well suited to economic time series, where relationships may be influenced by underlying trends or common movements. While standard correlation measures can still be informative, they may sometimes reflect shared trends rather than a relationship between the series, once those trends have been accounted for. DCCA addresses this by focusing on co-movements after removing underlying trends in the data.

The method transforms each series into a cumulative profile, constructed from deviations from its mean over time. These profiles are detrended within overlapping segments of length  $[s]$ , where each segment includes  $[s]$  periods. The remaining residuals capture local movements around the trend. The covariance between the two series and variance for each series is calculated using these residuals across all segments. These are then combined to produce a correlation measure for that segment. This process is then repeated for each time scale being measured.

One important limitation of DCCA in this context is that the results can be affected by periods of unusually high volatility. The coronavirus (COVID-19) pandemic created very large movements in GDP, PMI and MBS diffusion indices, with sharp falls followed by strong rebounds as restrictions were introduced and then eased. Because these movements were large and occurred at a similar time across the series, they can increase the estimated overall correlation, even if the relationship between the series is weaker during more stable economic periods, as shown in our [accompanying dataset](#). In practice, this means that including the pandemic years can inflate the DCCA coefficients and make the series appear to track each other more closely than they typically do. To avoid drawing conclusions that are influenced mainly by this exceptional period, results are presented separately for the pre-pandemic and post-pandemic periods.

However, this approach has some limitations. Splitting the sample reduces the number of observations in each period, which can affect the stability of the estimates, and the choice of break point is necessarily approximate given the gradual nature of the disruption. The post-pandemic period may also still reflect ongoing adjustment. As a result, differences in correlations across periods should be interpreted with caution.

Confidence intervals are derived using Monte Carlo simulations. Pairs of uncorrelated time series are generated by randomly generating values from a normal distribution, and the DCCA coefficient is calculated for each pair. The resulting distribution is used to determine the threshold for statistical significance.

We conducted a sensitivity analysis by repeating the DCCA analysis after leading and lagging the PMI, the MBS diffusion index and GDP by up to three months from their reference month. These results did not materially change the overall conclusions.

## GDP quality information

GDP measures the level of economic activity in a given period, where growth rates used in this article measure the change in the total value of economic output between periods. The PMI and MBS diffusion indices are business tendency measures that reflect breadth rather than depth of economic change.

GDP figures in this publication are consistent with the [GDP monthly estimate, UK: April 2026 bulletin released on 12 June 2026](#). This does not account for revisions from the July 2026 publication, which has revisions back to January 2024. As outlined in our [Why GDP figures are revised article](#), GDP estimates are subject to revision as more complete and higher-quality data become available over time. Final GDP estimates incorporate a wider range of administrative and structural data sources, alongside methodological improvements.

GDP estimates are seasonally adjusted to remove variations associated with time of year or the arrangement of the calendar. This topic is explored further in our [How the ONS assesses statistical outputs for residual seasonality methodology](#), published on 12 May 2026.

GDP data are accredited official statistics, independently reviewed by the Office for Statistics Regulation in March 2015. They comply with the standards of trustworthiness, quality and value in the Code of Practice for Statistics and should be labelled "accredited official statistics".

Quality and methodology information (QMI) on the data sources in this article are available in:

- our [Gross domestic product QMI](#)
- our [Construction output QMI](#)
- our [Index of Production QMI](#)
- our [Index of Services QMI](#)
- our [Business Insights and Conditions Survey QMI](#)

## 9 . Related links

### [Comparing ONS's economic data with IHS Markit and CIPS Purchasing Managers' Index surveys](#)

Article | Released 21 October 2019

A comparison between official estimates of UK output and diffusion indices, looking at the level of correlation between Office for National Statistics data and IHS Markit and Chartered Institute of Procurement and Supply Purchasing Managers' Indices

### [GDP monthly estimate, UK](#)

Bulletin | Released 16 July 2026

Gross domestic product (GDP) measures the value of goods and services produced in the UK. It estimates the size of the economy and its growth.

### [Economic activity and social change in the UK, real-time indicators](#)

Bulletin | Released 23 July 2026

Faster indicators of trends in the UK economy and society, using innovative surveys, methods and data sources. These are official statistics in development.

### [GDP revisions in Blue Book: 2025](#)

Article | Released 31 October 2025

Gross domestic product (GDP) revisions in annual and quarterly national accounts rounds, focusing on revisions in Blue Book 2025.

## 10 . Cite this article

Office for National Statistics (ONS), released 30 July 2026, ONS website, article, [Comparing ONS UK economic growth data with diffusion indices: 2012 to 2025](#)