

Article

Research Output: Economic activity, faster indicators, UK: August 2019

This is a timely release of new, faster, indicators of economic activity constructed from novel data sources.

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1 . Disclaimer

These research outputs are part of the [faster indicators of UK economic activity project](#) and are not official statistics. The indicators are still in development and not yet fully in production. We are making these data available at an early stage to invite feedback and comment on their further development.

2 . Main points from the latest data

- This release contains for the first time: Value Added Tax (VAT) monthly diffusion indices for August 2019 in three industrial sectors; VAT monthly diffusion indices for July 2019 in all other industries and for the total all-industries measure; new VAT reporters and record type indices for August 2019; data on shipping and road traffic in July 2019.
- Initial VAT indicators for August 2019 were mostly around or slightly below their 2008 to 2018 averages.
- The number of new VAT reporters was broadly stable in August 2019.
- In July 2019, the month-on-month and month-on-year ago VAT turnover diffusion indices for all industries combined were both around their historical averages.
- Ship traffic into important UK ports was broadly stable whilst the time spent by ships in these ports increased slightly in July 2019, non-seasonally adjusted.
- In July 2019, the average road traffic counts for England increased for the two longest vehicle categories, a pattern that was observed in all vehicle categories.

3 . Data analysis

VAT heatmap and commentary

Figure 1: The balance of VAT indicators shows a broadly stable picture in August 2019

The monthly Value Added Tax (VAT) indicators show a broadly stable picture in August 2019. Figure 1 shows that most of the values were slightly below or around their 2008 to 2018 averages (light red and light grey respectively), with no values considerably above (dark teal) or below (dark red) their long-run averages.

The month-on-month (MoM) turnover diffusion indices for both construction and agriculture were around their 2008 to 2018 averages (light grey) in August 2019, while for wholesale and retail trade the level was below its 2008 to 2018 average (light red). All of the VAT diffusion indices are in current prices.

The levels of the month-on-year ago (MoY) turnover diffusion indices in August 2019, relative to their 2008 to 2018 averages, were similar to the MoM turnover diffusion indices for the three industrial sectors where data are available. In the agriculture and construction industries, the levels of the MoY turnover diffusion indices in August 2019 were around their 2008 to 2018 averages (light grey) whilst in wholesale and retail trade, the level was slightly below its 2008 to 2018 average (light red).

Only three industries:

- agriculture, forestry and fishing
- construction
- wholesale and retail trade

have a sufficient number of reporters to be able to compile monthly diffusion indices within a month of the reporting period, which is August 2019 in this release (see the [Quality and methodology section](#) for more information). Monthly diffusion indices for other industries and the all-industries measure, containing many more reporters, are available up to July 2019 in this release. For the retail industry, it should be noted that the official [retail sales](#) figures for August 2019 have already been released.

In July 2019, both the all-industries MoM turnover diffusion index and the all-industries MoY turnover diffusion index were around their 2008 to 2018 averages (light grey). This contrasts with the previous month where both the all-industries MoM turnover diffusion index and the all-industries MoY turnover diffusion index were slightly lower than their 2008 to 2018 averages (light red).

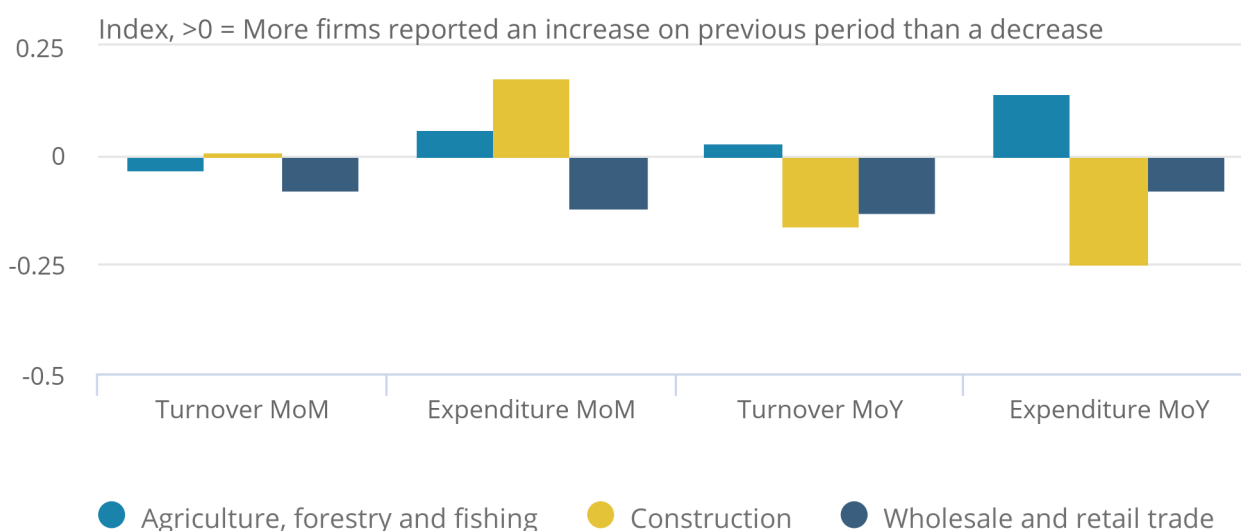
The heatmap is a useful visualisation tool to look across the indicators for a common signal. It can also help in identifying changes in particular indicators, which are worth investigating in more detail, as in Figures 2 to 6.

Figure 2: The month-on-month turnover diffusion index was mixed for the three available industrial sectors in August 2019

Turnover and expenditure diffusion indices for August 2019, month-on-month (MoM) seasonally adjusted, month-on-a-year ago (MoY) non-seasonally adjusted, current prices, UK

Figure 2: The month-on-month turnover diffusion index was mixed for the three available industrial sectors in August 2019

Turnover and expenditure diffusion indices for August 2019, month-on-month (MoM) seasonally adjusted, month-on-a-year ago (MoY) non-seasonally adjusted, current prices, UK



Source: HM Revenue and Customs – Value Added Tax returns

Figure 2 shows the latest monthly diffusion indices for August 2019 for the three available industries. These are:

- agriculture, forestry and fishing
- construction
- wholesale and retail trade

The MoM seasonally adjusted turnover diffusion indices show a mixed picture, with construction being slightly positive, and agriculture, and wholesale and retail trade being negative. This means that more firms in construction reported an increase in turnover between July 2019 and August 2019 than reported a decrease in turnover between the two periods. The opposite trend is seen in agriculture, and wholesale and retail trade, with more firms reporting a decrease in turnover between July 2019 and August 2019 than reporting an increase.

The MoY turnover diffusion index was positive for agriculture, with more firms in this industry reporting turnover increasing between August 2018 and August 2019 than reporting turnover decreasing between these periods. In construction, and wholesale and retail trade, however, the MoY turnover diffusion index was negative, indicating that more firms reported a decrease in turnover between August 2018 and August 2019 than reported an increase between these periods.

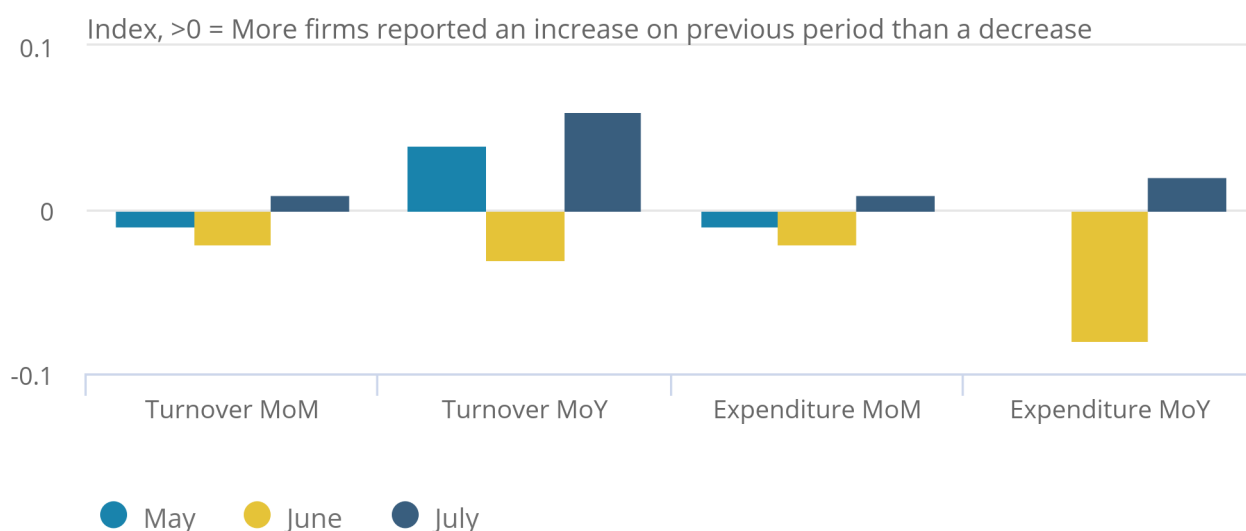
The MoM seasonally adjusted expenditure diffusion index for construction was positive 0.18 in August 2019. This means more construction firms reported an increase in expenditure than reported a decrease in August 2019, compared with July 2019. VAT expenditure data include intermediate consumption, investment in capital assets and inventories.

Figure 3: The month-on-month turnover diffusion index for all industries combined was slightly negative in May and June 2019 but positive in July 2019

Turnover and expenditure diffusion indices for all industrial sectors for May to July 2019, month-on-month (MoM) seasonally adjusted, month-on-a-year ago (MoY) non-seasonally adjusted, current prices, UK

Figure 3: The month-on-month turnover diffusion index for all industries combined was slightly negative in May and June 2019 but positive in July 2019

Turnover and expenditure diffusion indices for all industrial sectors for May to July 2019, month-on-month (MoM) seasonally adjusted, month-on-a-year ago (MoY) non-seasonally adjusted, current prices, UK



Source: HM Revenue and Customs – Value Added Tax returns

Figure 3 shows the latest monthly diffusion indices for May to July 2019 for all industries combined. The MoM seasonally adjusted turnover diffusion index for all industries combined was positive in July 2019 following three consecutive months of being negative. At positive 0.01 in July 2019, this means that slightly more firms reported an increase in turnover between June 2019 and July 2019 than reported a decrease in turnover between the two periods.

Analysis published in [Faster indicators of UK economic activity: Value Added Tax returns](#) showed that monthly reporters are more likely to be firms making repayment claims, which are often from certain industries. While firms from all industries can contribute towards these indices, these biases mean that the industry distribution of firms in these “all industries” indices is not equal to that in the economy.

Despite this, the all-industry MoM turnover diffusion index in July 2019 has 36,140 firms contributing towards it in comparison with the individual industry MoM turnover diffusion indices for August 2019, where:

- 70 firms contribute towards the agriculture, forestry and fishing index
- 40 firms contribute towards the construction index
- 50 firms contribute towards the wholesale and retail trade index

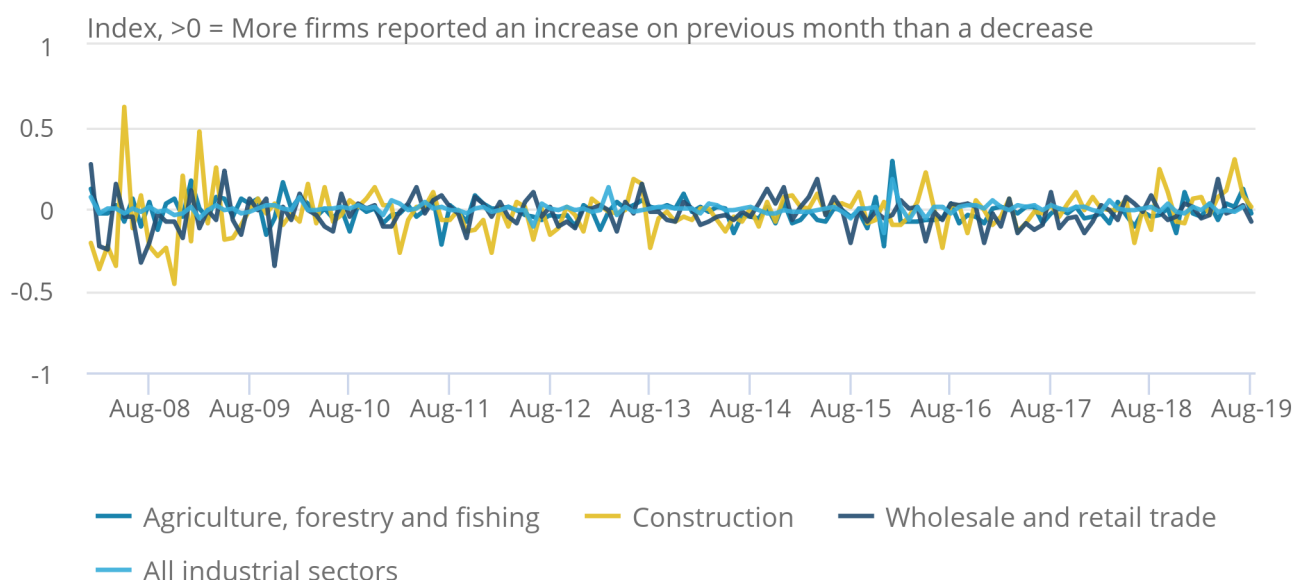
Monthly data to the end of July 2019 are available for other industries in the [Economic activity, faster indicators, UK dataset](#). Each firm contributing to the indices has the same weight regardless of industry, turnover and size.

Figure 4: The month-on-month turnover diffusion index for the Wholesale and retail trade industry in August 2019 was at its lowest level since January 2018

Month-on-month turnover diffusion indices, seasonally adjusted, current prices, January 2008 to August 2019, UK

Figure 4: The month-on-month turnover diffusion index for the Wholesale and retail trade industry in August 2019 was at its lowest level since January 2018

Month-on-month turnover diffusion indices, seasonally adjusted, current prices, January 2008 to August 2019, UK



Source: HM Revenue and Customs – Value Added Tax returns

Figure 4 shows the volatility in the time series for the MoM seasonally adjusted turnover diffusion indices. The August 2019 value for the MoM turnover diffusion index for wholesale and retail trade was negative 0.08, its lowest level since January 2018.

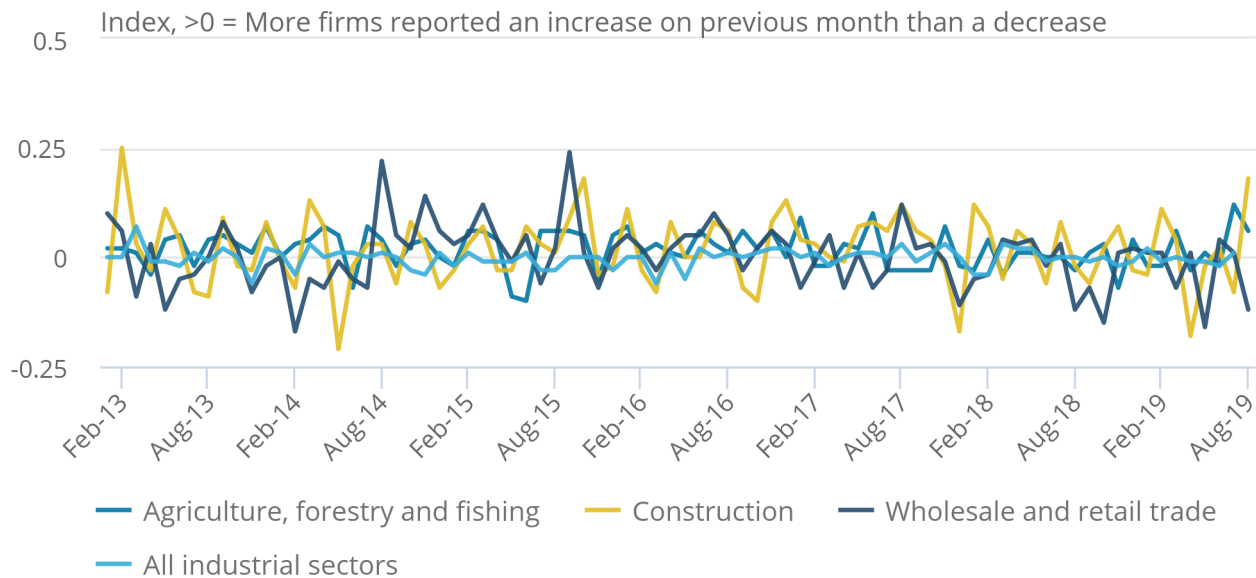
The MoM turnover diffusion index for construction was 0.01 and the MoM turnover diffusion index for agriculture, forestry and fishing was negative 0.03, in August 2019.

Figure 5: The month-on-month expenditure diffusion index for construction in August 2019 was at its highest level since October 2015

Month-on-month expenditure diffusion indices, seasonally adjusted, current prices, January 2013 to August 2019, UK

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Month-on-month expenditure diffusion indices, seasonally adjusted, current prices, January 2013 to August 2019, UK



Source: HM Revenue and Customs – Value Added Tax returns

Figure 5 shows the latest values of the MoM seasonally adjusted expenditure diffusion indices in context.

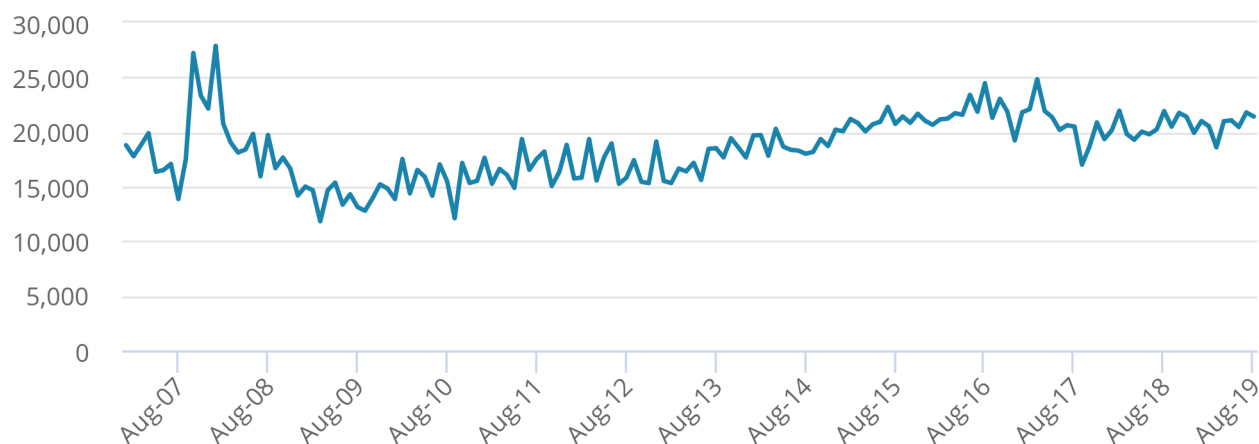
The MoM expenditure diffusion index for construction was 0.18 in August 2019, its highest level since October 2015. The MoM expenditure diffusion index for wholesale and retail trade was negative 0.12 in August 2019, while it was positive 0.06 for agriculture.

Figure 6: The number of new VAT reporters was broadly stable in August 2019

Number of new VAT reporters, seasonally adjusted, all industries, January 2007 to August 2019, UK

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Number of new VAT reporters, seasonally adjusted, all industries, January 2007 to August 2019, UK



Source: HM Revenue and Customs – Value Added Tax returns

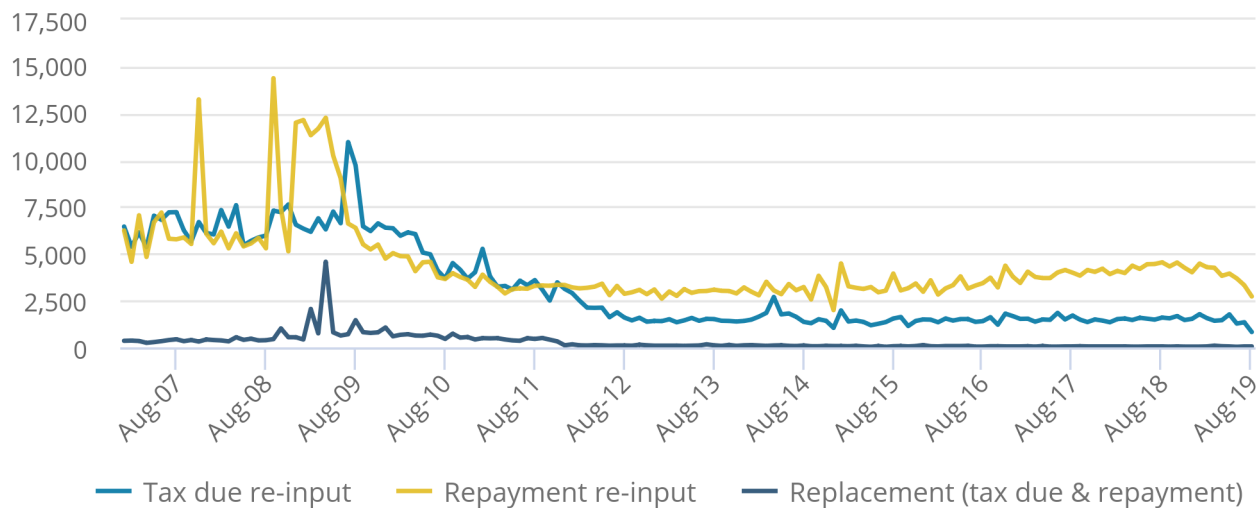
Figure 6 shows the number of new VAT reference numbers appearing in the VAT returns data, seasonally adjusted. In August 2019, the number of new reporters continued the broadly stable trend seen in recent months.

Figure 7: Number of re-input tax repayment returns continued to fall in August 2019

Number of re-input and replacement returns, seasonally adjusted, all industries, January 2007 to August 2019, UK

Figure 7: Number of re-input tax repayment returns continued to fall in August 2019

Number of re-input and replacement returns, seasonally adjusted, all industries, January 2007 to August 2019, UK



Source: HM Revenue and Customs – Value Added Tax returns

Figure 7 shows the number of some of the different record types reported to HM Revenue and Customs (HMRC) each month. The seasonally adjusted number of re-input tax repayment returns was 2,720 in August 2019, a reduction from 3,320 in July 2019.

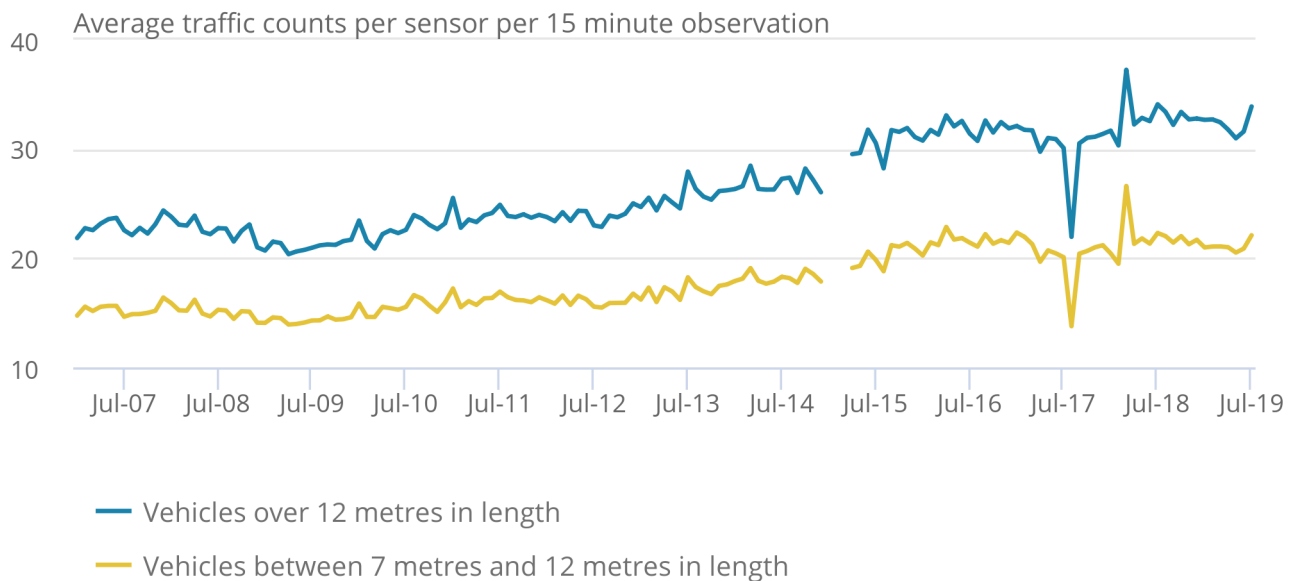
Road traffic commentary

Figure 8: The average number of large vehicles passing sensors on major roads in England increased in July 2019

Road traffic counts by vehicle length, seasonally adjusted, January 2007 to July 2019, England

Figure 8: The average number of large vehicles passing sensors on major roads in England increased in July 2019

Road traffic counts by vehicle length, seasonally adjusted, January 2007 to July 2019, England



Source: Highways England – Road traffic sensor data

Notes:

1. Data are for vehicles over 11.66 metres in length and between 6.6 metres and 11.66 metres in length.
2. The extreme values in August 2017 and March 2018 are the result of a large fall in the number of working sensors in those months. They should be interpreted with care.

In July 2019, the average traffic counts for England increased for the two longest vehicle categories, those over 11.66 metres and those between 6.6 metres and 11.66 metres. The number of vehicles over 11.66 metres in length increased by 7.3% and the number of vehicles between 6.6 metres and 11.66 metres in length increased by 5.8%. It should be noted that the average road traffic counts increased for all vehicle categories in July 2019.

We expect larger vehicles (over 6.6 metres in length, such as lorries) to be more closely related to the movement of goods than smaller vehicles (such as cars), and this is what was found in [Faster indicators of UK economic activity: road traffic in England](#).

Shipping commentary

The shipping indicators are non-seasonally adjusted, making any monthly changes harder to interpret. The shipping indicators are available from August 2016 in the [Economic activity, faster indicators, UK dataset](#) but a change in the data provider and methodology means only the data since October 2018 are comparable with the latest data. See Shipping indicators in Section 5 for more details.

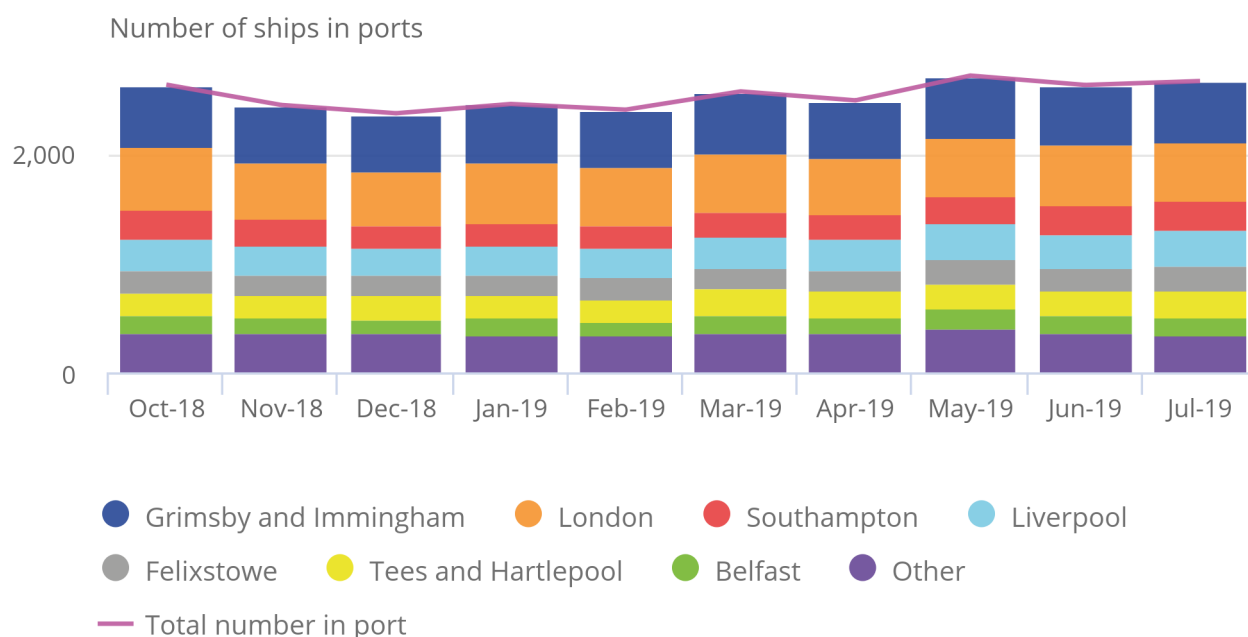
As discussed in [Faster indicators of UK economic activity: shipping](#), we expect the shipping indicators to be related to the import and export of goods. The relationship with imports and exports, and caveats, are presented in more detail in that release.

Figure 9: Port traffic was broadly unchanged in July 2019

Number of unique ships in ports, non-seasonally adjusted, October 2018 to July 2019, UK

Figure 9: Port traffic was broadly unchanged in July 2019

Number of unique ships in ports, non-seasonally adjusted, October 2018 to July 2019, UK



Source: Orbcomm

Notes:

1. Other includes: Dover, Forth, Holyhead, Larne, Milford Haven and Warrenpoint.

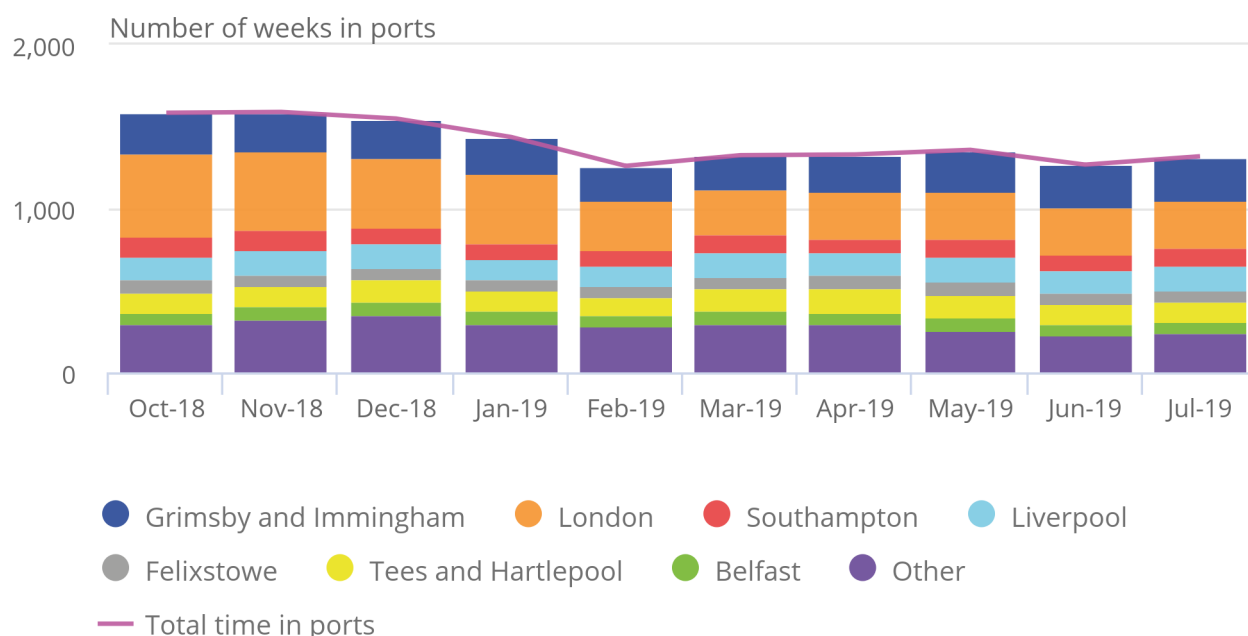
The number of different ships visiting important UK ports in July 2019 was similar to June 2019.

Figure 10: Time-in-port increased slightly in July 2019

Total time spent by ships in ports (time-in-port), weeks, non-seasonally adjusted, October 2018 to July 2019, UK

Figure 10: Time-in-port increased slightly in July 2019

Total time spent by ships in ports (time-in-port), weeks, non-seasonally adjusted, October 2018 to July 2019, UK



Source: Orbcomm

Notes:

1. Other includes: Dover, Forth, Holyhead, Larne, Milford Haven and Warrenpoint.

The total time ships spent in important UK ports increased by 4.0% in July 2019 compared with June 2019, though this was still lower than May 2019.

4 . What are these data?

This release is part of the [Faster indicators of UK economic activity project](#), led by the [Data Science Campus](#). The project is delivering new, faster, indicators of economic activity constructed from novel data sources. These indicators are available up to one month in advance of official estimates of gross domestic product (GDP). The release includes indicators constructed from three datasets.

Indicators from HM Revenue and Customs (HMRC) Value Added Tax (VAT) returns:

- monthly diffusion indicators from turnover reported on VAT returns, January 2008 to August 2019
- quarterly diffusion indicators from turnover reported on VAT returns, January 2008 to June 2019
- monthly diffusion indicators from expenditure reported on VAT returns, January 2013 to August 2019
- quarterly diffusion indicators from expenditure reported on VAT returns, January 2013 to June 2019
- VAT reporting types and new VAT reporters, January 2007 to August 2019

Road traffic sensor data for England from Highways England:

- monthly average road traffic counts for England and English port areas, January 2007 to July 2019
- monthly average road speeds for England and English port areas, January 2007 to July 2019

Shipping indicators from Automated Identification Systems (AIS):

- a monthly count of the time spent in UK ports from August 2016 to July 2019
- a monthly count of ships in UK ports from August 2016 to July 2019

It is important to note that we are not attempting to forecast or predict GDP or other headline economic statistics here, and the indicators should not be interpreted in this way. Rather, by exploring big, closer-to-real-time datasets of activity likely to have an impact on the economy, we provide an early picture of a range of activities that supplement official economic statistics and may aid economic and monetary policymakers and analysts in interpreting the economic situation.

Although some of the indicators we have developed track GDP and other economic statistics relatively well over some periods, there is sufficient difference that none should be used to predict GDP on their own. Rather, they should be considered early warning indicators providing timely insight into real activities in the economy, and their potential impact on headline GDP should be carefully interpreted. However, it may be that these indicators have the power to improve the performance of nowcasting or forecasting models, as components of these models.

A full description of the data, methodology and economic analysis, describing the time series, can be found in [Faster indicators of UK economic activity](#) and associated articles.

5 . Quality and methodology

VAT indicators

Data source

The Value Added Tax (VAT) indicators are constructed from the VAT returns reported to HM Revenue and Customs (HMRC) by all VAT-registered firms. Details on who reports, the timing of reporting, and differences between the approach used for these indicators and the use of VAT returns in official statistics can be found in [Faster indicators of UK economic activity: Value Added Tax returns](#).

Constructing the VAT diffusion indices

To construct the VAT diffusion index, all the firms that are in both the time period of interest (time, t) and the comparison period, for example, the previous month for month-on-month indices, are selected. Firms with 0 values in both periods are excluded. The index for each time period (t) is then constructed using the following formula:

$$VAT\ diffusion\ index_t = \frac{Number\ growing_t - Number\ declining_t}{Number\ growing_t + Number\ declining_t + Number\ unchanged_t}$$

Note that each firm is given equal weight. We do not adjust for the size of firms' activity.

The formula ensures the indices fall in the interval [negative 1 to 1], inclusive. If all firms report an increase in the latest period relative to the base period, the index would be 1. If all firms report a decline, the index would be negative 1. If an equal number of firms grow and decline, the index would be 0.

Quality

There are four main quality considerations for the VAT indicators.

Although the number of firms included in the indicator is over 250,000 on average for the all-industry quarterly diffusion indicators, the monthly diffusion indicators contain fewer than 100 firms in some periods. The number of firms contributing to each indicator are included in the [dataset](#).

Monthly reporters, used in the monthly diffusion indices, are not representative of the balance of firms across the economy, particularly those reporting in month 1 (within a month). The agriculture, forestry and fishing, construction, and wholesale and retail trade industries dominate the monthly returns in month 1. More generally, it is possible that early-reporting firms may have different characteristics from firms reporting later, even in the same industry.

Changes to tax and collection policies and the data checks performed by HMRC may have an impact on the indices that are not related to the underlying economic climate.

The expenditure measure captures all expenditure that must be reported to HMRC for VAT purposes. This means that it is the sum of intermediate consumption, investment in capital assets, and inventories. Care should be taken in interpreting which of these elements any changes should be attributed too.

Avoiding the identification of individual firms

Splitting the data by industry occasionally results in only a small number of firms left in the indices. In cases where fewer than 15 firms have reported in a particular component or industry, we suppress the entire series. In the event where only a single series is removed, we also remove the next smallest to prevent any derivation of the suppressed series from the total.

Figures are also rounded, to prevent possible inference of exact values. The diffusion index and percentage of new reporters are rounded to two decimal places, and the number of firms for any measure is rounded to the nearest 10.

It should be noted that for some indicators, although they meet these disclosure thresholds, the number of firms contributing can still be low, for instance below 100 firms, so caution is needed in interpreting the data.

Road traffic indicators

Data source

Average counts and average speed data for traffic on English motorways and major A-roads were obtained from [Highways England's TRIS dataset](#), which lists the roads covered. Traffic flow is measured by induction loop and radar sensors. The data can be split by four categories of vehicle length as follows:

- less than 5.2 metres – for example, cars, motorcycles
- 5.2 metres to 6.6 metres – for example, panel vans, minibuses
- 6.6 metres to 11.66 metres – for example, rigid lorries, buses
- greater than 11.66 metres – for example, larger rigid lorries and coaches, articulated lorries

Constructing the road traffic indicators

To construct the road traffic indicators for ports in England included in the dataset, we first take the geographic location of each port using the address and visual inspection. Then we find all sensors and road sections that start or end within a 10-kilometre radius of this point. Since the data often have gaps in the sensor outputs, we use all sensors or road sections within 10 kilometres of each port in constructing the indicators.

Further details can be found in [Faster indicators of UK economic activity: road traffic](#). The data for each port are available in the accompanying [dataset](#).

Quality

For the road traffic indicators, there are three main issues that need to be considered when interpreting the data.

Individual sensors can drop out unexpectedly, due, for example, to road works or faults. The missing data can cause gaps in the time series and affect the average values. For example, if sensors drop out in an area of high traffic counts, the overall average will fall, making it difficult to interpret the time series. The total number of counts for each area is included in the [dataset](#).

There was a change to the data collection methodology in 2015, which causes a step change and a gap in the time series. From January 2007 to December 2014, traffic counts and average speed were monitored for road sections (that is, between two junctions), at 15-minute intervals. From April 2015 onwards, traffic counts and average speeds were collected for individual sensors, also for 15-minute intervals.

There may be biases in the positioning of the sensors, which could be preferentially deployed to areas of heavy traffic, and in recent years, to road sections requiring active traffic management.

Shipping indicators

Data source

The shipping indicators are computed from Automated Identification Systems (AIS) data, which are available from various data providers.

For the period of July 2016 to August 2018, we have used a dataset provided by the [Maritime and Coastguard Agency \(MCA\)](#). Since October 2018, we have used data provided by [ORBCOMM](#). The ORBCOMM data uses satellites to track the position and movement of ships. The new dataset allows us to update the indicators more quickly and gives us access to global shipping information.

However, the change to the data source has resulted in a step change between the end of the MCA time series and the beginning of the ORBCOMM time series. As we currently have no overlapping period for the two data sources, we cannot carry out a full comparison between the two datasets.

The early indications are that different data collection methodology (satellite compared with terrestrial) results in different distributions for the captured message types and subsequently a discrepancy in the datasets. Therefore, the time series representing the August 2016 to July 2018 period and the time series since October 2018 should not be compared.

Constructing the shipping indicators

After initial filtering, which removes the messages from ships that do not move more than a predefined threshold distance over a rolling period of six months, the rectangular geo masks, defined in [Faster indicators of UK economic activity: shipping](#), are used to mark the messages as originating from a list of UK ports. Then, through appropriate grouping and aggregation operations, the values of the “time-in-port” and “port traffic” indicators are computed for each port.

In particular, the “time-in-port” indicator is computed for each specific port by summing all the periods between messages originating from within the port. The “port traffic” indicator is computed by counting the number of unique Maritime Mobile Service Identity (MMSI) observations that have originated within the port area in the particular period.

The UK’s 10 largest ports by cargo in 2017, as reported by the Department for Transport in [Port freight annual statistics: 2017 final figures](#), are included throughout the dataset. These 10 ports cover around 70% of total UK port freight (2017).

The indicators from October 2018 also contain three further ports: Holyhead, Warrenpoint and Large. Although these three ports are a small fraction of the total for both shipping indicators, this will also contribute to discrepancies between the pre-August 2018 time series, and that from October 2018. The data for each port are available in the accompanying [dataset](#).

Quality

A large number of corrupted messages have to be removed from the raw AIS data. Additionally, a high proportion of the MMSI identifiers report single or inconsistent messages. These must be removed before any sensible aggregations are possible. Also, some ships, like pilot vessels, spend most of their time in port.

Removing all of these messages is based on the presumption that active ships must travel a certain distance over a certain period of time. The specific filter rule that is used in computation of the indicators is that ships must move by more than 0.5 degrees in a combination of latitude and longitude over a period of six months.

Different AIS data providers use different methods for AIS data collection. This inconsistency results in different properties of the data distributions and noise patterns in the datasets, which makes them incompatible. For this reason, the time series representing the August 2016 to July 2018 period and the time series since October 2018 should not be compared.

Gaps in the data represent a significant problem for accurate aggregations. As the number of received messages should be relatively constant, monitoring the number of incoming messages in each period is used to detect and identify gaps in the data.

Avoiding the identification of individual ships

The two shipping indicators are based on monthly aggregates. As many ships visit the ports over the month, it is considered that no individual ship data are disclosed through the indicators.

Seasonal adjustment

Seasonal adjustment for the VAT indicators was performed using the software X-13ARIMA-SEATS. The method of seasonal adjustment used is the X-11 algorithm. The parameters used in the March 2019 publication were fixed for this release.

The monthly road traffic series were seasonally adjusted using the standard JDemetra+ seasonal adjustment package, with default settings. In JDemetra+, missing values are treated as outliers while X-13ARIMA-SEATS does not handle missing observations.

This methodology and the new data have led to small changes in the seasonally adjusted series relative to the previous publication.

Further details

Full details of the data, quality, methodology and economic analyses can be found in [Faster indicators of UK economic activity](#) and associated articles.

6 . Feedback

We welcome feedback and comments on these indicators, including on presentation, further development or other data sources to investigate. Feedback can be sent by email to Faster.Indicators@ons.gov.uk.