Office for National Statistics

Article

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

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

Contact:
James Scruton
Faster.Indicators@ons.gov.uk
+ 44 (0)1633 455284

Release date:
23 December 2019

Next release:
23 January 2020

Table of contents

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

- The first available month-on-month VAT turnover indicators for November 2019 were around their historical averages in construction, agriculture and retail.
- In the month-on-year ago turnover diffusion indices for November 2019, agriculture was around its historical average, with construction slightly below and retail slightly above.
- The month-on-month, all-industry turnover diffusion index for October 2019 was around its historical average, but below its historical average for month-on-year ago turnover diffusion indices.
- In October 2019, the average traffic counts for major roads in England increased for the two longest vehicle categories – those over 11.66 metres and those between 6.6 metres and 11.66 metres in length.
- The number of ships in ports fell in October 2019 from September 2019, while time in ports increased.
- The number of visits to major UK ports decreased in October 2019 compared with September 2019.

3 . Data analysis

This release contains:

- Value Added Tax (VAT) monthly diffusion indices for November 2019 in three industrial sectors, and for October 2019 in all other industries and the total all-industries measure
- New VAT reporters and record type indices for November 2019
- Data on shipping and road traffic by port in October 2019

VAT heatmap and commentary

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

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

The month-on-month (MoM) turnover diffusion indices for construction, agriculture, and wholesale and retail trade were around their 2008 to 2018 averages (light grey) in November 2019.

All of the VAT diffusion indices are in current prices. The levels of the month-on-year ago (MoY) for agriculture is around its 2008 to 2018 average (light grey), construction is slightly below its 2008 to 2018 average (light red) and wholesale and retail trade is slightly above its 2008 to 2018 average (light green).

Only three industries have a sufficient number of reporters to be able to compile monthly diffusion indices within a month of the reporting period, which is November 2019 in this release:

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

See the Quality and methodology section for more information.

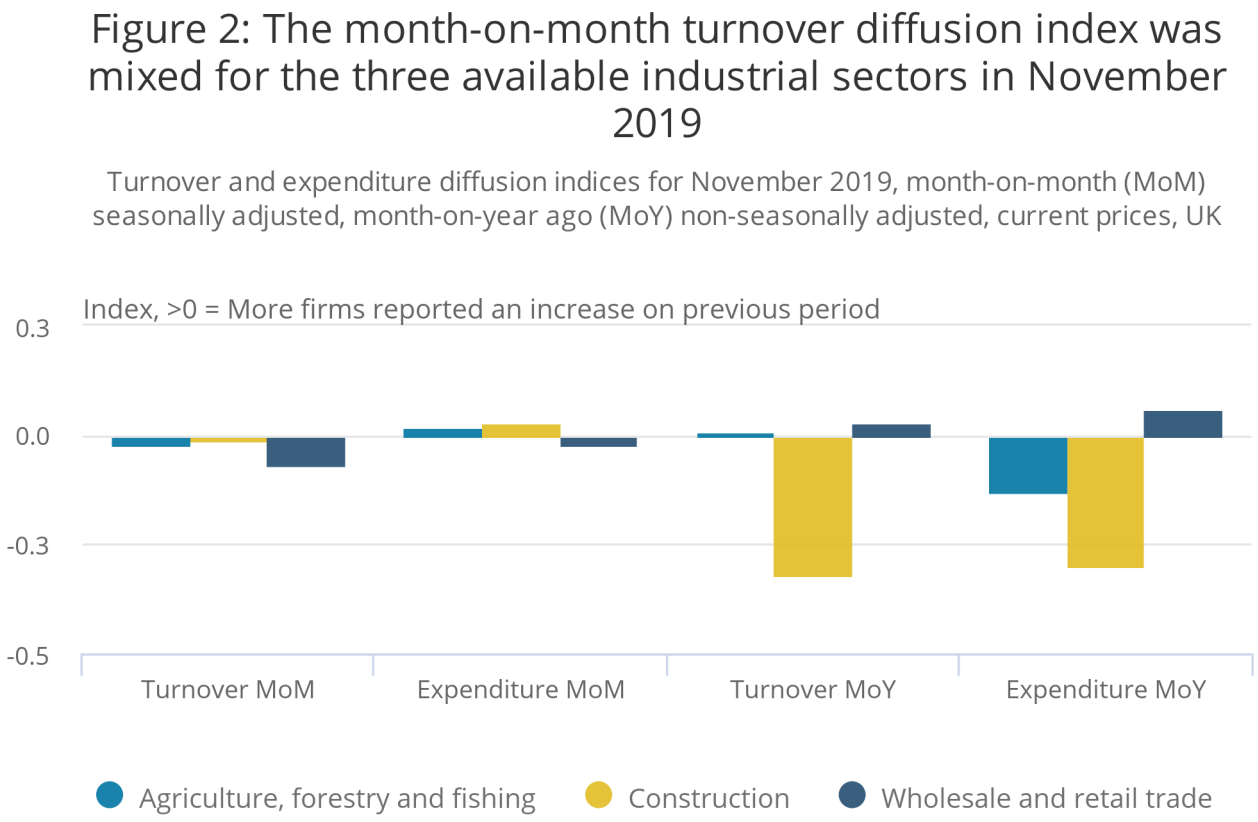
Monthly diffusion indices for other industries and the all-industries measure, containing many more reporters, are available up to October 2019 in this release. For the retail industry, it should be noted that the official Retail sales figures for November 2019 have already been released, and include additional analysis on the treatment of Black Friday.

In October 2019, the all-industries MoM turnover diffusion index was around its 2008 to 2018 average (light grey) while the MoY turnover diffusion index was slightly below its 2008 to 2018 average (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 November 2019

Turnover and expenditure diffusion indices for November 2019, month-on-month (MoM) seasonally adjusted, month-on-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 November 2019 for the three available industries. These are:

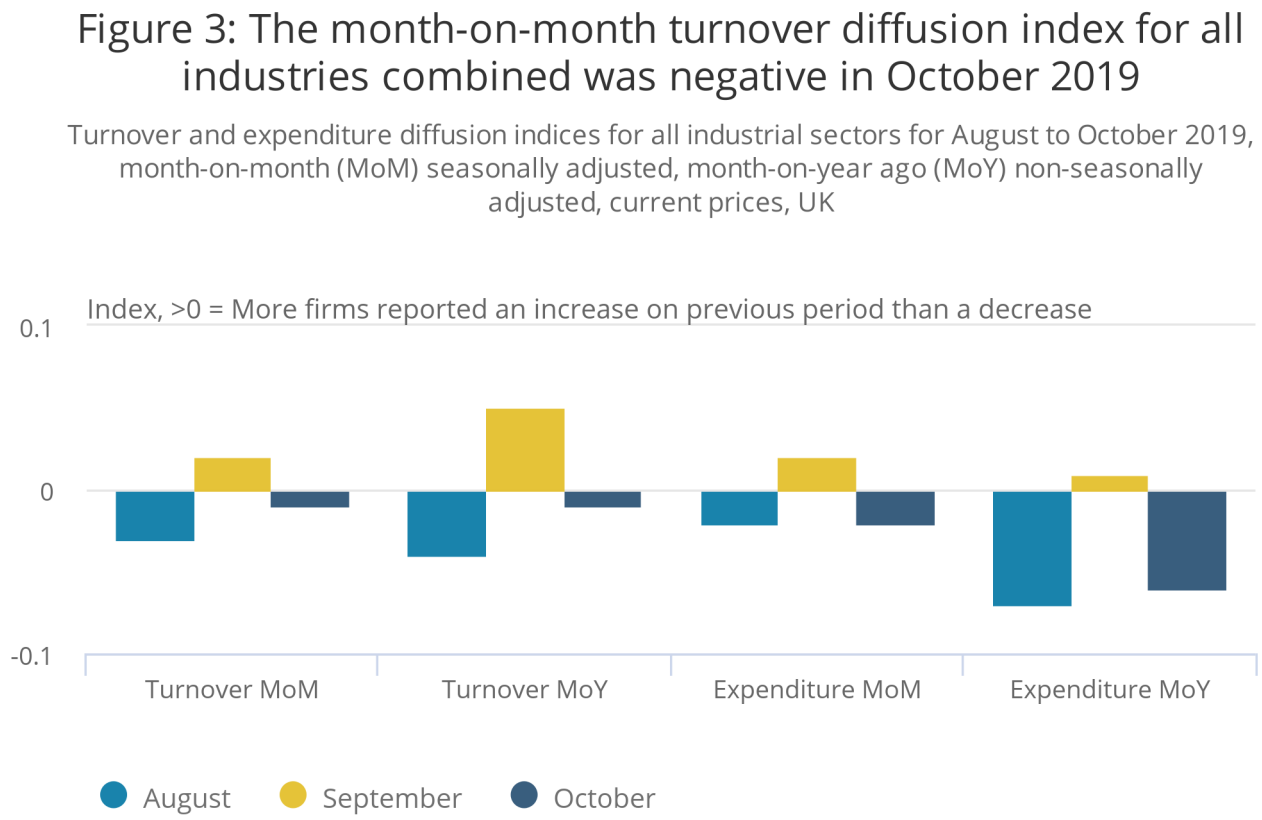
- agriculture, forestry and fishing
- construction
- wholesale and retail trade

The MoM seasonally adjusted turnover diffusion indices for the three industries shown in Figure 2 show a slightly negative picture in November 2019 for wholesale and retail trade, agriculture, and construction. This means that more firms in the three industries reported a decrease in turnover between October 2019 and November 2019 than reported an increase in turnover between the two periods.

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

Figure 3: The month-on-month turnover diffusion index for all industries combined was negative in October 2019

Turnover and expenditure diffusion indices for all industrial sectors for August to October 2019, month-on-month (MoM) seasonally adjusted, month-on-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 August to October 2019 for all industries combined. The MoM seasonally adjusted turnover diffusion index for all industries combined was negative in October 2019 after being positive in September 2019. At negative 0.01 in October 2019, this means that slightly more firms reported a decrease in turnover between September 2019 and October 2019 than reported an increase 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 the "all industries" indices is not equal to that in the economy.

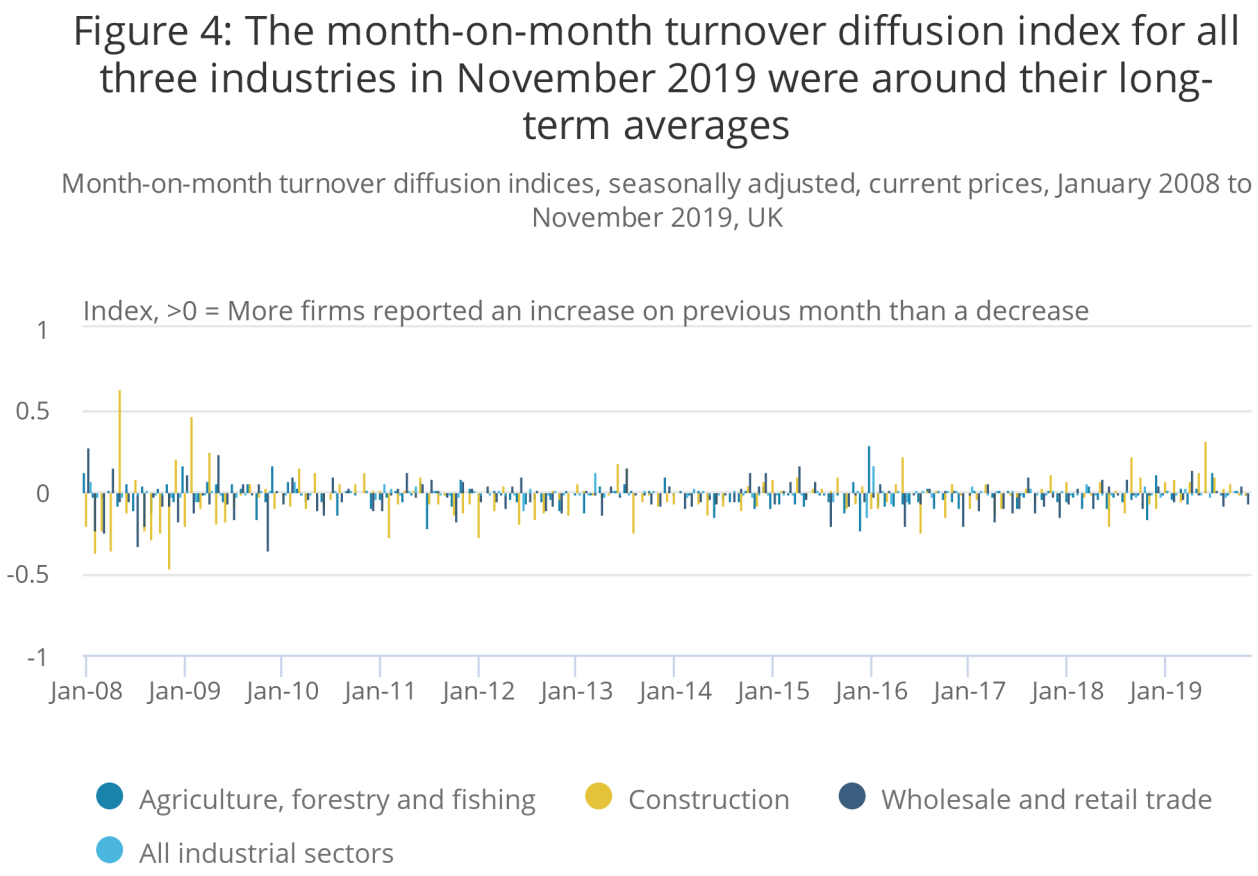
Despite this, the all-industry MoM turnover diffusion index in October 2019 has 37,030 firms contributing towards it, in comparison with the individual industry MoM turnover diffusion indices for November 2019, where:

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

Monthly data to the end of October 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 all three industries in November 2019 were around their long-term averages

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



Source: HM Revenue and Customs – Value Added Tax returns

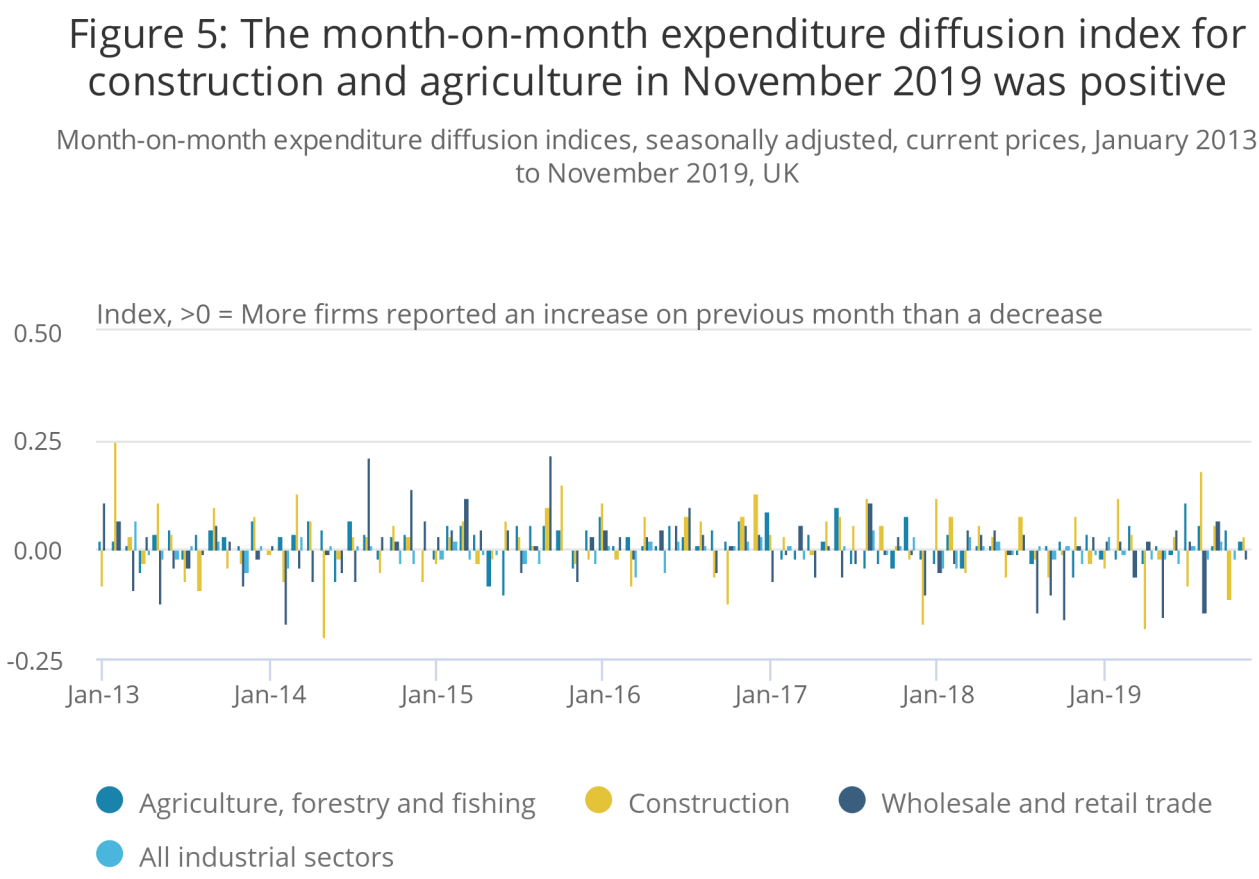
Figure 4 shows the volatility in the time series for the MoM seasonally adjusted turnover diffusion indices.

The November 2019 value for the MoM turnover diffusion index for the wholesale and retail trade industry was negative 0.07.

The MoM turnover diffusion index for the construction industry was negative 0.01 in November 2019. The MoM turnover diffusion index for the agriculture, forestry and fishing industry in November 2019 was negative 0.02.

Figure 5: The month-on-month expenditure diffusion index for construction and agriculture in November 2019 was positive

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



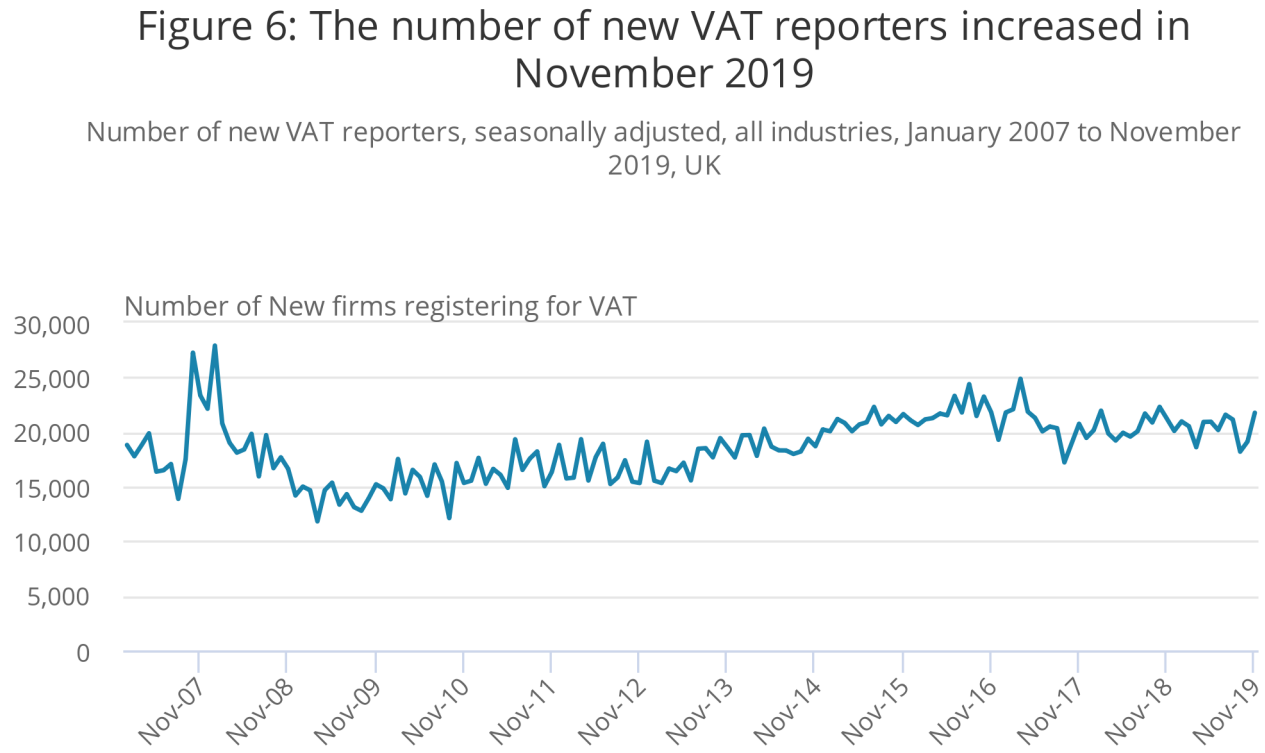
Source: HM Revenue and Customs – Value Added Tax returns

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

In November 2019, the MoM expenditure diffusion index for construction and agriculture was positive 0.03 and 0.02 respectively. In comparison, wholesale and retail trade was negative 0.02.

Figure 6: The number of new VAT reporters increased in November 2019

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



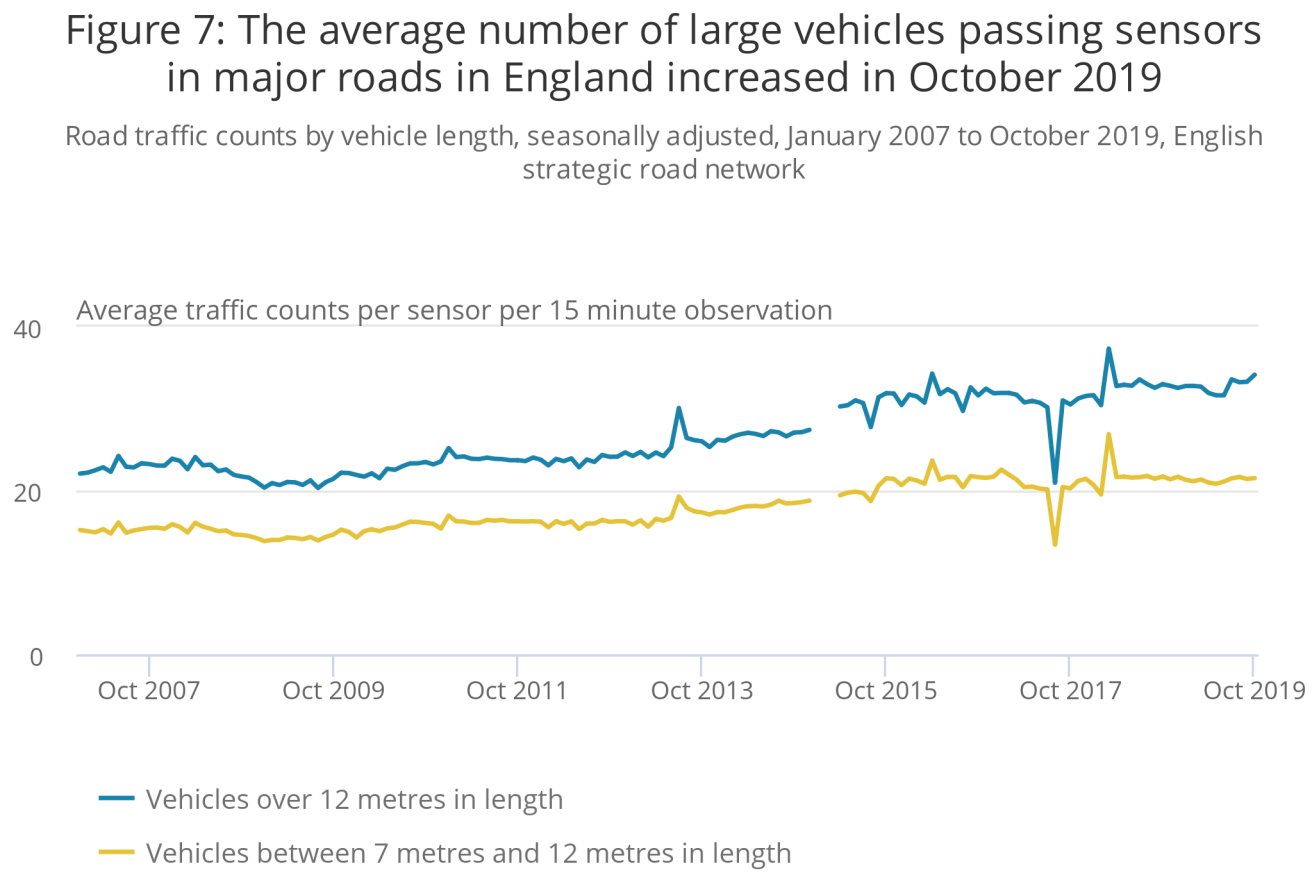
Source: HM Revenue and Customs – Value Added Tax returns

Figure 6 shows the number of new VAT reference numbers appearing in the VAT returns data, seasonally adjusted. In November 2019, the number of new reporters increased after falling to its lowest level in two years in September 2019.

Road traffic commentary

Figure 7: The average number of large vehicles passing sensors in major roads in England increased in October 2019

Road traffic counts by vehicle length, seasonally adjusted, January 2007 to October 2019, English strategic road network



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 October 2019, the average traffic counts for major roads in England increased for the two longest vehicle categories; those over 11.66 metres increased by 2.6%, and those between 6.6 metres and 11.66 metres in length increased by 0.5%.

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.

There has been an improvement to the methodology used in constructing the road traffic indicators. For data prior to April 2015, there was an issue resulting in the double counting of some sensors when allocating data to each port. This related to data being attributed to road sections as opposed to a single location. The updated methodology now avoids the issue of data duplication and no longer double counts any values. As such, there have been small revisions to some historical data.

Shipping commentary

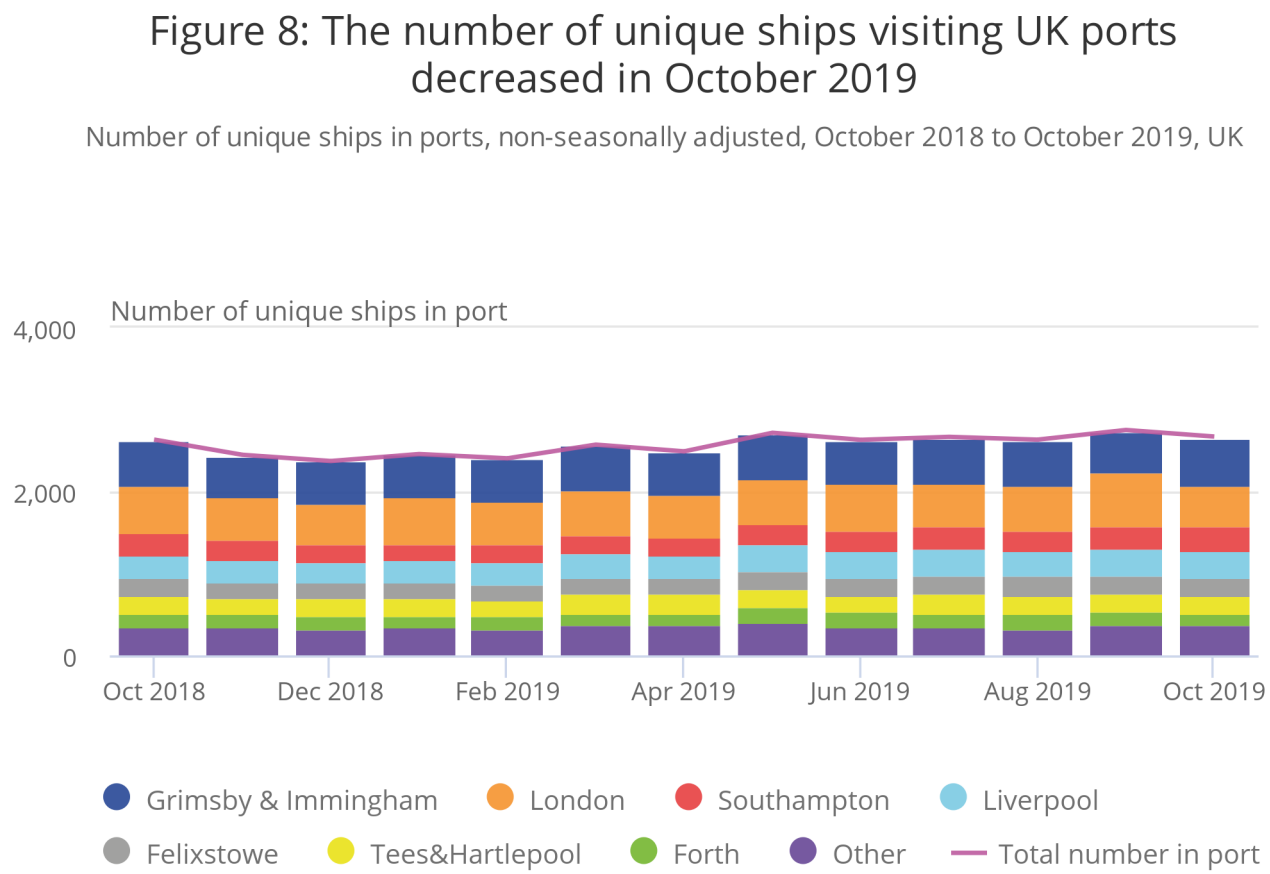
This section discusses the shipping indicators based on counts of all vessels to October 2019. We also have published weekly and monthly Exactearth shipping data for cargo and tankers for November 2019, and will include this analysis in the next release.

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 8: The number of unique ships visiting UK ports decreased in October 2019

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



Source: Orbcomm

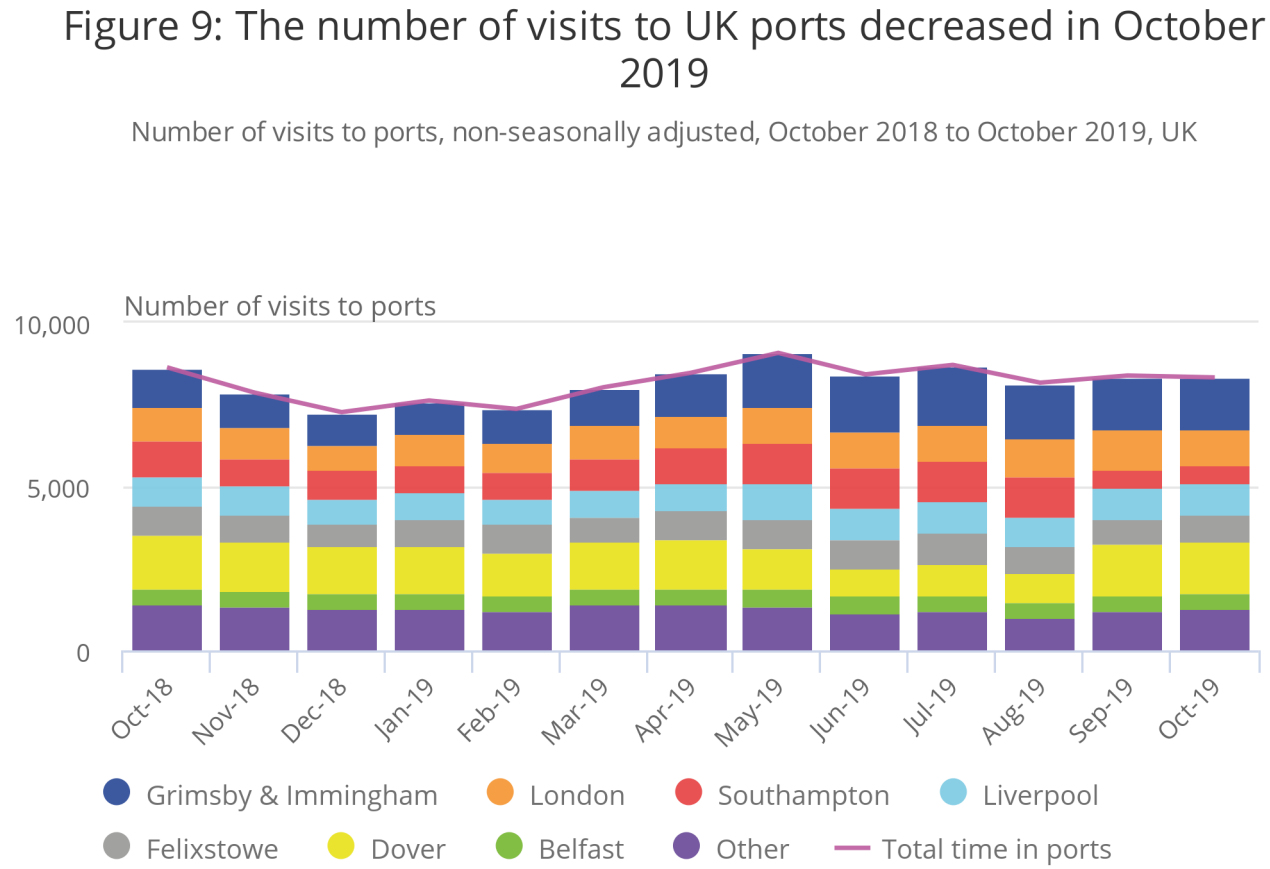
Notes:

1. “Other” includes: Dover, Belfast, Holyhead, Larne, Milford Haven and Warrenpoint.

The number of unique ships visiting important UK ports in October 2019 fell by 2.9% compared with September 2019.

Figure 9: The number of visits to UK ports decreased in October 2019

Number of visits to ports, non-seasonally adjusted, October 2018 to October 2019, UK



Source: Orbcomm

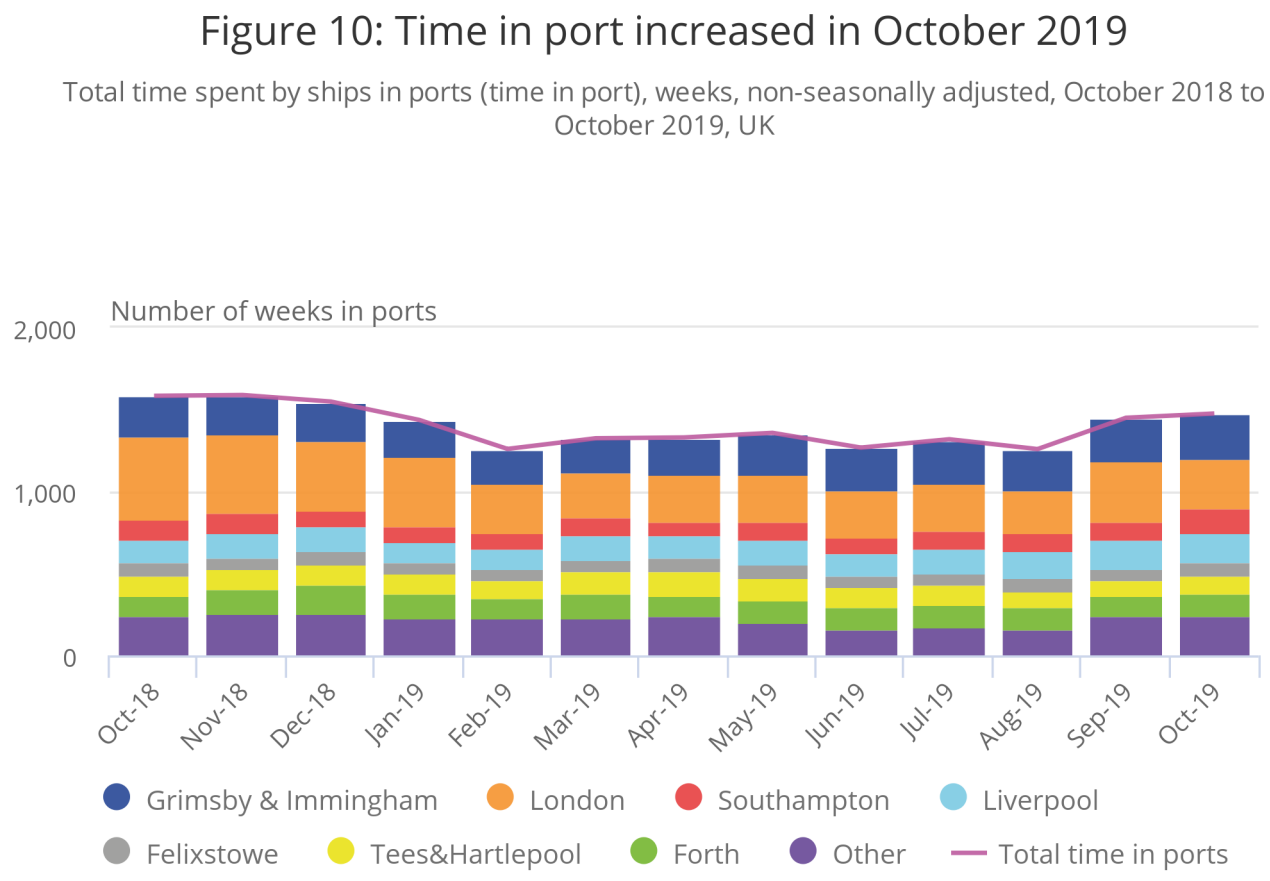
Notes:

1. “Other” includes: Forth, Holyhead, Larne, Milford Haven, Tees and Hartlepool, and Warrenpoint.

The number of unique visits to major UK ports decreased by 0.7% in October 2019 compared with September 2019.

Figure 10: Time in port increased in October 2019

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



Source: Orbcomm

Notes:

1. “Other” includes: Dover, Belfast, Holyhead, Larne, Milford Haven and Warrenpoint.

The total time ships spent in important UK ports increased by 1.8% in October 2019 in comparison with the previous month, its highest level since December 2018.

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

Road traffic sensor data for England from Highways England:

- monthly average road traffic counts for major roads in England and English port areas, January 2007 to October 2019
- monthly average road speeds for major roads in England and English port areas, January 2007 to October 2019

Shipping indicators from Automated Identification Systems (AIS):

- a monthly count of the time spent in UK ports from August 2016 to October 2019
- a monthly count of unique ships in UK ports from August 2016 to October 2019
- a monthly count of visits to UK ports from October 2018 to October 2019
- a monthly count of unique ships classified as cargo ships or tankers in UK ports from April to October 2019
- a monthly count of visits by cargo ships or tankers to UK ports from April to October 2019
- a weekly count of unique ships classified as cargo ships or tankers in UK ports from April to October 2019
- a weekly count of visits by cargo ships or tankers to UK ports from April to October 2019
- a weekly count of unique ships for all ship types in UK ports from April to October 2019
- a weekly count of visits for all ship types to UK ports from April to October 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. 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 zero values in both periods are excluded. The index for each time period (t) is then constructed using the following formula:

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

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 one to one], inclusive. If all firms report an increase in the latest period relative to the base period, the index would be one. If all firms report a decline, the index would be a negative one. If an equal number of firms grow and decline, the index would be zero.

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 one (within a month). The agriculture, forestry and fishing, construction, and wholesale and retail trade industries dominate the monthly returns in month one. 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 to.

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. As such, 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 into four categories of vehicle length as follows:

- less than 5.2 metres (for example, cars and motorcycles)
- 5.2 metres to 6.6 metres (for example, panel vans and minibuses)
- 6.6 metres to 11.66 metres (for example, rigid lorries and buses)
- greater than 11.66 metres (for example, larger rigid lorries, coaches and 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 geographical 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. As 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, for example, because of roadworks 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 caused 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 sources

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 use 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.

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.

From April 2019, data are also available from exactEarth, which has been enriched with the AIS Shiptype number to identify the type of ship. We use these data to construct indicators for “cargo ships and tankers” by selecting ships in the “cargo ships” and “tankers” categories. More information on Shiptypes and a full list of the classifications can be found in the article What is the significance of the AIS Shiptype number?

More than 99% of the ships in the exactEarth dataset are classified in this way. The classification of the remaining ships is modelled, using ship behaviour, geolocation and time spent at rest. The full details of this methodology, further information on the quality of these indicators, and economic analysis can be found in Faster indicators of UK economic activity: more timely and relevant shipping indicators. The “time in port” indicator is not constructed from the earthExact dataset currently because of insufficient user demand.

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. Through appropriate grouping and aggregation operations, the values of the “time in port”, “number of unique ships” and “number of visits” indicators are then 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 “number of unique ships” 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.

For the “number of visits” indicator, a visit to a specific port area is defined by a ship entering the boundary of a port after being outside of this area for at least one hour and staying for at least 15 minutes within the port boundary.

Because of the inherent noise in the location signal, there is a probability that ships close to the port boundary suddenly cross into a port when in reality this is just noise in their position data. This is why the 15-minute threshold is enforced upon any visit. We apply similar logic to the one-hour threshold, assuming that for a ship to have concluded a meaningful journey, it has to be away from the port for at least an hour before it returns.

The thresholds of 15 minutes and one hour are defined using heuristics and aim to capture a broad spectrum of visit purposes. More data-driven approaches to estimating these thresholds can be researched in further work. Once a marker for a visit is created in the data using the aforementioned conditions, these are then counted for a given time period and constitute the “number of visits” indicator.

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 Larne. Although these three ports are a small fraction of the total for the 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.

For each indicator the value for all ports is the sum of the values for each individual port.

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 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

In order to avoid disclosure, we have suppressed any counts of five or fewer and have suppressed further cells to avoid secondary disclosure where necessary. This mostly affects the weekly 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 seasonal adjustment methodology has been applied to each of the individual port breakdowns as well as the higher-level aggregations.

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.