

Article

# UK Services Producer Price Index (SPPI) standard errors: 2016 to 2017

Standard errors for quarter-on-quarter and year-on-year growth rates for the SPPI between Quarter 1 (Jan to Mar) 2016 and Quarter 3 (July to Sept) 2017 are examined in this article. Confidence intervals have been calculated for Gross Sector Output (GSO) growth rates at the highest level SPPI, and for a selection of industries with large standard errors.

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# 1 . Introduction to Services Producer Price Index

The Services Producer Price Index (SPPI) provides a measure of inflation for the UK services sector. It is constructed from a statutory quarterly survey, which measures changes in the price received for selected services provided by UK businesses to other UK businesses and government. Individual SPPIs are available, which provide information on price change for a selection of services industries. These individual price indices are also aggregated together to create a services industry SPPI with limited coverage (it does not provide full coverage of the “services sector”).

The services sector is estimated to account for around 78% of the UK economy based on its weight in gross domestic product (GDP). We do not produce an index for every industry in the services sector and so the SPPI is a partial, best estimate, of the overall inflation to UK businesses in the services sector.

## 2 . Purpose of standard errors

If the SPPI was based on a census of every business in the UK services sector and every survey was returned correctly and on time, then the true values of price movements would be known. However, since the SPPI is based on a sample of UK businesses, it means that the SPPI is an estimate of the population price movements and is subject to sampling variability. This means that if a different set of businesses had been sampled, then a different estimate would have resulted. Exactly how much these would differ, by taking different samples, cannot be measured directly but is approximated using a standard error (calculated as the square root of the variance of the estimate).

The standard error is the estimated standard deviation or measure of variability in the sampling distribution of a statistic. Thus, standard errors can be used to determine the spread of price movements and is an important way to assess the accuracy of a price index. The lower the standard error for a given price index, the more likely it is that the estimated index is close to the true value for the price index had all UK businesses been included.

## 3 . Confidence intervals

A confidence interval is an estimated range of values that lie around a sample estimate. This range identifies the likely values for the population value, defined by a specified probability. Confidence intervals for this publication are produced at the 95% level (noted as CI95%; represented as vertical bars). This means that if 100 samples were taken, then we would expect the true population parameter to fall between the upper and lower bounds 95 times.

## 4 . Aggregate SPPI: GSO

This section includes summary information of the top-level SPPI gross sector output (GSO) year-on-year and quarter-on-quarter standard errors for the growth rates between Quarter 1 (Jan to Mar) 2016 and Quarter 3 (July to Sept) 2017. The annual and quarterly percentage index changes with associated CI95% were plotted for each period. Table 1 showcases the quarterly and annual growth with a corresponding estimate of the standard errors computed for these periods.

**Table 1: Standard errors of the quarterly and annual growth in the aggregate SPPI**

2010=100, SIC2007

	Percentage change over quarter	Quarter-on-quarter standard error	Percentage change over year	Year-on-year standard error
2016 Q1	0.5	0.2	1.3	0.3
Q2	0.6	0.2	1.5	0.4
Q3	0.2	0.2	1.6	0.4
Q4	0.0	0.4	1.2	0.6
2017 Q1	0.4	0.3	1.1	0.1
Q2	0.5	0.6	1.0	0.2
Q3	0.5	0.2	1.3	0.6

Source: Office for National Statistics

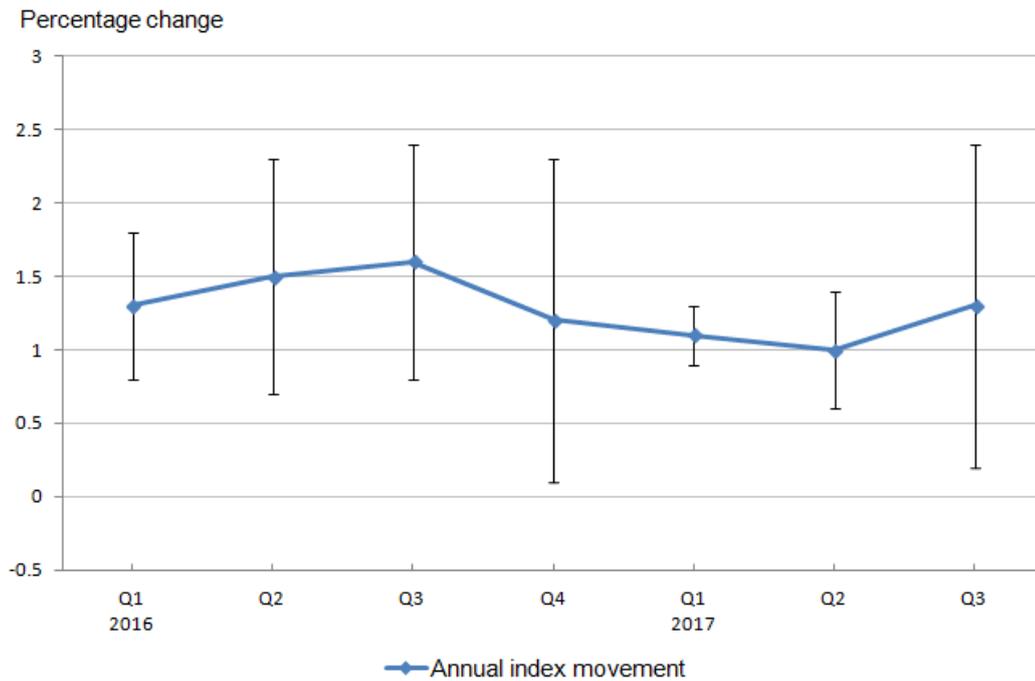
## Notes:

1. The aggregate SPPI is an aggregate of the individual industry level SPPIs (excluding Financial intermediation). It does not provide full coverage of the service sector.
2. The Gross Sector series is calculated using weights based on sales from all transactions in the UK to UK businesses and government.
3. Not all of the industry-level SPPIs used to construct the aggregate SPPI are National Statistics.
4. Q1 represents Quarter 1 (January to March); Q2 represents Quarter 2 (April to June); Q3 represents Quarter 3 (July to September); Q4 represents Quarter 4 (October to December).

CI95% showed that initially, the top level SPPI (GSO) annual growth had standard errors that gradually increased in a consistent manner up to Quarter 4 (Oct to Dec) 2016, but by Quarter 1 2017, the index change possessed the lowest standard error for the period examined (Figure 1). A rather small increase in the standard error was observed in the following quarter, but a sharp increase was detected by Quarter 3 2017.

**Figure 1: SPPI all services, gross sector output (GSO) – annual growth (quarter on same quarter previous year) with CI95%**

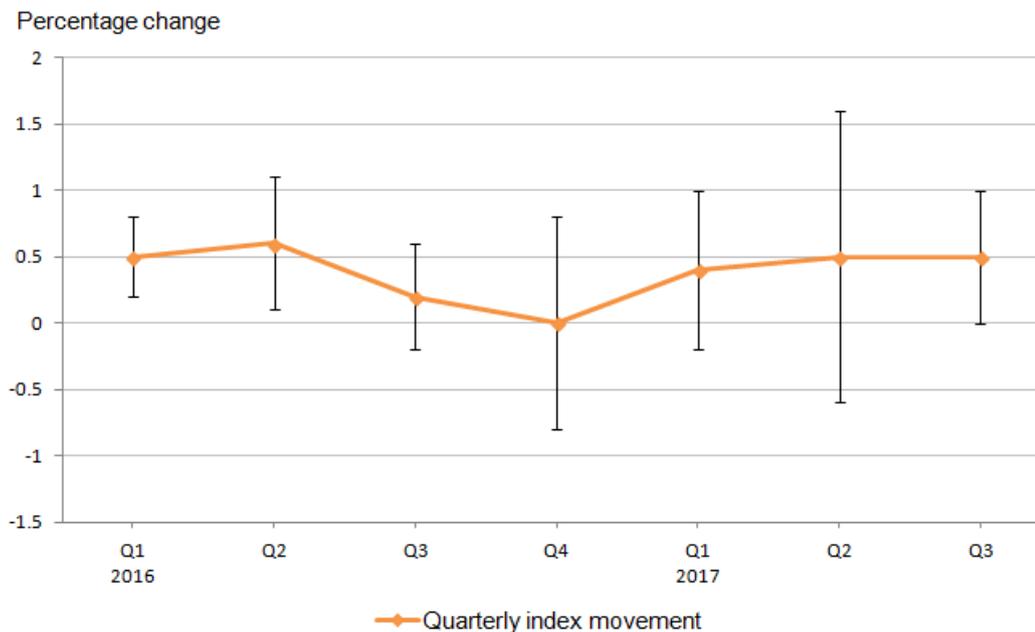
UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



By contrast, the standard errors of quarterly growth for the aggregate SPPI (GSO) were highest in Quarter 2 (Apr to June) of 2017, which is conveyed by the CI95% shown in Figure 2. Standard errors started off relatively small in this seven-quarter period and in general a gradual increase in standard errors was observed, reaching the largest value in Quarter 2 2017, but diminishing by the next quarter.

**Figure 2: SPPI all services, gross sector output (GSO) – Quarterly growth with CI95%**

UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



The median of the annual and quarterly standard errors over this period examined were found to be 0.4 and 0.2 respectively. Both values are relatively low, suggesting that the published growth rates of the annual and quarter-on-quarter SPPI movements are a reasonable estimator of the true population values.

## 5 . Industries with large standard errors

Standard errors for all industries can be found in the [Services Producer Prices Index Standard Errors Data](#) for Quarter 3 2017 dataset.

Consistent with the [previous SPPI standard errors publication](#), industries with the largest standard error for their price movements are commercial vehicle ferries, hotels, and advertising services. CI95% have been calculated for each of these in this section.

### Commercial vehicle ferries

This services industry currently comprises 15 service items and as a result the price growth of individual items can be highly influential at the industry level. This introduces the potential for large standard errors if the growth recorded for an individual item (that is, price quote) deviates from the general trend of other service items within an industry.

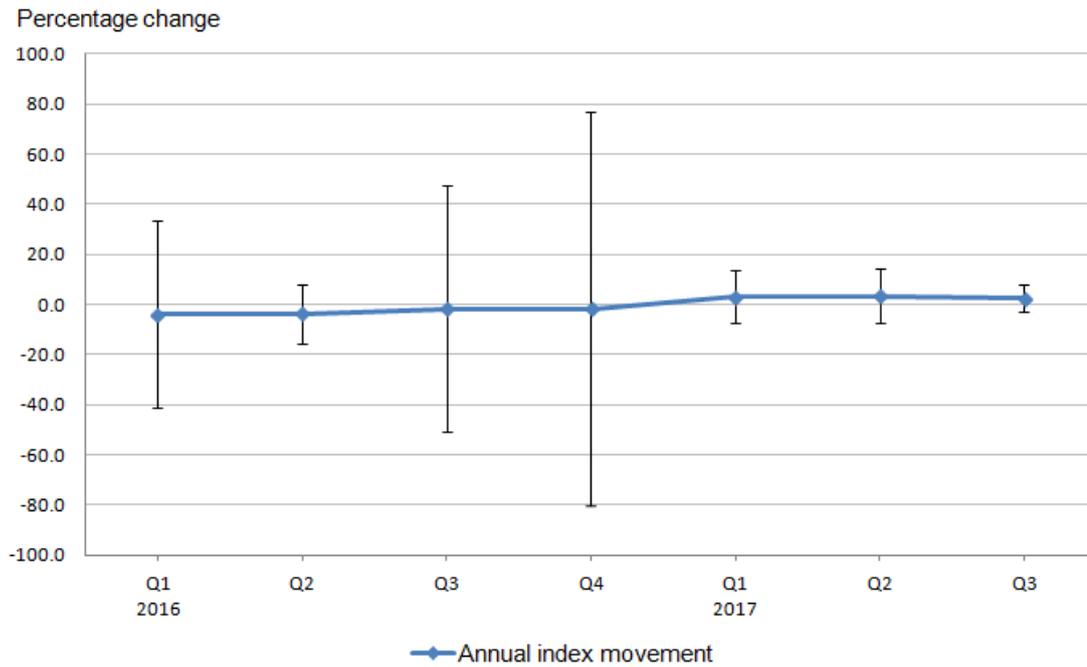
Some companies in this industry review their prices on an annual basis. This is usually captured in the prices taken for the first quarter of each year. The first period each year is most likely to have changing prices, which introduces variability into the index. This is readily apparent in Quarter 1 (Jan to Mar) 2016, which showed negative growth coupled with a large standard error for both annual and quarterly data.

While large annual standard errors were observed in this services industry price movement for Quarters 1 and 3 of 2016, a remarkably large standard error was detected in Quarter 4 (Oct to Dec) 2016. This is conveyed in the CI95% shown in Figure 3. Initially, confidence intervals showed a large standard error for the quarterly index change in Quarter 1 2016 (Figure 4), but the standard errors for the succeeding quarters remain relatively small in comparison.

The median of the annual and quarterly standard errors over this seven-quarter period were found to be 6.0 and 0.9 respectively. This large median annual standard error suggests that the published growth rates of annual movements are not a strong estimator for the true population values. This is likely an effect of the propagation of the larger standard error in Quarter 1 2016 and the consequently large quarter-on-quarter growth in Quarter 3 2016. The median quarterly standard error is comparatively smaller, suggesting that quarterly growth values for this index are more reliable estimators of the population values.

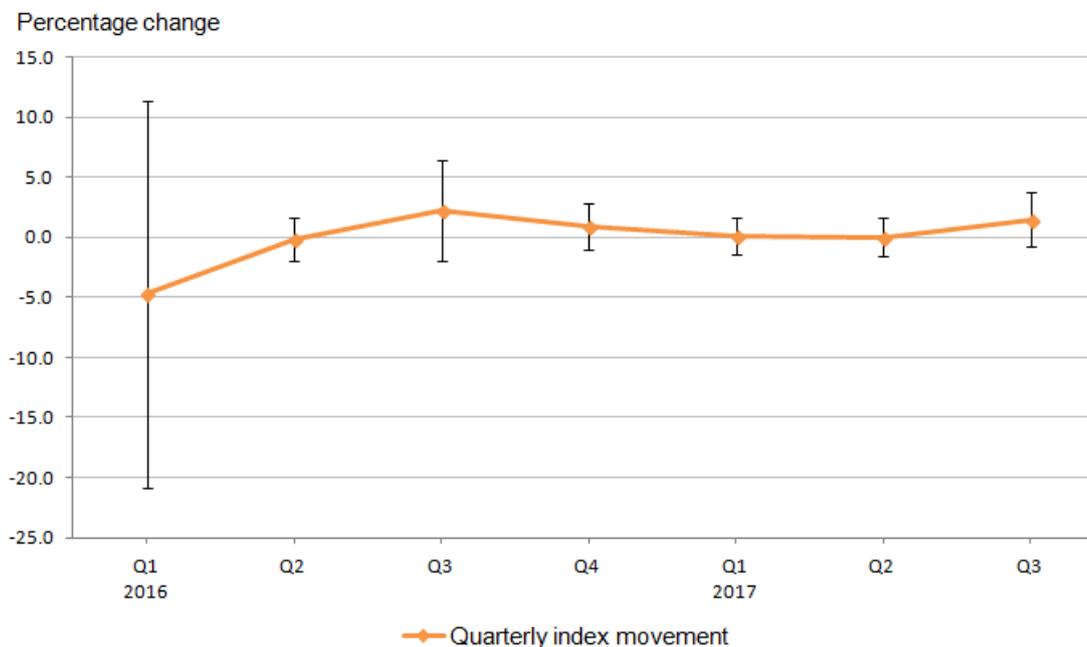
**Figure 3: Commercial vehicle ferries – annual growth (quarter on same quarter previous year) with CI95%**

UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



**Figure 4: Commercial vehicle ferries – quarterly growth with CI95%**

UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



## Hotels

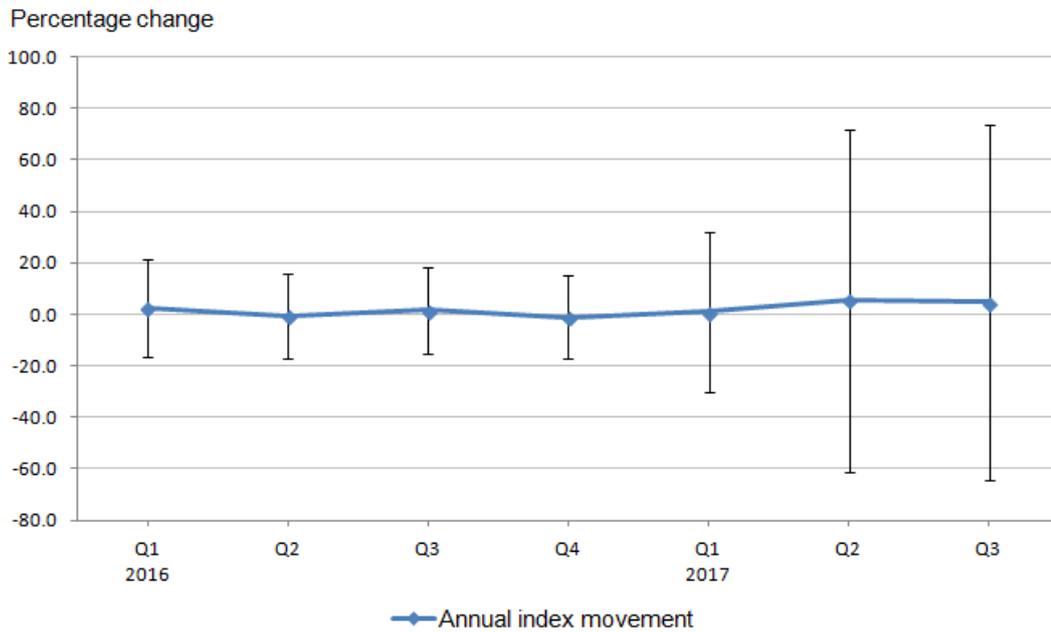
The hotels industry is known to have a rather volatile price index. This is readily apparent when assessing quarterly growth rates, which exhibits seasonal-dependent bouts in fluctuations. Large positive and negative growth is not an uncommon occurrence for this industry. Notably, due to overall differences in price relatives between hotels in London and those elsewhere in the UK, there is substantial spread of price quote data over a wide range of values, consequently producing large standard errors for the Hotels industry.

Large standard errors for annual growth were observed for all quarters throughout the period examined for hotels, which is especially pronounced in Quarter 2 2017 and Quarter 3 2017 (conveyed by the CI95% shown in Figure 5). The annual median standard error for this seven-quarter period is 9.8, revealing that the index for this service industry is not a precise estimate of the true population values. CI95% in Figure 5 reflect the range in which true values of annual growth may lie.

In general, the standard errors for the quarterly growth rates remained relatively small for this industry, except for two quarters, namely Quarter 1 and Quarter 2 2017. Despite moderate volatility in quarter-on-quarter growth, the median standard error is 1.6 for this seven-quarter period. While this is larger than the quarterly median standard errors of other industries, it is not unexpected given the disparities in location-dependent price quotes coupled with the seasonal nature of this industry. Figure 6 shows the quarterly growth and CI95% around each value.

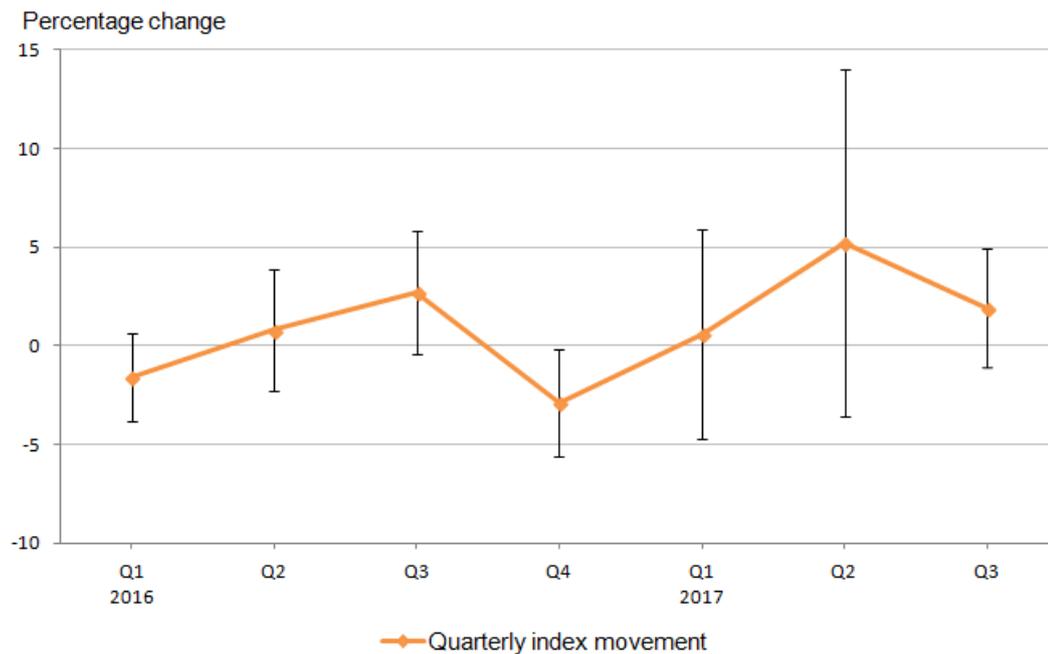
**Figure 5: Hotels (business customers only) – annual growth (quarter on same quarter previous year) with CI95%**

UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



**Figure 6: Hotels (business customers only) – quarterly growth with CI95%**

UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



## Advertising services

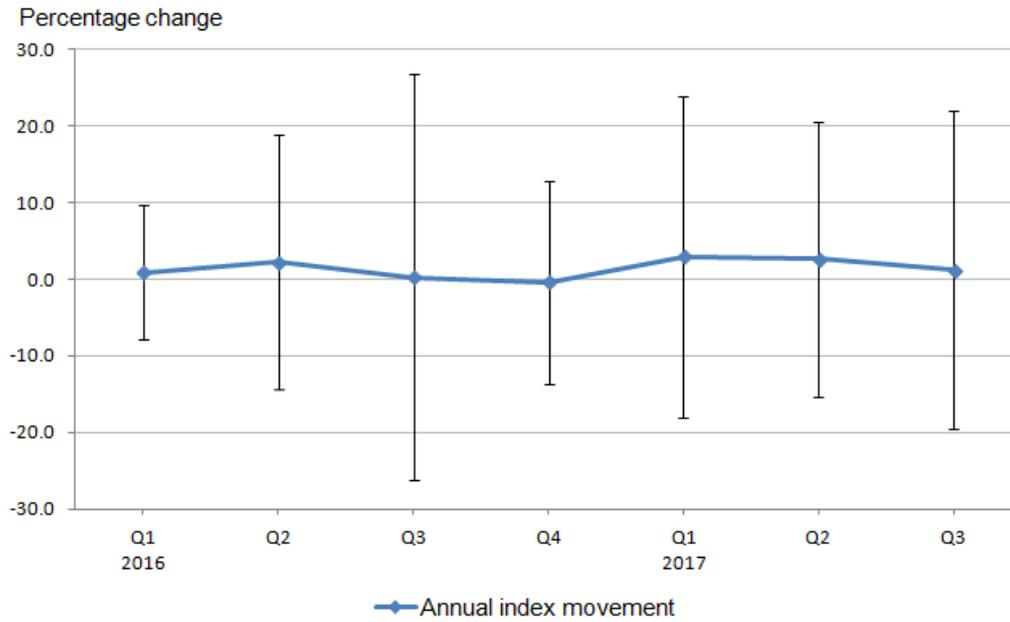
This industry is a time-based series since prices are set on a contract basis within this industry. Without using time-based methods, measuring a price for each specific service would be difficult. Therefore, a proxy service price is generated based on the content of each contract and calculated using the time committed by workers of different grades, to produce a best estimate of the cost of that contract. While this makes different contracts rather comparable, variability in price quotes can be increased.

Consistently large standard errors among the seven quarters evaluated were observed for advertising services, with Quarter 3 2016 possessing the largest standard error (conveyed by the CI95% in Figure 7). The median standard error of the annual growth for the period spanning Quarter 1 2016 and Quarter 3 2017 is 9.2.

The median standard error of quarterly growth of advertising services is 1.7, suggesting that the quarterly growth constitutes a reasonable measure of the true population value. The CI95% (Figure 8) show that a consistent level of accuracy was maintained for each quarter-on-quarter period.

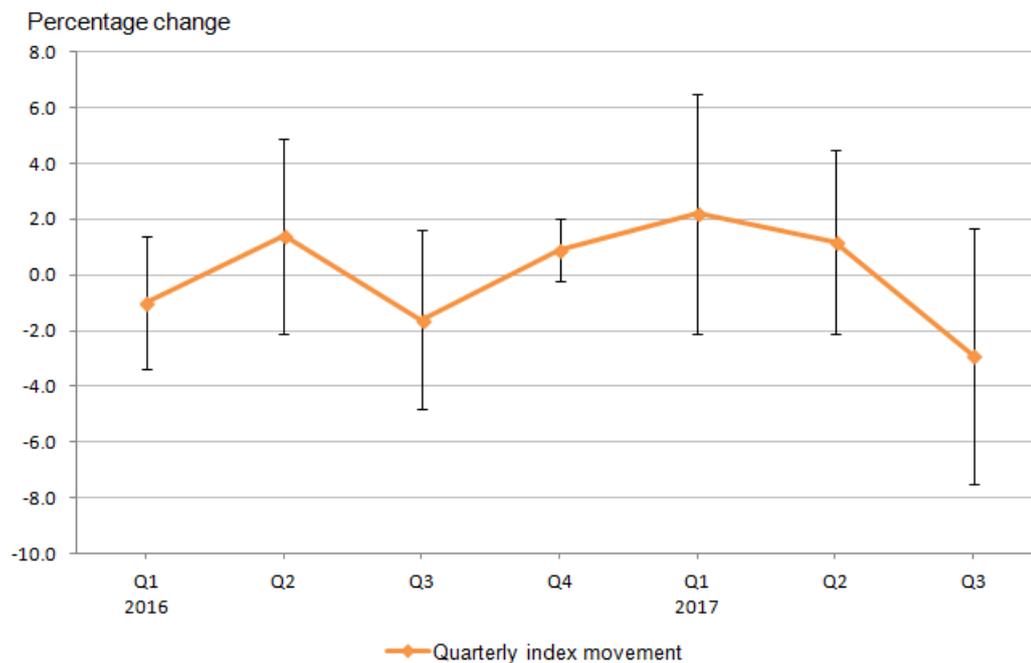
**Figure 7: Advertising services – annual growth (quarter on same quarter previous year) with CI95%**

UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



**Figure 8: Advertising services – quarterly growth with CI95%**

UK, Quarter 1 (Jan to Mar) 2016 to Quarter 3 (July to Sept) 2017



## 6 . Conclusions

The aggregate SPPI is a relatively precise measure for the true population values, with a seven-quarter median standard error for annual and quarter-on-quarter growths at 0.4 and 0.2 respectively.

In some industries, the annual standard errors are large, indicating that these indices are not very reliable estimators for the annual growth of the population. This is the case for commercial vehicle ferries, hotels, and advertising services. However, it is worth noting that these industries displayed relatively smaller standard errors for their quarterly growths, with median values of 0.9, 1.6, and 1.7 respectively.

With all this in mind, regularly re-examining the methods used in each index composition is a continuous process within Office for National Statistics (ONS). The aim to find powerful and cost-effective ways to optimise data collection is ongoing, to ensure that such indices correspond to the true value of price movements as precisely as possible.

## 7 . How are we doing?

We are constantly seeking to improve this release and welcome your feedback to help us achieve this. If you have any comments on the format, layout or content of this release please let us know. We would also be interested in knowing how you use these data to inform your work. Please email us: [sppi@ons.gsi.gov.uk](mailto:sppi@ons.gsi.gov.uk)

## 8 . Quality and methodology

### Annual standard error independence calculation

The calculation of standard errors requires a number of assumptions to hold in order for a valid standard error to be produced. The main assumption in the method used to calculate annual standard error is that there is some statistical dependence between the growths of the current period and the preceding period. That is, that the covariance between the quarters are non-zero for some quarters. However, in some industries the growths are uncorrelated, which means the covariance between them is equal to zero. When the growths are uncorrelated the method has been adapted to use this information in the calculation of standard errors.

### Coverage of SPPI

The SPPI is a measure of inflation for the UK service sector; however, prices are not collected from Northern Ireland for any of the service industries which are collected as part of the quarterly survey. This is because the Statistics of Trade Act which makes the SPPI survey mandatory does not extend to Northern Ireland. The omission of prices from Northern Ireland means that the SPPI makes the assumption that prices received by companies in Northern Ireland change at the same rate as prices in the rest of the UK.

The SPPI is published quarterly in a [SPPI statistical bulletin](#).

### Guidance for users

The SPPI is calculated on a “business-to-business” basis. This means that only transactions between UK businesses and other UK businesses or government are included. Sales made to customers outside of the UK or to members of the public are excluded.

Statistics in this article are on a gross sector basis unless otherwise stated. This means that they include transactions between UK service sector businesses and all other UK businesses and government.

Indices relate to average prices per quarter. The full effect of a price change occurring within a quarter will only be reflected in the index for the following quarter. All index numbers exclude VAT and are not seasonally adjusted. Since SPPIs exclude VAT, they are not affected by the increase in the standard rate of VAT to 20% from 4 January 2011.

## Data sources

The SPPI is compiled using the results of a mandatory survey carried out under the [Statistics of Trade Act \(1947\)](#). To keep the burden on respondents to a minimum, alternative data sources are used to compile the indices wherever possible. Currently six SPPIs are compiled using external data sources, these data sources are:

- Property rental payments – Investment Property Databank (IPD)
- Financial intermediation (banks) – Bank of England (BoE)
- Sewerage services – The Water Services Regulation Authority (Ofwat)
- Business rail fares – Office for Rail Regulation
- National post parcels – Parcelforce Worldwide
- Business telecoms – Office of Communications (Ofcom)

## Revisions

SPPI follows our [policy for revisions and corrections](#) and will show significant revisions but minor changes are suppressed to avoid unnecessary inconvenience to users. Indices for the most recent two quarters are regarded as provisional and may be revised as later data become available.

As part of the SPPI statistical bulletin, Table 1R in the [SPPI dataset](#) highlights revisions to movements in price indices previously published in the previous quarter's statistical bulletin.

## QMI report

The [SPPI Quality and Methodology Information document](#) contains important information on:

- the strengths and limitations of the data
- the quality of the output: including the accuracy of the data and how it compares with related data
- uses and users
- how the output was created

The methods used to calculate standard errors presented here follow the same methodology as used to calculate the PPI standard errors, which can be found in [Survey Methodology Bulletin No.62, pages 62 to 80](#).