



An Official Statistics Publication for Scotland

## ECONOMY AND LABOUR MARKET

# Labour Productivity Statistics

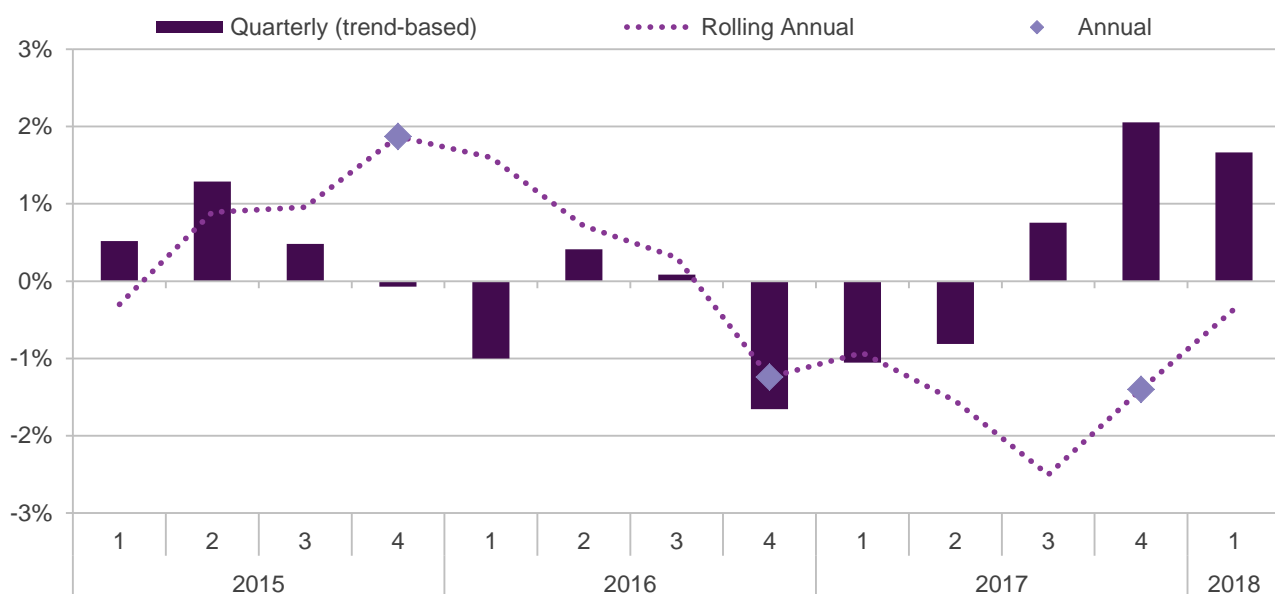
## Quarter 1 2018

Release Date: 22 August 2018

### KEY FINDINGS

- This release contains estimates of labour productivity for Scotland's onshore economy up to the first quarter of 2018 (January-March). Quarterly movements in labour productivity can be volatile, making short term trends difficult to discern. To aid interpretation, two methods of smoothing out this volatility are presented.
- On a rolling annual basis to 2018 Quarter 1, comparing the most recent four quarters to the previous four quarters, labour productivity in Scotland, as measured by output per hour worked, decreased by 0.4% in real terms (inflation adjusted).
- Additionally, this release contains a trend-based estimate of productivity growth. This indicates the underlying rate of change during the latest quarter by removing both seasonal and irregular (volatile) movements from the data. It is estimated that the trend in real output per hour worked increased by 1.7% in the first quarter of 2018.
- This publication also includes estimates of output per job and current price productivity measures (not adjusted for inflation). Experimental estimates of labour productivity for broad industry groups are also available online.

Figure 1: Labour Productivity, growth in output per hour



## **ABOUT THIS RELEASE**

Labour productivity measures the amount of economic output that is produced, on average, by each unit of labour input, and is an important indicator of economic performance.

It is a derived statistic which means that it is not directly estimated, but is based on separate estimates for economic output and labour input. It is calculated by dividing a measure of output (gross value added, GVA) by a measure of input (number of jobs or total number of hours worked). An increase in GVA or a decrease in jobs/hours contributes toward an increase in labour productivity whilst a decrease in GVA or an increase in jobs/hours contributes toward a decrease.

Labour input is measured in terms of the number of jobs in the economy (giving a measure of output per job), and also the total number of hours worked (giving output per hour worked). Output per hour worked is usually viewed as the most comprehensive indicator of whole economy labour productivity and taken as the headline measure. Output statistics (gross value added, GVA) are sourced from Scottish Government quarterly national accounts statistics. Labour input measures in this release are based on NUTS1 results for countries and regions published by the Office for National Statistics (ONS).

Three different measures of productivity growth are presented in this release.

- Annual growth: comparing the latest calendar year and the previous calendar year.
- Rolling annual growth (4Q-on-4Q): comparing the average of the latest four quarters to the average of the preceding (non-overlapping) four quarters, using the seasonally adjusted series. Rolling annual growth corresponds to annual growth in Quarter 4 of each year.
- Quarterly trend-based growth: comparing the most recent quarter to the previous quarter, using a trend-based estimate of productivity. This measure indicates the underlying change in productivity after the removal of irregular volatility from the series, as well as recurring seasonal features.

Further information about these statistics and the methods used to produce them is available in the background notes.

### **Real Terms Productivity Statistics**

Labour productivity statistics can be presented in real terms, also known as constant prices or volume terms, where the effects of price inflation have been removed. The main use of real terms productivity statistics is to analyse changes in the level of activity over time within a particular country or region, or to compare growth rates between countries or regions on a consistent basis.

Real terms productivity estimates are indexed to a reference year. The index year is set at 2007=100 in order to focus on movements since the onset of recession in 2008.

### **Current Price Productivity Measures**

Labour productivity can also be expressed in current prices, also known as nominal terms, which are not adjusted to remove the effects of inflation. The main use of current price productivity statistics is to make comparisons of the relative level (not growth rate) between countries or regions at a particular point in time.

## Revisions in this release

Exceptionally, this release of labour productivity statistics includes revisions to all results back to the start of 1998. These updates are the result of the underlying gross value added (GVA) series undergoing revision. More information on these revisions can be found in the latest Quarterly National Accounts Scotland 2018 Q1 publication:

<https://www.gov.scot/Topics/Statistics/Browse/Economy/QNAS2018Q1>.

**Figure R1: Revisions to growth in annual output per hour, real terms**

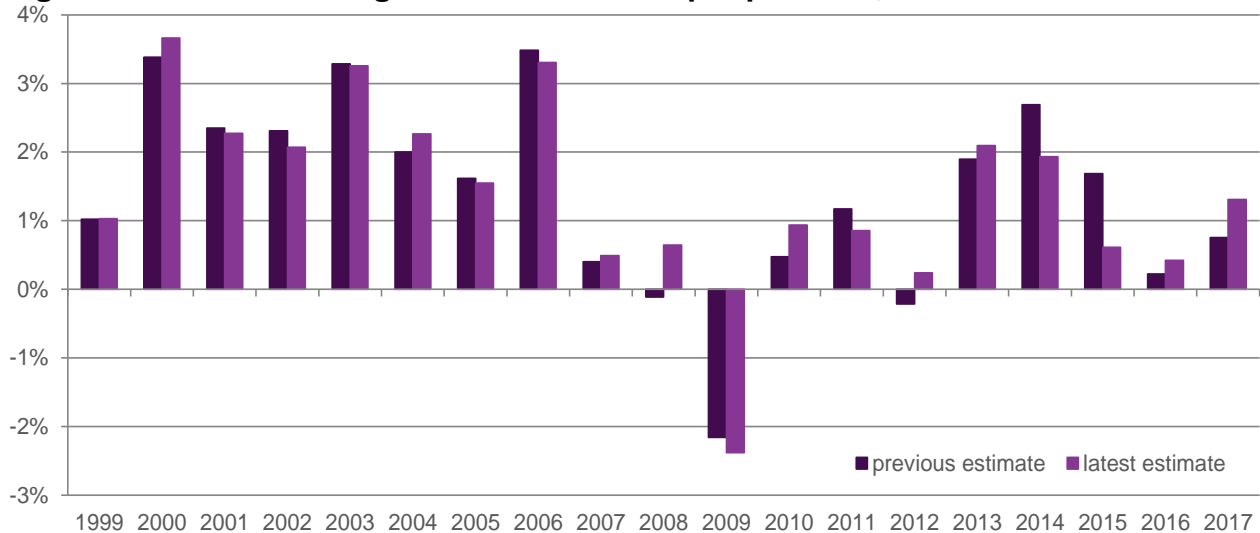
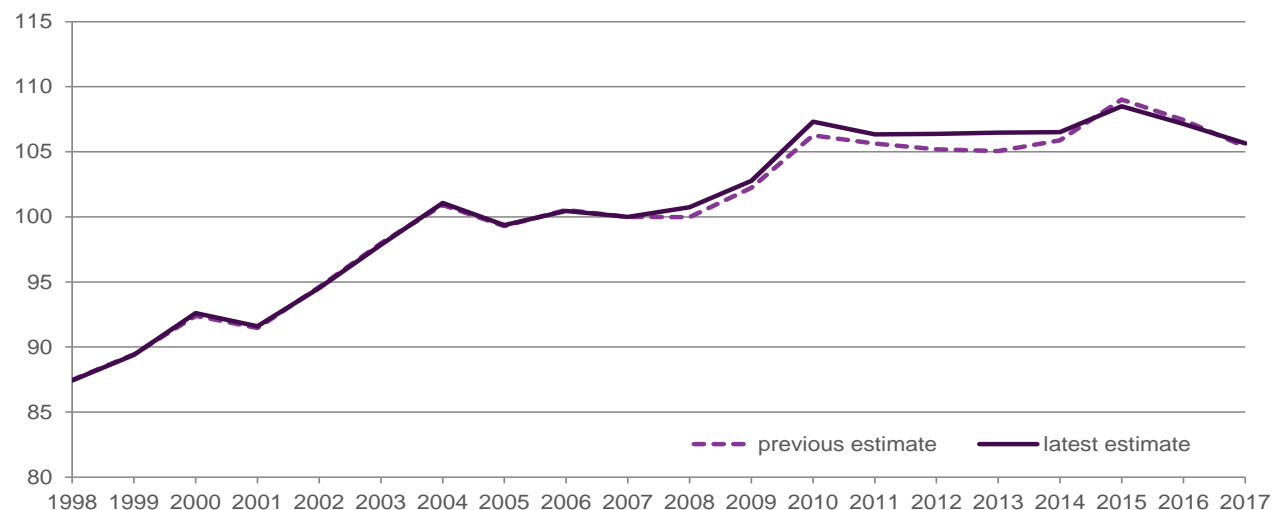


Figure R1 displays the impact revisions to the Scottish onshore GVA series have had on annual labour productivity growth rates. There was a downward revision to the growth rate in 2014 and 2015, and an upward revision in the latest two years.

Put simply, where GVA has been revised down we see a decrease in labour productivity growth, and where GVA is revised upwards we see an increase in the growth rate.

It is important to note however, that the underlying long-term trend in Scottish labour productivity since the onset of recession in 2008 remains unaffected. Although the year-on-year growth rates have been revised slightly, Figure R2 shows that the growth in Scottish labour productivity since 2007 remains largely unchanged.

**Figure R2: Revisions to annual output per hour index, real terms (2007=100)**



## LATEST RESULTS

### Real Output Per Hour

On a rolling annual basis to 2018 Quarter 1, comparing the most recent four quarters to the previous four quarters, output per hour worked decreased by 0.4% in real terms (inflation adjusted). This rate of change in productivity is due to the growth of 1.3% in GVA being outweighed by an increase of 1.7% in the total number of hours worked. In the latest full calendar year (2017), output per hour fell by 1.4% in real terms.

On a quarterly basis, it is estimated that the trend in real output per hour worked increased by 1.7% between the fourth quarter of 2017 and the first quarter of 2018, following growth of 2.1% in the previous quarter. The quarterly path of output per hour is displayed in figure 2 below, in both seasonally adjusted and trend-based terms.

**Figure 2: Real output per hour, 1998 to 2018 Q1 (2007=100)**

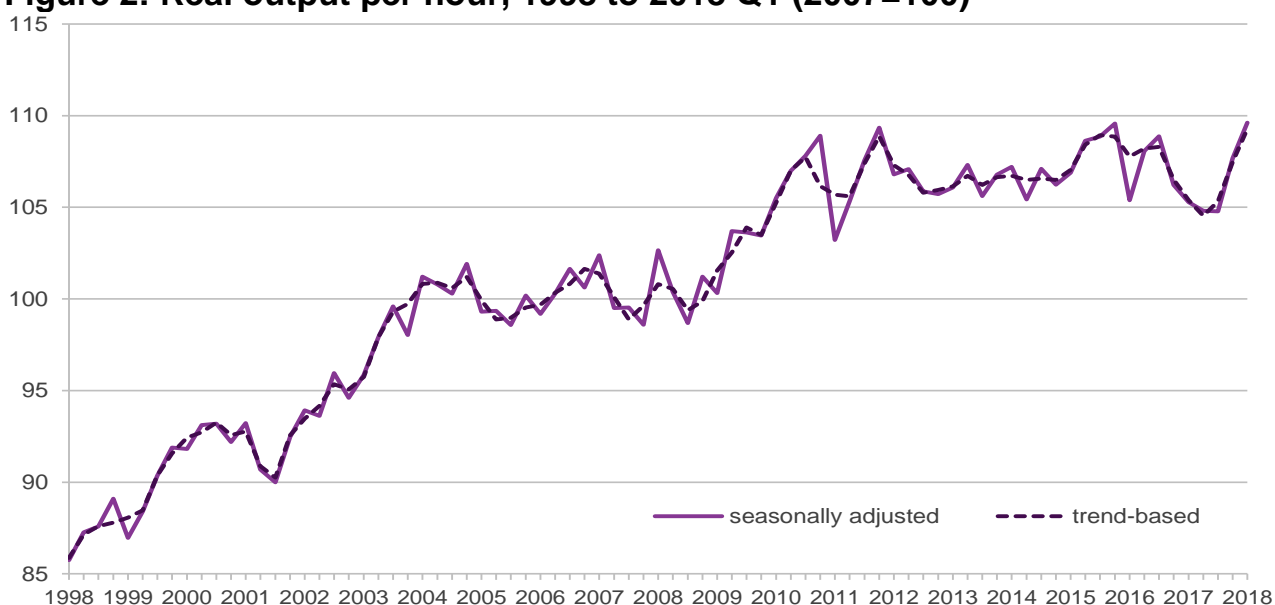


Figure 2 demonstrates the volatility in quarterly estimates of output per hour, even after seasonal adjustment to remove peaks caused by regular annual events. This is largely due to statistical variance in the regional results of the Labour Force Survey used to estimate the hours worked in each industry.

Two methods are used in this publication to smooth out this volatility. The four quarter on four quarter (rolling annual) growth rate essentially provides a quarterly update on the development of the annual measure and corresponds to annual growth in the fourth quarter of each year. The downside of a rolling annual growth rate is that it is lagged compared to the quarterly data.

An alternative measure, is a trend-based estimate of quarterly growth based on a centred moving average. This can be used to identify underlying short term changes in a more timely way than the rolling annual measure. However, due to the calculations used for the trend-based estimate, the latest two quarters are always provisional and subject to potential revision when new data become available. While the trend-based estimate is ideal for assessing individual quarterly changes, the seasonally adjusted series is preferable for calculating longer-term changes and average growth rates in the series. Further information on these methods is available in the background notes.

## **Real Output Per Job**

On a rolling annual basis to 2018 Quarter 1, output per job decreased by 0.1% in real terms (inflation adjusted). In the latest full calendar year (2017), output per job decreased by 0.6%.

On a quarterly basis, it is estimated that the trend in real output per job increased by 1.2% between the fourth quarter of 2017 and the first quarter of 2018, following growth of 0.9% in the previous quarter.

As with the estimate of output per hour worked, changes in the rolling annual growth rate or quarterly trend-based measure are useful for removing the impact of short term volatility in the data.

## **Current price measures**

Labour productivity measures presented in terms of current prices (not adjusted for inflation) are suitable for cross-country comparison of levels (not growth rates) in a single year.

Within the UK, productivity for the countries and regions is expressed relative to the UK average excluding extra regio (offshore and overseas) activity. Such comparisons use annual data from the UK Regional Accounts statistics. UK comparisons for the year 2017 will be available in the Scottish Labour Productivity release for 2018 Quarter 3 in February 2019.

In 2016, Scottish output per hour worked was estimated to be 98.2% of the average UK value (excluding extra regio output), representing a gap of 1.8 percentage points. The gap between labour productivity levels in Scotland and the UK average narrowed considerably from around 9 or 10 percentage points prior to 2008 until 2015 when the level of Scottish output per hour worked exceeded that of the UK average for the first time. In the latest year the gap has opened up again to around 2 percentage points. Output per job was 97.0% of the average UK value (excluding extra regio output) in 2016, representing a gap of 3.0 percentage points.

Over time, the levels of output per job and per hour relative to the UK have followed a similar pattern. Since 2009, there has been a small divergence and the relative level of output per job has been lower than output per hour, indicating that changes in average hours per job in Scotland do not mirror the average changes across the UK.

## **Labour Market and Workforce Trends**

Differences in trends between the number of jobs and total hours worked are due to changes in working patterns over time. This is indicated by the average number of weekly hours per job in the economy.

Average weekly hours per job in Scotland followed a gradual downward trend between 1998 and 2010 before recovering slightly in more recent years. While the average now appears to be broadly stable over time, there are still shorter-term fluctuations between years. A decrease in average weekly hours per job can be due to a greater number of people employed in part time jobs, reductions in contracted hours or overtime, or some combination of all these factors (or the opposite for an increase in average hours).

**Table A: Real Terms Labour Productivity Indices**  
**Whole Economy Output Per Hour and Output Per Job**

2007=100<sup>1</sup>

Year	Quarter	Gross Value Added (GVA) <sup>2</sup>	Output per hour <sup>3</sup>		Output per job <sup>3</sup>	
1998		82.2	87.4		89.5	
1999		83.0	89.4	1.0%	90.7	
2000		86.0	92.6	3.7%	93.6	
2001		88.0	91.6	2.3%	93.0	
2002		89.8	94.5	2.1%	94.5	
2003		92.8	97.9	3.3%	96.7	
2004		94.9	101.1	2.3%	98.5	
2005		96.3	99.4	1.6%	98.1	
2006		99.5	100.4	3.3%	100.3	
2007		100.0	100.0	0.5%	100.0	
2008		100.6	100.7	0.6%	99.5	
2009		98.3	102.8	-2.4%	100.6	
2010		99.2	107.3	0.9%	103.5	
2011		100.0	106.3	0.9%	103.3	
2012		100.3	106.4	0.2%	103.4	
2013		102.4	106.5	2.1%	105.2	
2014		104.3	106.5	1.9%	104.9	
2015		105.0	108.5	0.6%	105.3	
2016		105.4	107.1	0.4%	105.9	
2017		106.8	105.6	1.3%	105.2	
		seasonally adjusted	Seasonally adjusted	Trend based <sup>4</sup>	Seasonally adjusted	Trend based <sup>4</sup>
2015	1	105.0	106.9	107.0	105.0	105.0
	2	105.0	108.6	108.4	105.7	105.4
	3	104.7	108.9	108.9	105.1	105.2
	4	105.2	109.6	108.9	105.6	105.5
2016	1	105.0	105.4	107.8	105.3	105.3
	2	105.4	108.1	108.2	105.8	105.9
	3	105.6	108.9	108.3	106.5	106.3
	4	105.7	106.2	106.5	105.8	105.7
2017	1	106.4	105.3	105.4	105.2	105.4
	2	106.5	104.8	104.5	104.8	104.7
	3	107.0	104.8	105.3	105.0	105.0
	4	107.3	107.7	107.5	105.9	106.0
2018	1	107.8	109.6	109.3	107.5	107.3
<b>Percentage change, latest year compared to previous year</b>						
2017		1.3%	-1.4%	-	-0.6%	-
<b>Percentage change, most recent 4 quarters compared to preceding 4 quarters</b>						
2017	4	1.3%	-1.4%	-	-0.6%	-
2018	1	1.3%	-0.4%	-	-0.1%	-
<b>Percentage change, latest quarter compared to previous quarter<sup>4</sup></b>						
2017	4	0.3%	-	2.1%	-	0.9%
2018	1	0.4%	-	1.7%	-	1.2%

<sup>1</sup>Volume indices with reference period 2007 selected to assist interpretation over the course of the recovery from recession in 2008 and 2009

<sup>2</sup> Consistent with Quarterly National Accounts Scotland for 2018 Quarter 1

<sup>3</sup> Consistent with NUTS1 Labour Input series from ONS Labour Productivity 2018 Q1 release

<sup>4</sup> This measure indicates the underlying change in productivity after the removal of irregular volatility from the series, and is recommended to analysis of quarterly changes

**Table B: Current Price Labour Productivity**  
**Whole Economy Output Per Hour and Output Per Job**

Year	Quarter	Gross Value Added (GVA) <sup>1</sup> £ million	Output per hour <sup>2</sup>		Output per job <sup>2</sup>	
			Cash value £.pp	Index 2007=100	Cash value £	Index 2007=100
1998		69,344	17.54	69.7	28,936	71.4
1999		69,519	17.80	70.7	29,103	71.8
2000		72,824	18.63	74.0	30,342	74.8
2001		76,650	18.97	75.3	31,035	76.5
2002		80,049	20.03	79.6	32,258	79.5
2003		84,863	21.29	84.5	33,897	83.6
2004		90,190	22.85	90.8	35,875	88.5
2005		96,024	23.55	93.5	37,463	92.4
2006		101,993	24.48	97.2	39,355	97.1
2007		105,894	25.18	100.0	40,551	100.0
2008		110,976	26.41	104.9	42,019	103.6
2009		111,411	27.71	110.1	43,686	107.7
2010		110,091	28.32	112.5	43,978	108.5
2011		113,234	28.62	113.7	44,780	110.4
2012		116,845	29.47	117.1	46,157	113.8
2013		122,610	30.32	120.4	48,247	119.0
2014		129,070	31.32	124.4	49,674	122.5
2015		130,431	32.05	127.3	50,118	123.6
2016		132,685	32.06	127.3	51,024	125.8
2017		136,845	32.18	127.8	51,628	127.3
<b>Seasonally Adjusted</b>						
2015	1	32,562	31.52	125.2	12,461	122.9
	2	32,447	31.93	126.8	12,504	123.4
	3	32,383	32.02	127.2	12,450	122.8
	4	33,040	32.74	130.0	12,703	125.3
2016	1	32,612	31.13	123.7	12,525	123.6
	2	33,062	32.25	128.1	12,719	125.5
	3	33,540	32.87	130.6	12,945	127.7
	4	33,471	32.00	127.1	12,835	126.6
2017	1	33,750	31.76	126.2	12,783	126.1
	2	34,115	31.94	126.9	12,858	126.8
	3	34,322	31.97	127.0	12,894	127.2
	4	34,659	33.07	131.3	13,094	129.2
2018	1	35,054	33.92	134.7	13,386	132.1

1 Consistent with Quarterly National Accounts Scotland for 2018 Quarter 1

2 Consistent with NUTS1 Labour Input series from ONS Labour Productivity 2018 Q1 release

## Table C1: Labour Productivity Input Series (Seasonally Adjusted)

### Whole Economy Jobs Filled and Hours Worked<sup>1</sup>

Year	Quarter	Productivity	Index	Whole Economy:	Index	Whole Economy:
		Jobs	2007=100	Average Weekly Hours	2007=100	Average Weekly Hours per job
1998		2,396,418	91.8	76,024,093	94.0	31.7
1999		2,388,704	91.5	75,107,595	92.9	31.4
2000		2,400,148	91.9	75,168,754	92.9	31.3
2001		2,469,785	94.6	77,716,484	96.1	31.5
2002		2,481,514	95.0	76,858,008	95.0	31.0
2003		2,503,569	95.9	76,672,005	94.8	30.6
2004		2,514,037	96.3	75,915,943	93.9	30.2
2005		2,563,161	98.2	78,408,948	96.9	30.6
2006		2,591,606	99.2	80,135,306	99.1	30.9
2007		2,611,365	100.0	80,890,541	100.0	31.0
2008		2,641,072	101.1	80,817,229	99.9	30.6
2009		2,550,282	97.7	77,329,922	95.6	30.3
2010		2,503,311	95.9	74,753,130	92.4	29.9
2011		2,528,645	96.8	76,081,628	94.1	30.1
2012		2,531,454	96.9	76,237,773	94.2	30.1
2013		2,541,291	97.3	77,771,693	96.1	30.6
2014		2,598,334	99.5	79,244,625	98.0	30.5
2015		2,602,498	99.7	78,269,921	96.8	30.1
2016		2,600,453	99.6	79,594,702	98.4	30.6
2017		2,650,590	101.5	81,777,226	101.1	30.9
<b>Seasonally Adjusted<sup>2</sup></b>						
2015	1	2,613,110	100.1	79,474,018	98.2	30.4
	2	2,594,899	99.4	78,177,310	96.6	30.1
	3	2,601,044	99.6	77,791,575	96.2	29.9
	4	2,600,937	99.6	77,636,780	96.0	29.8
2016	1	2,603,683	99.7	80,580,765	99.6	30.9
	2	2,599,410	99.5	78,850,083	97.5	30.3
	3	2,590,977	99.2	78,480,138	97.0	30.3
	4	2,607,744	99.9	80,467,824	99.5	30.9
2017	1	2,640,273	101.1	81,732,579	101.0	31.0
	2	2,653,255	101.6	82,160,696	101.6	31.0
	3	2,661,963	101.9	82,588,289	102.1	31.0
	4	2,646,869	101.4	80,627,339	99.7	30.5
2018	1	2,618,622	100.3	79,497,324	98.3	30.4

<sup>1</sup> Based on NUTS1 Labour Input Series from ONS Labour Productivity release for 2018 Quarter 1

[Productivity Jobs and Productivity Hours by NUTS1 region \(pdf\)](#)

<sup>2</sup> Seasonally adjusted series are preferable for calculating longer-term changes but with these data (particularly average weekly hours) there can be large volatile when analysing short term movements.



## Table C2: Labour Productivity Input Series (Trend Series)

### Trend Whole Economy Jobs Filled and Hours Worked<sup>1</sup>

Year	Quarter	Productivity	Index	Whole Economy:	Index	Whole Economy:
		Jobs	2007=100	Average Weekly	2007=100	Average Weekly
				Hours		
1998		2,396,418	91.8	76,024,093	94.0	31.7
1999		2,388,704	91.5	75,107,595	92.9	31.4
2000		2,400,148	91.9	75,168,754	92.9	31.3
2001		2,469,785	94.6	77,716,484	96.1	31.5
2002		2,481,514	95.0	76,858,008	95.0	31.0
2003		2,503,569	95.9	76,672,005	94.8	30.6
2004		2,514,037	96.3	75,915,943	93.9	30.2
2005		2,563,161	98.2	78,408,948	96.9	30.6
2006		2,591,606	99.2	80,135,306	99.1	30.9
2007		2,611,365	100.0	80,890,541	100.0	31.0
2008		2,641,072	101.1	80,817,229	99.9	30.6
2009		2,550,282	97.7	77,329,922	95.6	30.3
2010		2,503,311	95.9	74,753,130	92.4	29.9
2011		2,528,645	96.8	76,081,628	94.1	30.1
2012		2,531,454	96.9	76,237,773	94.2	30.1
2013		2,541,291	97.3	77,771,693	96.1	30.6
2014		2,598,334	99.5	79,244,625	98.0	30.5
2015		2,602,498	99.7	78,269,921	96.8	30.1
2016		2,600,453	99.6	79,594,702	98.4	30.6
2017		2,650,590	101.5	81,777,226	101.1	30.9
<b>Trend<sup>2,3</sup></b>						
2015	1	2,610,554	100.0	79,368,249	98.1	30.4
	2	2,601,889	99.7	78,341,565	96.8	30.1
	3	2,599,128	99.6	77,748,744	96.1	29.9
	4	2,602,144	99.7	78,161,567	96.6	30.0
2016	1	2,602,797	99.7	78,817,592	97.4	30.3
	2	2,597,504	99.5	78,760,080	97.4	30.3
	3	2,593,850	99.4	78,906,863	97.5	30.4
	4	2,609,644	100.0	80,260,638	99.2	30.8
2017	1	2,636,533	101.0	81,668,112	101.0	31.0
	2	2,655,764	101.7	82,398,142	101.9	31.0
	3	2,659,694	101.9	82,174,754	101.6	30.9
	4	2,644,839	101.3	80,781,818	99.9	30.5
2018	1	2,622,630	100.5	79,762,486	98.6	30.4

1 Based on NUTS1 Labour Input Series from ONS Labour Productivity release for 2018 Quarter 1

[Productivity Jobs and Productivity Hours by NUTS1 region \(pdf\)](#)

2 Trend series adjust for the irregular movements prevalent in the seasonally adjusted series and are preferable for analysing quarter-on-quarter changes and growth rates.

3 After removal of the irregular component from the quarterly series, the average of the four quarterly values in a year no longer equates to the annual value

## Table D: UK Comparisons of Labour Productivity

Whole Economy (excluding extra-regio)

Current prices

Year	Output per hour	Output per job
	UK = 100 <sup>1</sup>	UK = 100 <sup>1</sup>
1998	92.0	92.3
1999	91.0	91.0
2000	90.8	91.1
2001	89.9	90.3
2002	90.2	90.1
2003	90.8	90.1
2004	93.9	91.8
2005	92.7	91.5
2006	92.0	92.1
2007	90.9	91.2
2008	93.4	92.9
2009	96.7	96.7
2010	97.5	95.7
2011	96.5	95.6
2012	97.8	96.0
2013	98.5	97.7
2014	99.5	98.1
2015	100.3	97.5
2016	98.2	97.0

1 UK excluding extra regio, consistent with Table 9: Productivity Measures  
By Region in ONS Labour Productivity 2017 Q3

## **BACKGROUND NOTES**

### **Release Notes**

1. Labour productivity measures the amount of economic output that is produced by a unit of labour input (measured in this release in terms of jobs and hours worked).
2. Output statistics in this release are consistent with the latest Quarterly National Accounts Scotland for 2018 Quarter 1, published on 15 August 2018.
3. Labour input measures are consistent with the NUTS1 results for countries and regions in Labour Productivity 2018 Q1 published by the ONS on 6 July 2018.
4. Some of the component series used for output and labour inputs are designated as National Statistics, meaning they have been assessed as being readily accessible, produced according to sound methods and managed impartially and objectively in the public interest. The derived productivity series in this release have not been assessed by the UK Statistics Authority and so do not carry this designation.

### **Methodology and Definitions**

5. The labour productivity measures in this bulletin are presented in terms of current prices (also known as nominal estimates; without adjustment for inflation) and real terms (also known as constant prices, or volume estimates, which have been adjusted for inflation). The current price measures are suitable for country and regional comparisons of levels of productivity for a single year. The real terms measures are suitable for analysis of changes in productivity performance over time.
6. Real terms productivity estimates are indexed to a reference year. The index year is set at 2007=100 in order to focus on movements in labour productivity since the onset of recession in 2008.
7. GVA estimates for Scotland are for the onshore economy only (identified as the NUTS1 region of the UK with code UKM). Comparisons with the UK average (Table D) are consistent with those published by ONS for all NUTS1 regions and countries in its 2017 Quarter 3 productivity release. These are made to 'onshore' UK GVA only (that is, UK excluding overseas and offshore activity classed as extra regio in UK regional accounts). The main reason for using only onshore output in analysis of UK countries and regions is that the labour inputs series associates all workers and hours with one of the 12 onshore countries and regions of the UK, and therefore there are no labour inputs directly associated with offshore activities.
8. Users should note that this introduces a potential bias to the onshore productivity estimates, given that a portion of the workforce is not counted against the output that they produce. For Scotland, and the UK total, this means that labour input series are larger than they might otherwise be, and therefore that reported productivity will be lower than if only the 'onshore' workforce was used in the calculation. The analysis of the scale of this effect and investigation of potential adjustments to mitigate it are included in the development plan for future productivity statistics releases.

## Key Quality Issues

9. Labour productivity estimates are derived statistics produced using simple calculations on other source statistics. Their quality and accuracy is therefore dependent on the output and labour input data. While there are some known issues with the consistency between GVA and labour market statistics due to factors including the different survey sources, workforce residency and commuting effects, and differing definitions of business unit classifications, the data sources used to produce the estimates in this bulletin are all individually recognised to be of high quality and are designated as such.
10. There is a trade-off between the level of disaggregation and reliability of productivity estimates; productivity estimates for Scotland are published at a level of aggregation which ensures a sufficient level of quality. For industry breakdowns, this means that estimates are only published at an annual level, whereas quarterly estimates are published at whole economy level.
11. Quarter-on-quarter changes in labour productivity can be volatile and should be interpreted with caution, not least due to difficulties in ensuring consistency of seasonal adjustment between the numerator and denominator. We recommend using the four quarter-on-four quarter (rolling annual) growth rate when analysing the quarterly estimates. In Quarter 4 of each year, this gives the same result as the annual (year on year) growth rate. Additionally, to assist with interpreting underlying movements on a quarter-by-quarter basis, an alternative measure based on the short term trend in output per hour and output per job is also presented in this publication

## A trend-based measure of productivity growth

12. Annual labour productivity estimates are derived by dividing the annual estimate of economic output by the annual estimate of labour input. On a quarterly basis, the economic output and labour input series are seasonally adjusted to allow for meaningful comparison between quarters without (for example) temporary seasonal workers at Christmas affecting the resulting labour productivity estimate.
13. Quarterly estimates of hours worked are particularly volatile due to statistical variance in the regional results of the Labour Force Survey which result in a similarly volatile labour productivity series. To aid interpretation of quarterly movements, trend series (the underlying movements after adjusting for seasonal and irregular components of the time series) of the unadjusted ONS productivity jobs and hours series are published and used to calculate what are defined in this release as 'trend-based' productivity estimates. This is estimated as part of the X-12 ARIMA seasonal adjustment process, with the trend estimate defined as the D12 output from this procedure.
14. The resulting productivity series are much smoother and allow for more timely identification of short term change and turning points in the series. It should be noted, however, that the two most recent quarterly estimates are provisional subject to potential revision in future releases.
15. Trend estimates of quarterly productivity jobs and hours are derived directly, rather than as a component of annual productivity jobs or hours. As a result the averages of the four quarterly trend-based productivity jobs and hours series do not equal the annual total for the labour input series.

## **Other Productivity Statistics for Scotland**

16. Current price estimates in this release are produced to provide productivity statistics which are consistent with Quarterly National Accounts Scotland and other economic statistics produced by the Scottish Government.
17. Alternative statistics are available from the Office for National Statistics which are consistent with the NUTS1 Gross Value Added (Balanced approach) produced for all countries and regions of the UK. ONS estimates of GVA differ from Scottish Government estimates because of adjustments made by the Scottish Government during the production of Supply and Use Tables which balance estimates of GVA using Production and Expenditure data sources as well as Income.
18. Estimates of labour productivity are derived directly from GVA statistics, and are often analysed alongside GVA and GDP. It is therefore important that productivity statistics should be used in context with the GVA data they are consistent with.
19. For users of Scottish Government GDP and Quarterly National Accounts Scotland statistics, the recommended productivity statistics are those in this release. Users of ONS Regional GVA statistics are recommended to continue using the ONS Regional Productivity statistics as a consistent product. Likewise, users who focus primarily on productivity statistics should ensure that any comparison to GVA or GDP makes reference to the consistent product.
20. Real terms productivity estimates show the evolution of productivity within a country or region, but should not be used to compare productivity levels across countries or regions at a point in time. Productivity growth can be decomposed into growth of output minus growth of prices and the growth of labour input, and these components can move in different directions within and across countries. This should be borne in mind in interpreting the real terms productivity estimates in this release.

## Development programme for Scottish Labour Productivity Statistics

21. As part of the Scottish National Accounts Programme (SNAP), a work package has been investigating further development of productivity statistics for Scotland. This involves working closely with ONS, and is examining what data are available and how they can be used to extend the scope of existing statistics to better meet the needs of users.
22. Since their first release in 2014, Scottish Government labour productivity statistics have undergone the following developments:
  - Productivity statistics, previously published annually with a 9 month lag, are now published quarterly one week after the release of the quarterly national accounts.
  - These productivity statistics produced on a quarterly basis are based on labour input data available on the same basis as the annual figures.
  - Estimates are now produced, on an experimental basis, of labour productivity for different industries as well as for the whole economy. These are based on labour input series which have been developed to be consistent with the whole economy data already available.
23. Planned and ongoing developments include:
  - Exploring the possibility of producing additive decompositions of productivity growth by industry in order to facilitate a deeper understanding of what drives growth.
  - Investigating whether the labour market source data can be used to produce output per worker and unit labour costs measures as well as jobs and hours.
  - Ongoing development and quality assurance of the industry level labour input series.
  - Investigating the treatment of offshore (extra-regio) GVA and offshore workers in existing labour market statistics and their impact on productivity estimates. UK whole economy productivity statistics include all offshore GVA and all offshore workers, but the situation is not as simple for sub-UK statistics including those for Scotland, as mentioned in note 8 above.
24. Some users have expressed interest in the development of estimates of Total Factor Productivity (also known as Multi-Factor Productivity) for Scotland, which takes account of changes in the composition of labour input and the utilisation of capital input to production as well as the labour input measured in Labour Productivity statistics. At present the required data on capital stocks, investment and depreciation are not available to allow such estimates to be produced for Scotland or other sub-UK areas, but the SNAP team plan to research opportunities for this in the future. Recent experimental estimates for the UK are published by ONS, with a fuller explanation of the definition of TFP and methodologies used in the article at:

<https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/articles/multifactorproductivityestimates/experimentalestimatesto2015>

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### **Correspondence and enquiries**

For enquiries about this publication please contact:

Ian Gardiner

National Accounts Statistics

e-mail: [ian.gardiner@gov.scot](mailto:ian.gardiner@gov.scot) or [economic.statistics@gov.scot](mailto:economic.statistics@gov.scot)

For general enquiries about Scottish Government statistics please contact:

Office of the Chief Statistician, Telephone: 0131 244 0442,

e-mail: [statistics.enquiries@scotland.gsi.gov.uk](mailto:statistics.enquiries@scotland.gsi.gov.uk)

### **How to access background or source data**

The data collected for this statistical bulletin:

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- are available via an alternative route
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