



16 December 2021

Total Factor Productivity of the United Kingdom agriculture industry, second estimate 2020

This release presents the second estimate of Total Factor Productivity (TFP) of the UK agriculture industry for 2020. It also presents volume indices for inputs and outputs. These figures are a scheduled update to those published in May 2020 using additional data that became available in the second half of the year.

Total factor productivity is a measure of how well inputs are converted into outputs, giving an indication of the efficiency and competitiveness of the agriculture industry. Although external factors such as weather conditions or disease outbreaks may have a short-term impact on productivity, it is developments that improve productivity over a longer period that constitute one of the main drivers of agricultural income.

TFP estimates are derived from the aggregate farm accounts data used to calculate UK Total Income from Farming (TIFF). TIFF second estimates for 2020 are published in parallel with these and can be found on GOV.UK.

Key Messages

- Total Factor Productivity is estimated to have decreased by 4.5% between 2019 and 2020, a fall from what was the highest level ever recorded in 2019. This was driven by a decrease in overall levels of production, which outweighed a small decrease in volumes of inputs.
- The volume of all outputs decreased by 5.7%. This was driven by the following volume changes:
 - a 14.1% volume decrease in total crop output
 - a 0.8% volume decrease in the output of livestock for meat
 - a 0.5% volume decrease in the output of livestock products
- The volume of all inputs decreased by 1.2%.

Revisions since first estimates

The value of Total Factor Productivity for 2020 has been revised upwards by 3.3% since the first estimates were published in May 2021. The main amendments were increased volume of diversification (Inseparable non-agricultural activities) and decreased volumes of farming inputs (seeds, fertilisers and plant protection products). The revisions were due to both methodological improvements and availability of more robust survey data to replace previous estimates. The survey data from the Farm Business Survey, in particular, provided evidence that volumes of diversification through 2020 were greater than had been forecast. Full details of the revisions are provided in section 2.2.1 (page 11).

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What you need to know about this release

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National Statistics Status

National Statistics status means that our statistics meet the highest standards of trustworthiness, quality and public value, and it is our responsibility to maintain compliance with these standards.

The continued designation of these statistics as National Statistics was confirmed in December 2017 following a compliance check by the Office for Statistics Regulation [Total factor productivity of the UK agriculture industry](#)

The statistics last underwent a full assessment [[Assessment Report 271 Statistics on Agriculture](#)] against the [Code of Practice for Statistics](#) in 2014.

Since the latest review by the Office for Statistics Regulation, we have continued to comply with the Code of Practice for Statistics and have enhanced data quality by reviewing methodologies and data sources.

For general enquiries about National Statistics, contact the National Statistics Public Enquiry Service:

Tel: 0845 601 3034

Email: info@statistics.gov.uk.

You can find National Statistics on the internet [on the Gov.uk website](#).

Changes to Release Schedule

As part of our efforts to maintain a high standard of statistical releases, we are currently performing a review of our production for estimates of the Total Factor Productivity in the UK. As part of this review, we are considering adjusting the publication schedule for Total Factor Productivity in the UK. We would be interested to hear from users on how they use these data and of any impact potential changes to this publication would have on their use of the data.

Please send all feedback to the responsible statistician for this release, Joshua Moatt, using the contact details above.

Key words

All outputs - the change in volume (expressed as an index) of all outputs sold off the farm. This excludes transactions within the industry.

All inputs - the change in volume (expressed as an index) of goods and services purchased and consumed. This excludes transactions within the industry.

Total factor productivity - how efficiently all inputs are turned into outputs. Derived by dividing all outputs by all inputs.

Partial productivity - how efficiently intermediate consumption, capital, labour or land is transformed into outputs. Derived by dividing all outputs by each factor.

Definition and explanation of Total Factor Productivity

Total Factor Productivity (TFP) is a key measure of the economic performance of agriculture and an important driver of farm incomes. It represents how efficiently the agriculture industry uses the resources that are available to turn inputs into outputs. These are measured in volumes rather than values to remove any effects of price fluctuations and inflation over time. It is expressed here as a relative measure rather than an absolute measure, enabling us to see if improvements are made by comparing one year to another. Data are compared with a base year with a value set to 100, so for example a figure of 150 would represent a 50% increase compared with the base year.

External factors such as weather and animal disease can have short term effects on Total Factor Productivity. When we look at the results, we should consider the overall, long-term trend. In the long-term, developments in productivity constitute one of the major factors that impact on income.

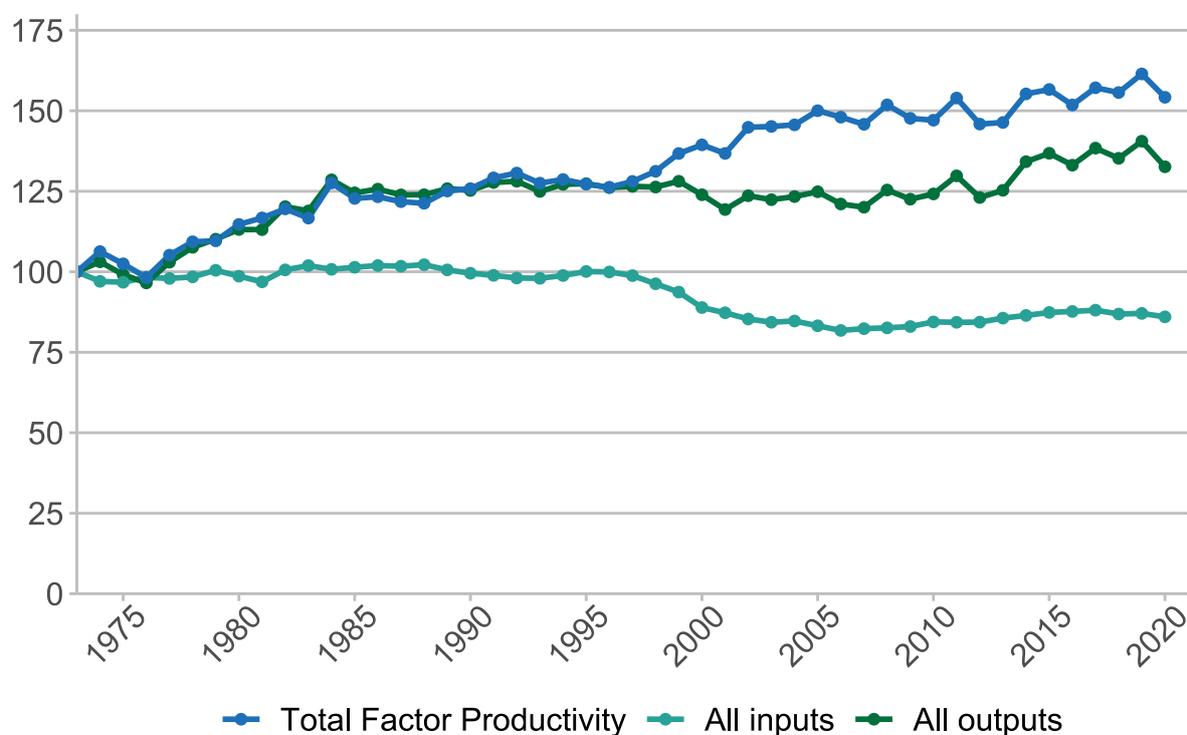
Section 1 – Total factor productivity

1.1 Total Factor Productivity, latest figures and long-term trend summary

Total Factor Productivity of the agriculture industry in the United Kingdom decreased by 4.5% between 2019 and 2020. The annual decrease is driven by a fall of 5.7% for outputs combined with a small decrease of 1.2% in the volume of inputs. As shown in figure 1 this continues the pattern of fluctuations seen from around the year 2000 onwards. In spite of this annual variability, the long-term trend is still one of slow but steady overall improvement.

Since 1973, Total Factor Productivity has increased by 54.2%, driven by a 32.6% increase in the volume of outputs and a 14.0% fall in the volume of inputs.

Figure 1 Total Factor Productivity of the UK agriculture industry (1973 = 100)



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1.2 Detailed comparison of annual change in volumes of outputs and inputs between 2019 and 2020

Outputs (Table 1.1)

The volume of all outputs decreased by 5.7% between 2019 and 2020, driven by a decrease of 14.1% in the volume of total crop output and a decrease of 0.7% in the volume of total livestock output.

Output of cereals decreased by 30.6% in 2020, in sharp contrast to 2019 which saw some of the highest levels of production ever recorded for the UK. The wet weather in autumn 2019 during the planting season for winter cereals prevented sowing across significant areas and also led to poor establishment for many crops that were planted. This was followed by a dry spell in the spring of 2020 that delayed crop development. There was a compensatory increase in planting of spring crops, which have lower yields than winter sown cereals, and this, together with the poor start to crop development and very wet weather during the main harvest of wheat in 2020, led to a fall in the outputs of cereals, which for wheat was the lowest since 1981.

Both oilseed rape and sugar beet saw similar sharp falls, with decreases of 40.8% and 24.1% respectively. Both crops were adversely affected by insect pests and wet weather at critical stages of development.

Total livestock output showed an overall decrease of 0.7%. There was some disruption to the livestock sector due to Covid-19 restrictions which led to a delay in animals going to markets. Production was later adapted to market conditions where this was feasible.

Milk increased marginally whilst eggs decreased by 0.4%. Milk production was held back early in the year as the sector adapted to new market conditions following the first Covid-19 lockdown and the shutdown of hospitality and institutional outlets. Without this, milk may have seen a larger increase in outputs.

Output of livestock for meat decreased by 0.8%. Cattle, pigs and other animals saw increases of 2.8%, 2.3% and 2.5% respectively. However, sheep and poultry both fell by 4.3%.

Inputs (Table 1.2)

Overall, there was a slight decrease of 1.2% in the volume of all inputs including labour.

Most inputs showed minor decreases. However, animal feed, the largest input by value, showed an increase of 1.6% overall. Seeds also saw a sharp increase of 18.4% due to the failure of some crops that needed to be replanted and the increase in spring planting due to the wet conditions for winter crops.

The reduction in winter cereals plus the dry spell in spring meant less fertiliser was used in 2020 with a 5.5% reduction in the overall volume applied. Furthermore, lower disease pressure, thanks to the mild and dry spring, coupled with the reduction in winter crop area resulted in a 19.3% reduction in the volume of plant protection products applied.

Table 1.1 Volume indices for outputs (2015 = 100)

	2019	2020	% Change from 2019
1 Output of cereals	99.2	68.8	-30.6%
wheat	96.0	54.7	-43.1%
rye	100.0	85.0	-15.0%
barley	106.3	103.9	-2.3%
oats and summer cereal mixtures	118.8	150.2	26.4%
other cereals	155.5	189.8	22.1%
2 Output of industrial crops	79.6	56.8	-28.7%
oil seeds	69.0	42.6	-38.3%
oilseed rape	68.9	40.8	-40.8%
other oil seeds	87.2	187.6	115.1%
protein crops	78.8	78.0	-1.0%
sugar beet	124.8	94.8	-24.1%
other industrial crops	104.6	95.5	-8.7%
3 Output of forage plants	100.0	100.0	0.0%
4 Output of vegetables and horticultural products	97.1	98.9	1.9%
fresh vegetables	91.9	95.0	3.5%
plants and flowers	103.1	103.2	0.1%
5 Output of potatoes	93.9	97.7	4.0%
6 Output of fruit	105.4	99.3	-5.8%
7 Output of other crop products	110.4	83.0	-24.8%
Total crop output (sum 1 - 7)	96.6	83.0	-14.1%
8 Output of livestock (meat)	105.9	105.1	-0.8%
cattle	100.7	103.5	2.8%
pigs	107.9	110.4	2.3%
sheep	102.5	98.1	-4.3%
poultry	113.2	108.4	-4.3%
other animals	100.8	103.3	2.5%
9 Output of livestock products	104.5	104.0	-0.5%
milk	101.3	101.4	0.0%
eggs	118.2	117.7	-0.4%
raw wool	92.3	92.5	0.3%
other animal products	180.6	141.4	-21.7%
Total livestock output (8 + 9)	105.4	104.7	-0.7%
10 Inseparable non-agricultural activities	116.8	116.1	-0.6%
11 All outputs	102.7	96.9	-5.7%

Table 1.2 Volume indices for inputs (2015 = 100)

	2019	2020	% Change from 2019
12 Seeds	89.8	106.3	18.4%
13 Energy	94.8	94.3	-0.5%
electricity and fuels for heating	100.0	100.3	0.3%
motor and machinery fuels	92.3	91.5	-0.9%
14 Fertilisers	88.3	83.5	-5.5%
15 Plant protection products	78.9	63.7	-19.3%
16 Veterinary expenses	85.7	86.1	0.5%
17 Animal feed	104.4	106.1	1.6%
compounds	107.9	109.2	1.1%
straights	97.0	99.7	2.8%
18 Total maintenance	102.0	100.0	-1.9%
materials	102.7	96.4	-6.2%
buildings	100.8	105.5	4.6%
19 FISIM	100.0	100.0	0.0%
20 Other goods and services	100.2	96.5	-3.7%
21 Intermediate consumption (excluding Agricultural services)	97.5	96.1	-1.4%
22 Consumption fixed capital (excluding livestock)	105.0	104.4	-0.5%
equipment	109.7	109.3	-0.4%
buildings	96.8	96.0	-0.8%
23 All Labour	101.0	100.0	-1.0%
Compensation of employees	98.3	94.3	-4.1%
Entrepreneurial workers (farm and specialist contractor)	102.4	102.9	0.6%
24 Land	102.2	100.7	-1.5%
25 All Inputs and Entrepreneurial Labour	99.7	98.4	-1.2%

Table 1.3 Summary volumes indices and Total Factor Productivity (2015 = 100)

	2019	2020	% Change from 2019
All outputs	102.7	96.9	-5.7%
All inputs	99.7	98.4	-1.2%
Total factor productivity	103.1	98.5	-4.5%

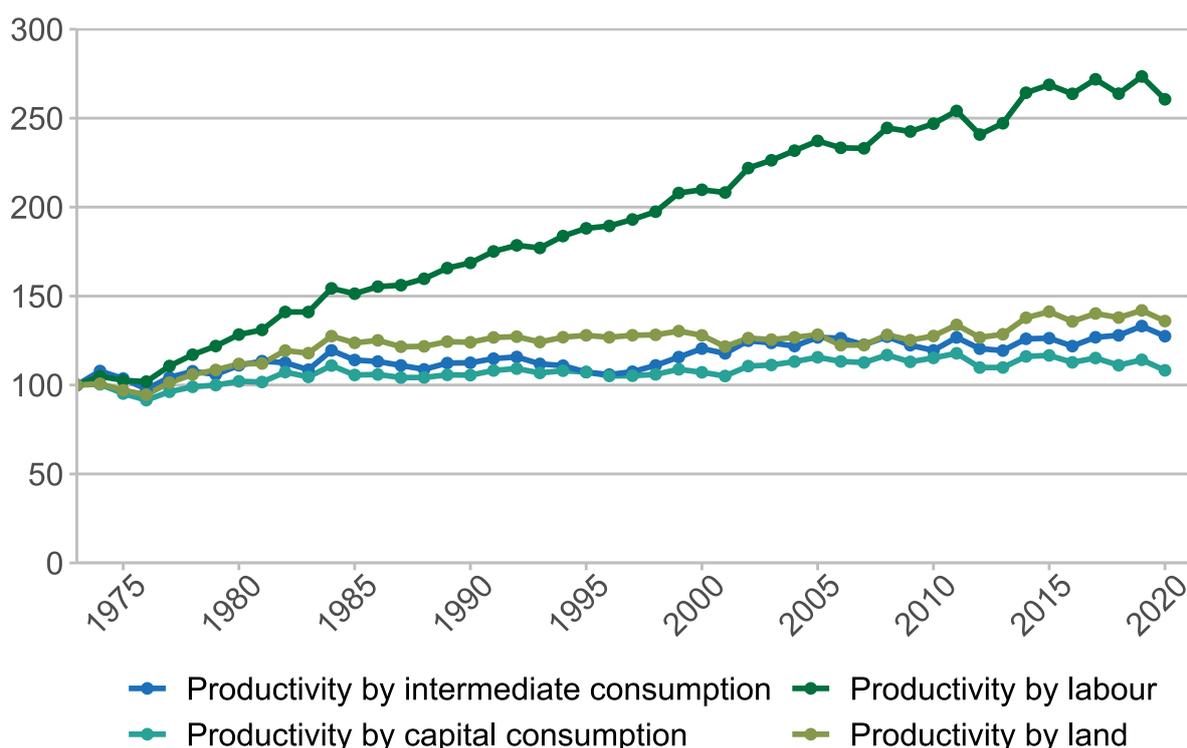
1.3 Partial productivity

Partial productivity shows the impact key inputs have on productivity. It measures total outputs against a part of the inputs. Table 2 and figure 2 clearly show that labour is the key input driving productivity gains. Productivity by labour shows a steady increase over the whole period. Labour volumes are now approximately half of what they were in 1973. However, more recent growth in labour productivity is due to increased output rather than a reduction in labour volume.

Table 2 Partial factor productivity (2015 = 100)

Partial factor productivity indicators	2019	2020	% Change from 2019
Productivity by intermediate consumption	105.4	100.9	-4.3%
Productivity by capital consumption	97.9	92.8	-5.2%
Productivity by labour	101.7	97.0	-4.7%
Productivity by land	100.5	96.2	-4.2%

Figure 2 Partial productivity indicators (1973 = 100)



Source: Defra © Crown copyright

Section 2 – About these statistics

2.1 Background to Total Factor Productivity

These results are produced as part of the preparation of aggregate agricultural accounts UK National Statistics. The agricultural accounts are also used to produce other measures of performance of the agriculture industry, including Total Income from Farming.

2.2 Revisions

Revisions are generally made when more up-to-date data become available, or as a result of methodology reviews.

The main change in recent years has been the introduction of land in the productivity indicator for the 2014 and subsequent estimates. The volume of land is based on the utilised agricultural area. The price associated for land is the rental value. Owned land is given a notional rent value. Due to the value associated with land, it has become a key component of the productivity indicator. The overall impact of land on the indicator was a slight reduction in apparent productivity gains.

2.2.1 Revisions from 2020 first estimate

There has been a substantial revision to the volume of inputs for 2019 and 2020. This was due to a correction for the impact of an artefact in the methodology used to calculate the Intermediate Consumption component of Total Factor Productivity (TFP) for the UK; the resulting anomaly became significant and noticeable due to the exceptional weather conditions in late 2019 and 2020 – it is much less evident in less unusual years.

For the second estimate of TFP, Farm Business Survey (FBS) data on input volumes is available, which replaces the forecast data necessarily used for the TFP first estimate. The FBS reporting period runs from March to February, whereas TFP follows the calendar year. Consequently, the FBS data from two survey years are apportioned across the relevant calendar year to give an estimated volume of the inputs used on a calendar year basis for the TFP calculation.

Owing to bad weather in 2019/20 affecting winter planting, many farmers abandoned winter crops in favour of spring sowing. This resulted in increased seed and fertiliser usage in January and February of 2020. This increased usage fell in the 2019/2020 FBS year and consequently inflated the estimated volume of seeds and fertiliser for the 2019 TFP account. For the first estimate, where no FBS data is available, standard forecasting techniques are used to estimate the volume of inputs used in the year. These forecasting techniques use the previous year's volume as a base, i.e. to forecast the volume of seeds for 2020, the volume of seeds in 2019 is used as

a base. Consequently, when these forecasting techniques were applied for the 2020 first estimate, they used the artificially inflated volume of seeds and fertiliser for 2019 as a base, resulting in an overestimation of the 2020 volume of these input items in the TFP 2020 first estimate.

To correct for this methodological artefact, we have replaced the FBS seeds and fertiliser volumes for 2019 and 2020, with volumes generated using 2018 volume data as a base and applying forecasting techniques for 2019 and 2020 respectively. To ensure the validity of this data, we checked that the sum of our new volumes across 2019 and 2020 closely matched the sum of the FBS data for 2019/2020 and 2020/21, because the total volume of seeds and fertiliser across the two FBS reporting years and the two TFP years, should be aligned. There is very good consistency between the two methods. Consequently, we feel this new approach more accurately partitions the volume of seeds and fertiliser between 2019 and 2020 for the calculation of TFP.

Additionally, there were significant revisions to the volume of plant protection products. FBS data available for these second estimates has replaced a forecast which appears to have been an overestimate for 2020. This overestimation was due to the difficulty in accurately forecasting the volumes of plant protection products used following the banning of the commonly used fungicide, Chlorothalomid. Additionally, the volume used in the first estimate, was a forecast of consumption, rather than expenditure. Ordinarily, these two values would be closely matched, however, in more extreme weather years, the differences between them are likely to be larger.

As with plant protection products, forecasting of 'inseparable non-agricultural activities' was challenging for 2020 owing to the Covid-19 pandemic and the resulting lockdowns. Consequently, our forecasting underestimated the volume of 'inseparable non-agricultural activities' in 2020. With FBS data suggesting that although some areas were significantly impacted by the Covid-19 pandemic and lockdowns (such as tourism), other areas of 'inseparable non-agricultural activities', such as leisure activities, did better than in 2019. Therefore, there has been a significant revision upwards in the volume of 'inseparable non-agricultural activities' for the TFP second estimate.

Unlike the calculation of Total Income from Farming, TFP is relatively robust to minor year on year revisions, with longer term effects, such as developments that improve productivity, driving changes in TFP. Consequently, these revisions have only resulted in a 3.3% increase in TFP, rising to 98.5 at the second estimate. This change reflects a 0.7% increase in the volume of all outputs, and a 2.5% decrease in the volume of all inputs.

Table 3 gives a detailed breakdown of the volume indices of the four items that have undergone significant revision from the first estimate and the impact these revisions have had on TFP.

Table 3 Revisions from first estimate (May 2021) to second estimate (December 2021) and their impact on Total Factor Productivity (2015 = 100).

Account item	Published May 2021 (First estimate)	Published Dec 2021 (Second estimate)	% change (first-second estimates)
Inseparable non-agricultural activities	96.1	116.1	20.8%
Seeds	120.6	106.3	-11.9%
Fertilisers	90.5	83.5	-7.8%
Plant protection products	78.0	63.7	-18.3%
All outputs	96.3	96.9	0.7%
All inputs	101.0	98.4	-2.5%
Total Factor Productivity	95.3	98.5	3.3%

2.3 Quality Assurance

Defra has in place quality assurance processes to check the accuracy and reliability of the aggregate agricultural accounts that includes:

- Ongoing review of methods employed in the calculation of the accounts.
- Assessment of the quality of the estimates of components of the accounts with internal and external experts.

A [summary quality report for this statistical release](#) can be found on the GOV.UK website.

This is an overview note which is not release-specific but will be reviewed and updated at regular intervals. It pulls together key qualitative information on the various dimensions of quality as well as providing a summary of methods used to compile the output. It provides users with information on usability and fitness for purpose of these estimates.

2.4 Main users and uses of total factor productivity

Total Factor Productivity is used in conjunction with other economic information to:

- Inform policy decisions and to help monitor and evaluate current policies relating to agriculture in the UK by Government.
- Inform stakeholders of the performance of the agriculture industry.
- Inform research into the economic performance of the agriculture industry.
- As an impact indicator of Government policy.

2.5 User engagement

As part of our ongoing commitment to compliance with the Code of Practice for Official Statistics, we wish to strengthen our engagement with users of these statistics and better understand the use made of them and the types of decisions that they inform. Consequently, we invite users to make themselves known, to advise us of the use they do, or might, make of these statistics, and what their wishes are in terms of engagement. Feedback on this notice and enquiries about these statistics are also welcome. Contact details are provided on page 2 of this statistical notice.

2.6 Future publications

The first estimate for Total Factor Productivity in the UK for 2021 will be published in Spring 2022.

To find out when these statistics will be next released go to research and statistics on the Gov.uk website and click on statistics (up-coming).