



Total Factor Productivity for England by Farm Type, based on the Farm Business Survey (Experimental Statistics)

This publication provides estimates of Total Factor Productivity (TFP) for England from 1990/91 to 2017/18 for selected farm types using the Farm Business Survey. Results for specialist pig, specialist poultry and horticulture farms have not been presented due to concerns about smaller sample sizes for these farm types. However the data for these farm types are included in the 'All farm types'/England series. The full time series and breakdown can be found at: <https://www.gov.uk/government/statistics/total-factor-productivity-for-england-by-farm-type>

Total Factor Productivity is a key measure of the economic performance of agriculture. It represents how efficiently the agricultural industry uses the resources that are available to turn inputs into outputs. The methodology used to calculate the National Statistics for "TFP for the UK agricultural industry" has been applied to data from the Farm Business Survey for England.

It is important to note that these are **Experimental Statistics** and as such have not yet been shown to meet the quality criteria for National Statistics branding. They are being published to involve users in their development. **We would value user feedback on these statistics to improve their value.** Please send any feedback to FBS.queries@defra.gov.uk

Given that the statistics presented in this notice are experimental, the UK National Statistics for "TFP for the UK agricultural industry" should continue to be used as the main source of statistics on agricultural productivity.

Key results are given below:

- The total factor productivity of agriculture in **England** is estimated to be 16% higher in 2017/18 compared to 1990/91. Over this period there has been an increase in outputs (7%) and a decrease in inputs (8%).
- In 2017/18, general cropping farms had the greatest increase in TFP compared to 1990/91, 32%. For dairy and cereal farms the increases were 27% and 25% respectively.
- TFP for grazing livestock farms was 21% lower in 2017/18 compared to 1990/91; 21% for Lowland grazing livestock and 9% for LFA grazing livestock farms
- For mixed farms, TFP was 4% lower in 2017/18 compared to 1990/91.

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1. Background

Total factor productivity (TFP) is a measure of how efficiently the agricultural industry turns inputs into outputs. Inputs are land, labour, capital expenditure and purchases, while output is the volume of outputs sold off the farm (i.e. sales). The method only incorporates the inputs and outputs that are associated with monetary transactions, and excludes transactions within the industry (i.e. lambs and cattle being sold for onward fattening or straw sold as bedding). Outputs and inputs volumes are weighted by price. (Farm) Support payments, such as direct payments are excluded from output.

$$\text{Total Factor Productivity} = \frac{\text{volume of total outputs}}{\text{volume of total inputs}}$$

There are many scenarios in which TFP will increase; for example if the volume of inputs stays the same while the volume of outputs increases, or if the volume of inputs decreases while the volume of outputs stays the same, or if the volume of outputs increases at a greater rate than the volume of inputs.

Partial factor productivity measures how efficiently intermediate consumption, capital, labour and land are transformed into outputs, and thus serves to break down total factor productivity to the productivity by each input. It takes into account the development in other inputs, for instance, if farms start using more capital that allows labour to be used more effectively, an increase in the partial factor productivity by labour will be seen.

$$\text{Partial Factor Productivity} = \frac{\text{volume of total outputs}}{\text{volume of input component}}$$

Results are measured in terms of the trend in volume of output leaving the industry per unit of all inputs, including labour. Changes from year to year are often shaped by factors outside the control of farmers, such as weather, disease, policy interventions, general economic conditions and are rarely the main driving factor behind long-term changes in farm incomes. However, over a longer period, developments in productivity constitute one of the major factors that impact on income.

There has been considerable interest in calculating TFP for each farming sector (e.g. cereal, dairy, grazing livestock etc.). A sector level TFP measure enables us to get below the aggregate series, to compare trends in productivity across sectors and to see how productivity varies over time within a sector. This has not been done elsewhere within the UK. Other countries, for example Australia, are also looking at producing sector level TFP.

Some of the data sources used to produce aggregate values and volumes for TFP at a UK level do not allow for the provision of farm type break down. Therefore, the Farm Business Survey has been used to produce a TFP series for each farming sector for England from 1990/91 to 2017/18, using the same methodology as for the UK National Statistics "TFP of the UK agricultural industry". However, there have been several difficulties and limitations encountered when adapting the FBS data to fit the UK TFP model. Not all FBS items map directly to those used in the UK model; some items have been combined to match the specified definition, whilst some smaller items have been grouped to avoid negative values (such as work in progress). Some items also had different definitions, for example capital consumption (depreciation).

The FBS is a sample survey of commercial farms. The smallest farms are excluded from the survey population. Whilst the survey currently accounts for around 60% of farm businesses, these businesses are estimated to account for 98% of output, and more than

90% of agricultural land. The FBS is a panel survey with around 93% of the sample retained annually.¹

The FBS has seen several changes in typology and entry threshold since 1990; the most notable in 2009/10 when the typology changed from using Standard Gross Margins and a lower threshold of 0.5 Standard Labour Requirement to a typology based on Standard Outputs and minimum lower threshold of 25,000 Euros. This resulted in a change in the composition of the sample and if not accounted for correctly a break in the time series is caused. For more detail about the issues encountered please refer to the accompanying [technical note](#).

¹ For more statistical information about FBS see https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/557607/fbs-statisticalinformation-4oct16.pdf

2. Detailed results

2.1 England level TFP

Key findings:

- Total factor productivity for agriculture in **England** is estimated to have increased by 16% between 1990/91 and 2017/18. This increase is driven by an increase in outputs (7%) and a decrease in inputs (8%).

Total factor productivity for agriculture (includes all farm types) in **England** is estimated to have increased by 16% between 1990/91 and 2017/18 (Figure 1). This increase has been driven by an increase in outputs (7%) and a decrease in inputs (8%). Although there are annual fluctuations in the series, TFP in England saw a gradual increase until its peak in 2005/06 and since then there has been a slight decline but with some fluctuations.

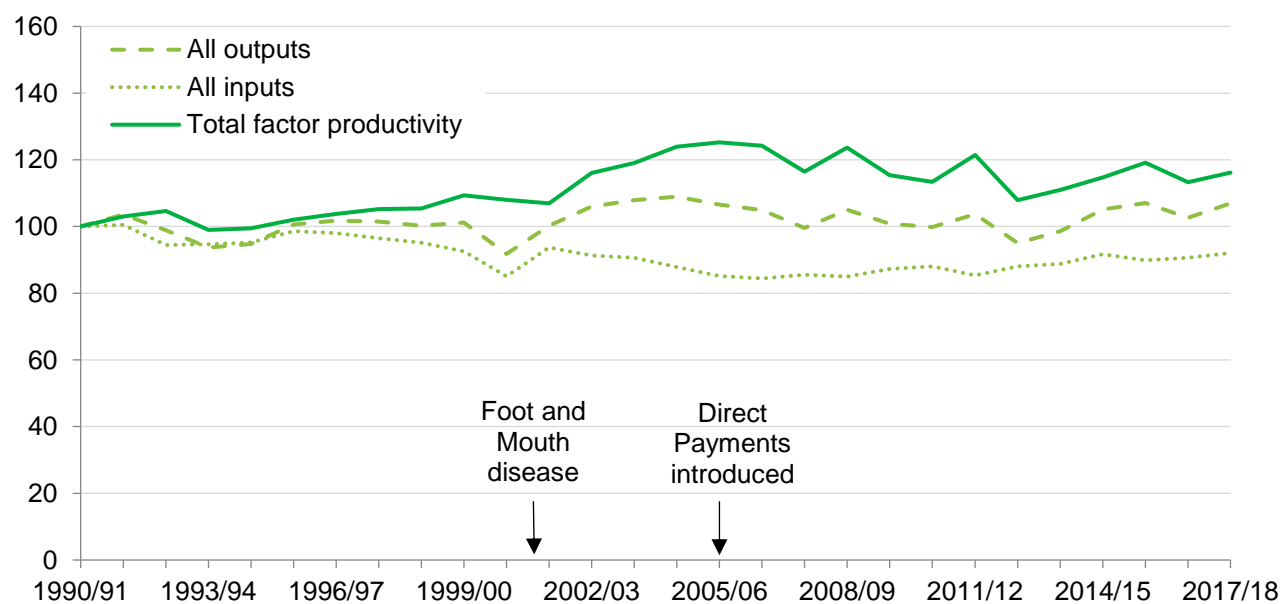
Given that these statistics presented in this notice are experimental, the UK National Statistics for “TFP for the UK agricultural industry” should continue to be used as the main source of statistics on productivity. For comparisons to the UK TFP series see section 3.

Table 1: Average annual change in the volume of inputs, outputs and TFP all farm types, England

	1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Outputs	-0.8%	0.8%	1.0%	0.2%
Inputs	-1.5%	0.3%	0.6%	-0.3%
Total Factor Productivity	0.8%	0.5%	0.4%	0.6%

Source: Defra, Farm Business Survey, England.

Figure 1: Total factor productivity of agriculture in England (1990=100)



Source: Defra, Farm Business Survey, England.

2.2 Sector Level TFP

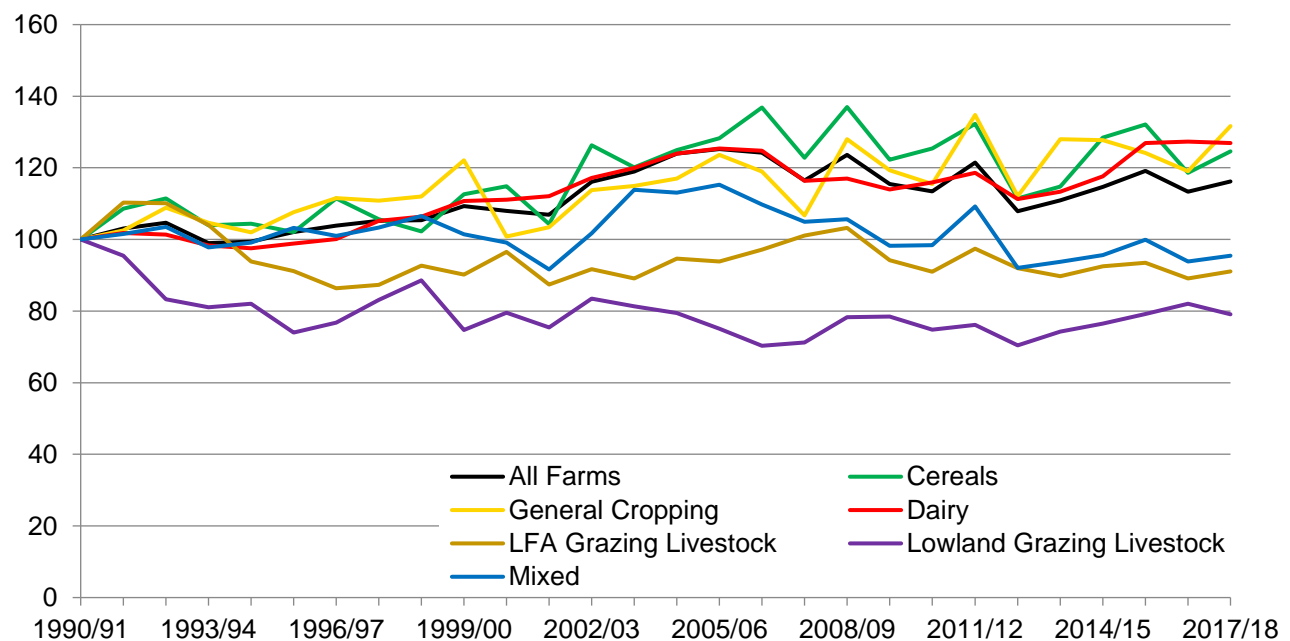
Key findings:

- TFP for cereal and dairy farms increased by about 25% between 1990/91 and 2017/18, while TFP increased 32% on general cropping farms.
- TFP for grazing livestock farms decreased between 1990/91 and 2017/18; 21% for Lowland grazing livestock and 9% for LFA grazing livestock farms.
- For Mixed farms, TFP decreased by 4% from 1990/91 to 2017/18.

This section provides the results for 1990/91 to 2017/18 for a selection of farm types (cereals, general cropping, dairy, lowland grazing livestock, LFA grazing livestock and mixed). Results for specialist pig, specialist poultry and horticulture farms have not been presented due to concerns about smaller sample sizes, the variability within the sectors and the reliability of the resulting series for these farm types. Volume indices for inputs and outputs are also presented.

Figure 2 shows the TFP series for each of the individual farm types as well as for all farms. For cereals, general cropping and dairy farms, TFP tends to have increased over the period, whilst for grazing livestock and mixed farms TFP has fallen, particularly for lowland grazing livestock farms. Across all farm types there are annual fluctuations in the series which could occur for a variety of reasons including the weather or variability in the FBS sample. Annex 1 summarises the average 10 yearly movements of each farm type, and for England, for both inputs, outputs and TFP.

Figure 2: Total Factor Productivity for England by farm type (1990=100)

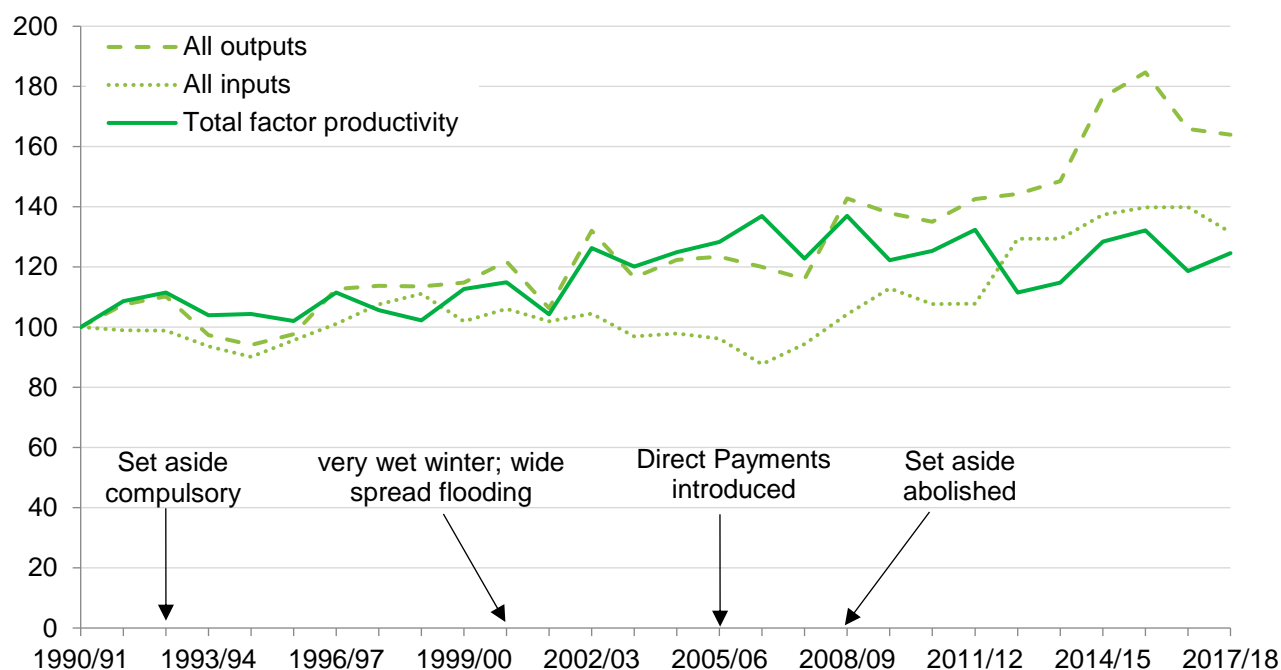


Source: Defra, Farm Business Survey, England.

2.2.1 Cereal farms

Total factor productivity for cereal farms is estimated to have increased by 25% between 1990/91 and 2017/18, an average annual increase of 0.9%. This increase has been driven by a 64% increase in the volume of outputs, which has only been partially offset by a 32% increase in the volume of inputs.

Figure 3: Total Factor Productivity for Cereal Farms, England (1990=100)



Source: Defra, Farm Business Survey, England.

Table 2: Average annual change in the volume of inputs, outputs and TFP, cereal farms

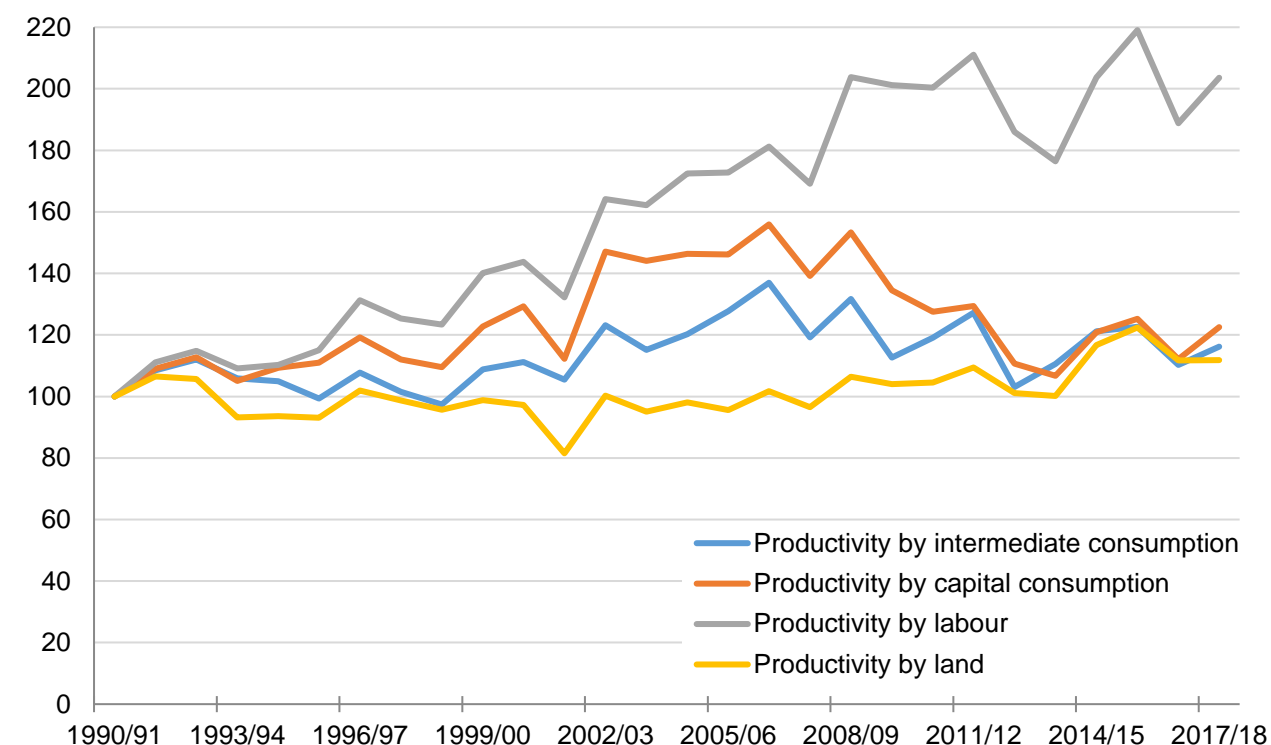
	1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Outputs	2.2%	1.1%	3.1%	2.4%
Inputs	0.6%	0.1%	3.2%	1.2%
Total Factor Productivity	1.5%	0.9%	-0.1%	0.9%

Source: Defra, Farm Business Survey, England.

The introduction of compulsory set aside in 1992 might have contributed to a short term reduction in the volume of outputs and the productivity of the sector. Overall, the long term trend has been an increase in the volume of outputs, particularly over the last 10 years. The volume of inputs tended to reduce in the early 2000s leading to a short period of greater TFP growth. More recently there has been little overall change in TFP as the volume of outputs and inputs have increased at similar rates.

Some of the variability in TFP could be related to weather. For example the very wet winter of 2000 had a considerable impact on cereal production the following year. Much of the land which would have been sown in the autumn of 2000 was left unsown for many weeks. Similarly, cereal yields in 2007 were affected by a hot dry spring, followed very wet weather in the 2 months before harvest.

Figure 4 – Partial factor productivity indicators for Cereal Farms, England 1990 = 100



Source: Defra, Farm Business Survey, England.

The increase in productivity by labour has doubled since 1990 (figure 4). Productivity by capital consumption also increased from 2001/02 until it returned to previous levels in 2011/12 following a change in the methodology around capital consumption within the FBS in 2009/10.

2.2.2 General Cropping

Between 1990/91 and 2017/18, total factor productivity for general cropping farms has increased by 32% (Figure 5), an average annual increase of 1.2%. This farm type has seen a small increase in the volume of outputs (4%) and a reduction in the volume of inputs (21%). Over the 27 year period there has been a 39% reduction in the volume of labour used.

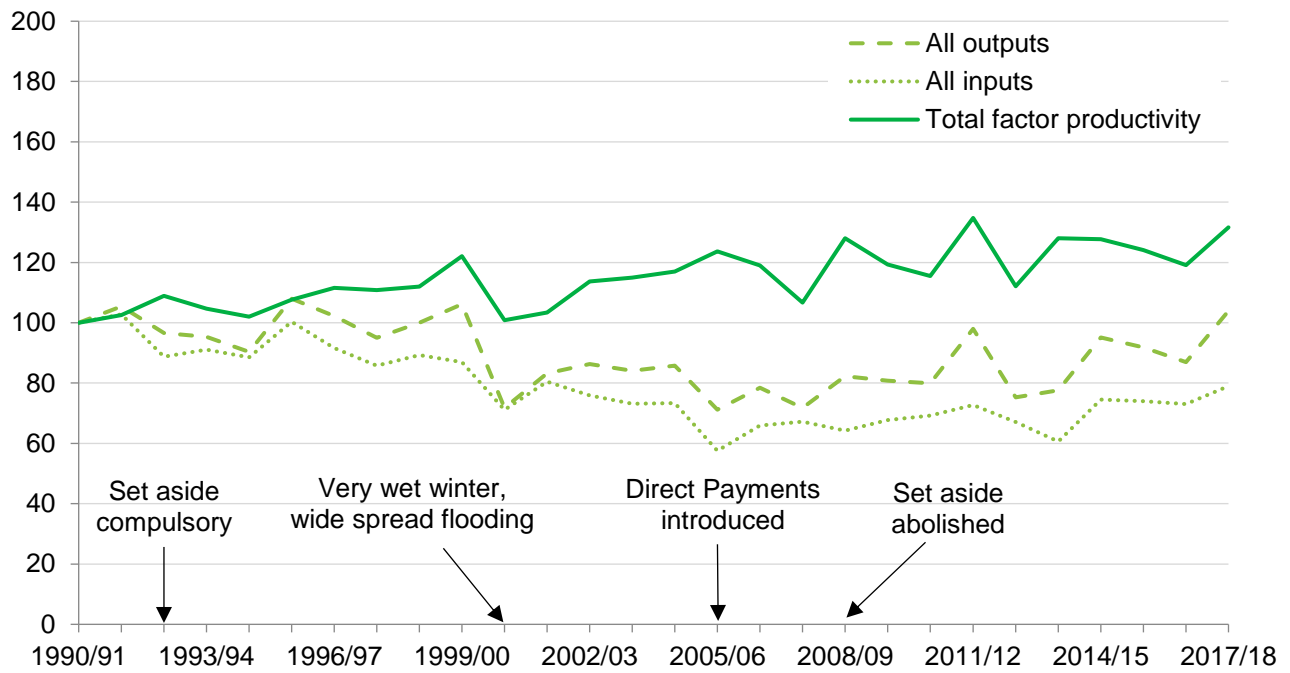
Table 3: Average annual change in the volume of inputs, outputs and TFP, general cropping farms

	1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Outputs	-2.8%	1.1%	4.3%	0.1%
Inputs	-2.9%	-0.3%	2.0%	-0.8%
Total Factor Productivity	0.1%	1.5%	2.0%	1.2%

Source: Defra, Farm Business Survey, England.

Similarly to cereals, some of the variability is caused by bad weather such as the severe wet winter in 2000 and flooding in 2007. While outputs and inputs fell over the first ten years, there has since been an increase in both, particularly over the last 10 years.

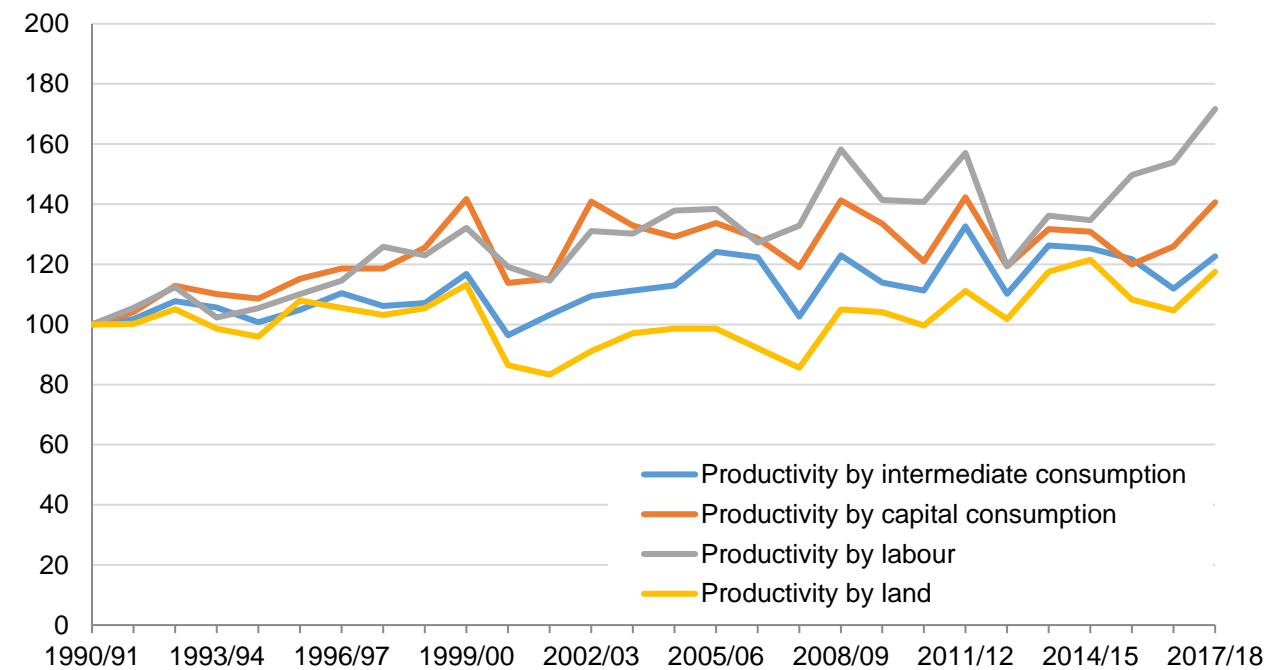
Figure 5: Total Factor Productivity for General Cropping Farms, England (1990=100)



Source: Defra, Farm Business Survey, England.

The productivity by labour and capital consumption has not grown as much as for cereal farms over the period from 1990/91 to 2017/18, figure 6. The change in methodology for capital consumption within the FBS in 2009/10 does not have as clear an impact.

Figure 6 – Partial factor productivity indicators for General Cropping Farms, England 1990 = 100

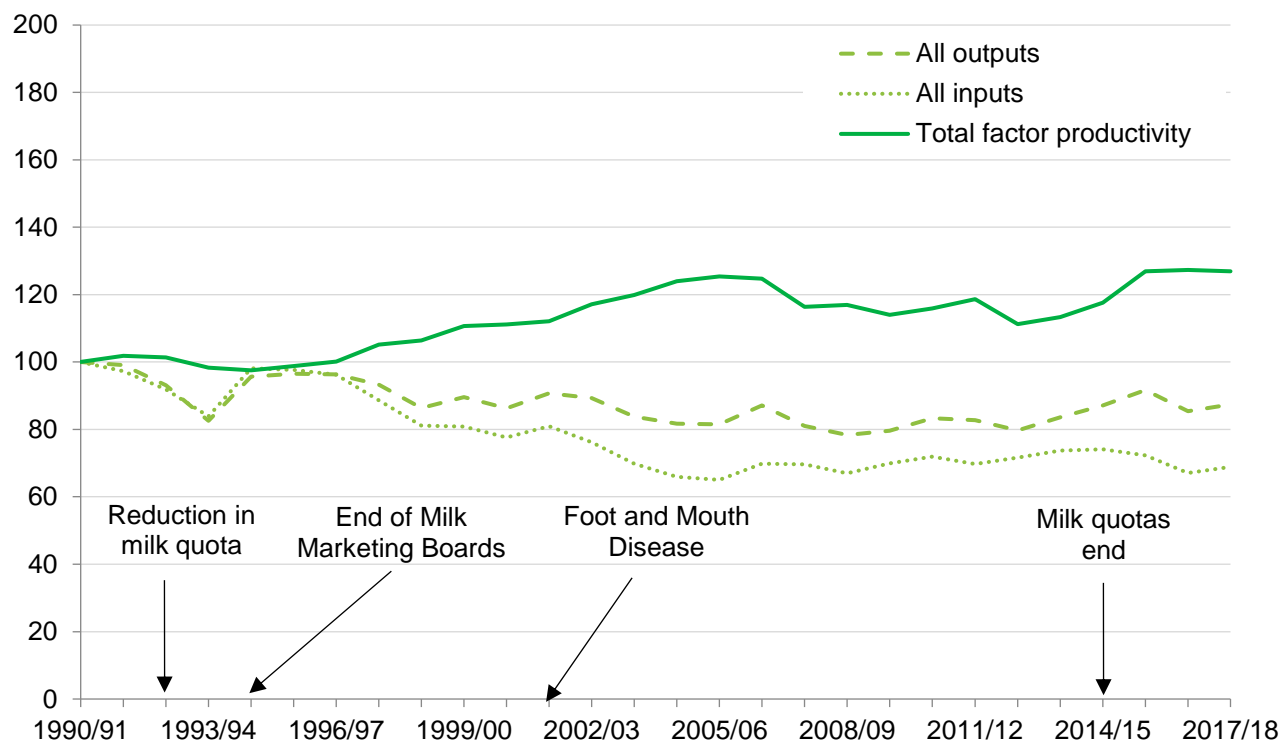


Source: Defra, Farm Business Survey, England.

2.2.3 Dairy

Total factor productivity for dairy farms increased by 27% between 1990/91 and 2017/18 (Figure 7), an average annual increase of 1.0%. During this period the volume of outputs decreased by 13% and the volume of inputs decreased by 31%. The volume of labour decreased by around 44% over the same time period.

Figure 7: Total Factor Productivity for Dairy Farms, England (1990=100)



Source: Defra, Farm Business Survey, England.

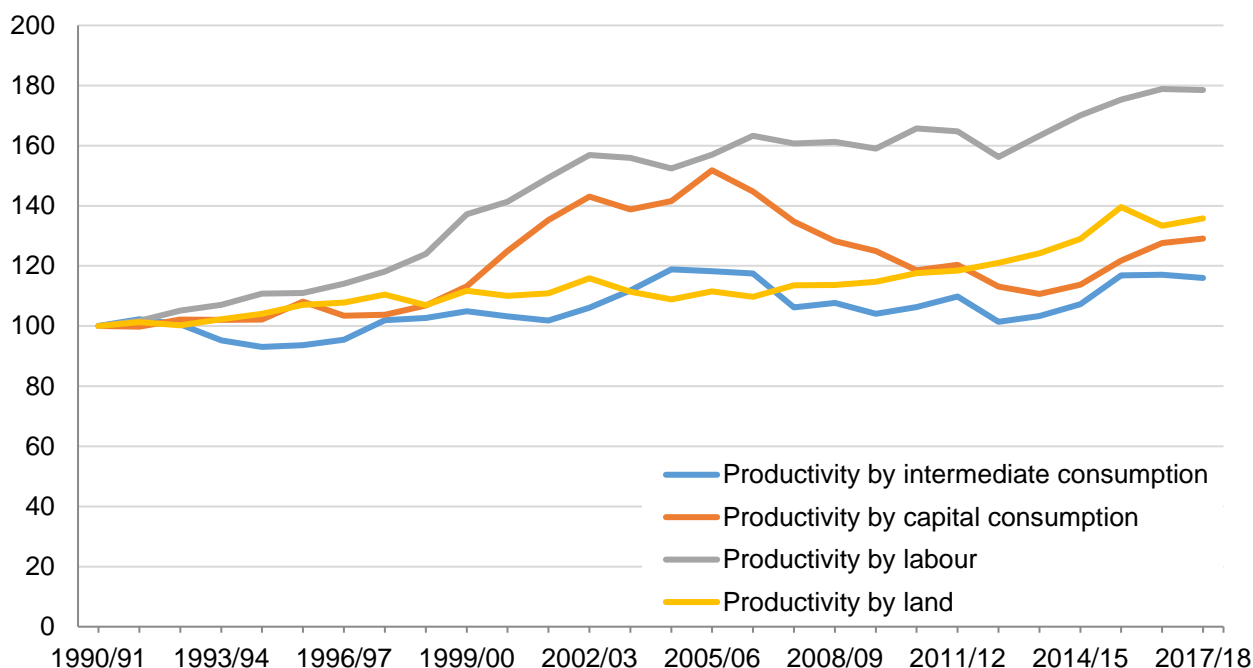
Milk quotas limited production for most of this period. In the early 1990s, there were reductions in milk quotas, however price increases following the end of the Milk Marketing Boards in 1994 led to a short term increase in production. In order for dairy farms to become more productive the volume of inputs needed to decrease as their outputs were restricted. Dairy farms have experienced the greatest reduction in the volume of inputs since 1990/91 in comparison to other farm types.

Table 4: Average annual change in the volume of inputs, outputs and TFP, dairy farms

	1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Outputs	-1.4%	-0.3%	0.7%	-0.5%
Inputs	-2.2%	-0.7%	-0.6%	-1.2%
Total Factor Productivity	1.1%	0.4%	1.4%	1.0%

Source: Defra, Farm Business Survey, England.

Figure 8 – Partial factor productivity indicators for Dairy Farms, England 1990 = 100



Source: Defra, Farm Business Survey, England.

As with other farm types, increasing productivity by labour, due to the reduction in the volume of labour exceeding the reduction in the volume of output, continues to be the main driver of the TFP increase for dairy farms, with an increase of 78% between 1990/91 and 2017/18. As for cereal farms there is a large increase in the productivity by capital consumption from 1999/00 but it returns to previous levels in 2010/11 following the methodological changes introduced in 2009 to FBS in terms of the capital consumption.

2.2.4 Grazing Livestock (Lowland)

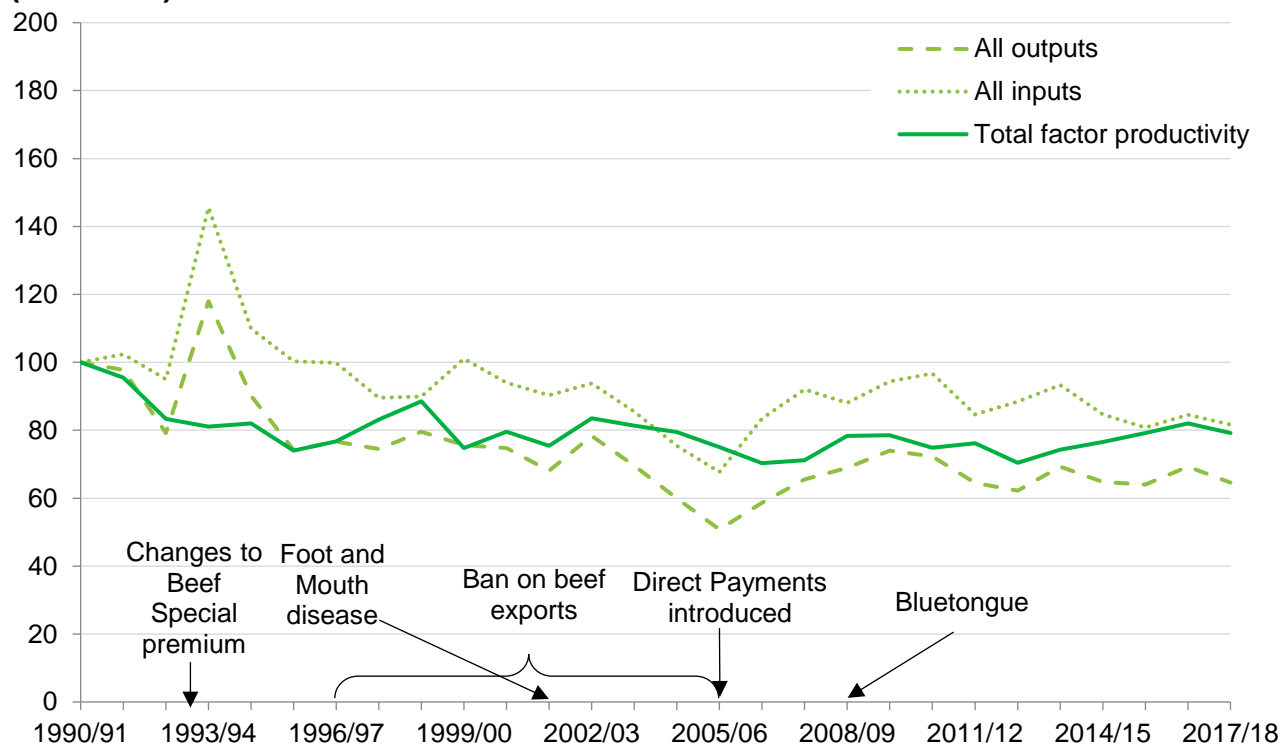
Lowland grazing livestock farms saw a reduction of 21% in total factor productivity between 1990/91 and 2017/18 (Figure 9), an average annual fall of 0.8%. This decrease in productivity has largely been driven by a reduction in the volume of outputs (35%) which has only partially been offset by a reduction in inputs (18%). TFP has generally declined since 1990/91 but has started to rise slowly in the last six years. The volume of inputs largely tracks the volumes of outputs across the time period, with the spike in both inputs and outputs in 1993/94.

Table 5: Average annual change in the volume of inputs, outputs and TFP, Lowland grazing livestock farms

	1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Outputs	-2.5%	-0.3%	-1.5%	-1.3%
Inputs	-0.6%	0.3%	-2.2%	-0.7%
Total Factor Productivity	-2.0%	-0.6%	0.8%	-0.8%

Source: Defra, Farm Business Survey, England.

Figure 9: Total Factor Productivity for Lowland Grazing livestock Farms, England (1990=100)



Source: Defra, Farm Business Survey, England.

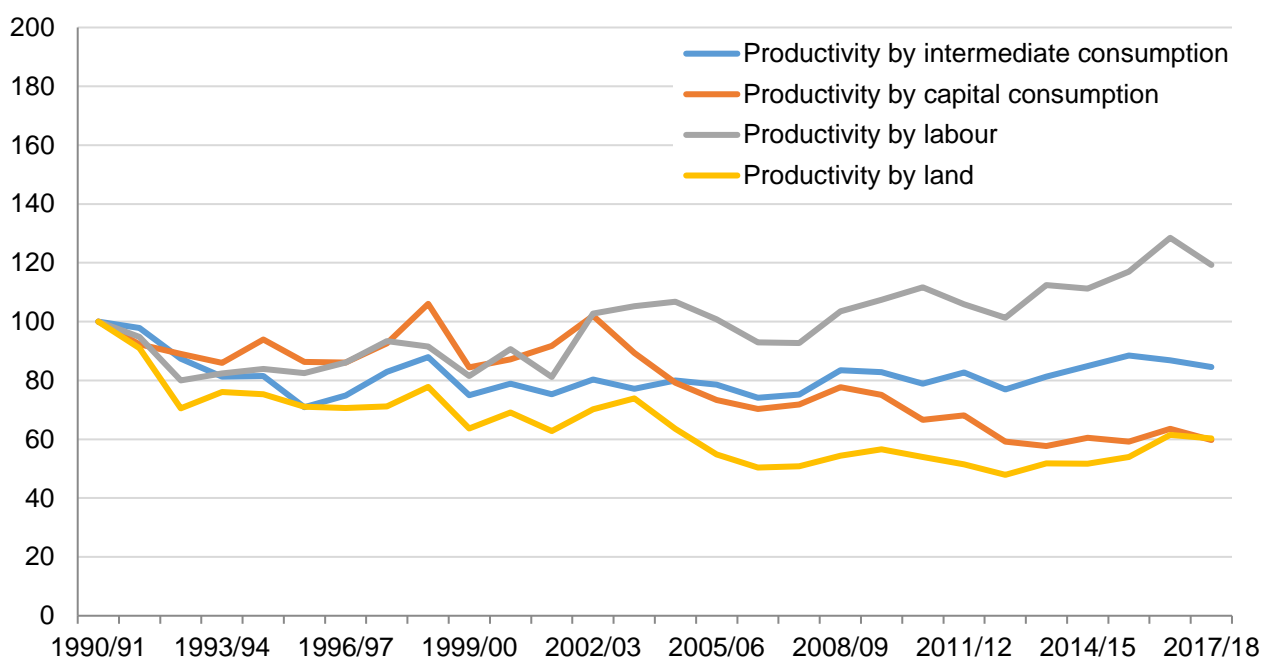
In the 1990's the beef market was considerably affected by BSE; cattle aged over thirty months were removed from the food chain and a ban on exports of British beef by the European Union was imposed between 1996 and 2006 amid concerns about the link between BSE and CJD.

A second Beef Special Premium payment was introduced for male cattle aged 20 months in 1993 which led to some short term changes in marketing patterns.

A sustained period of increasing livestock production from 2005/06 – 2010/11 contributed to year on year increasing inputs and outputs across this period, but, as inputs increased at the same rate as outputs, resulting in little change to the overall TFP.

The decrease in TFP for lowland grazing livestock farms is being driven by more land and capital being used to produce the same level of output, leading to productivity by land and capital consumption both decreasing by about 40% since 1990/91 (figure 10). Productivity by labour is the only component to increase (20%) for lowland farms, as the reduction in the volume of labour is larger than the reduction in the volume of output.

Figure 10 – Partial factor productivity indicators for Grazing livestock (lowland) farms, England 1990 = 100



Source: Defra, Farm Business Survey, England.

2.2.5 Grazing Livestock (LFA)

Total factor productivity for LFA grazing livestock farms decreased by 9% from 1990/91 to 2017/18. The decrease in productivity is largely driven by an increase in the volume inputs (9%), while there has been no increase in the volume of outputs over the period. Since 1994/95 there have been annual fluctuations but overall productivity has remained at a similar level.

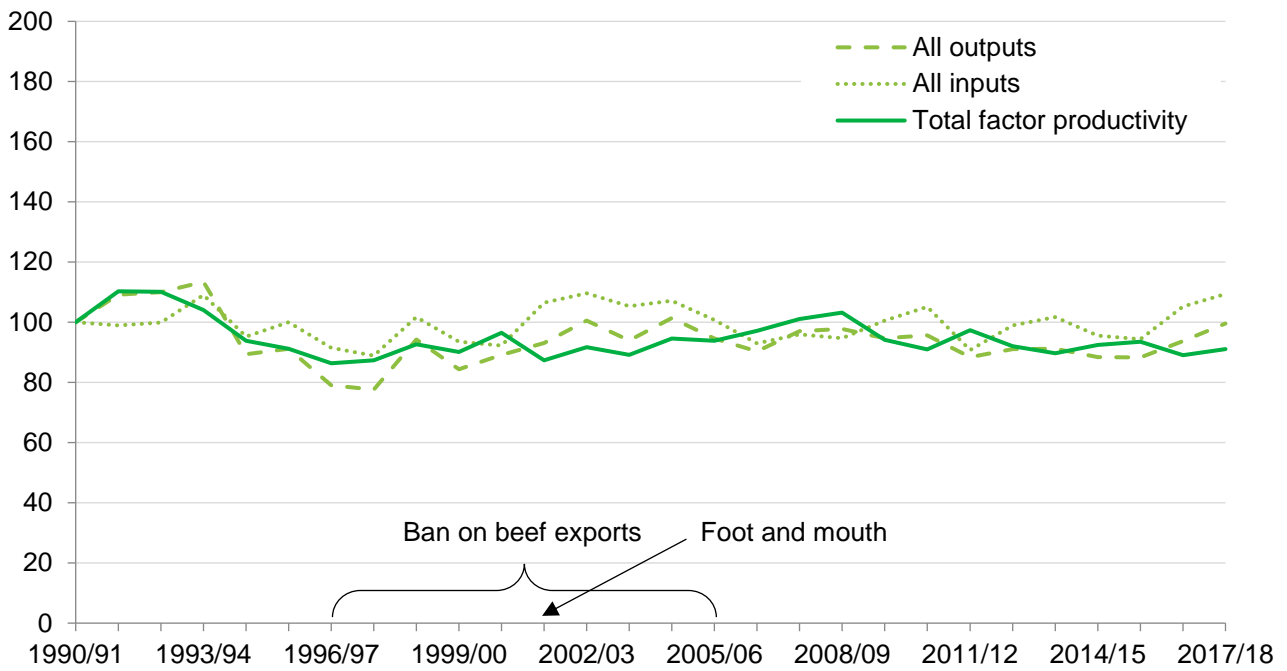
Table 6: Average annual change in the volume of inputs, outputs and TFP, LFA grazing livestock farms

	1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Outputs	-1.1%	0.7%	0.6%	0.0%
Inputs	-0.8%	1.4%	0.6%	0.3%
Total Factor Productivity	-0.3%	-0.6%	0.0%	-0.3%

Source: Defra, Farm Business Survey, England.

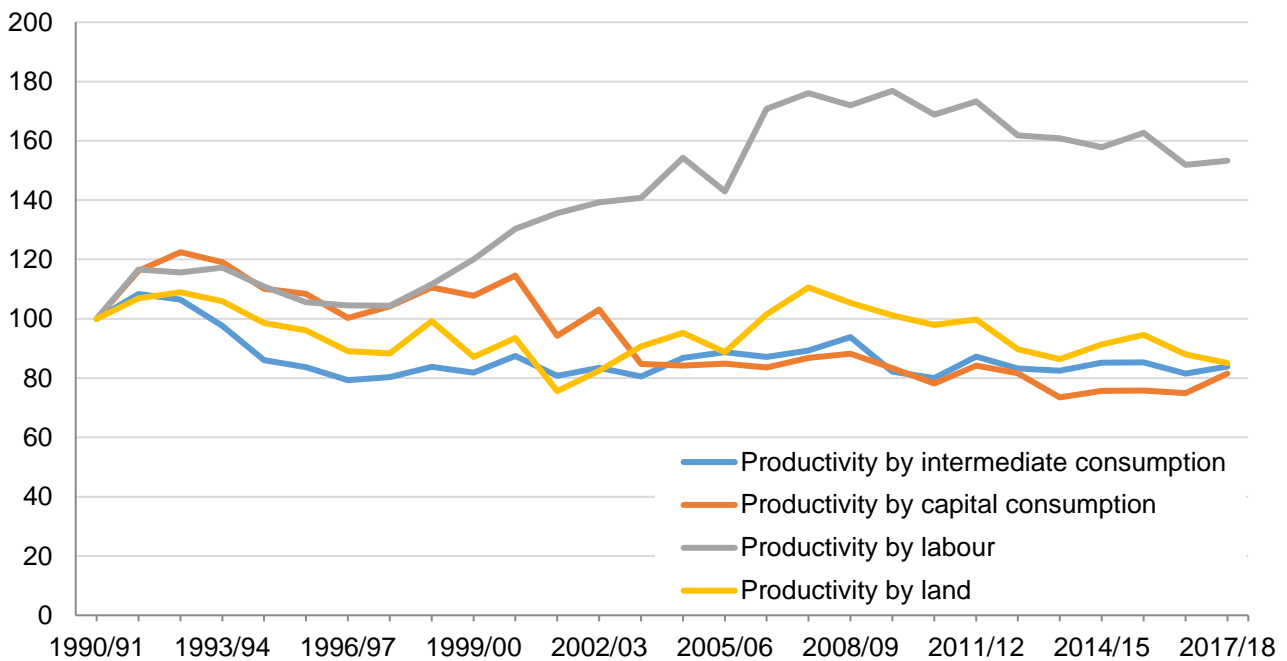
As with other farm types, LFA grazing livestock farms have seen productivity by labour increase, although only by 54% since 1990/91, as the volume of labour has decreased while output has been stable. At the same time, productivity by the other three components has decreased by around 15% over the period (figure 12), as more land, capital, and intermediate consumption has been used to produce the same level of output.

Figure 11: Total Factor Productivity for LFA Grazing livestock Farms, England (1990=100)



Source: Defra, Farm Business Survey, England.

Figure 12 – Partial factor productivity indicators for Grazing livestock (LFA) farms, England 1990 = 100

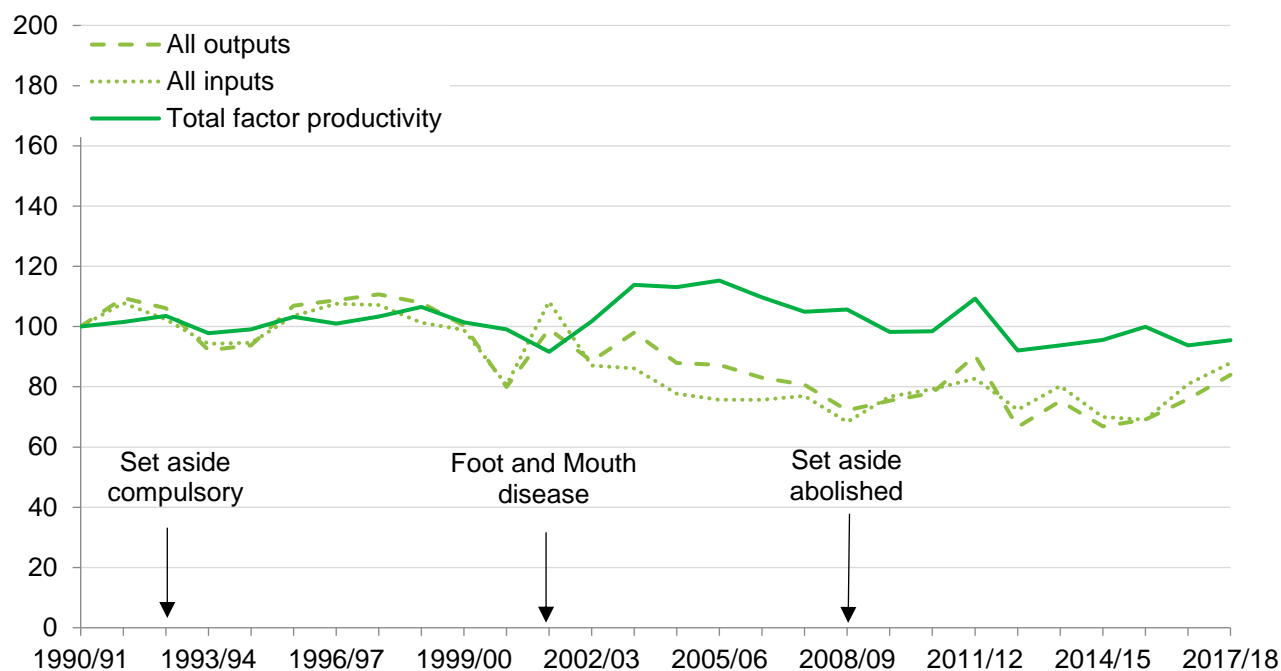


Source: Defra, Farm Business Survey, England.

2.2.6 Mixed farms

For mixed farms, total factor productivity has decreased by 4% from 1990/91 to 2017/18 (Figure 13). The volume of outputs and inputs have both decreased, with a 16% reduction in the volume outputs which has only been partially offset by a 12% reduction in the volume of inputs. Overall, the volumes of inputs and outputs mirror each other over the period. The TFP series fluctuates across the 27 year period, reflecting the changes both in the cropping and livestock sectors.

Figure 13: Total Factor Productivity for Mixed Farms, England (1990=100)



Source: Defra, Farm Business Survey, England.

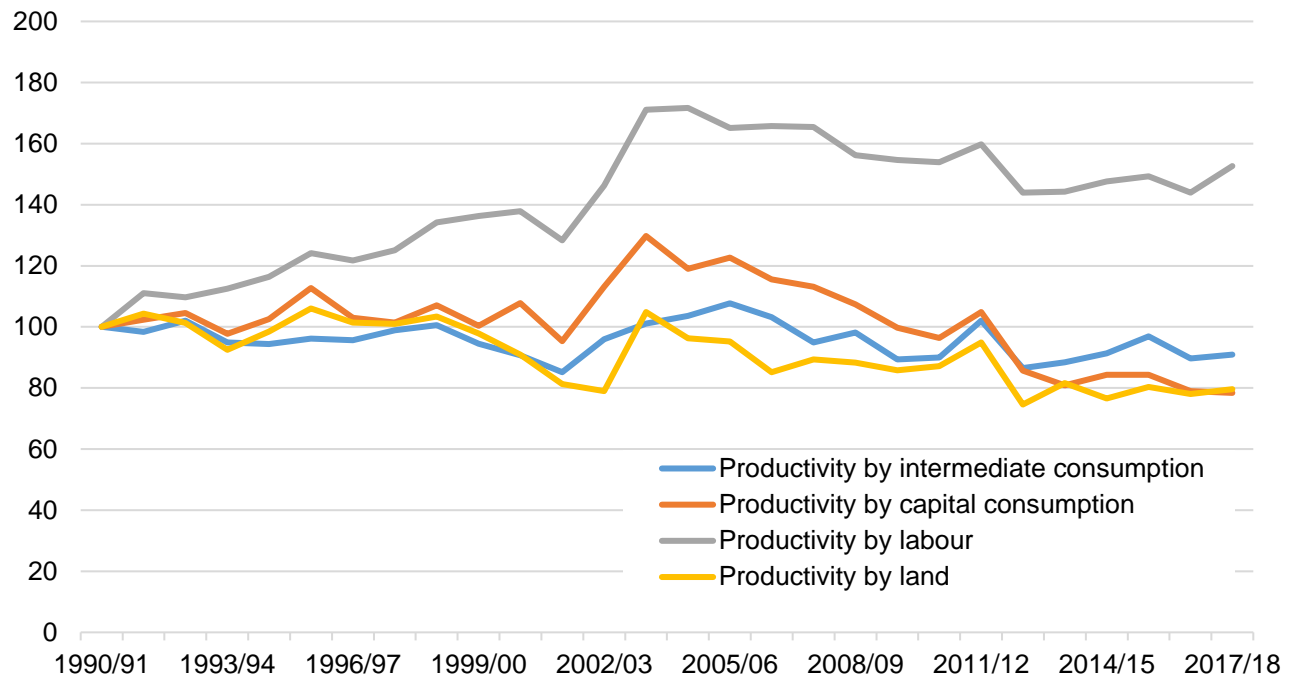
Table 7: Average annual change in the volume of inputs, outputs and TFP, mixed farms

	1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Outputs	-2.0%	-0.2%	1.1%	-0.6%
Inputs	-1.9%	-0.2%	1.6%	-0.4%
Total Factor Productivity	-0.1%	-0.1%	-0.4%	-0.2%

Source: Defra, Farm Business Survey, England.

Mixed farms also saw an increase in the productivity by labour (53%), as the volume of labour used has declined more than output. Overall productivity still declined over the period due to a more land and capital being used to produce less output (a decrease in the productivity of land and capital consumption by about 20%), and the reduction in intermediate consumption being smaller than the reduction in outputs (9% decrease in the productivity by intermediate consumption). As with other farm types, mixed farms saw an increase in the productivity of capital from 2001/02, which returned to previous levels (and subsequently declined) after the change in the methodology for capital consumption in the FBS in 2009.

Figure 14 – Partial factor productivity indicators for Mixed farms, England 1990 = 100



Source: Defra, Farm Business Survey, England.

3. Comparisons to the UK measure

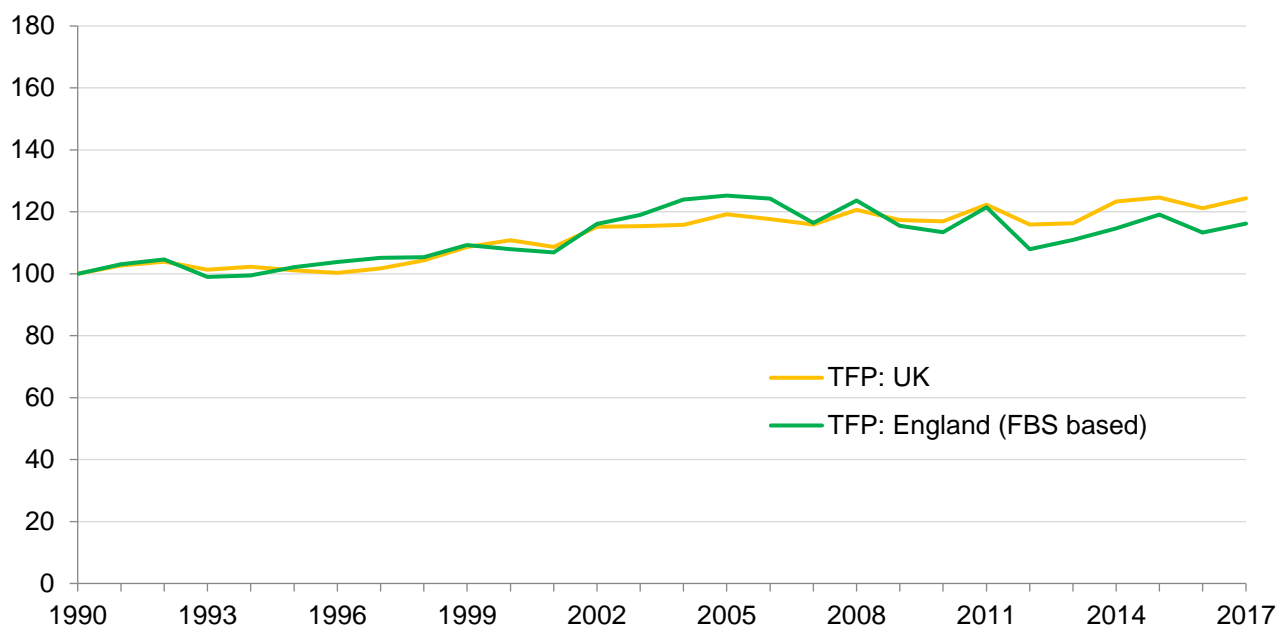
3.1 Comparison of UK and England TFP

Both the UK and England TFP series show similar trends over the time period. There are annual fluctuations in both series but the long-term trend shows a slow but steady overall improvement. Between 1990/91 and 2017/18, total factor productivity increased by 16% for England using data from the Farm Business Survey and 24% for the UK using data from the aggregate agricultural accounts (Figure 15). The England series is slightly more volatile to the UK series.

There are good reasons why the two series will not completely agree including:

- The difference in geographic coverage (England vs UK)
- The UK series is based on a calendar year whilst the FBS is based on March February years, meaning some expenditure and receipts will fall in different time periods.
- The FBS is based on a sample and has a threshold so smaller farms are excluded from the survey.

Figure 15: Total factor productivity of the UK agriculture industry and England (FBS based) (1990=100)

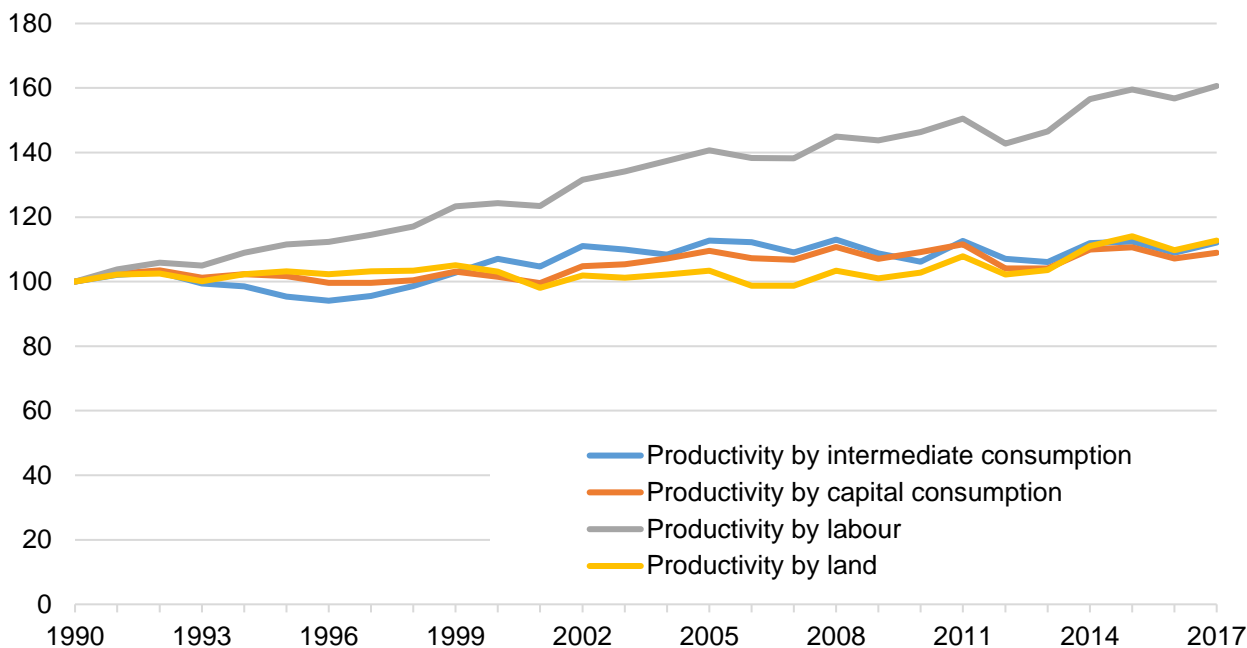


Sources: Defra, Farm Business Survey, England
Defra, UK Total Factor Productivity

3.2 Component series

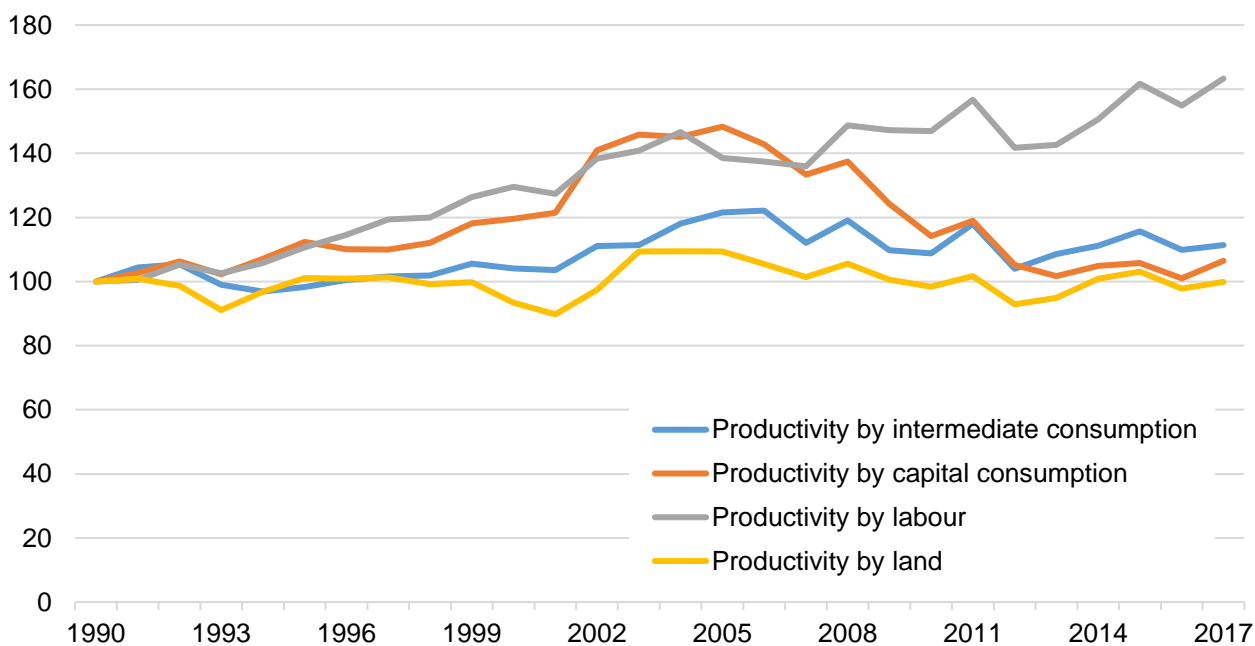
For both the UK and England TFP series, the increase in productivity is driven primarily by a reduction in the amount of labour used to produce a higher level of output (i.e. an increase in the productivity by labour). In the UK series, there was a 61% increase in the productivity of labour for the UK over the period 1990/91 to 2017/18 (figure 16), while the England series saw a similar 63% increase in the productivity of labour (figure 17). This is also true at farm sector level as seen throughout section 2.

Figure 16 – UK Partial factor productivity indicators



Source: Defra, UK Total Factor Productivity

Figure 17 – England Partial factor productivity indicators



Source: Defra, Farm Business Survey, England.

Both series saw minor increases in the productivity by capital consumption over the period as a whole, with a 9% increase for the UK series and a 7% increase for the England FBS series. Productivity of capital consumption was higher for the England FBS series during the early 2000's, but returned to previous levels following a change in the FBS methodology for capital consumption in 2009. The difference between the two series might be due to this difference in methodology which relates to how the cost of capital is spread across the

lifetime of the capital items. For more information, see section 4.3 of the accompanying [technical report](#). This may also contribute to some of the difference between the UK and England series in the period 2002-2007 (Figure 15).

The UK series saw a 13% increase in the productivity of land. Whilst there was no overall change for the overall England FBS series, there were changes at sector level. This is due to the FBS series showing an increase in the volume of land. This is due to an increase in the area of land accounted for by farms that are eligible to be part of the FBS population².

Both the UK and England FBS series also saw minor increases in the productivity by intermediate consumption of about 12% over the period 1990/91 to 2017/18.

The four components are weighted by value with capital consumption having a much smaller weight in comparison to the other 3 components; hence the large movements seen in productivity of capital consumption does not have as much influence on TFP. Intermediate consumption has a considerably higher weight and the most the influence on TFP.

3.3 Which productivity series should be used?

Given that these statistics presented in this notice are experimental, the UK National Statistics for “TFP for the UK agricultural industry” should continue to be used as the main source of statistics on productivity. The England farm sector TFP is still in development and it is possible that the figures presented here could be revised whilst the methodology is developed further based on any feedback received following this publication.

² This is not the same as the Total area of agricultural land. The FBS threshold is based on standard output coefficients.

4. Survey details

Survey content and methodology

The Farm Business Survey (FBS) is an annual survey providing information on the financial position and physical and economic performance of farm businesses in England. The sample covers all regions of England and all types of farming with the data being collected by face to face interview with the farmer. The current sample is around 1,750 (in 1990 the sample was around 2,000 and in 2003 around 2,250) farm businesses. Results are weighted to represent the whole population of farm businesses. In 2017, this accounted for approximately 54,700 farm businesses³.

Farm type classification

Until 2009/10 farm typology was derived using Standard Gross Margin (SGM) coefficients. The classification of farms was revised for the 2010/11 Farm Business Survey, to bring the classification in line with European guidelines using 2007 Standard Output Coefficients. These were calculated using a 5 year average centred on 2007. The changes were backdated to 2009/10 for comparability. In line with EU methodology, Standard Output coefficients were updated to 2010 coefficients from 2012/13.

Changes to the threshold level

The survey covers all farms above a minimum threshold. For accounting years up to 2003/04 the minimum size threshold was 8 European Size Units (ESU). The sample structure was re-designed for 2004/05 when the minimum size was defined by Standard Labour Requirements (SLR). At that time, the coverage of the survey was restricted to part-time and full-time farms and to the main farm types. Spare-time farms with less than 0.5 SLR or farms with negligible economic activity were excluded. From 2010/11 the survey was again re-designed following the changes to farm typology and the coverage was now restricted to those farms with at least 25,000 Euros of Standard Output.

Changes to the sample size

Before 2003/04 accounting year, the sample size for the England FBS was 2,250 farm businesses. From 2004/05 until 2009/10, it was 1,850 businesses. From 2009/10 the sample size has been around 1,950 farms. For 2015/16, the sample size for the English FBS was 1800 farms. From 2016/17 onwards the sample size is 1750 farms.

From 2010/11, the population of farms covered by the survey has been stratified into 14 farm types and 7 regions. Within each stratum, sampling is with uniform probability, however, minimum publication thresholds are applied and some farm types are sampled at a higher rate to ensure adequate coverage for analysis. Farms are retained in the sample for several years and around 10% of the sample is replenished each year.

For further information about the Farm Business Survey please see:

<https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/series/farm-business-survey>

³ Prior to the 2010/11 campaign, the coverage of the FBS was restricted to those farms of size $\frac{1}{2}$ Standard Labour Requirement (SLR) or more. For a definition of SLR please see the UK classification document here: <https://www.gov.uk/farm-business-survey-technical-notes-and-guidance>

Total Factor Productivity Methodology

Total factor productivity represents how efficiently the agricultural industry uses the resources that are available to turn inputs into outputs. The inputs are labour, capital expenditure and purchases. The output is the volume of sales. The method only incorporates the inputs and outputs that are associated with monetary transactions. Outputs and inputs are adjusted for quality by weighting the volumes by values. Support payments are excluded from output. Total factor productivity is the 'volume of outputs' divided by 'the volume of inputs'.

The TFP measure is calculated by using the Fisher Index with chain linking. The Fisher index is the geometric mean of the Laspeyres and Paasche quantity indexes. To calculate a chain linked index the base year is always the previous year (t-1) to the year (t) of the index.

The Laspeyres index uses the base year value as the weight for the volume index.

$$\text{Laspeyres index} = \frac{\sum v_{t-1} \cdot \frac{q_t}{q_{t-1}}}{\sum v_{t-1}} = \frac{\sum p_{t-1} \cdot q_t}{\sum p_{t-1} \cdot q_{t-1}}$$

The Paasche index uses the current year's value as the weight for the volume index.

$$\text{Paasche index} = \frac{\sum v_t}{\sum v_t \cdot \frac{q_{t-1}}{q_t}} = \frac{\sum p_t \cdot q_t}{\sum p_t \cdot q_{t-1}}$$

$$\text{Fisher index} = \sqrt{\text{Laspeyres} \cdot \text{Paasche}}$$

Where:

v = value (price * quantity)

q = quantity (volume)

p = price

t - 1 = base year (current year -1)

t = current year

To overcome the issue of breaks in the FBS time series caused by the changes in farm typology and entry criteria, the TFP model uses two series – a series running from 1990/91 to 2009/10 based on the SGM typology and a series running from 2009/10 to 2017/18 based on the SO typology. Both series were initially indexed at 2009/10=100, the year in which they overlap, to make the series continuous. This series has then been rebased to 1990/91=100, thereby effectively using SGM chain-links in the period 1990/91 to 2009/10, and SO chain-links between 2009/10 to 2017/18.

For further information on how TFP has been calculated using the FBS please refer to the accompanying [technical note](#).

Availability of results

This release contains headline results for each section. The full breakdown of results can be found at: <https://www.gov.uk/government/statistics/total-factor-productivity-for-england-by-farm-type>

Defra statistical notices can be viewed on the Food and Farming Statistics pages on the Defra website at <https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/about/statistics>. This site also shows details of future publications, with pre-announced dates.

Data Uses

Data from the Farm Business Survey (FBS) are provided to the EU as part of the Farm Accountancy Data Network (FADN). The data have been used to help inform policy decisions (e.g. Reform of Pillar 1 and Pillar 2 of Common Agricultural Policy) and to help monitor and evaluate current policies relating to agriculture in England (and the EU). It is also widely used by the industry for benchmarking and informs wider research into the economic performance of the agricultural industry.

User engagement

As part of our ongoing commitment to compliance with the Code of Practice for Official Statistics <http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html>, 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.

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Annex 1 Average annual change in the volume of inputs, outputs and TFP by farm type

		1990/91 to 2000/01	2000/01 to 2009/10	2010/11 to 2017/18	1990/91 to 2017/18
Cereals	Outputs	2.2%	1.1%	3.1%	2.4%
	Inputs	0.6%	0.1%	3.2%	1.2%
	TFP	1.5%	0.9%	-0.1%	0.9%
General Cropping	Outputs	-2.8%	1.1%	4.3%	0.1%
	Inputs	-2.9%	-0.3%	2.0%	-0.8%
	TFP	0.1%	1.5%	2.0%	1.2%
Dairy	Outputs	-1.4%	-0.3%	0.7%	-0.5%
	Inputs	-2.2%	-0.7%	-0.6%	-1.2%
	TFP	1.1%	0.4%	1.4%	1.0%
Lowland Grazing Livestock	Outputs	-2.5%	-0.3%	-1.5%	-1.3%
	Inputs	-0.6%	0.3%	-2.2%	-0.7%
	TFP	-2.0%	-0.6%	0.8%	-0.8%
LFA Grazing Livestock	Outputs	-1.1%	0.7%	0.6%	0.0%
	Inputs	-0.8%	1.4%	0.6%	0.3%
	TFP	-0.3%	-0.6%	0.0%	-0.3%
Mixed	Outputs	-2.0%	-0.2%	1.1%	-0.6%
	Inputs	-1.9%	-0.2%	1.6%	-0.4%
	TFP	-0.1%	-0.1%	-0.4%	-0.2%
All farm types	Outputs	-0.8%	0.8%	1.0%	0.2%
	Inputs	-1.5%	0.3%	0.6%	-0.3%
	TFP	0.8%	0.5%	0.4%	0.6%

Source: Farm Business Survey