

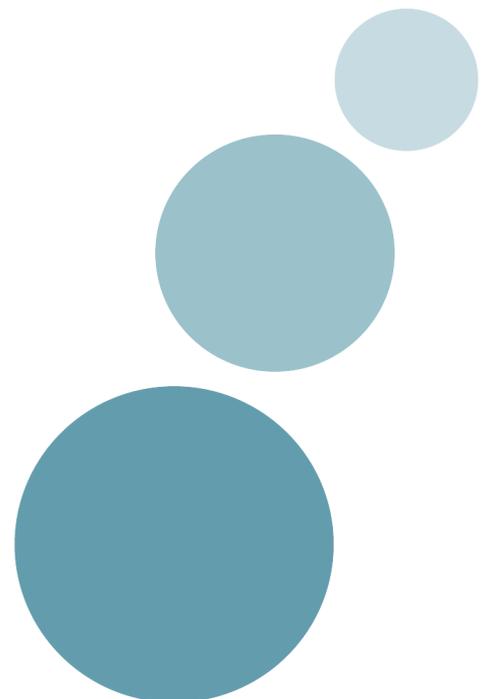


The real value of English red meat
Economic analysis

Final report

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1.0 Executive summary

Objective

The aim of this report is to quantify the economic value generated by the red meat industry in England. In the context of continued economic uncertainty, including increasing food prices as a result of growing demand in emerging economies and changing weather patterns, together with the growth in imports, it is important to acknowledge the economic value generated by domestic meat production.

Previously published literature has estimated the size of the red meat industry in terms of, for instance, total market value of output and number of people employed. This report aims to improve on these estimates in two ways. First, to consider the alternative uses to which the resources employed by the industry could be put. That is, existing research estimates the gross value added of the industry, while the net value added is the more relevant number. Second, to capture the broader economic value added by the industry through contributions to allied industries, such as pre-farming, processing, wholesale, and retail.

The analysis focuses on the benefits for which reliable quantifiable data was available, and which are of interest in the current debate. The following benefits are covered:

- Value added to the economy.
- Contribution to employment levels.

Results

It is estimated that around 2.6 million hectares are currently used to farm beef cattle, sheep and pigs in England. The sector currently employs around 96,000 people in farming, and 0.8 million individuals in its key allied industries such as pre-farming, food manufacturing and retail. Nearly 91,000 people are employed in rural areas, providing a valuable contribution to the sustainability of rural communities.

The net contribution of the red meat industry to the English economy is summarised in Table 1. It demonstrates that the English red meat industry provides a significant contribution to the national economy and society, including:

- £762m added to the economy, over and above employment effects.
- £907m added in terms of jobs created.

These savings are those compared to the situation if there was not a healthy beef cattle, sheep and pig meat industry of equivalent size to that which currently exists.

Table 1

The net economic value of the English red meat industry (in £2010/11)

Benefit	Beef cattle	Sheep	Pigs	Total
Contribution to economy	£389.8m	£174.5m	£197.3m	£761.7m
Farming	£114.3m	£45.2m	£71.8m	£231.3m
Allied industries	£275.5m	£129.3m	£125.5m	£530.3m
Contribution to employment	£507.6m	£291.4m	£107.6m	£906.6m
Farming	£255.9m	£157.8m	£26.9m	£440.7m
Allied industries	£251.7m	£133.6m	£80.7m	£466.0m
Total	£897.4m	£465.9m	£304.9m	£1,668.3m

Source: Matrix estimates

n/a: not applicable

Conclusion

The red meat industry makes a significant contribution to the English economy. It is estimated that the net economic contribution of the English red meat industry is £1.67bn.

It should be noted that these estimates exclude a number of important additional contributions of the red meat industry, including the aesthetic value of farming landscapes, an enhanced sense of national pride, the contribution of the industry to food security, and the potential contribution to maintaining equilibrium in carbon stocks and emissions.

As with any analysis, some of the data used is subject to uncertainty and assumptions. In response to this uncertainty, conservative estimates have been used throughout, thus potentially underestimating the value of the industry. Further research should be undertaken to improve the data available. Detail on the data used is available in the body of the report.

2.0 Introduction

This report asks: what is the economic value of the English red meat industry? The English red meat industry, more specifically the beef cattle, sheep and pig producers, generate benefits to England through a range of channels:

- **Economy.** The industry is a significant provider of employment, export income and tax revenue for the UK.
- **Health and wellbeing.** Meat is a valuable component of a balanced diet and hence contributes to well-being and health.
- **Rural communities.** The industry supports sustainable rural communities by providing employment.
- **Environmental.** Responsible agriculture can have a positive impact on enhancement of biodiversity and land management. Producers also contribute to preservation of natural landscape and maintenance of recreational green space.
- **Society.** The domestic food industry contributes toward national food security, self-sufficiency and sense of national pride.

In the context of continued economic uncertainty, including increasing food prices as a result of growing demand in emerging economies and changing weather patterns, it is important to acknowledge the economic value generated by domestic food production. [Matrix Evidence](#) was commissioned by [EBLEX](#), the organisation for the English beef and sheep meat industry, and [BPEX](#), the organisation representing pig levy payers in England, to estimate the economic value generated by the English red meat industry.

The contribution of the English red meat industry in terms of economic output and tax revenue has been previously explored. This report builds on this work in two key ways:

- First, the report provides estimates of the **net** economic contribution of the meat industry. Previous estimates of the economic contribution of the meat industry tend to be what is referred to as 'gross value added', as they do not take into account the fact that in the absence of the English red meat industry, some of the resources employed by the industry would find alternative uses. Estimates of the net economic contribution of the industry make this adjustment.
- Second, it is important to look at the industry's contribution to the economy in broader manner, to acknowledge the impact of the industry that falls outside the traditional economic analysis. As indicated above, the meat industry contributes to the well-being of the English population in a number of ways other than through its direct economic contribution. It is possible to put a monetary value on some of these benefits.

This report summarises the benefits of the English red meat industry for which reliable quantitative evidence is available. The following benefits are covered:

- Value added to the economy.
- Contribution to employment levels.

In this report the red meat industry is defined as the beef cattle, sheep and pig industry, including the following points on the supply-chain¹:

- Pre-farming, including the supply of inputs such as fertiliser, animal feed, and machinery.
- Farming, including veterinary services.
- Processing and wholesale, including slaughtering, packaging, and wholesale.
- Retail, including supermarkets, specialist shops and other food outlets.

This report is structured as follows:

- Section 3 estimates the size of the English red meat industry in terms of the market value of outputs, employment, and land use.
- Section 4 estimates the **net** economic contribution of the English red meat industry.
- Section 5 summarises the results of the analysis.

¹ There are other industries which can be linked to farming, such as transport. However their relationship with the red meat industry could not be quantified in a reliable way.

3.0 The size of the English red meat industry

The purpose of this section is to present the current size and composition of the English red meat industry. This baseline scenario is then compared against a scenario in which there is no national production in order to estimate the net economic contribution of the industry. All monetary figures are presented in 2010/11 prices.

Economic value

Table 2 presents estimates of the economic value of the beef cattle, sheep and pig farming industries. It is important to mention that we base these on the notion of **income**, which differs from the concepts of **output** and **value added**. The difference lies in that income estimates exclude:

- (i) Consumption of intermediate goods – e.g. animal feed, pesticides and fertilisers – given that these are treated separately as allied industries.
- (ii) Compensation of employees, also considered separately in the employment section.
- (iii) Consumption of fixed capital – e.g. equipment and buildings – as these investments would be lost if the English red meat national industry contracted or disappeared.
- (iv) Taxes and subsidies on production, as at a societal level these are considered as transfers, and not a contribution from or to the industry.

Income figures were estimated based on Defra's statistics published in the report *Agriculture in the United Kingdom*. Our calculation follows Defra's approach to obtaining income estimates based on value of output estimates. Detailed calculations are presented in the Appendix.

The results in Table 2 show that the gross income from farming is estimated at £372 million per year. Of this, around £213 million is generated by the beef cattle industry, whilst sheep production contributes £87 million and the pig industry £72 million.

Table 2

Economic value generated by the English red meat allied industries (in £2010/11)

Industry	Beef cattle	Sheep	Pigs	Total
Farming	£212.8m	£86.8m	£72.5m	£372.1m
Allied industries	£2,582.3m	£1,052.6m	£879.1m	£4,513.9m
Pre-farming and farming inputs	£138.8m	£56.6m	£47.2m	£242.6m
Processing and wholesale	£1,059.7m	£431.9m	£360.7m	£1,852.3m
Retail	£1,383.8m	£564.1m	£471.1m	£2,419.0m
Total	£2,795.1m	£1,139.3m	£951.5m	£4,885.9m

Source: Matrix estimates based on Defra (2011a)

In addition to generating economic value in farming directly, the English red meat industry creates value in a range of allied industries. These include pre-farming and farming inputs (such as animal feed and veterinary services), processing and wholesale, and retail. The results in Table 2 show that:

- In total it is estimated that the English red meat industry generates £4,514 million per year through allied industries. Of this, pre-farming and input industries generate £243 million per year and meat processing around £1,852 million. Retail attributable to red meat generates £2,419 million annually.
- When disaggregated by species, around £2,500 million is generated by the beef industry, whilst sheep production contributes £1,053 million and the pig industry £879 million.

Detailed calculations are presented in the Appendix.

Employment

Table 3 and Table 4 summarise current employment in the English red meat farming sector.

- The English red meat industry employs around 96,000 people in total on farms with beef cattle, sheep and pigs. Out of them around 55,000 are employed in beef cattle production, 34,000 in sheep production and 7,000 in the pig industry.
- The majority of individuals, around 75,000, are principal farmers (i.e. farmers, partners, directors and spouses). The industry also employs around 8,000 full-time workers, 8,000 part-time workers and 5,000 casual workers.
- A large majority of employment (around 95 per cent) in the red meat industry is located in rural areas. The industry provides, in total, nearly 91,000 rural jobs.

Table 3

Employment in the English red meat farming industry, by type of employment

Total employment	Beef cattle	Sheep	Pigs	Total
Farmers, partners, directors and spouses	43,581	26,880	4,527	74,988
Full-time	3,835	2,365	1,448	7,648
Part-time	4,524	2,790	568	7,882
Casual workers	3,095	1,909	242	5,245
Total	55,035	33,945	6,784	95,764

Source: Matrix estimates based on Defra June Survey, 2009

Table 4

Employment in the English red meat farming industry, by rural classification

Industry	Rural	Urban	Total
Beef cattle	52,793	2,242	55,035
Sheep	32,562	1,383	33,945
Pigs	6,012	772	6,784
Total	91,366	4,397	95,764

Source: Matrix estimate based on Defra Farm Business Survey, 2010

In addition to providing employment in farming directly, the English red meat industry creates demand for a range of allied industries. These include pre-farming and farming inputs (such as animal feed and veterinary services), food processing, wholesale, and retail. Table 5 provides estimates of the size of supporting industries. Detailed calculations are presented in the Appendix.

- In total, the English red meat industry provides employment for around 0.8 million people through allied industries. Of these, around 390,000 are employed through the beef industry, around 111,000 through sheep production and 273,000 through the pig industry.
- Pre-farming and input industries employ around 62,000 people and meat processing around 134,000 people. Retail attributable to red meat employs 0.6 million people.
- The contribution to the transport industry is not covered due to lack of data.

Table 5

Employment in the English red meat allied industries, total employment

Industry	Beef cattle	Sheep	Pigs	Total
Farming	55,035	33,945	6,784	95,764
Allied industries	388,714	111,405	272,877	772,998
Pre-farming and farming inputs	35,882	22,132	4,423	62,437
Processing	62,354	19,086	52,093	133,533
Retail	290,478	70,187	216,361	577,027
Total	443,749	145,350	279,661	868,762

Source: Matrix estimates based on Defra (2011a), Defra Slaughtering Statistics and AHDB calculations based on HMRC Trade data.

Land use

Table 6 summarises land use by the three English red meat farming industries, by type of land.

- Based on number of animals and average livestock units, it is estimated that around 2.6 million hectares are currently used to farm beef cattle, sheep and pigs in England.
- Of this, 1.6 million hectares are used for beef cattle, 971,000 for sheep and 36,000 for pigs.
- The majority of beef cattle are grazed on permanent grassland, with 10 per cent and 5 per cent grazing on temporary grassland and rough grazing respectively.
- For sheep, 61 per cent, 35 per cent and 4 per cent graze on permanent grassland, rough grazing and temporary grassland respectively.
- For pigs, 72 per cent are farmed indoors. The remaining 28 per cent corresponds to outdoor pigs, of which equal proportions are estimated to graze on bare fallow and permanent grassland.²

Table 6
Land use of the English red meat farming industry, by land type

Industry	Land type	% of land in industry	Ha
Beef cattle	Temporary grassland	10%	164,770
	Permanent grassland	85%	1,330,257
	Rough grazing	5%	79,107
	Total	100%	1,574,134
Sheep	Temporary grassland	4%	34,399
	Permanent grassland	61%	595,614
	Rough grazing	35%	340,885
	Total	100%	970,898
Pigs	Bare fallow	14%	4,948
	Permanent grassland	14%	5,052
	Indoor	72%	25,905
	Total	100%	35,905
Total			2,580,937
Total excluding indoor pigs			2,555,032

Source: Matrix estimate based on Defra June Survey, 2009

² The figure for outdoor pigs may be underestimated as part of the herd is born outdoors but finished indoors. The statistics however do not capture this dynamic. This limitation implies that the distribution by land type (bare fallow; permanent grassland; and indoor) may lead to an underestimation of the actual benefits generated by the industry in that the proportion of land used for indoor pigs is assumed to have no alternative economic use in a scenario of no national production.

4.0 Estimation of benefits generated by the English red meat industry

4.1 Alternative use of resources

In order to convert the above estimates of the size of the English red meat industry into estimates of the net contribution generated by the industry, it was necessary to ask:

- What would be the alternative use of the resources employed by the industry if it was to disappear?
- What alternative source of meat would consumers have in the absence of a domestic industry?

Table 7 summarises the best alternatives considered for each of the benefits included in the analysis. In the case of the economic contribution associated with the use of land, the alternative use would depend on the type of land. In the case of the economic value generated by the allied industries in the pre-farming and farming sector, the alternative use depends on the type of land whilst for the processing, wholesale, and retail industries, the alternative scenario is importation. For employment, the alternative use would be, at least to some extent, re-employment in other industries.

Table 7
Best alternative for red meat industry

Benefit valued	Alternative to red meat industry
Economic contribution farming industries	
Temporary grassland	Crop
Permanent grassland	Crop
Rough grazing	Managed
Bare fallow	Crop
Indoor pigs	No alternative use ³
Economic contribution allied industries: pre-farming and farming	Varies by land type: crop; managed land; no alternative use
Economic contribution allied industries: processing, wholesale and retail	Importation
Employment	Re-employment in other industries

³ It is possible that some buildings have alternative uses. These uses have not been considered in the analysis. This assumption may potentially overestimate the benefits of the industry.

To evaluate the contribution of the industry we considered the best alternative use of resources (as shown in Table 7) and estimated the value generated by the industry net of such alternative use. The next sections provide the results of this analysis for each of the benefits considered in this report.

4.2 Contribution to the economy

English red meat farming industries

Currently, the English red meat industry generates £372 million per year in terms of gross income. In the absence of the red meat industry, the use of the land – and hence the resulting economic value – would vary depending on the type of land and its best alternative use. For each industry and land type, Table 8 specifies the land area (hectares) and alternative use of the land. In the absence of the English red meat industry, the majority of land would be used for crops – this is the case for temporary grassland, permanent grassland and bare fallow. The remaining land would not be suitable for agriculture purposes and may need to be managed. This is the case for land dedicated to indoor pigs and land classified as rough grazing, respectively.

Table 8
Contribution to the economy in terms of gross income (in £2010/11)

Industry	Land type	% of land in industry	Hectares	Alternative use	Economic value lost
Beef cattle	Temporary grassland	10%	164,770	Crop	£11.4m
	Permanent grassland	85%	1,330,257	Crop	£92.2m
	Rough grazing	5%	79,107	Managed	£10.7m
	Total	100%	1,574,134	-	£114.3m
Sheep	Temporary grassland	4%	34,399	Crop	£0.8m
	Permanent grassland	61%	595,614	Crop	£14.0m
	Rough grazing	35%	340,885	Managed	£30.5m
	Total	100%	970,898	-	£45.2m
Pigs	Bare fallow	14%	4,948	Crop	£9.7m
	Permanent grassland	14%	5,052	Crop	£9.9m
	Indoor	72%	25,905	No alternative use	£52.3m
	Total	100%	35,905	-	£71.8m
Total			2,580,937		£231.3m

Source: Matrix estimates based on Defra June Survey, 2009 and Defra (2011a).

With the purpose of estimating the economic value generated in the alternative use, we estimated the **gross income per hectare** for each of the three English red meat industries and for crops. These estimates are based on the total income generated by each activity (£) and estimates of the land area (hectares) dedicated to such activities (Table 6). It was estimated that:

- The gross income per hectare dedicated to beef cattle is £135 per year.
- The gross income per hectare dedicated to sheep is £89 per year.
- The gross income per hectare dedicated to pigs is £2,018 per year.
- The gross income per hectare dedicated to crop is £66 per year.

Detailed calculations of the above estimates are presented in the Appendix. Based on these estimates of gross income per hectare, we calculated the economic value that would be lost in the absence of the English red meat industry, presented in last column of Table 8. These estimates were calculated as the difference between the gross income per hectare in each industry and the gross income per hectare in the alternative use (if any), multiplied by the corresponding land area.

Based on the above process, it is estimated that the income loss in the absence of the English red meat industry would be £231.3 million per year. Of this, £114.3 million corresponds to the beef industry, £45.2 million to the sheep industry, and £71.8 million to the pig industry.

English red meat allied industries

It is likely that the loss of the domestic red meat industry would have an effect on the allied industries. However, the effect of a rise in imported meat to compensate for reduced domestic production (assuming consumption remains flat) will vary for the different allied industries. For example, the provision of wholesale or retail services is not tied to the location of the primary production. On the other hand provision of farming inputs, such as veterinary services, requires a domestic livestock industry.

To quantify these losses, we estimated the reduction that each of the allied industries would likely suffer, depending on the alternative use of the resources. Detailed calculations are presented in the Appendix.

The economic value lost in the allied industries in the absence of the English red meat industry is summarised in Table 9:

- It is estimated that the overall loss in allied industries would be about £530 million per year.
- The majority of this would be value lost in the processing industry due to national red meat being partially replaced by imported meat that is already processed.
- The remainder corresponds to value lost in the pre-farming and farming inputs industries, as part of the land currently used for livestock would not have a productive use in the absence of the red meat industry.

Table 9

Net contribution to the economy in terms of gross income, allied industries (in £2010/11)

Allied industry	Baseline	Alternative scenario	Economic value lost
Pre-farming and farming inputs	£242.6m	£181.7m	£60.9m
Processing and wholesale	£1,852.3m	£1,382.9m	£469.4m
Retail	£2,419.0m	£2,419.0m	£0.0m
Total	£4,513.9m	£3,983.6m	£530.3m

Source: Matrix estimates based on Defra (2011a).

4.3 Contribution to employment

English red meat farming industries

Currently, the English red meat industry employs directly around 96,000 individuals as farmers, full-time and part-time employees and casual workers. To evaluate the net contribution of the industry to the economy, it is important to consider the best alternative for that employment. That is, it is necessary to provide an estimate of the number of people who would, in the absence of the industry, find alternative employment either in other agricultural production, or in other sectors of the economy. The proportion of individuals who would find alternative employment was estimated based on the annualised re-employment rate calculated by the Office for National Statistics (ONS).⁴

Table 10 shows the estimates of the number of jobs lost in the absence of the industry:

- In total, the net loss of employment in the absence of the industry would be around 20,000 people. Out of them, 12,000 are currently employed in the beef industry, 7,000 in the sheep industry, and 1,400 in the pig industry.
- Around 19,000 of the lost employment would be in rural areas, reflecting the geographical concentration of the industry. The red meat industry therefore plays a key role in maintaining rural employment and supporting rural communities.

⁴ Based on the quarterly re-employment rate (32 per cent), the annualised re-employment rate is 79 per cent.

Table 10
Contribution to employment, farming

Industry	Rural classification	Current employment	Alternative scenario	
			Employed in other industries	Unemployed/ jobs lost
Beef cattle	Rural	52,793	41,626	11,167
	Urban	2,242	1,768	474
	Total	55,035	43,394	11,641
Sheep	Rural	32,562	25,674	6,887
	Urban	1,383	1,090	293
	Total	33,945	26,765	7,180
Pigs	Rural	6,012	4,740	1,272
	Urban	772	609	163
	Total	6,784	5,349	1,435
Total	Total	95,764	75,508	20,256

Source: Matrix estimates based on Defra June Survey, 2009, Farm Business Survey, 2010, and Labour Force Survey, 2011.

The employment contribution value was based on productivity. This takes into account:

- The type of employment, i.e. principal farmer, full-time employee, part-time employee or casual labour.
- The average number of hours worked per year.
- The agricultural hourly wage per type of employment.

Table 11 shows the estimates of the productivity value of the jobs lost in the absence of the industry. The total annual value of the employment contribution of the industry is £441 million. The contribution of the beef cattle industry is £256 million, the sheep industry £158 million, and pig £27 million.

Table 11
Contribution to employment, farming (in £2010/11)

Industry	Rural classification	Unemployed/ jobs lost	Unit value of productivity	Total value of jobs lost
Beef cattle	Rural	11,167	£22,079	£246.6m
	Urban	474	£19,739	£9.4m
	Total	11,641	£21,984	£255.9m
Sheep	Rural	6,887	£22,079	£152.1m
	Urban	293	£19,739	£5.8m
	Total	7,180	£21,984	£157.8m

Industry	Rural classification	Unemployed/ jobs lost	Unit value of productivity	Total value of jobs lost
Pigs (all)	Rural	1,272	£18,895	£24.0m
	Urban	163	£17,657	£2.9m
	Total	1,435	£18,754	£26.9m
Total	Rural	19,326	£21,870	£422.7m
	Urban	930	£19,373	£18.0m
	Total	20,256	£21,755	£440.7m

Sources: Matrix estimates based on Defra June Survey, 2009, Farm Business Survey, 2010, Survey of Earnings and Hours of Agricultural and Horticultural Workers, 2010, and Labour Force Survey, 2011.

English red meat allied industries

The loss of the domestic red meat industry would have an effect on the number of people employed in allied industries. The effect of importing meat would vary across the different allied industries. For example, the provision of wholesale or retail services is not tied to the location of primary production. On the other hand provision of farming inputs, such as veterinary services, requires a domestic livestock industry.

Table 12 shows the estimates of the productivity value of the jobs lost in the absence of the allied industries.

- The net contribution of the allied industries in terms of employment is estimated to be around 19,000 people. Of this, 13,000 are employed in pre-farming and farm input industries, and 6,000 in meat processing.
- The total value of lost productivity is £466 million. Of this £317 million is attributable to pre-farming, and £149 million to meat processing.

Table 12

Contribution of employment to economic value added, allied industries (in £2010/11)

Industry	Current employment	Unemployed/ jobs lost	Unit value of productivity	Total value of jobs lost
Pre-farming and farming inputs	62,437	13,207	£23,972	£316.6m
Processing and wholesale	133,533	6,231	£25,038	£149.4m
Retail	577,027	-	£12,740	£0.0m
Total	772,998	19,438	£23,972	£466.0m

Source: Matrix estimates based on Defra June Survey, 2009, Defra (2011a) and Average Weekly Earnings, February 2011.

5.0 Summary of benefits and conclusions

Table 13 presents the summary of the estimated net benefits of the English red meat industry. These demonstrate that the English red meat industry provides a significant contribution to the national economy and society of around £1,67bn, including:

- £762m added to the economy, over and above employment effects.
- £907m added to employment levels.

Table 13

Summary of net economic value added by the English red meat industry (in £2010/11)

Benefit	Beef cattle	Sheep	Pigs	Total
Contribution to economy	£389.8m	£174.5m	£197.3m	£761.7m
Farming	£114.3m	£45.2m	£71.8m	£231.3m
Allied industries	£275.5m	£129.3m	£125.5m	£530.3m
Contribution to employment	£507.6m	£291.4m	£107.6m	£906.6m
Farming	£255.9m	£157.8m	£26.9m	£440.7m
Allied industries	£251.7m	£133.6m	£80.7m	£466.0m
Total	£897.4m	£465.9m	£304.9m	£1,668.3m

Source: Matrix estimates

When interpreting these results, it is important to consider that:

- The estimation of benefits is driven by the chosen best alternative use. There may be multiple uses for the industry inputs, with the best one being determined by factors not considered in our analysis.
- Little data was available on allied industries related to the red meat industry, and specifically to the beef, sheep and pig industries. It was thus necessary to make adjustments to statistics relating to the agricultural sector as the whole.
- The analysis covers only a limited selection of benefits generated by the red meat industry. There may be other benefits, such as the aesthetic value of land and citizens gaining a sense of pride from having an English red meat industry, which have not been addressed, which would lead to an underestimation of the benefit.
- A noteworthy benefit, for example, is the value of employment in rural areas. Given the majority of opportunities in the red meat industry concentrate in rural areas, they play a major role in the sustainability of these communities. While this benefit cannot be quantified, it is important to acknowledge the negative impact that the absence of the red meat industry would cause on individuals and families living in rural communities.
- Lastly, the English red meat industry plays a significant role in the self-sufficiency of domestic production to consumption. This is of key importance as the country's self-sufficiency ratio has been in noticeable decline over the last decade (Defra, 2006). This trend, together with concerns over the power of globally-sourcing supermarkets, growing awareness of environmental issues, the potential for short-term interruptions to

fuel supply, and longer-term concerns over energy security and climate change, have heated the food security debate. In this context, the contribution made by the national red meat industry to food self-sufficiency cannot be overstated.

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7.0 Appendix: Method and data used for economic analysis

7.1 Method

Data collection

Literature and statistical sources were used to identify the key data pieces required for quantifying the value produced by the industry. The following were the main sources used:

- BPEX, EBLEX and AHDB reports.
- BPEX, EBLEX and AHDB market intelligence statistics and specialist advice.
- Reports and statistics by Defra.
- Other statistical sources such as ONS.
- Academic and grey literature.

Where readily available data could not be identified, statistical methods were used to derive parameter estimates where possible. If parameter values could not be reliably estimated, no valuation of the benefit was produced.

Models and presentation of results

After the necessary data had been identified, models were constructed in Excel to synthesise the data into estimates of the value of the industry. The results are presented in this report. All estimates represent annual benefits and are expressed in 2010/11 prices. The data used to populate the economic models and the processes to obtain estimates are described in detail in the remainder of this Appendix.

7.2 Land use

Total land use for beef cattle and sheep was estimated based on number of animals and the average number of livestock units per hectare. The values used to estimate the total land area are presented in Table A.1.

Distribution by land type was estimated using estimates from the Defra June Survey 2009. As the land use is not available for beef cattle and sheep separately, grazing livestock distribution was used for both. To account for the different type of land generally grazed by the two species, a distinction was made between land in Less Favourable Areas (LFA) and lowland. The assumption was made that sheep are more likely to graze in areas that are classified as LFA, while beef cattle are more appropriate for lowlands, though there will be elements of both in both land types. Distribution of total land occupied by beef cattle and sheep was therefore disaggregated into land types using lowland and LFA distributions respectively. The estimated distribution of land is presented in Table A.2.

The estimated land distribution for outdoor pigs is presented in Table A.3. The total land area used for outdoor pigs, 10,000 hectares, was extracted from the June Survey. The simplifying assumption was made that all outdoor pigs are either on bare fallow or permanent grass.

Table A.1
Estimation of total land area, beef cattle and sheep

Industry	Beef cattle	Sheep
Number of livestock ⁵	3,463,094	14,239,840
Number of animals per livestock unit	1	0.15
Number of animals per 2.2 units	2.2	14.7
Implied area (ha)	1,574,134	970,898

Source: Matrix estimates based on Defra (2011), Defra June Survey, 2009, Defra (2004).

Table A.2
Distribution of land area by land type, beef cattle and sheep

Calculated area	Beef cattle	Sheep	Total	Beef cattle	Sheep	Total
	ha			%		
Temporary grass ⁽⁷⁾	164,770	34,399	199,169	10%	4%	8%
Permanent grass ⁽⁸⁾	1,330,257	595,614	1,925,871	85%	61%	76%
Rough grazing ⁽⁹⁾	79,107	340,885	419,992	5%	35%	17%
Total area	1,574,134	970,898	2,545,032	100%	100%	100%

Source: Matrix estimate based on Defra June Survey, 2009.

Table A.3
Distribution of land area by land type, pig

Current land use	Pig holdings		Outdoor pig (model)
Total	ha	%	ha
Arable crops & bare fallow/GAEC12 land	13,144	41%	4,948
Temporary grass	2,302	7%	-
Permanent grass	13,421	42%	5,052
Rough grazing	1,164	4%	-
Farm woodland	2,142	7%	-
Total area	32,173	100%	10,000

Source: Matrix estimates based on Defra June Survey, 2009.

⁵ Beef estimate includes all cattle except "Total dairy".

7.3 Economic contribution

This section presents details of the methodology and data to estimate the size of the English red meat industry and the economic loss that a scenario in which there was no national production would cause. We present farming and its allied industries separately.

English red meat farming industries

The size of the red meat industry was measured in terms of **income** which, as described in Section 2, differs from the concepts of **output** and **value added**. The process for obtaining income estimates was based on the following steps:

1. We estimated the value generated by the beef cattle, sheep and pig industries in England at 2010/11 prices measured by the gross **output** at basic prices. This estimate is based on the total gross output at basic prices for livestock activities in the UK in 2010, published by Defra (2011a). This figure was modified as follows:
 - Adjusted by the agricultural land area in England as a percentage of the UK (83 per cent, Defra 2011a).
 - Adjusted by the output associated with beef cattle, sheep and pigs both primarily for meat and for capital formation (breeding) relative to the total livestock output (45 per cent, Defra 2011a).
 - Updated to 2010/11 prices using HM Treasury GDP deflator.
2. The gross **output** at basic prices is inclusive of the value of intermediate consumption (e.g. animal feed, pesticides and fertilisers). We deducted this to obtain estimates of the gross **value added** at basic prices.
3. The gross **value added** at basic prices is inclusive of compensations of employees and consumption of fixed capital. We deducted these to obtain estimates of the gross **income** generated by the industries. Subsidies/taxes on production were not added/deducted as at a societal level these are considered transfers, and not a contribution to or from the industry.

Table A.4 illustrates steps two and three of the process described above and provides estimates of the income generated by the beef cattle, sheep and pig farming industries in England.

Table A.4

Economic value generated by the English red meat farming industries (in £2010/11)

	Beef cattle	Sheep	Pigs	Total
Gross output at basic prices	£2,460m	£1,003m	£837m	£4,300m
Minus: Intermediate consumption	£1,602m	£653m	£545m	£2,800m
Gross value added at basic prices	£858m	£350m	£292m	£1,500m
Minus: Compensation of employees	£254m	£103m	£86m	£443m
Minus: Consumption of fixed capital	£389m	£158m	£132m	£679m
Gross income from farming (excluding subsidies/taxes)	£213m	£87m	£72m	£372m

Source: Matrix estimates based on Defra (2011a).

Note: numbers may not add up due to rounding.

Estimates of the income loss in the absence of the English red meat industry were calculated as the difference between the gross income per hectare in each industry and the gross income per hectare in the alternative use (if any), multiplied by the corresponding land area. This section presents detailed calculations of the gross income per hectare dedicated to beef cattle, sheep, pigs and crop. Estimates of land area by type of land were presented in Section 3.

The gross income per hectare was calculated as the total gross income for the industry (as presented in Table A.4) by the area dedicated to such activity (as presented in Table 6). Due to data limitations and to ensure the confidence of the estimate, in the case of crop, the calculation was made based on data for cereals, rather than all types of crop. The estimates are presented in Table A.5.

Table A.5

Gross income per hectare by industry

Industry	Total gross income	Hectares	Gross income per hectare
Beef cattle	£213m	1,574,134	£135
Sheep	£87m	970,898	£89
Pigs	£72m	35,905	£2,018
Crop*	£0.19m	3,013	£66

* Only cereals

Source: Matrix based on Defra (2011a).

English red meat allied industries

The size of the industries associated with beef cattle, sheep and pig was estimated based on output and income values. The process involved the following steps:

Pre-farming and farming inputs. We estimated the value of these industries attributable to beef cattle, sheep and pig by adopting the same general approach as with the farming industries. Our starting point was the total value of agriculture intermediate consumption in the UK published by Defra (2011a). This figure was then modified as follows:

- Adjusted by the agricultural land area in England as a percentage of the UK (83 per cent, Defra 2011a).
- Adjusted by the output associated with beef cattle, sheep and pigs both primarily for meat and for capital formation (breeding) relative to the total agriculture output (25 per cent, Defra 2011a).
- Derived income, rather than output values, using the ratio income/output derived from the farming industries (9 per cent, based on Table A.4).
- Updated to 2010/11 prices using HM Treasury GDP deflator.

Processing, wholesale and retail. We estimated the value of these industries attributable to beef cattle, sheep and pig by adopting the same general approach as with the farming industries. Our starting point was the estimated value added by the agri-food sector in the UK published by Defra (2011a). The agri-food sector includes the following five subsectors: agriculture; food and drink manufacturing, wholesaling and retailing; and non-residential catering. Based on these we calculated the ratio of each sub-sector relative to agriculture – e.g. the value added ratio between wholesaling and agriculture. The estimates are presented in Table A.6.

Table A.6
Agri-food sector: value added ratios

Industry	Value added ratio
Agriculture	1.00
Food and drink manufacturing	3.60
Food and agricultural wholesaling	1.38
Food and drink retailing	3.47
Non-residential catering	3.04

Source: Matrix based on Defra (2011a).

The gross income generated by the processing, wholesale and retail industries associated with beef cattle, sheep and pigs was then calculated by applying these ratios to the gross income generated by farming (Table A.4). The underlying assumption of this approach is that the relationship between the size of the agricultural industry and the size of the allied industries is constant across different types of agricultural produce.

Estimates of the income loss in the absence of the English red meat industry will vary for the different allied industries. The estimated reductions in economic value in the allied industries are summarised in Table A.7.

- The impact on pre-farming and farming inputs is based on the proportion of land that would not be employed for either livestock or crop in the alternative scenario. The underlying assumption is that all land that would alternatively be dedicated to crop would maintain an allied industry the same as if it was used for livestock.
- The impact on processing is based on the assumption that the proportion of meat that is imported highly processed remains constant at around 35 per cent (Defra, 2011a), resulting in a proportionate loss of economic value.
- Wholesale and retail are assumed to be unaffected.

Table A.7

Economic value added lost in allied industries

Industry	Reduction in economic value
Pre-farming and farming inputs	
Beef cattle	54%
Sheep	52%
Pigs	99%
Processing	35%
Wholesale	0%
Retail	0%

Source: Matrix estimates based on Defra (2011a).

7.4 Employment

This section presents details of the methodology and data to estimate the size of the English red meat industry in terms of employment and the loss that a scenario in which there was no national production would cause. We present farming and its allied industries separately.

English red meat farming industries

The number of individuals employed in the three industries was estimated using June survey statistics available on the Defra website which provide agricultural labour figures broken down by type of employment and farm type. To estimate the total employment per industry per type of employment, the following modifications were required:

- It was assumed that the distribution of labour across farm types also applies for labour on farms classified as “Mixed”. For example, out of labour not classified as “mixed” or “other types”, 2 per cent is employed on pig farms. Therefore 2 per cent of labour on “mixed” farms is attributed to the pig industry.
- While employment in the pig industry was available as a separate category, employment in grazing livestock industries was not broken down to enough detail to make a distinction between beef cattle and sheep industries. To ensure consistency

between the different types of benefit, the grazing livestock figures were distributed using the relative land use by beef cattle and sheep.

To provide estimates of rural employment, the following modifications were performed:

- The proportion of grazing livestock and pig farms situated in urban areas was extracted using the Farm Business Survey.
- The average number of employees by employment type was extracted for urban and rural areas.
- The likelihood of an employee, given type of employment, being employed by a farm classified as urban was calculated and applied to the total number of employees by type.

This process is illustrated using an example in Table A.8.

Table A.8
Example of employment calculation

Data piece	Estimate
Number of farmers, partners and other unpaid workers, urban	1.70
Number of farmers, partners and other unpaid workers, rural	1.73
Probability farm urban	3.30%
Likelihood of farmers, partners and other unpaid workers being urban	$(3.3\% \times 1.7) / (3.3\% \times 1.7 + 96.7\% \times 1.73) = 3.2\%$

Source: Farm Business Survey, 2010

The employment contribution to the economy was estimated based on productivity gains. The number of hours worked per person per year was multiplied by the agricultural hourly wage and annualised. The values used for the estimation of value of productivity are summarised in Table A.9.

Table A.9
Employment parameters (in £2010/11)

Data item	Employment type	Livestock	Pigs
Hours per year per person	Farmers, partners, directors and spouses	3,079	2,573
	Fulltime	2,148	2,304
	Part-time	827	887
	Casual workers	1,482	1,482
Earnings per hour	Fulltime	£7.8	£8.1
	Part-time	£7.3	£7.5
	Casual workers	£6.8	£7.0

Data item	Employment type	Livestock	Pigs
Annual value of productivity	Farmers, partners, directors and spouses	£24,139	£20,171
	Fulltime	£16,841	£18,063
	Part-time	£6,030	£6,468
	Casual workers	£10,080	£10,080

Source: Defra Survey of Earnings and Hours of Agricultural and Horticultural Workers, 2010

English red meat allied industries

The assumption is made that the relationship between the size of the agricultural industry and the size of the allied industries is constant across different types of agricultural produce. The relationships are summarised in Table A.10.

- For the agricultural supply industry, employment was estimated through the Defra input and output estimates for the agricultural sector. The ratio of intermediate consumption (inputs) to gross output at market prices was applied to the employment figures for the red meat industry.
- For manufacturing, wholesaling, retailing and catering the employment estimates for the allied industries are based on Defra employment estimates for the agri-food sector in Great Britain.

Table A.10
Employment ratios

Industry	Employment ratio
Agriculture	1.00
Agricultural supply industry	0.65
Food and drink manufacturing	0.88
Food and agricultural wholesaling	0.52
Food and drink retailing	2.77
Non-residential catering	3.25

Source: Defra (2011a).

Having estimated the size of the English red meat allied industries using the employment ratios defined above, the distribution between species was done based on the following:

- For the agricultural supply industry, the distribution between the beef cattle, sheep and pig industry is based on the number of employees in the respective farming industries.
- For manufacturing and wholesaling, the distribution between the beef cattle, sheep and pig industry is based on the volume of meat produced by each industry based on Defra Slaughtering Statistics: beef cattle (47 per cent), lamb (39 per cent), and pork (39 per cent).

- For retailing and catering, the distribution between the beef cattle, sheep and pig industry is based on the volume of meat consumed (estimated as the volume produced minus the volume exported derived from AHDB calculations based on HMRC Trade data). The resulting distribution is as follows: beef cattle (50 per cent), lamb (12 per cent), and pork (37 per cent).

The estimated reduction in employment as a result of the loss of a domestic red meat industry is summarised in Table A.11.

- The employment impact on pre-farming and farming is based on an annualised ONS re-employment rate (LFS, 2010).
- The impact on processing is based on the assumption that the proportion of meat that is imported highly processed remains constant at around 35 per cent (Defra, 2011a), resulting in a proportionate loss of employment. Taking into account re-employment, the total effect on employment is around 7.4 per cent.
- Retail and wholesale are assumed to be unaffected.

Table A.11

Employment effect due to the loss of the English red meat industry

Industry	Reduction in employment
Pre-farming and farming inputs	21.2%
Farming	21.2%
Processing	7.4%
Wholesale	0%
Retail	0%

Employment in the allied industries is value based on average weekly wage, presented in Table A.12.

Table A.12

Earnings per employee, allied industries (in £2010/11)

Earnings	Per week	Per year
Processing	£461	£23,972
Wholesale trade	£502	£26,104
Retail	£265	£13,780
Accommodation and food	£225	£11,700

Source: Average Weekly Earnings, February 2011.