Economic Contributions of the US Beef Industry

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Economic Contributions of the US Beef Industry

The impact of the US beef industry spans far beyond supplying consumers with high-quality beef products. Economic contributions generated by the production, harvest, and processing of cattle can be felt by other industries as the effects ripple through US regions, and across the nation as a whole.

Executive Summary

Gross Contributions:

Sales

$167.0 Billion

Jobs

721,488 Jobs

Employee Compensation

$10.8 Billion

Total Value Added

$30.1 Billion

The beef industry makes an important contribution to economic output and development within the United States (US). Every year over 90 million head of cattle are raised on more than 800,000 cattle operations, leading to the production of around 27 million pounds of beef annually. In 2016, sales from the US beef industry represented 76% of all red meat, 39% of animals and animal products (including poultry and other misc. livestock), and 18% of all agricultural commodities sold by US producers. While beef sales alone provide significant contributions to the US economy, the importance of the US beef industry spans far beyond supplying consumers with high quality beef and value added beef products. The raising of beef from pasture to plate is a complex process involving interactions between various actors along the supply chain.

Economic contributions from the US beef industry extend across the entire nation. In 2016, US beef production and processing generated $167.0 billion in gross sales. These sales supported nearly 721,500 beef industry jobs, which paid workers more than $10.8 billion in employee compensation. Overall, the beef industry was responsible for generating over $30.0 billion in total value added (employee compensation, proprietary income, returns to capital, and taxes) to the national economy in 2016. Of the $167.0 billion in gross sales generated by the beef industry, $18.0 billion represented export sales to countries such as Japan, South Korea, Mexico, and Canada. These export sales represent almost 29,000 of the 721,500 beef industry jobs, $1.5 billion in employee compensation, and $2.6 billion in total value added across the US beef industry. In producing its exports, the beef industry purchased inputs from other US businesses. In 2016, the value generated across other industries as a result of beef exports (i.e. indirect beef export contributions) totaled $44.3 billion in sales, representing over 291,700 jobs, $8.6 billion in employee compensation, and $19.9 billion in total value added to other sectors of the economy. As a result, beef exports alone generated $62.3 billion in sales, 320,700 jobs, $10.1 billion in employee compensation and $22.5 billion across all areas of the US economy. The top industries indirectly affected by beef exports were wholesalers, grain and feed producers, real estate, trucking, and those performing support activities for cattle production. Without the US beef industry, businesses throughout these industries would lose sales, jobs, and value added.

In addition to bringing new dollars into the economy through the export of beef products, the US beef industry also plays a role in keeping existing dollars within the country. In 2016, US beef producers prevented the loss of over $149 billion in sales from the national economy by supplying local businesses and other consumers with high-quality beef products made in the USA. This represented over 692,500 beef industry jobs, $9.4 billion in employee compensation, and $27.4 billion in total value added to the US economy which may have otherwise been lost to other nations through the import of beef products from foreign producers.

The beef industry may be divided into two parts: on-farm beef cattle production and post-farm cattle harvest and beef processing. On-farm beef production is part of the *Agriculture, Forestry, Fishing, and Hunting* sector of the North American Industry Classification System (NAICS). Out of nineteen industries making up this sector, on-farm beef cattle production ranked #2 in sales, jobs, and value added, generating 13.4% of sales, 15.0% of jobs, 2.3% of employee compensation, and 8.6% of total value added across the sector. Post-farm cattle harvest and beef processing is part of the NAICS *Manufacturing* sector. As this sector is comprised of more than 300 industries, we limit our focus to 98 industries within *Manufacturing* that are related to agriculture. Among these ag-related manufacturing industries, post-farm cattle harvest and beef processing ranked #1 in sales and #3 in jobs and total value added, representing 7.0% of total sales, 5.3% of jobs, 5.1% of employee compensation, and 4.2% of total value added generated by across the ag-related manufacturing sector.

While the US beef industry makes substantial contributions to the national economy, these contributions are felt more strongly across different regions of the US. For instance, in 2016 the Southern Plains region (Texas, Oklahoma, and Kansas) was the top region in the country for beef industry sales ($44.5B), jobs (242,225), employee compensation ($2.5B) and total value added ($8.5B). The Northern Plains and Midwest regions were also large contributors to the US beef industry with each region generating around 20% of beef's gross sales value. Looking at beef activity as a percentage of total economic activity within each region, the beef industry made a up a greater proportion of the Northern Plains economy than that of any other region. The beef industry also made notable contributions to regional agriculture activity with on-farm beef cattle production ranking #1 in sales across the Southern Plains, Northern Plains, and Northwest's *Agriculture, Forestry, Fishing, and Hunting* sector and post-farm cattle harvest and processing ranking 1st, 2nd, 3rd, and 4th in agriculture-related manufacturing sales across the Northern Plains, Midwest, Southwest, and Northwest, respectively.

In addition to generating economic activity, like all types of production, the beef industry is also associated with a variety of environmental impacts. A comparison of the share of economic activity within a region to the share of environmental impacts generated by beef production across regions showed that, in general, economic contributions tended to mirror environmental contributions, indicating that environmental impacts may be linked to economic activity.

Overall, the US beef industry consists of a series of complex interactions with broad impacts spanning a variety of areas. As a result of these interactions, the US beef industry is able to supply consumers, both domestic and abroad, with high quality beef and value added beef products, while in the process, also generating significant contributions in the form of sales, jobs, employee compensation and value added to regional economies and the nation as a whole. Without the existence of the beef industry and its exports, consumers in the US economy would be reliant on imports of beef from other countries to meet both consumption and production needs. In addition, losses would also be felt across industries reliant on purchases made by the beef industry to sustain their business. Because of this, the loss to the economy without the existence of the beef industry could have amounted to as much as $200 billion in lower sales, one million fewer jobs and a loss of $50 billion in value added, thus highlighting the importance of the beef industry to the US economy in 2016.

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Background

The beef industry makes an important contribution to economic output and development within the United States (US). Every year over 90 million head of cattle are raised on more than 800,000 cattle operations across the country. Production from US cattle operations contribute to the production of around 27 million pounds of beef annually (USDA ERS, 2020a; USDA NASS, 2020; USDA NASS, 2019). The beef industry represents 76% of all red meat, 39% animals and animal products (including poultry and other misc. livestock), and 18% of all agricultural commodities sold by US producers (USDA ERS, 2020b). While these sales alone provide significant contributions to the US economy, the importance of the US beef industry spans far beyond supplying consumers with high quality beef and value added beef products. The raising of beef from pasture to plate is a complex process involving interactions between various actors along the supply chain.

Dollars spent by cattle producers and processors on the purchase of local inputs, as well as wages and other compensation paid to employees also serve to bolster the economy. This is because cattle producers, their employees, and those employed in industries that process beef products, or supply inputs to the beef industry, all spend a portion of their earnings locally. This money gets spent at local restaurants and retail stores, on assets such as land or vehicles, and for other expenses such as healthcare. Because of this, economic contributions and growth within an industry can be felt in seemingly unrelated areas of the economy.

Some industries, namely agriculture and manufacturing, are considered “export base industries” as they primarily function to produce goods for export out of a region. Other industries such as retailers and restaurants are considered “local support industries” as their primary role is to provide products and services to local consumers. Although local support industries play an important role in supporting the local economy, ***export base industries are generally considered the primary drivers of economic growth within a region. In other words, export base industries can be thought of as the engine that drives an economy. It is the sector (or sectors) providing exports from the local area to the rest of the world.***

In this report, the contribution of the US beef industry is examined from an <u>economic base</u> perspective. Beef cattle on-farm production and post-farm harvest and processing activities were analyzed to determine their roles in either driving economic growth through export base activities, or in maintaining the current economy through the support of local industries (i.e. export support and local consumption activities). The analysis was performed in two parts. First, an analysis was conducted for the US as a whole, with a focus on the contribution of beef exports to foreign nations. Regional analyses were then performed for seven US regions: Southern Plains, Northern Plains, Midwest, Northwest, Southwest, Southeast, and Northeast. These analyses focused on the contribution of beef exports to areas outside of the region of interest (i.e. both domestic and foreign exports).

In a previous report, data and input-output (I-O) modeling software from IMPLAN Group, LLC were used to estimate economic contributions of the beef industry for the US, as well as the same seven US regions (Thoma et al., 2017). The type of analysis performed using IMPLAN software and methods is known as the hypothetical extraction method (HEM). While this method has been widely applied, there are some limitations to its use. First, IMPLAN’s models make use of a sectoring scheme based on the North American Industry Classification System (NAICS). For the 2016 data year, IMPLAN's sectoring methods separate the economy into 536 sectors. With this system, on-farm beef cattle production is aggregated into one sector – beef cattle ranching and farming – encompassing all cow-calf, stocker-background, feedlot, and dairy herd replacement activity, while the post-farm beef harvest and processing sectors are aggregated into sectors containing other red meat processing (e.g. pork, lamb, etc.). For those wishing to disaggregate the default sectors into smaller parts, the rigid structure of IMPLAN's software system makes it somewhat difficult.

Second, the hypothetical extraction method is used to answer the question: What would be the economic impact if an industry were removed from the economy? This method generates a *hypothetical* economic equilibrium with the economic contribution measured as the difference between actual observed economic activity and this counterfactual equilibrium. Since the model is not bound by *actual* observed economic values, it is easy to overstate the value of an industry within a regional economy using this method. To account for these limitations, economists are seeking alternative methods to describe the economic contribution of an industry. One method finding acceptance among researchers is the "economic base contribution" method. As this study called for disaggregating the cattle sector into parts smaller than those delineated by IMPLAN, and to prevent an accidental overstatement of industry value, we chose to utilize the economic base contribution method for this analysis.

By utilizing the economic base contribution method, as opposed to the formerly used hypothetical extraction method, values presented in this report will likely be lower than those found in our previous study. This is due to the fact that the hypothetical extraction method reports the economic contribution through use of an additive multiplier effect. Here, indirect beef export contributions, occurring when industries purchase supplies or services from local businesses, and induced contributions that result from the spending of wages by industry employees and their suppliers, are added to the direct contribution (i.e. the actual observed economic value). Comparing these summed values to the economic value of the entire economy often causes some confusion as the industry contribution appears to be much larger than what is actually measured. With export base contribution analysis, the sum of the economy's total economic activity remains the same, while the values of individual industries are adjusted to account for their recognized "beef export" or "export support and local consumption" contributions. Taking these factors into account, provides a realistic view of the regional economy while highlighting the importance of local industry support in the production of exports.

Important Concepts and Definitions Used in an Economic Base Contribution Analysis

We begin by defining terms used throughout this report.

Beef Industry – for the purposes of this report, the aggregate beef industry is divided into two parts: on-farm beef cattle production and post-farm cattle harvest and beef processing.[1]

On-farm Beef Cattle Production – represents the on-farm portion of beef production, namely the raising of beef cattle. Operations classified under on-farm production include: cow-calf, stocker-background, and feedlot operations.

Post-farm Cattle Harvest and Beef Processing - firms involved in the harvest and further processing of beef products. Operations classified under this category include: cattle harvest, beef processing, and beef by-product facilities. Values include the harvest and processing of beef from operations involved in the production of beef cattle, as well as beef stemming from the dairy industry (e.g. culled dairy cattle and veal calves).

Economic Activity – the observed economic activity of an industry. These activities are reported in terms of sales, jobs, employee compensation, and total value added to the economy.

Sales – represent the value of industry production (sometimes referred to as output). These are annual production estimates, given in producer prices.

Jobs – represent employment of wage-earning and salaried employees, including those self-employed. It should be noted that these values represent average annual job counts, not individual workers. Here, a specific job may be performed by multiple persons throughout the year, and may be filled on a full-time, part-time, or temporary basis. Because of this, individual workers holding multiple job roles throughout the year may be counted twice in some cases (i.e. seasonal workers who perform different roles throughout the year).

Employee Compensation – total payroll cost of the employee paid by the employer. This includes wages and salaries, all benefits (e.g. health and retirement), and payroll taxes (e.g. social security, unemployment, etc.).

Value Added – sum of employee compensation, proprietor income, taxes on production and imports (minus subsidies received), and gross operating surplus[2]. Represents the difference between an industry's total sales and the cost of its intermediate inputs.

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[1] Beef industry sales and purchases made to and from wholesalers and retailers are captured. However, the value of beef sold by wholesalers, retailers, restaurants, etc. is not directly estimated within the study.

[2] Value added and gross state product (GDP by State as published by the US Bureau of Economic Analysis) are equivalent measures in total, but are estimated using different methods and data sources. GDP is based on an expenditure approach, whereas value added is measuring using an income approach. Value

Local - throughout this report, "local" refers to goods sold or purchased within a specified region. In the national analysis, "local" refers to the entire US. In the regional analyses, "local" refers to activity occurring within the states comprising each region.

Exports – refer to goods sold outside of a specified region. If the region is a country (such as the US), exports refer to goods sold to foreign nations. If the region is a group of states (e.g. Southern Plains), exports refer to goods sold anywhere outside of the states comprising that region.

Next, we revisit the important functions of industries within the economy and define how those contributions are measured.

As stated above, industries within an economy perform two important activities: 1) the production of goods that are sold to consumers outside of a region (i.e. exports), and 2) the production of goods that are consumed within the local region. Economic activity associated with the production of exports may be classified as either direct export or indirect export activities. These export activities are important for growing the economy as they bring new dollars into the region. The production of goods for local consumption is also important as this helps to keep existing dollars within the local economy by meeting local demand for products and services. Without local production, businesses and consumers would be required to purchase items and services outside of the region, thus removing dollars from the local economy.

Given those two activities, there are then three ways in which to measure the importance of the beef industry to an economy:

1. ***Gross Contributions*** – represents the actual reported value of sales, jobs, employee compensation, and value added reported *within the beef industry* itself. These contributions may be divided into parts representing the production of beef for export out of the region (direct beef export contributions), or the production of beef for local consumption by households and/or other industries within the region (export support and local consumption contributions)

2. ***Beef Export Contributions*** – give credit to the beef industry for bringing in new dollars into the region through the production of beef exports. These "export" contributions are sometimes referred to as "base" contributions. The total beef export contribution is the sum direct and indirect beef export contributions.

   - ***Direct Beef Export Contributions*** - economic activity (sales, jobs, employee compensation, total value added) that is generated *within the beef industry* as a result of beef production for export.

   - ***Indirect Beef Export Contributions*** **-** economic activity (sales, jobs employee compensation, total value added) that is generated *outside of the beef industry* as a result of beef export sales.

3. ***Export Support and Local Consumption*** - represents sales, jobs, employee compensation and value added generated *within the beef industry* that is attributed to production of beef for

added is generally considered a better measure of economic activity because it nets out the value of inter-industry purchases.

local consumption. This represents the economic activity not related to the direct production of beef exports, but does include the value of beef products that are used as inputs for the production of exports by other industries within the region (i.e. export support).

Borrowing an example from Watson, Taylor and Cooke (2008), suppose a tire merchant sells a tire to a local cow-calf operation. In a gross contribution analysis, the value of this tire sale (as well as the jobs, employee compensation and value added created), would be counted in the "tire sale" sector (which, officially is part of the "retail" sector). However, because this sale was only possible because of the new dollars that the beef industry brought into the region through sales of its exports, the base contribution analysis gives credit for this sale to the beef industry, not the retail sector.

The **gross contribution analysis** answers the question: *What is the observed economic activity of the beef industry in the region for both export and domestic use?*

The **export contribution analysis** answers the question: *What is the total economic activity generated in the economy across all sectors because of beef exports?*

Methods

Estimating the economic contribution of the US beef industry involved two primary steps: 1) estimating regional beef sales, and 2) performing an economic base analysis of the US beef industry. These methods are described in the following sections.

Estimating Regional Beef Sales

Sales represent the value of production for an industry (also known as outputs). These are annual production estimates for a given year, presented in producer prices. For beef producers, these values are measured by recorded sales and other operating income, plus/minus inventory change. Sales are an important metric used in determining the economic activity of an industry. Economists may utilize sales values with other variables (e.g. sales-to-employment or sales-to-compensation ratios) to estimate jobs, employee compensation, or value added for a given industry.

The beef industry is comprised of a complex matrix of interconnected players, each buying and selling from each other. In determining the economic contribution of the beef industry, it is important to consider the role of the various players involved in the production of beef products. Within the United States, contributions made by the beef industry vary across regions. To examine these variations, the US was separated into seven regions (Figure 1),

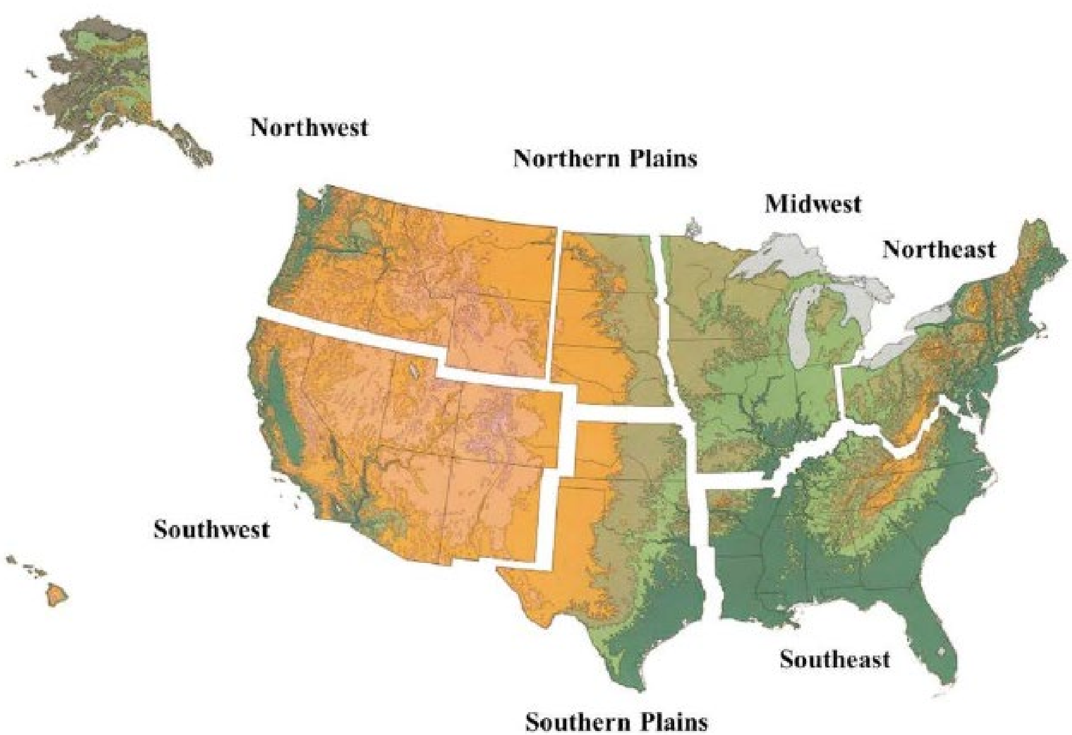


Figure 1: Study Regions for Analysis

While some national-level economic data were available, these data were not adequate to appropriately detail the complexity of the US beef industry. To overcome this problem, methods were developed to estimate beef sales for several sub-industries involved in the production, harvest, and processing of beef products.

Major sub-industries related to beef production were identified and divided into two main categories:

1. **On-farm Beef Cattle Production**
   - Cow-Calf Operations
   - Stocker-Background Operations
   - Feedlot Operations

2. **Post-farm Cattle Harvest and Beef Processing**
   - Cattle Harvest[3]
   - Beef Processing
   - Beef By-products

Based on data obtained from IMPLAN, LLC, sales were estimated for each of these sub-industries (IMPLAN, 2018). Methods for estimating these sales can be found in Appendix A. These estimated sales were then used as inputs for the second part of our study: performing an economic base analysis.

Economic Base Analysis of the US Beef Industry

As previously described, economic base analysis allows us to examine the various roles played by industries involved in on-farm beef cattle production and post-farm cattle harvest and beef processing. In particular, we analyze the ability of industries to drive economic growth by performing direct and indirect export base activities.

To develop the economic base models, national and regional input-output models were built using data and software obtained from IMPLAN, LLC (IMPLAN, 2018). These baseline models were extracted from IMPLAN and modified to account for the addition of the new sub-industries defined in the previous section. These modified models were then imported into the Automated Social Accounting Matrix (ASAM) software tool where Symmetric Input-Output Tables (SIOTs) were derived for each region (Watson, 2010-2011; Alward, 2019). Detailed methods are in Appendix B.

Data found in the SIOTs were used to estimate the economic contribution of the US beef industry. These contributions demonstrate the various roles played by the beef industry throughout the national, and regional economies. Depending on the discussion, results are presented as contributions to/from one of the 20 broad 2-digit NAICS sectors (e.g, *Real Estate and Rental and Leasing* or *Manufacturing*) or to/from one of the 549 IMPLAN derived sectors (e.g., grain farming,

[3] Includes beef cattle, culled dairy cattle, and calves sold for veal.

or dog and cat food manufacturing). A list of all 2-digit NAICS industries and their definitions in presented in Appendix C. The IMPLAN sectoring scheme is presented in Appendix D.

Results of this analysis for each region are reported in five parts:

1) ***Contributions of the 2-Digit NAICS Sectors to the Economy*** – breaks the economy of the region studied into 20 aggregated sectors and illustrates what percent of the economic activity is generated by groupings of sectors in the economy. For names and definitions of these sectors see Appendix C.

2) Relative Ranking of the Beef Industry within its Aggregate 2-Digit NAICS Sector in the Economy- The activities contained within the beef industry's on-farm production sector are captured in the NAICS sector entitled *Agriculture, Forestry, Fishing and Hunting*. The beef industry's harvest and processing activities fall within the large *Manufacturing* sector. The beef industry's contribution to sales, jobs, employee compensation and value added are ranked compared to other IMPLAN agriculture industries within the 2-digit sector. This suggests a relative importance of beef compared to other agricultural activities within the region.

3) ***Gross Contributions*** - count <u>all</u> of the measures of economic activity (sales, jobs, employee compensation and value added) that are generated from sales within the beef industry. It tells us how much economic activity exists within a region in the beef industry itself

4) ***Export Base Contributions*** –give credit to the beef industry for bringing in new dollars into the region through exports. These "export" contributions are sometimes referred to as "base" contributions. The total base contribution is the sum of the exports themselves (direct beef exports), plus associated indirect stimulation of sales from other sectors within the region (indirect beef exports).

5) ***Export Support and Local Consumption Contributions -*** actual value attributed to the beef industry as a result of local beef consumption and sales of other industries' products for export. In other words, this represents the economic activity not related to the production of beef exports.

<u>A final note about jobs:</u>
In agriculture, it is difficult to estimate employment for several reasons. One problem stems from the fact that it is common for a single farm to produce multiple agricultural commodities. In these situations, workers from the same farm may take on roles categorized under different agricultural sectors, making it difficult to assign employment to one specific sector. Another difficulty emerges when farming is the secondary occupation of the farm operator, as is often the case. In this instance, employment may be attributed to their primary occupation instead of the farm. It is also common for some amount of farm labor to come in the form of unpaid employment which is not accounted for in annual farm employment estimates.

Because of these and other difficulties, IMPLAN (the primary source of employment data for this study) has developed methods that attempt to account for some of these issues, making these estimates preferred over those available from other sources (IMPLAN, 2019).

Results

Estimating Regional Beef Sales

To analyze the US beef industry at the regional sub-industry level, it was necessary to first disaggregate existing economic data. The original national and state-level datasets obtained from IMPLAN represented data for the year 2016, with the following four sectors identified as relating to the beef industry: 1) Sector 11: Beef cattle ranching and farming; 2) Sector 89: Animal, except poultry, slaughtering; 3) Sector 90: Meat processed from carcasses; and 4) Sector 91: Rendering and meat by-product processing (IMPLAN, 2018).

For the purposes of this study, each of these beef-related sectors were disaggregated into various sub-industries with values attributable solely to on-farm beef cattle production, or post-farm cattle harvest and beef processing. Values for these sub-industries were estimated for each region and can be found in Tables 1-2. Detailed methods and output results may be found in Appendix A.

On-farm Beef Cattle Production - values pertaining to on-farm beef cattle production were originally aggregated under one IMPLAN sector (11: Beef cattle ranching and farming). This aggregate value was disaggregated to provide regional sales estimates for *Cow-calf*, *Stocker-Background*, and *Feedlot* operations[4]. Table 1 shows the regional values for beef industries analyzed within the study.

Table 1: Regional Sales Estimate for On-farm Beef Cattle Production Sub-Industries

REGION	Cow-Calf (million $'s)	Stocker-Background (million $'s)	Feedlot (million $'s)
Southern Plains	6,536	3,618	7,940
Northern Plains	5,089	62	8,746
Midwest	3,697	1,482	3,240
Northwest	3,094	275	1,447
Southwest	2,323	40	2,804
Southeast	2,995	1,219	56
Northeast	789	298	173
NATIONAL TOTAL	**24,523**	**6,994**	**24,407**

[4] Values for the on-farm production of dairy heifer replacements are found within the aggregate IMPAN sector 11, but were excluded from the analysis as those values are more properly attributed to the dairy production sector. Values estimated for dairy heifer production may be found in Appendix A.

Post-farm Cattle Harvest & Beef Processing - values pertaining to post-farm cattle harvest and beef processing were originally aggregated under three IMPLAN sectors (89: Animal, except poultry, slaughter; 90: Meat processed from carcasses; 91: Rendering and meat by-product processing). Aggregate values for each of these sectors were disaggregated to provide regional sales estimates for *Beef Cattle Harvest, Beef Processing*, and *Beef by-product* operations. Table 2 shows the regional values for cattle harvest and beef processing industries analyzed within the study[5].

Table 2: Regional Sales Estimates for Post-farm Cattle Harvest & Beef Processing Sub-Industries

REGION	Cattle Harvest (million $'s)	Beef Processing (million $'s)	Beef By-products (million $'s)
Southern Plains	18,040	7,982	390
Northern Plains	16,081	2,897	148
Midwest	14,022	10,895	197
Northwest	2,793	1,774	95
Southwest	9,571	4,252	397
Southeast	4,611	3,787	695
Northeast	5,076	7,079	293
NATIONAL TOTAL	**70,188**	**38,666**	**2,215**

These estimated sales were used as the primary inputs for the second part of our study: performing an economic base analysis. Here, sales ratios were used to in conjunction with these data to estimate other economic values for each sub-industry. Estimated economic values include jobs, employee compensation, and total value added.

[5] Values for culled dairy cattle and veal harvest and processing are included within these estimates.

Economic Base Analysis of the US Beef Industry

For this report, economic base methods were used to estimate contributions of the US beef industry at both the national, and regional levels. The following sections describe the results from each of these analyses.

National Contribution of the US Beef Industry

When examining economic contributions from an economic base perspective, it is important to appropriately define the study area in order to gain a proper understanding of what is meant by the terms "import" and "export". For a national analysis, the study area is defined as the entire US In this case, imports/exports refer to goods exchanged between the US and any foreign nation (Figure 2). From the economic base perspective, imports represent a decrease in economic growth, exports grow the national economy, and trade between industries within the country sustain the economy. As discussed in a later section, these terms take on an alternative meaning when the study area is defined in a different manner (e.g. a multi-state region).

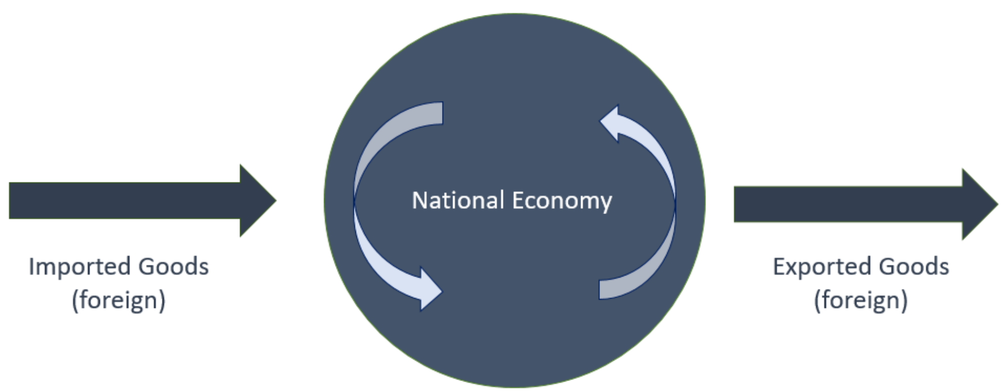


Figure 2: Representation of a National Economy

<u>Industry Overview</u>

In analyzing the economic contribution of the US beef industry, it is helpful to first gain a broad understanding of the national economy as a whole. The North American Industry Classification System (NAICS)[6] divides the economy into twenty, 2-digit sectors. Table 3 shows a breakdown of sectors by economic activity. Industries related to beef may be found within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors.

[6] See NAICS 2 Digit Sector Codes for definitions and examples: https://www.census.gov/eos/www/naics/. A brief summary of definitions is provided in Appendix C.

Table 3: Regional Contributions by 2-Digit NAICS - US (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	417,545	3,632,674	57,791	158,544
21	Mining, Quarrying, and Oil and Gas Extraction	384,864	1,345,274	75,890	255,587
22	Utilities	655,472	591,952	79,260	285,235
23	Construction	1,702,009	10,451,753	419,248	829,747
31-33	Manufacturing*	6,672,454	12,996,770	998,512	2,085,654
42	Wholesale Trade	1,628,290	6,690,815	516,152	1,088,716
44-45	Retail Trade	1,562,636	18,284,558	547,906	1,015,441
48-49	Transportation and Warehousing	1,125,117	6,756,845	330,130	567,231
51	Information	1,711,772	3,436,522	340,678	870,386
52	Finance and Insurance	2,492,762	9,707,521	734,995	1,377,550
53	Real Estate and Rental and Leasing	3,471,963	8,689,759	142,028	2,361,774
54	Professional, Scientific, and Technical Services	2,404,368	14,814,835	1,075,928	1,560,112
55	Management of Companies and Enterprises	597,304	2,425,631	303,271	368,460
56	Administrative and Support and Waste Management and Remediation Services	905,815	12,182,477	418,620	595,654
61	Educational Services	273,903	4,239,000	165,107	182,790
62	Health Care and Social Assistance	2,212,600	21,612,897	1,137,484	1,396,267
71	Arts, Entertainment, and Recreation	346,068	4,213,269	98,200	200,408
72	Accommodation and Food Services	1,019,271	15,049,914	349,631	590,092
81	Other Services (except Public Administration)	774,532	12,019,294	348,933	525,191
92	Public Administration	2,555,994	23,682,644	1,838,878	2,309,637
	Totals	**32,914,740**	**192,824,400**	**9,978,641**	**18,624,475**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

In 2016, *Manufacturing* represented the largest share of gross sales (20.3%) generated across the twenty 2-digt NAICS sectors nationwide (Table 4). In terms of jobs, *Public Administration* held the largest share (12.3%). This sector consists of establishments of federal, state, and local government agencies that administer, oversee, and manage public programs and have executive, legislative, or judicial authority over other institutions within a given area (USCB, 2017). The overall role of this sector is to offer services (as opposed to *Manufacturing* which primarily generates of goods for sale), resulting in a high share of employment versus sales for the sector. *Real Estate and Rental and Leasing* represents the greatest share of total value added (12.7%). Similar to *Public Administration*, the economic importance of the *Real Estate Rental and Leasing* sector may not be represented by gross sales, but instead can be recognized in the generation of proprietor income, other property income, and property taxes, thus capturing a high percentage of total value added.

Table 4: Share of Contributions by 2-Digit NAICS - US (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting	1.3%	1.9%	0.6%	0.9%
21	Mining, Quarrying, and Oil and Gas Extraction	1.2%	0.7%	0.8%	1.4%
22	Utilities	2.0%	0.3%	0.8%	1.5%
23	Construction	5.2%	5.4%	4.2%	4.5%
31-33	Manufacturing	20.3%	6.7%	10.0%	11.2%
42	Wholesale Trade	4.9%	3.5%	5.2%	5.8%
44-45	Retail Trade	4.7%	9.5%	5.5%	5.5%
48-49	Transportation and Warehousing	3.4%	3.5%	3.3%	3.0%
51	Information	5.2%	1.8%	3.4%	4.7%
52	Finance and Insurance	7.6%	5.0%	7.4%	7.4%
53	Real Estate and Rental and Leasing	10.5%	4.5%	1.4%	12.7%
54	Professional, Scientific, and Technical Services	7.3%	7.7%	10.8%	8.4%
55	Management of Companies and Enterprises	1.8%	1.3%	3.0%	2.0%
56	Administrative and Support and Waste Management and Remediation Services	2.8%	6.3%	4.2%	3.2%
61	Educational Services	0.8%	2.2%	1.7%	1.0%
62	Health Care and Social Assistance	6.7%	11.2%	11.4%	7.5%
71	Arts, Entertainment, and Recreation	1.1%	2.2%	1.0%	1.1%
72	Accommodation and Food Services	3.1%	7.8%	3.5%	3.2%
81	Other Services (except Public Administration)	2.4%	6.2%	3.5%	2.8%
92	Public Administration	7.8%	12.3%	18.4%	12.4%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

An examination of the contribution of the beef industry alone across the *entire* national economy shows that on-farm beef cattle production and post-farm cattle harvest and beef processing activity represent around 0.5% of national sales, 0.4% of employment, 0.1% of employee compensation, and 0.2% of total value added (Table 5).

Because the beef industry represents one of many hundreds of industries that make up the twenty 2-digit NAICS sectors, it is no surprise that the beef industry's contribution to the overall economy appears small. A better presentation of the beef industry's importance may be demonstrated by its relative contribution to its own 2-digit NAICS sectors. That is, we examine: *How does the beef industry contribute to an economy relative to other agricultural industries within the study region?*

Table 5: Share of Beef Contributions to the National Economy - US (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	% of US	Beef Industry	% of US	Beef Industry	% of US	Beef Industry	% of US
Cow-Calf	24,523	0.07%	238,335	0.12%	582	0.01%	5,994	0.03%
Stocker-Background	6,994	0.02%	67,976	0.04%	166	0.00%	1,710	0.01%
Feed Lot	**24,407**	**0.07%**	**237,208**	**0.12%**	**579**	**0.01%**	**5,966**	**0.03%**
On-farm Beef Cattle Production	***55,924***	***0.17%***	***543,519***	***0.28%***	***1,327***	***0.01%***	***13,669***	***0.07%***
Cattle Harvest	70,189	0.21%	100,342	0.05%	5,151	0.05%	10,084	0.05%
Beef Processing	38,665	0.12%	73,269	0.04%	4,065	0.04%	5,964	0.03%
Beef By-products	2,215	0.01%	4,358	0.00%	302	0.00%	365	0.00%
Post-farm Harvest and Processing	*111,069*	*0.34%*	*177,969*	*0.09%*	*9,517*	*0.10%*	*16,413*	*0.09%*
Beef Industry Total	**166,993**	**0.51%**	**721,488**	**0.37%**	**10,844**	**0.11%**	**30,082**	**0.16%**

On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* 2-digit NAICS sector[7]. Within this sector, on-farm beef cattle production represents13.4% of sales, 15.0% of jobs, 2.3% of employee compensation and 8.6% of total value added (Figure 3).

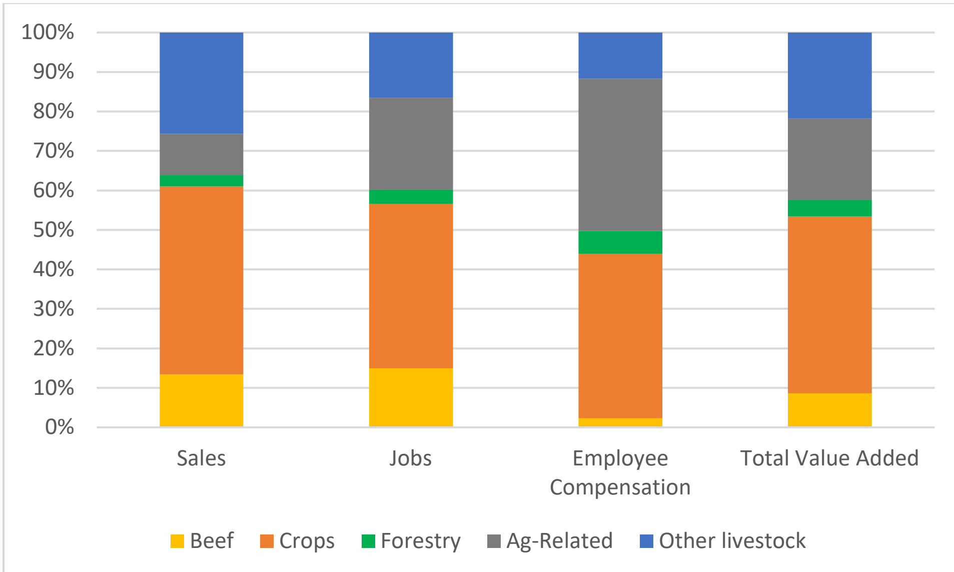


Figure 3: Share of Contributions for Agriculture, Forestry, Fishing and Hunting Sector Industries

Table 6 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Across all 19 industries, on-farm beef cattle production ranks 2nd in terms of sales, jobs, and total value added to the sector. The grain farming industry had the highest sales given its importance in nutrition for both humans and animals. Support activities for agriculture and forestry represent businesses providing services for agricultural and forest production. Some of these services such as breeding and livestock spraying are contracted by beef cattle producers. Therefore, a portion of jobs, employee compensation, and total value added that is reported for the support activities for agriculture and forestry sector occur as a result of sales being generated by beef and other industries. Because of this, support activities for agriculture and forestry showed the greatest number of jobs, employee compensation and total value added among the US *Agriculture, Forestry, Fishing, and Hunting* industries (Table 6).

[7] For a list of industries included under the *Agriculture, Forestry, Fishing, and Hunting* sector see Appendix D.

Table 6: Top Ten Agriculture, Forestry, Fishing, and Hunting Industries by Sales - US (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Grain farming	1	6	13	8
On-farm beef cattle production	2	2	12	2
Oilseed farming	3	12	18	3
Poultry and egg production	4	11	8	10
Support activities for agriculture and forestry	5	1	1	1
Dairy cattle and milk production	6	10	9	6
Animal production, except cattle and poultry and eggs	7	5	10	4
Fruit farming	8	4	2	5
Vegetable and melon farming	9	9	5	7
All other crop farming	10	3	4	11

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. Within this sector, post-farm cattle harvest and beef processing activities represented 1.7% of sales, 1.4% of jobs, 1.0% of employee compensation, and 0.8% of total value added. While the value of beef product manufacturing may appear relatively small, the aggregate *Manufacturing* sector is made up of hundreds of industries, covering all forms of manufacturing - from the production of beef products, to cars, to pesticides and pharmaceuticals. Because of this, it may be more relevant to consider the beef industry in comparison to industries that manufacture agricultural goods[8]. In 2016, agriculture related industries in *Manufacturing* made up 23.7% of *Manufacturing* sales, 25.8% of *Manufacturing* jobs, 18.5% *Manufacturing* employee compensation and 18.6% of *Manufacturing* value added in the US economy. Across agriculture-related manufacturing, post-farm cattle harvest and beef processing represented 7.0% of total agriculture-related manufacturing sales, 5.3% of jobs, and 5.1% of employee compensation and 4.2% of total value added (Figure 4).

[8] For a list of agriculture related manufacturing industries considered within this analysis, see Appendix D.

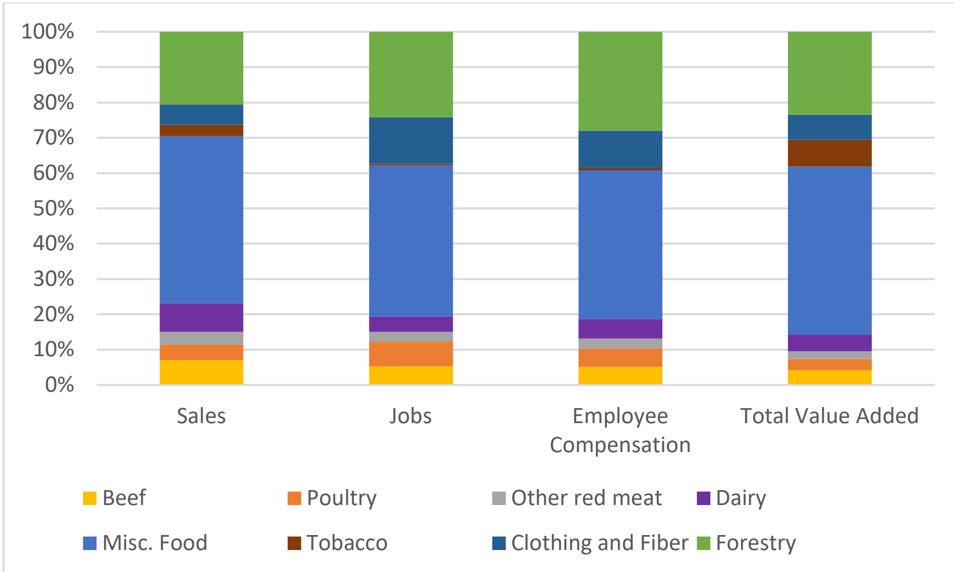


Figure 4: Share of Industry Contributions to Agriculture-Related Manufacturing

The post-farm cattle harvest and beef processing industry ranks among the top of agricultural manufacturing industries, placing 1st in sales, 3rd in jobs, 4th in employee compensation, and 3rd in value added out of the eighty-eight agriculture-related manufacturing industries (Table 7). The US is home to scores of bakery and bread manufacturing plants owned by Bilbo, Campbells Foods and others, producing nationally recognized name products (Pepperidge Farm, Hostess, Sara Lee, Mrs. Bairds, Arnold, among others) as well as dozens of regional brands. These manufacturing activities exist in some degree in every region of the US, thrusting this industry into the number one spot in terms of jobs and employee compensation.

Table 7: Top Industry Rankings for Agriculture-Related Manufacturing - US (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Cattle harvest and beef processing	1	3	4	3
Bottled and canned soft drinks & water	2	5	5	6
Poultry processing	3	2	3	9
Paperboard container manufacturing	4	4	2	4
Bread and bakery product, except frozen, manufacturing	5	1	1	2
Other red meat harvest and processing	6	6	6	8
Paper mills	7	13	40	1
Tobacco product manufacturing	8	65	22	22
Other animal food manufacturing	9	25	17	23
Cheese manufacturing	10	19	4	3

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity generated within the beef industry itself?**

Gross economic contributions represent a simple count of all the measures of economic activity (sales, jobs, employee compensation, and value added) that are generated from sales made by an industry. In 2016, the US beef industry generated almost $167.0 billion in gross sales, equating to 721,488 jobs. In addition to selling beef products and providing jobs, the industry also brings value to the economy in the form of employee compensation, proprietary income, returns to capital and indirect business taxes. These items, collectively known as “value added”, totaled almost $30.1 billion for the beef industry during 2016 (Table 8).

Of the total beef industry value, on-farm beef cattle production represented $55.9 billion of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $24.5, $7.0, and $24.4 billion respectively. These sales represent over 543,519 jobs, resulting in the payment of more than $1.3 billion in employee compensation and almost $13.7 billion in total value added being generated across the region (Table 8).

Sales from post-farm cattle harvest and beef processing made up the remaining $111.1 billion in gross sales with beef harvest, beef processing, and beef by-products contributing $70.2, $38.7, and $2.2 billion respectively. These sales generated 177,969 jobs, resulting in the payment of more than $9.5 billion in employee compensation and over $16.4 billion in total value added being generated across the region (Table 8).

Table 8: Gross Economic Contributions of Beef - US (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	24,523	238,335	582	5,994
Stocker/Backgrounding	6,994	67,976	166	1,710
Feedlot	24,407	237,208	579	5,966
On-farm Production Total	**55,924**	**543,519**	**1,327**	**13,669**
Cattle Harvest	70,188	100,342	5,151	10,084
Beef Processing	38,666	73,269	4,065	5,964
Beef By-products	2,215	4,358	302	365
Post-farm Harvest and Processing Total	**111,070**	**177,969**	**9,517**	**16,413**
BEEF INDUSTRY TOTAL	***166,994***	***721,488***	***10,844***	***30,082***

Beef Export Contributions

Here, we consider: **How much value is the beef industry responsible for generating across the entire economy through the production of beef goods for export?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the added economic activity (in terms of sales, jobs, employee compensation and value added) that are generated *within the beef industry* as a result of beef exports. In 2016, the US beef industry generated more than $17.9 billion in direct export sales (Table 9) to countries such as Japan, South Korea, Mexico and Canada (USDA ERS, 2020c). These direct beef export sales equate to 4.0% of jobs, 13.6% of employee compensation and 8.8% of total value (from table 8) generated by the entire beef industry that year.

Of this beef industry direct export value, on-farm beef cattle production represented $127 million of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $56, $16, and $56 million respectively. These sales represent 1,239 jobs and generated around $3 million in employee compensation and $31 million in value added across the region (Table 9).

Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($17.8 billion), with beef harvest, beef processing, and beef by-products contributing $13.1 billion, $4.4 billion, and $308 million respectively. These sales represent 27,733 jobs and generated almost $1.5 billion in employee compensation and over $2.6 billion in total value added across the region (Table 9).

Table 9: Direct Beef Export Contributions - US (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	56	543	1	14
Stocker/Backgrounding	16	155	0	4
Feedlot	56	541	1	14
On-farm Production Total	**127**	**1,239**	**3**	**31**
Cattle Harvest	13,095	18,720	961	1,881
Beef Processing	4,437	8,407	466	684
Beef By-products	308	606	42	51
Post-farm Harvest & Processing Total	**17,839**	**27,733**	**1,469**	**2,616**
BEEF INDUSTRY TOTAL	***17,967***	***28,973***	***1,472***	***2,648***

Indirect Beef Export Contributions

While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or veterinary services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms (in the section above titled "Gross Economic Contributions"), the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the "feed store" or retail sector. However, with economic base analysis, the value is credited to the beef industry, as it is exports from beef that are ultimately responsible for generating these sales. This economic activity is referred to as indirect beef export contributions.

US beef exports were indirectly responsible for generating $44.3 billion in sales across other local industries. These indirect beef export sales equate to 291,743 jobs, $8.6 billion in employee compensation and $19.9 billion in total value generated in other parts of the economy (Table 10).

Of this indirect beef export value, on-farm beef cattle production represented $219 million in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $96, $27, and $96 million respectively. These sales represent more than 1,200 jobs, resulting in the payment of $52 million in employee compensation and $108 million in total value added being generated within other industries across the region (Table 10).

Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($44.1 billion), with beef harvest, beef processing, and beef by-products contributing $32.6 billion, $10.8 billion, and $625 million respectively. These indirect sales represent over 290,500 jobs, and generated more than $8.5 billion in employee compensation and almost $19.8 billion in total value added in other industries across the region (Table 10).

Table 10: Indirect Beef Export Contributions - US (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	96	534	23	47
Stocker/Backgrounding	27	153	7	14
Feedlot	96	532	23	47
On-farm Production Total	**219**	**1,218**	**52**	**108**
Slaughtering	32,645	224,601	6,310	14,826
Carcass Processing	10,834	62,557	2,102	4,625
Rendering and By-Products	625	3,367	151	301
Post-farm Harvest & Processing Total	**44,105**	**290,525**	**8,563**	**19,753**
BEEF INDUSTRY TOTAL	***44,323***	***291,743***	***8,615***	***19,861***

The level of these indirect contributions varies across industries. Table 11 presents the top industries in terms of economic activity generated as a result of beef industry export production. For example, on farm production requires the purchase and/or rent of land to raise cattle. Of all the real-estate expenditures required for production, approximately $11.1 million goes toward producing beef exports. In turn, this $11.1 million in real estate purchases generates 53 jobs and $8.1 million in value added within the real estate sector. Further, like most industries, the beef industry requires a lot of credit (loans) to operate, and needs places for employees to live. Together they bring added value to the monetary authorities and depository credit intermediation[9] and owner-occupied dwellings[10] sectors (Table 11). Of all of the real-estate based expenditures required for post-farm harvest and processing, $1.4 million of it goes towards producing beef exports. This result is expected as less land is needed for post-farm activities compared to on-farm production. With the exception real-estate, economic activity generated through on-farm beef cattle activity is relatively lower than that associated with post-farm harvest and processing as most of the exports are generated from the post-farm harvest and processing industry (Table 11).

[9] The *Monetary Authorities and Depository Credit Intermediation* sector represents establishments that engage in central banking functions and those that are primarily engaged in accepting deposits and in lending funds from those deposits. Therefore, additional value is gained through the use of banking institutions for deposits and lending that results from value generated in the production of beef exports.
[10] The *Owner-occupied Dwelling* industry represents the value of housing services provided to occupants who own their homes. This is comparable to the hypothetical value of rent paid for housing, or in other words, a landlord renting to him or herself. This implies that a portion of value added generated through the export of beef products represents the value of housing for those that own their own homes.

Table 11: Economic Activity Generated by Beef Exports - Top Industries

Sales	**On-farm Production**	Wholesale trade	$19,504,000
		Other animal food manufacturing	$14,559,000
		Real estate	$11,140,000
		Grain farming	$10,083,000
		Support activities for agriculture and forestry	$8,608,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$7,295,929,000
		Wholesale trade	$2,534,807,000
		Animal production, except cattle and poultry and eggs	$2,506,924,000
		Truck transportation	$2,072,824,000
		Real estate	$1,446,000
Jobs	**On-farm Production**	Support activities for agriculture and forestry	174
		Wholesale trade	80
		All other crop farming	66
		Real estate	53
		Truck transportation	46
	Post-farm Harvest and Processing	On-farm beef cattle production	70,908
		Animal production, except cattle and poultry and eggs	31,186
		Support activities for agriculture and forestry	13,817
		Truck transportation	12,812
		Dairy cattle ranching and farming	10,769
Value Added	**On-farm Production**	Wholesale trade	$13,041,000
		Real estate	$8,092,000
		Support activities for agriculture and forestry	$6,505,000
		Owner-occupied dwellings	$4,992,000
		Monetary authorities and depository credit intermediation	$3,406,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$1,783,320,000
		Wholesale trade	$1,694,837,000
		Animal production, except cattle and poultry and eggs	$1,395,069,000
		Real estate	$1,050,488,000
		Truck transportation	$912,963,000

Note: *The contributions to the post-farm harvest and processing sectors greatly outweigh those from on-farm because most exports are generated from the post-farm harvest and processing sector, thus some of the value from the on-farm production sectors is credited to post-farm harvest and processing industries.*

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries and provide beef products for local consumption?**

In addition to bringing new money into the US through the direct sale of beef exports, the beef industry also plays a supporting role within the national economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, non-beef businesses and consumers across the country purchased $149.0 billion worth of goods from the US beef industry. The presence of the beef industry in the US not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the country by supporting the production of exports across other industries. These export support and local consumption sales were responsible for generating 692,515 jobs, $9.4 billion in employee compensation and $27.4 billion in total value added. (Table 12).

Table 12: Export Support and Local Consumption Contributions - US (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	24,467	237,792	580	5,980
Stocker/Backgrounding	6,978	67,821	166	1,706
Feedlot	24,351	236,667	578	5,952
On-farm Production Total	**55,796**	**542,280**	**1,324**	**13,638**
Cattle Harvest	57,094	81,622	4,190	8,203
Beef Processing	34,230	64,862	3,598	5,280
Beef By-products	1,907	3,752	260	314
Post-farm Harvest & Processing Total	**93,230**	**150,235**	**8,048**	**13,797**
BEEF INDUSTRY TOTAL	***149,027***	***692,515***	***9,372***	***27,435***

As with Indirect beef export contributions, the level of these export support and local consumption contributions varies across industries. Table 13 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production. The households and government spending industries represent the bulk of local consumption activity occurring within the region[11]. The link between on-farm and post-farm export activity can be seen as on-farm beef cattle producers sold $7.3 billion to post-farm cattle harvest and beef processing to support their production of exports (Table 13). Scientific research and development and custom computer programming services represent a significant share of value generated across the US economy. Because of this, those industries show strong consumption interactions with the beef industry (and most other industries across the US). As will later be seen, these contributions primarily stem from regions where tech and scientific research are key economic players.

Table 13: Export Support and Local Consumption Contributions - US (2016)

Sales	**On-farm Production**	Households	$24,234,595,000
		Post-farm cattle harvest and beef processing	$7,295,929,000
		Government spending	$6,106,703,000
		Other red meat processing	$3,257,354,000
		Scientific research and development services	$1,248,350,000
	Post-farm Harvest & Processing	Households	$49,379,690,000
		Government spending	$12,424,069,000
		Scientific research and development services	$2,468,468,000
		Wholesale trade	$1,770,715,000
		Custom computer programming services	$1,529,661,000
Jobs	**Beef Cattle Production**	Households	235,533
		Beef processing	70,908
		Government spending	59,350
		Other red meat processing	31,658
		Scientific research and development services	12,133
	Beef Processing	Households	79,732
		Government spending	20,052
		Scientific research and development services	3,980
		Wholesale trade	2,854
		Custom computer programming services	2,465
Value Added	**Beef Cattle Production**	Households	$5,923,581,000
		Beef processing	$1,783,320,000
		Government spending	$1,492,641,000
		Other red meat processing	$796,184,000
		Scientific research and development services	$305,130,000
	Beef Processing	Households	$7,310,614,000
		Government spending	$1,839,165,000
		Scientific research and development services	$365,329,000
		Wholesale trade	$262,045,000

[11] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

Regional Contributions to the US Beef Industry

Although the beef industry plays a significant role in both growing and maintaining the US economy, regional differences in contributions can be found across the nation. Certain regions are more specialized in the production of cattle and calves to be sold to other beef cattle producers for breeding or finishing. Some regions may house large numbers of cattle on feedlot operations, or contain processing facilities, giving them an advantage in the processing of beef processing. Looking beyond beef cattle production or processing alone, the regional production of inputs used in the production of beef products may affect how the beef industry interacts with other businesses in the economy. To examine these interactions, the following section analyzes the contributions of the beef industry across seven US regions.

When examining regional contributions, it's important to recognize the difference between "regional" imports/exports and "national" imports/exports. While national imports and exports refer to goods exchanged in relation to foreign nations, regional imports and exports take on a different meaning. Since the regional economy is the primary focus, imports and exports refer to any good, both foreign AND domestic that is either entering the region for final use (import), exiting the region for final sale (export) (Figure 5).

Figure 5: Representation of a Regional Economy

The next section provides an overview of the US beef industry in terms of the respective regional contributions. While the sum of gross regional contributions should equal gross national contributions, it should be noted that, because of differences in how national versus regional economies are defined (see Figs. 2 & 5 above), regional export base and local contributions are not comparable to those given at the national level.

OVERVIEW OF REGIONAL CONTRIBUTIONS

A regional comparison of contributions of the beef industry offers insight into the comparative strength of beef on-farm production and post-farm harvest and processing activities across the country.

Regional Contributions to the US Beef Industry

Table 14 shows the gross value of sales, jobs, employee compensation and value added for each region, and for the US as a whole[12]. In 2016, the Southern Plains was the greatest contributor of economic activity for the US beef industry. This region alone represented $44.5 billion in beef industry sales, 242,225 beef industry jobs, $2.5 billion in compensation paid to beef employees, and $8.5 billion in total value added. This equates to 26.7%, 33.6%, 23.4%, and 28.3 % of the national beef industry total (Table 15). The Midwest and Northern Plains were also major contributors to the total share of economic activity across the US beef industry, generating 20.1% and 19.8% of total beef industry sales, as well as a significant portion jobs employee compensation and value added for the industry (Table 15).

Table 14: Beef Industry Total Economic Activity - 2016

Region:	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
United States	166,994	721,488	10,844	30,082
Southern Plains	44,508	242,225	2,538	8,515
Northern Plains	33,023	85,863	1,871	5,764
Midwest	33,533	130,161	2,489	6,392
Northwest	9,477	43,205	492	1,835
Southwest	19,388	61,623	1,331	2,849
Southeast	13,363	105,645	843	2,515
Northeast	13,707	50,341	1,240	2,223

[12] Values for the District of Columbia are included within the US values, but were excluded from the regional analysis due to lack of data. Because of this, the sum of the regions is slightly less than the US total.

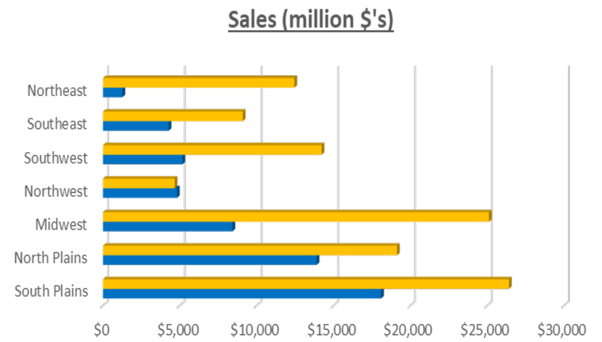
Table 15: Regional Share of US Beef Industry by Economic Activity

Region:	Sales	Jobs	Employee Compensation	Value Added
Southern Plains	26.7%	33.6%	23.4%	28.3%
Northern Plains	19.8%	11.9%	17.3%	19.2%
Midwest	20.1%	18.0%	23.0%	21.2%
Northwest	5.7%	6.0%	4.5%	6.1%
Southwest	11.6%	8.5%	12.3%	9.5%
Southeast	8.0%	14.6%	7.8%	8.4%
Northeast	8.2%	7.0%	11.4%	7.4%

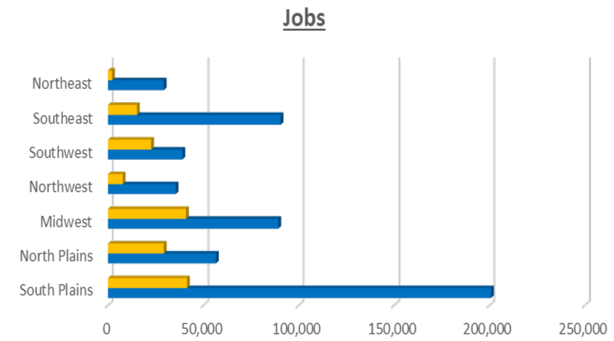
The US beef industry is comprised of both on-farm production and post-farm harvest and processing activities. Figure 6 compares the economic contributions from these industries across regions. With the exception of post-farm employee compensation in the Midwest, the Southern Plains region leads in both on-farm production, and post-farm harvest and processing activities. across all economic activities: sales, jobs, employee compensation, and value added.

In comparing the beef industry activities across all regions, post-farm harvest and processing sales are greater than the on-farm production sales value for almost every region. This is expected as the processing industry transforms beef cattle into products that are sold at a higher value, thus resulting in a higher value for the industry's sales.

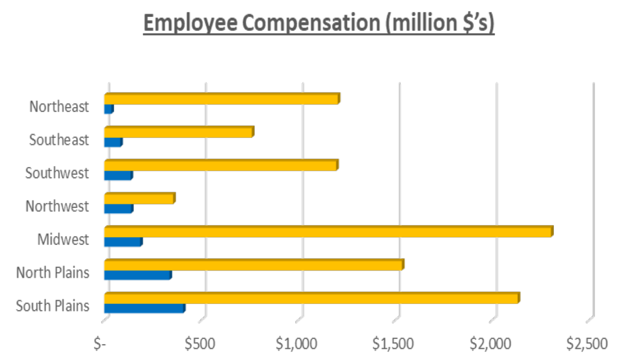
When looking at employment in on-farm production versus post-farm harvest and processing industries, on-farm appears to employ significantly more workers than post-farm firms. **However, this value can be misleading as employment values are measured in terms of head counts, not full-time equivalents.** This means that workers brought in seasonally, or those working only a few days a year are included in the employment value. While it is common for producers to hire seasonal workers, processing plants generally hire full-time, or part-time employees that work year-round. The median wage rate for a post-farm harvesting and processing employee in the US is roughly $20 per hour versus $13 per hour for farmworkers (BLS, 2020). While it would seem intuitive that higher employment in the production sector might offset this wage disparity, the difference in seasonal versus permanent employment within the two sectors of the beef industry negates this reasoning. Individual workers employed in the post-farm harvest and processing industry are paid higher wages, while working more total hours, resulting in the greater value for gross employee compensation shown in Figure 6. This helps to explain the higher employment value for on-farm production, as well as the higher compensation value shown for post-farm harvest and processing across regions.



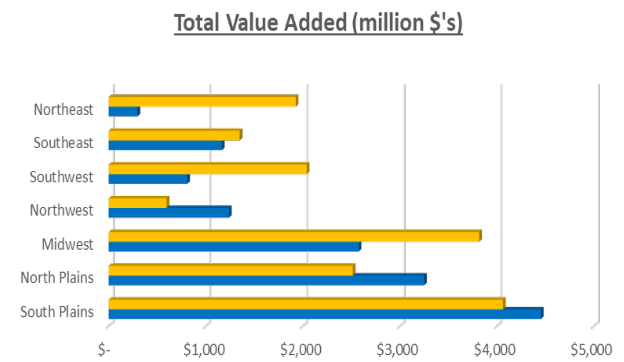
	South Plains	North Plains	Midwest	Northwest	Southwest	Southeast	Northeast
Processing	$26,413	$19,126	$25,114	$4,661	$14,220	$9,092	$12,448
Production	$18,095	$13,898	$8,420	$4,815	$5,168	$4,270	$1,259



	South Plains	North Plains	Midwest	Northwest	Southwest	Southeast	Northeast
Processing	41,424	29,262	40,886	7,719	22,612	15,176	2,110
Production	200,802	56,601	89,274	35,486	39,012	90,469	29,231



	South Plains	North Plains	Midwest	Northwest	Southwest	Southeast	Northeast
Processing	$2,132	$1,535	$2,304	$355	$1,196	$761	$1,204
Production	$406	$336	$185	$137	$135	$82	$36



	South Plains	North Plains	Midwest	Northwest	Southwest	Southeast	Northeast
Processing	$4,062	$2,515	$3,817	$596	$2,040	$1,349	$1,927
Production	$4,453	$3,249	$2,575	$1,239	$809	$1,166	$296

Figure 6: Regional Beef Industry Gross Contributions

Regional Contributions by Share of US Total

Analyzed in a different way, regional contributions show the respective impact that on-farm and post-farm beef activities make across the US. The charts in Figures 7 and 8, show the share that each region contributes to the overall US total in terms of on-farm beef cattle production (Figure 7) and post-farm cattle harvest and beef processing (Figure 8)

Figure 7 shows the regional share of the US on-farm beef cattle production industry in terms of gross sales, jobs, employee compensation, and value-added contributions. As expected, the Southern Plains holds the greatest share of contributions across the board, with this single region representing 32.9% of on-farm beef cattle sales, 37.9% of on-farm jobs, 27.8% of employee compensation, and 31.5% of total value added. The Northern Plains and Midwest regions also made significant contributions to US on-farm beef cattle production.

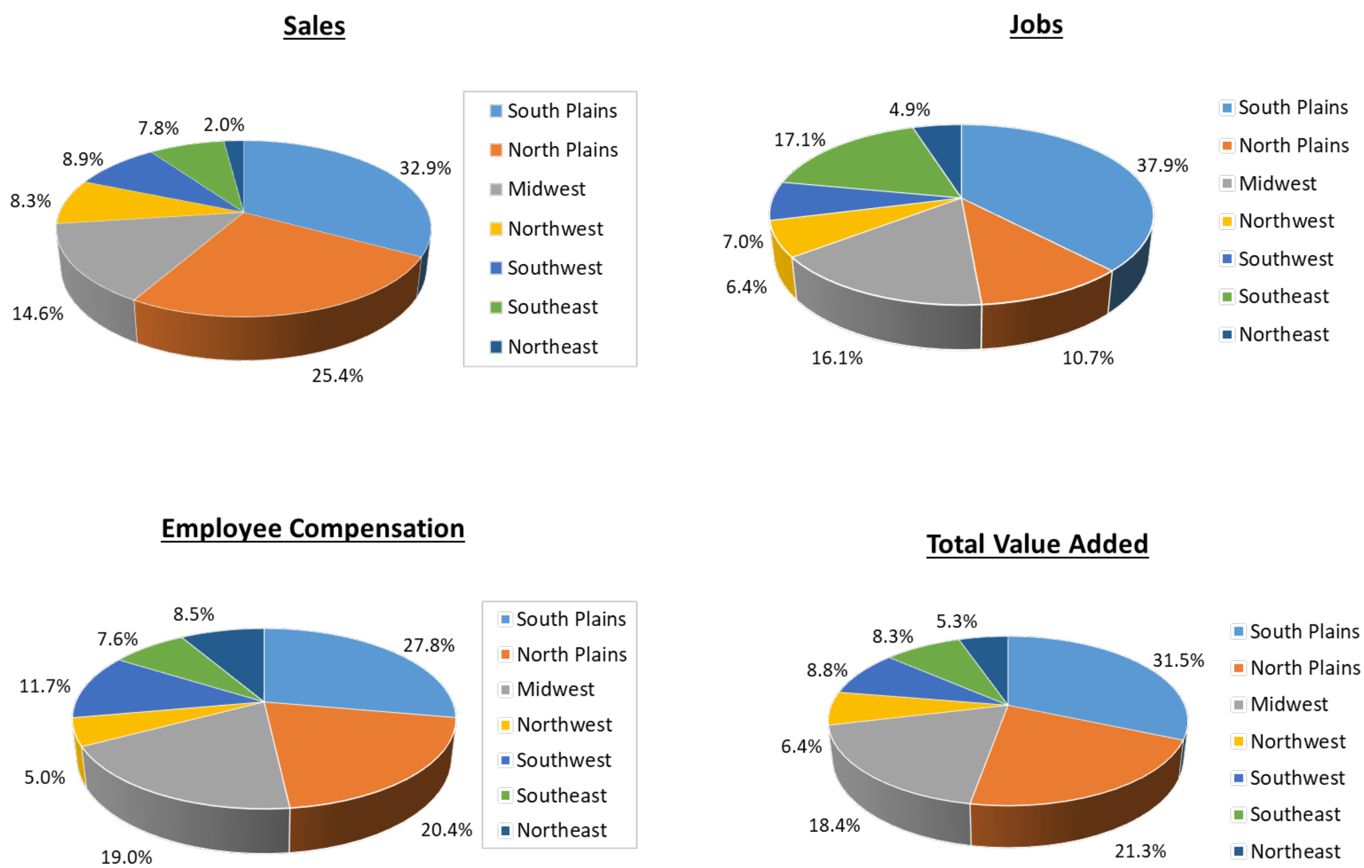


Figure 7: Regional Share of US On-farm Beef Cattle Production Contributions

Figure 8 shows the regional share of the US post-farm cattle harvest and beef processing industry in terms of gross sales, jobs, employee compensation, and total value-added contributions. In contrast to on-farm beef cattle production where contributions from the Southern Plains region were notably greater than all other regions, post-farm contributions show the Southern Plains contribution being only slightly higher the Midwest for sales, jobs, and value added, with the Midwest being the largest contributor to post-farm employee compensation across the US. This is due to the comparatively large manufacturing sector present in the Midwest.

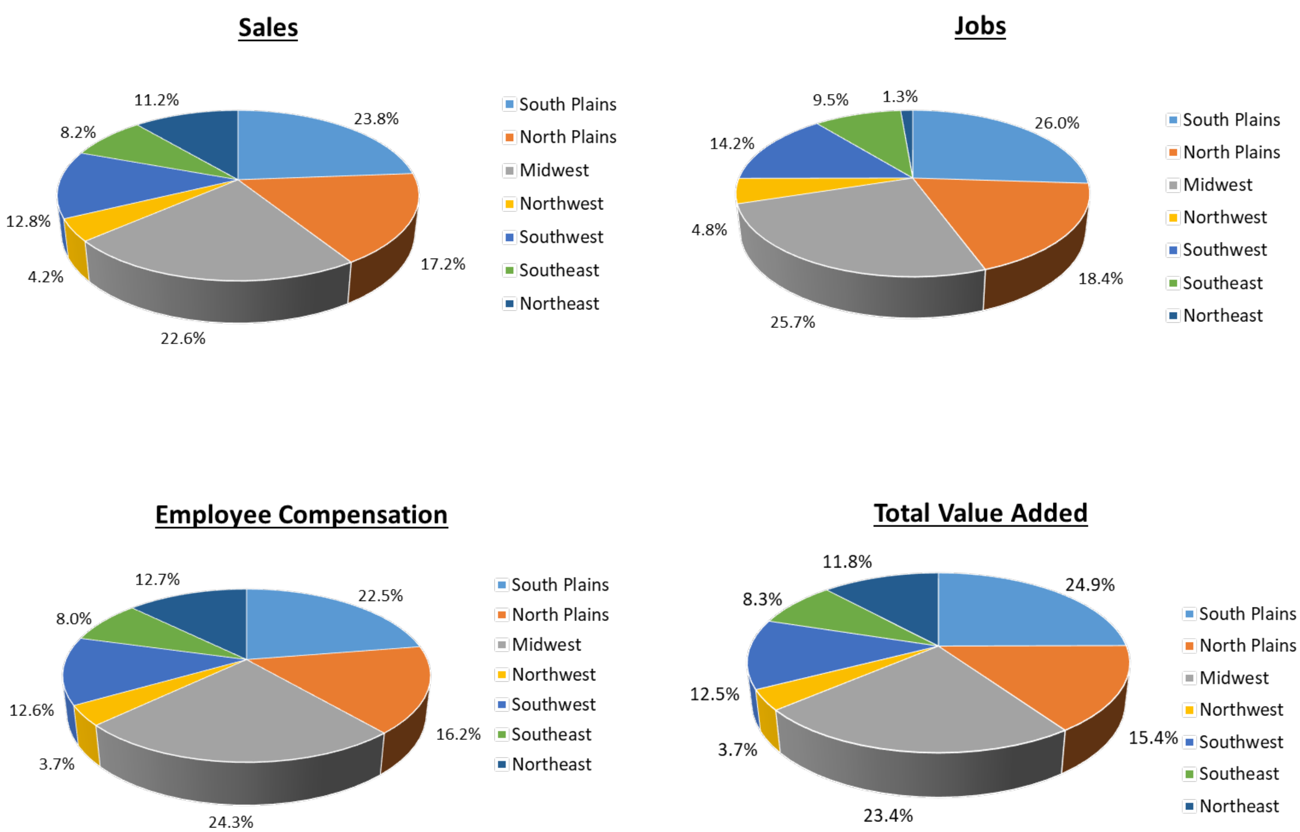


Figure 8: Regional Share of US Post-farm Cattle Harvest and Beef Processing Contributions

Beef Contributions by Share of Regional Total

Table 16 presents the economic contributions of the beef industry as a percentage of each region's total economic activity. Here, we find that the US beef industry as a whole represented only 0.5% of total sales, 0.4% of jobs, 0.1% of employee compensation, and 0.2% of value added for the US in 2016. While shares of economic contributions made by the beef industry may appear somewhat low when looking at the national economy as a whole, Table 16 highlights some of the differences in the relative importance of the beef industry across different regions. For instance, although beef sales represent only 0.5% of total US sales, in the Northern Plains, sales from the beef industry represent a notably larger share (7.6%) of the regional economy. The beef industry contributed a larger percentage of sales, jobs, employee compensation and value added in the Northern Plains and Southern Plains regions than in any other region studied. The percentage contributions of the beef industry in the Midwest and Northwest regions was similar to the percentage contributions for the US as a whole. Percentage contributions in the Southwest, Southeast, and Northeast were slightly lower than those at the national level (Table 16).

Table 16: Beef Industry Gross Contributions (% of regional value)

Region:	Sales	Jobs	Employee Compensation	Value Added
United States	0.5%	0.4%	0.1%	0.2%
Southern Plains	1.2%	1.2%	0.3%	0.4%
Northern Plains	7.6%	3.4%	1.7%	2.7%
Midwest	0.6%	0.4%	0.2%	0.2%
Northwest	0.6%	0.4%	0.1%	0.2%
Southwest	0.3%	0.2%	0.1%	0.1%
Southeast	0.2%	0.2%	0.0%	0.1%
Northeast	0.2%	0.1%	0.0%	0.0%

Beyond examining contributions as a percentage of the overall economy, a clearer picture of the relative importance of the beef industry is better seen in its gross contributions made to the agricultural portions of the economy. Here, on-farm production represents 13.4% of total sales stemming from US *Agriculture, Forestry, Fishing, and Hunting* sector, with these operations providing 15.0% of jobs, 2.3% of employee compensation, and 8.6% of total value added (Table 17). On-farm production held the greatest share of regional economic value across the Southern and Northern Plains, with each representing almost 34% of sales and 38% of jobs from agriculture, respectively.

When looking at agricultural related manufacturing within each region, beef was the #1 ag-related manufacturing industry in terms of sales, jobs, employee compensation, and value added for both the Southern and Northern Plains regions. Nationally, beef manufacturing ranked #1 in sales, #3 in jobs, #4 in employee compensation and #3 in total value added. Beef manufacturing contributions were largest in the Northern Plains where the beef industry represented almost half (47.0%) of all ag-related manufacturing sales generated, 44.2% of jobs, 44.1% of employee compensation and 40.6% of value added by ag-related manufacturing in the region (Table 18).

Table 17: On-farm Beef Gross Contributions to Agriculture, Forestry, Fishing and Hunting Sector (% of regional value and rank within sector)

Region:	Sales %	Sales Rank	Jobs	Jobs Rank	Employee Compensation	Employee Compensation Rank	Value Added	Value Added Rank
United States	13.4%	2	15.0%	2	2.3%	12	8.6%	2
Southern Plains	38.0%	1	40.5%	1	8.4%	4	27.6%	1
Northern Plains	33.7%	1	38.9%	1	21.3%	2	28.0%	1
Midwest	7.9%	4	13.3%	3	2.6%	10	7.9%	5
Northwest	13.5%	1	10.1%	4	1.8%	9	7.3%	5
Southwest	6.7%	6	5.4%	3	0.7%	8	0.8%	8
Southeast	5.6%	6	11.1%	3	0.8%	15	4.0%	11
Northeast	3.7%	8	6.8%	3	0.7%	12	2.3%	11

Table 18: Post-farm Beef Contributions to the Ag-related Manufacturing Sector (% of regional value and rank within sector)

Region:	Sales	Sales Rank	Jobs	Jobs Ranks	Employee Compensation	Employee Compensation Rank	Value Added	Value Added Rank
United States	7.0%	1	5.3%	3	5.1%	4	4.2%	3
Southern Plains	20.2%	1	15.3%	1	17.3%	1	15.4%	1
Northern Plains	47.0%	1	44.2%	1	44.1%	1	40.6%	1
Midwest	7.0%	2	6.2%	3	5.9%	4	5.0%	4
Northwest	5.3%	4	3.7%	7	3.2%	7	3.1%	8
Southwest	6.6%	3	4.3%	4	4.3%	6	2.0%	6
Southeast	2.0%	15	1.6%	15	1.5%	19	1.0%	21
Northeast	4.2%	5	3.1%	3	3.1%	7	2.6%	13

Regional Economic and Environmental Impact Contributions

A recent study quantified the regional environmental sustainability characteristics of US beef production (Thoma et al., 2020b). In Figure 9, each region's percentage contribution to sales, jobs, employee compensation and value added were included with those environmental characteristics in order to compare relative economic and environmental contributions by region. In general, the share of economic contributions tended to mirror the share of environmental impacts generated across regions. For example, the Southern Plains region exhibits higher levels of environmental impacts across most categories, however, as previously discussed, this region also generates greater economic contributions across each type of economic activity. Variation in levels of economic activity versus environmental impacts across regions may be caused by differences in the dominant type of beef industry activity occurring within the region. For example, economic and environmental contributions between the Northwest and Northeast regions appear to be opposing, however, the Northwest region favors on-farm beef production over post-farm processing, resulting in greater levels of land use, water consumption, and other environmental impacts associated with raising beef cattle. On the other hand, economic activity generated by the beef industry in the Northeast relies more heavily on post-farm processing, offering a greater economic value and comparatively lower environmental footprint.

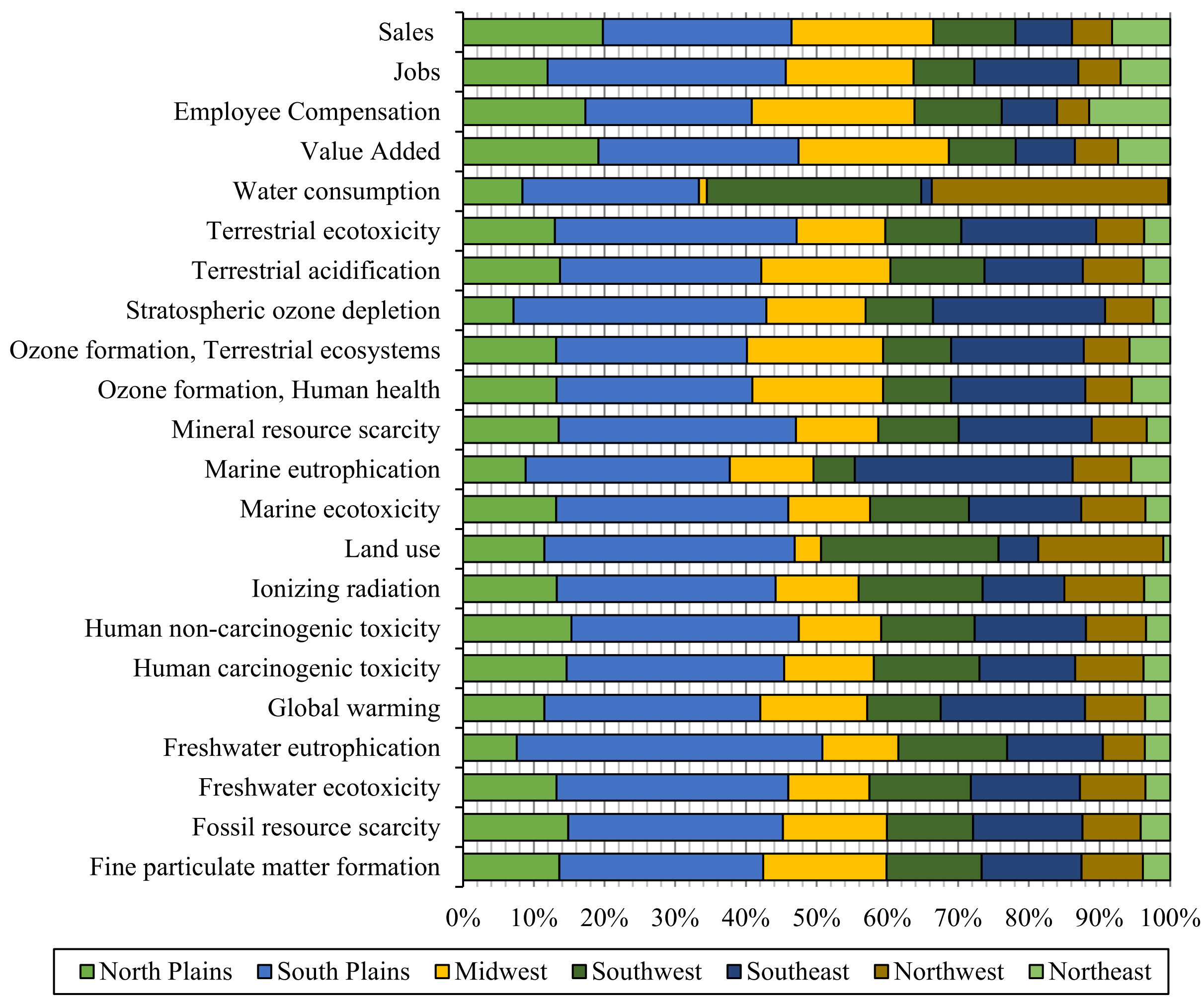


Figure 9: Regional Economic and Environmental Impact Contributions

Regional Details

The remainder of this report focuses on providing more details regarding the contributions of the beef industry in the various regions of the US. Each section is structured similar to that of the national contribution discussion and therefore some information may seem repetitive. However, this approach allows for a stand-alone report of the contributions made by the beef industry within each study region.

SOUTHERN PLAINS: (Kansas, Oklahoma, Texas)

Industry Overview

To understand the broad contributions of the beef industry to the regional economy, results were first analyzed at the 2-digit North American Industry Classification System (NAICS) level.[13] Table 19 shows a breakdown of the Southern Plains economy by NAICS sector and type of economic activity. Industries related to beef are found within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors.

Table 19: Regional Contributions by 2-Digit NAICS - Southern Plains (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	47,616	495,506	4,809	16,121
21	Mining, Quarrying, and Oil and Gas Extraction	186,916	626,638	40,479	141,974
22	Utilities	89,528	75,646	9,630	42,760
23	Construction	222,426	1,344,628	53,729	109,077
31-33	Manufacturing*	826,816	1,224,103	97,549	247,220
42	Wholesale Trade	209,588	785,455	61,440	146,246
44-45	Retail Trade	165,708	1,943,468	55,552	108,221
48-49	Transportation and Warehousing	139,801	773,190	41,387	69,783
51	Information	149,993	304,556	24,077	64,934
52	Finance and Insurance	242,031	1,133,864	64,182	111,929
53	Real Estate and Rental and Leasing	315,692	841,268	16,091	207,478
54	Professional, Scientific, and Technical Services	222,089	1,448,773	98,051	142,892
55	Management of Companies and Enterprises	45,760	207,506	21,653	26,183
56	Administrative and Support and Waste Management and Remediation Services	102,681	1,349,026	46,936	69,435
61	Educational Services	16,683	304,538	10,024	11,001
62	Health Care and Social Assistance	197,131	2,028,336	100,985	122,814
71	Arts, Entertainment, and Recreation	24,247	329,695	6,357	12,899
72	Accommodation and Food Services	107,652	1,611,058	33,627	61,329
81	Other Services (except Public Administration)	82,669	1,303,611	35,476	55,937
92	Public Administration	256,540	2,677,383	180,736	228,248
	Totals	**3,651,568**	**20,808,246**	**1,002,770**	**1,996,482**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

[13] See NAICS 2 Digit Sector Codes for definitions and examples: https://classcodes.com/naics-2-digit-sector-codes/ . A brief summary of definitions is provided in Appendix C.

In 2016, *Manufacturing* represented the largest share of gross sales (22.6%) and total value added (12.4%) generated by industries across the Southern Plains, with *Public Administration* holding the largest share of jobs (12.9%) and employee compensation (18.0%). It's no surprise that a sector such as *Public Administration* would represent a large share of jobs and employee compensation as the overall role of this sector is to offer services (as opposed to *Manufacturing* which primarily generates of goods for sale), resulting in a high share of employment versus sales for the sector (Table 20).

Table 20: Share of Contributions by 2-Digit NAICS - Southern Plains (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting*	1.3%	2.4%	0.5%	0.8%
21	Mining, Quarrying, and Oil and Gas Extraction	5.1%	3.0%	4.0%	7.1%
22	Utilities	2.5%	0.4%	1.0%	2.1%
23	Construction	6.1%	6.5%	5.4%	5.5%
31-33	Manufacturing*	22.6%	5.9%	9.7%	12.4%
42	Wholesale Trade	5.7%	3.8%	6.1%	7.3%
44-45	Retail Trade	4.5%	9.3%	5.5%	5.4%
48-49	Transportation and Warehousing	3.8%	3.7%	4.1%	3.5%
51	Information	4.1%	1.5%	2.4%	3.3%
52	Finance and Insurance	6.6%	5.4%	6.4%	5.6%
53	Real Estate and Rental and Leasing	8.6%	4.0%	1.6%	10.4%
54	Professional, Scientific, and Technical Services	6.1%	7.0%	9.8%	7.2%
55	Management of Companies and Enterprises	1.3%	1.0%	2.2%	1.3%
56	Administrative and Support and Waste Management and Remediation Services	2.8%	6.5%	4.7%	3.5%
61	Educational Services	0.5%	1.5%	1.0%	0.6%
62	Health Care and Social Assistance	5.4%	9.7%	10.1%	6.2%
71	Arts, Entertainment, and Recreation	0.7%	1.6%	0.6%	0.6%
72	Accommodation and Food Services	2.9%	7.7%	3.4%	3.1%
81	Other Services (except Public Administration)	2.3%	6.3%	3.5%	2.8%
92	Public Administration	7.0%	12.9%	18.0%	11.4%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

Next, we examine the contribution of the beef industry alone across the *entire* regional economy. At this level, on-farm beef cattle production and post-farm cattle harvest and beef processing activity represents 1.2% of regional sales, 1.2% of employment, 0.3% of employee compensation, and 0.4% of total value added (Table 21).

Table 21: Share of Beef Contributions to the Regional Economy - Southern Plains (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region
Cow-Calf	6,536	0.18%	72,528	0.35%	147	0.01%	1,608	0.08%
Stocker-Background	3,618	0.10%	40,154	0.19%	81	0.01%	891	0.04%
Feed Lot	7,940	0.22%	88,118	0.42%	178	0.02%	1,954	0.10%
On-farm Beef Cattle Production	***18,094***	***0.50%***	***200,801***	***0.97%***	***406***	***0.04%***	***4,453***	***0.22%***
Cattle Harvest	18,039	0.49%	25,412	0.12%	1,299	0.13%	2,818	0.14%
Beef Processing	7,983	0.22%	15,241	0.07%	1,014	0.10%	1,534	0.08%
Beef By-products	390	0.01%	770	0.00%	52	0.01%	63	0.00%
Post-farm Harvest and Processing	***26,412***	***0.72%***	***41,424***	***0.20%***	***2,366***	***0.24%***	***4,415***	***0.22%***
Beef Industry Total	**44,507**	**1.22%**	**242,224**	**1.16%**	**2,772**	**0.28%**	**8,868**	**0.44%**

A better presentation of the beef industry's importance to the regional economy is demonstrated by the relative contribution to its own 2-digit NAICS sector. On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* sector. Within this sector, on-farm beef cattle production represented 38.0% of sales, 40.5% of jobs, 8.4% of employee compensation and 27.6% of total value added (Figure 10).

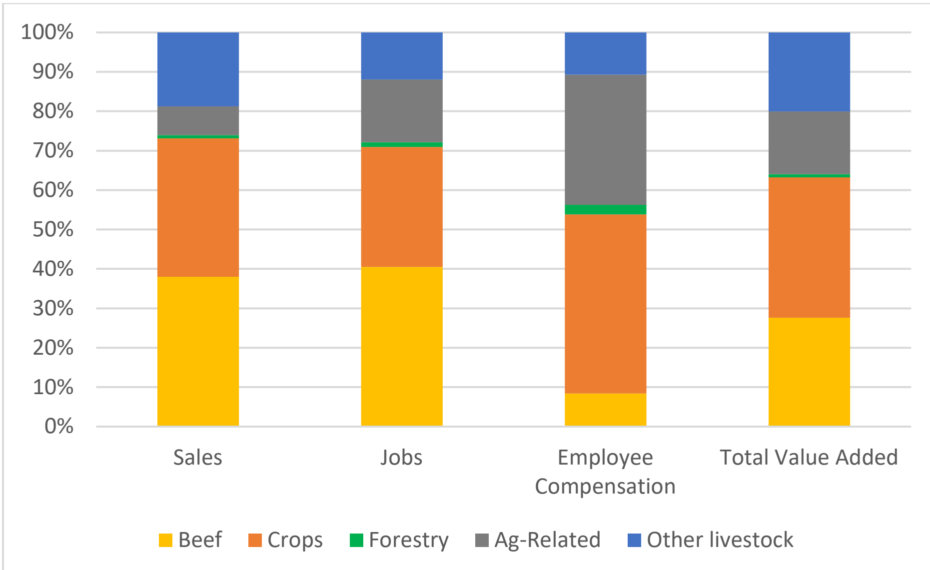


Figure 10: Share of Contributions to Agriculture, Forestry, Fishing and Hunting - Southern Plains (2016)

Table 22 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Across all 19 industries, on-farm beef cattle production ranked 1st in terms of sales, jobs, and total value added, with support activities for agriculture and forestry ranking highest in employee compensation. This is no surprise as Texas, Kansas and Oklahoma rank 2nd, 3rd and 6th in the nation overall in terms of cash receipts collected for cattle and calves (USDA ERS, 2020d) Support activities include activities such as farm management, breeding, and vaccination services, which offer relatively higher wages than other types of farm labor. Thus, explaining the industry's high ranking for employee compensation across regions.

Table 22: Top Ten Agriculture, Forestry, Fishing, and Hunting Industries by Sales - Southern Plains (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
On-farm beef cattle production	1	1	4	1
Grain farming	2	5	8	6
Poultry and egg production	3	9	6	10
Support activities for agriculture and forestry	4	3	1	2
Cotton farming	5	6	2	3
Dairy cattle and milk production	6	8	9	7
All other crop farming	7	2	3	5
Oilseed farming	8	15	17	9
Animal production, except cattle and poultry and eggs	9	4	7	4
Greenhouse, nursery, and floriculture production	10	7	5	8

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. In 2016, agriculture related industries in *Manufacturing* made up 15.8% of *Manufacturing* sales, 22.1% of *Manufacturing* jobs, 14.0% *Manufacturing* employee compensation and 11.6% of *Manufacturing* value added for the Southern Plains. Looking at ag-related manufacturing alone, post-farm cattle harvest and beef processing represented 20.2% of total sales, 15.3% of jobs, 15.8% of employee compensation and 14.3% of total value added across agriculture-related manufacturing industries in the Southern Plains (Figure 11).

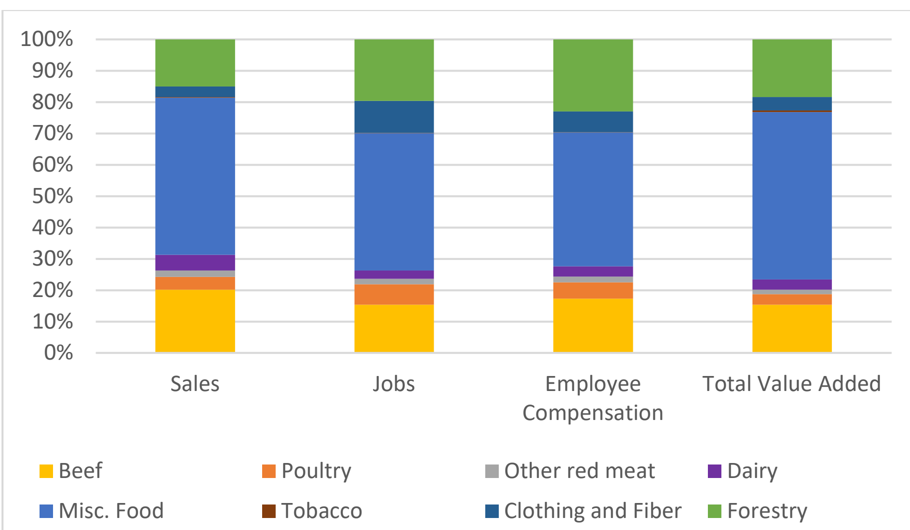


Figure 11: Share of Contributions to Agriculture-Related Manufacturing - Southern Plains (2016)

Table 23 shows the top ten agriculture-related manufacturing industries, ranked in terms of sales. Across all 88 industries, post-farm cattle harvest and beef processing ranked 1st in sales, jobs, employee compensation, and total value added. The bottled and canned soft drinks and water industry also ranks high in the Southern Plains, largely due to the high number of syrup producers and bottlers located across Texas (ChangeLabSolutions, 2012) (Table 23). The presence of Mrs. Baird's, Hostess, Bimbo and other bakery manufacturing firms across the region help make the Bread and bakery product, except frozen, manufacturing number two in terms of jobs and employee compensation (Dun&Bradstreet, 2020a, b, c).

Table 23: Top Ten Agriculture-Related Manufacturing Industries by Sales - Southern Plains (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Post-farm cattle harvest and beef processing	1	1	1	1
Bottled and canned soft drinks & water	2	4	3	2
Other animal food manufacturing	3	9	7	10
Dog and cat food manufacturing	4	16	11	4
Poultry processing	5	3	5	9
Bread and bakery product, except frozen, manufacturing	6	2	2	3
Paperboard container manufacturing	7	5	4	8
Soybean and other oilseed processing	8	56	45	33
Flour milling	9	24	13	12
Other snack food manufacturing	10	14	9	6

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity (export AND local) generated within the beef industry itself across the Southern Plains?**

In 2016, the Southern Plains beef industry generated more than $44.5 billion in gross sales, representing 242,225 jobs. In addition to gross sales and jobs, $8.5 billion was added to the economy through employee compensation, proprietary income, returns to capital, and indirect business taxes provided by the operation of on-farm beef production and post-farm harvest and processing firms (Table 24).

On-farm production of beef cattle represented $18.1 billion of total gross sales with cow-calf, stocker/backgrounding, and feedlot producers contributing $6.5, $3.6, and $7.9 billion respectively. These sales generated 200,802 jobs, resulting in the payment of $406 million in employee compensation and almost $4.5 billion in total value being added to the regional economy (Table 24).

Sales from the post-farm harvest and processing sector made up the remaining $26.4 billion in gross sales with beef and dairy cattle harvest, beef processing, and beef by-products contributing $18.0, $8.0, and $0.4 billion respectively. From these sales, 41,424 jobs were generated, representing $2.1 billion in employee compensation and almost $4.1billion in total value being added to the regional economy (Table 24).

Table 24: Gross Economic Contributions of Beef - Southern Plains (2016)

Sector	**Sales** (million $'s)	**Jobs**	**Employee Compensation** (million $'s)	**Total Value Added** (million $'s)
Cow-Calf	6,536	72,529	147	1,609
Stocker/Backgrounding	3,618	40,155	81	891
Feedlot	7,941	88,118	178	1,954
On-farm Production Total	**18,095**	**200,802**	**406**	**4,453**
Cattle Harvest	18,040	25,412	1,300	2,818
Beef Processing	7,982	15,241	781	1,180
Beef By-products	390	770	52	63
Post-farm Harvest & Processing Total	**26,413**	**41,424**	**2,132**	**4,062**
BEEF INDUSTRY TOTAL	***44,508***	***242,225***	***2,538***	***8,515***

Beef Export Contributions

Here, we consider: **How much value is the beef industry responsible for generating across the entire Southern Plains economy through the production of beef goods for export outside of the region?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the economic activity (in terms of sales, jobs, employee compensation and value added) that is generated within the beef industry as a result of beef exports. In 2016, the Southern Plains beef industry generated more than $24.9 billion in direct export base sales (Table 25).

Of the beef industry's direct export value, on-farm beef cattle production represented $6.8 billion of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $2.4, $1.3, and $3.0 billion, respectively. These sales represent more than 75,224 jobs and generated around $152 million in employee compensation and $1.7 billion in total value added across the region (Table 25).

Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($18.1 billion), with beef harvest, beef processing, and beef by-products contributing $13.0 billion, $4.8 billion, and $295 million, respectively. These sales represent around 28,060 jobs, $1.4 billion in employee compensation and $2.8 billion in total value added across the region (Table 25).

Table 25: Direct Beef Export Contributions - Southern Plains (2016)

Sector	**Sales** (million $'s)	**Jobs**	**Employee Compensation** (million $'s)	**Total Value Added** (million $'s)
Cow-Calf	2,415	26,801	54	594
Stocker/Backgrounding	1,285	14,263	29	316
Feedlot	3,078	34,161	69	758
On-farm Production Total	**6,779**	**75,224**	**152**	**1,668**
Cattle Harvest	12,951	18,243	933	2,023
Beef Processing	4,837	9,236	473	715
Beef By-products	295	581	39	48
Post-farm Harvest & Processing Total	**18,083**	**28,060**	**1,445**	**2,786**
BEEF INDUSTRY TOTAL	***24,861***	***103,285***	***1,597***	***4,454***

Indirect Beef Export Contributions

While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or vaccination services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms, the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the "feed store" or retail sector. However, with economic base analysis, the value credited to the beef industry, as it is exports from beef that are ultimately responsible for generating these sales. This economic activity is referred to as indirect beef export contributions.

In 2016, regional beef exports were indirectly responsible for generating $35.3 billion in sales across other local industries. These indirect beef export sales equate to almost 266,919 jobs, $6.4 billion in employee compensation and almost $15.8billion in total value added to other parts of the economy (Table 26). Of this indirect beef export value, on-farm beef cattle production represented $8.8 billion in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $3.1, $1.8, and $3.9 billion, respectively. These sales represent almost 60.373 jobs, resulting in the payment of $1.8 billion in employee compensation and $4.2 billion in total value added within other industries across the region (Table 26). Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($35.3 billion), with beef harvest, beef processing, and beef by-products contributing $20.1 billion, $6.0 billion, and $378 million, respectively. These indirect sales represent over 206,500 jobs, and generated $4.6 billion in employee compensation and almost $11.6 billion in total value added in other industries across the region (Table 26).

Table 26: Indirect Beef Export Contributions - Southern Plains (2016)

Sector	**Sales** (million $'s)	**Jobs**	**Employee Compensation** (million $'s)	**Total Value Added** (million $'s)
Cow-Calf	3,089	21,151	651	1,479
Stocker/Backgrounding	1,753	12,202	360	828
Feedlot	3,944	27,020	831	1,888
On-farm Production Total	**8,786**	**60,373**	**1,843**	**4,194**
Harvest	20,109	164,323	3,430	8,859
Beef Processing	6,049	40,051	1,078	2,549
Beef By-products	378	2,173	92	183
Post-farm Harvest & Processing Total	**26,536**	**206,547**	**4,600**	**11,591**
BEEF INDUSTRY TOTAL	***35,322***	***266,919***	***6,443***	***15,785***

The level of these indirect contributions varies across industries. Table 27 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production[14].

For example, the table indicates that on-farm beef cattle production heavily depends of input purchases from wholesalers in order to raise cattle. Of all of the wholesale expenditures required for on-farm beef cattle production, approximately $933 million goes toward producing beef that are exported from the region. In turn, this $933 million in wholesale purchases is responsible for generating 3,498 jobs and $651 million in value added within the wholesale sector. The existence of the large petroleum sector in the region makes it easy to supply on farm beef cattle productions operations with its fuel needs.

Looking at the industries indirectly affected by post-farm cattle harvest and beef processing, it's no surprise to see on-farm beef cattle production topping the list. This is because cattle purchased from local producers represent the primary input for post-farm beef exports (Table 27).

[14] Note that sales, jobs, employee compensation and value added accrued to a given industry due to beef exports may be greater here than at the US level. This is because the export base for a region of the US is greater than for the US level. The export base for the US level includes only foreign countries. The export base for a regional (e.g., Southern Plains) level include both foreign countries as well as regions of the US except the Southern Plains.

Table 27: Top Industries by Indirect Beef Export Contributions - Southern Plains (2016)

Sales	On-farm Production	Wholesale trade	$933,350,000
		Other animal food manufacturing	$620,122,000
		Petroleum refineries	$389,715,000
		Real estate	$385,036,000
		Truck transportation	$383,523,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$7,156,009,000
		Truck transportation	$1,756,309,000
		Wholesale trade	$1,744,521,000
		Animal production, except cattle and poultry and eggs	$1,106,346,000
		Owner-occupied dwellings	$775,068,000
Jobs	On-farm Production	Support activities for agriculture and forestry	7,827
		All other crop farming	4,910
		Wholesale trade	3,498
		Truck transportation	2,406
		Real estate	2,154
	Post-farm Harvest and Processing	On-farm beef cattle production	79,413
		Animal production, except cattle and poultry and eggs	16,018
		Truck transportation	11,020
		Support activities for agriculture and forestry	8,213
		Wholesale trade	6,538
Value Added	On-farm Production	Wholesale trade	$651,271,000
		Real estate	$260,981,000
		Support activities for agriculture and forestry	$247,732,000
		Owner-occupied dwellings	$208,521,000
		Truck transportation	$165,667,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$1,761,170,000
		Wholesale trade	$1,217,289,000
		Animal production, except cattle and poultry and eggs	$767,898,000
		Truck transportation	$758,658,000
		Owner-occupied dwellings	$502,993,000

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries while also providing beef products for local consumption?**

In addition to bringing new money into the region through the direct sale of beef exports, the beef industry also plays a supporting role within the regional economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, non-beef businesses and consumers across the country purchased $19.6 billion worth of goods from the Southern Plains beef industry. The presence of the beef industry in the region not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the region by supporting the production of exports across other industries. These export support and local consumption sales were responsible for generating almost 139,000 jobs, $941 million in employee compensation and $4.1 billion in total value added. (Table 28).

Table 28: Export Support and Local Consumption Contributions - Southern Plains (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	4,121	45,728	92	1,014
Stocker/Backgrounding	2,333	25,892	52	574
Feedlot	4,862	53,958	109	1,197
On-farm Production Total	**11,316**	**125,577**	**254**	**2,785**
Cattle Harvest	5,089	7,169	367	795
Beef Processing	3,145	6,005	308	465
Beef By-products	96	189	13	16
Post-farm Harvest & Processing Total	**8,330**	**13,363**	**687**	**1,276**
BEEF INDUSTRY TOTAL	***19,646***	***138,941***	***941***	***4,061***

The level of these export support and local consumption contributions varies across industries. Table 29 presents the top industries in terms of economic activity generated within the beef industry, as a result of sales to local businesses and other local consumers.

The households and government spending industries represent the bulk of local consumption activity occurring within the region[15]. The link between on-farm and post-farm export activity can be seen as on-farm beef cattle producers sold $7.2 billion to post-farm cattle harvest and beef processing to support their production of exports (Table 29). Table 29 also suggests that the beef industry contributes greatly to sales, jobs, compensation and value added in the dog and cat food manufacturing sector as beef products are used in the manufacturing of pet foods. Pet food manufacturing within the Kansas City Animal Health Corridor are responsible for a substantial portion of all pet food sold in the US (Phillips-Donaldson, 2015).

Table 29: Top Industries by Export Support and Local Consumption Contribution - Southern Plains (2016)

Sales	**On-farm Production**	Post-farm Harvest & Processing	$7,156,009,000
		Households	$970,940,000
		Other red meat processing	$470,170,000
		Government spending	$246,168,000
		Dog and cat food manufacturing	$221,999,000
	Post-farm Harvest & Processing	Households	$2,659,138,000
		Dog and cat food manufacturing	$751,180,000
		Government spending	$672,053,000
		Other red meat processing	$300,849,000
		Wholesale trade	$170,893,000
Jobs	**On-farm Production**	Post-farm Harvest & Processing	79,413
		Households	10,775
		Other red meat processing	5,218
		Government spending	2,732
		Dog and cat food manufacturing	2,464
	Post-farm Harvest & Processing	Households	4,298
		Dog and cat food manufacturing	1,304
		Government spending	1,085
		Other red meat processing	461
		Wholesale trade	275
Value Added	**On-farm Production**	Post-farm Harvest & Processing	$1,761,170,000
		Households	$238,958,700
		Other red meat processing	$115,714,000
		Government spending	$60,585,000
		Dog and cat food manufacturing	$54,636,000
	Post-farm Harvest & Processing	Households	$406,606,000
		Dog and cat food manufacturing	$113,224,000
		Government spending	$102,784,000
		Other red meat processing	$46,420,000
		Wholesale trade	$26,144,000

[15] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

NORTHERN PLAINS: (Nebraska, North Dakota, South Dakota)

Industry Overview

To understand the broad contributors of the beef industry to the regional economy, results were first analyzed at the 2-digit North American Industry Classification System (NAICS) level.[16] Table 30 shows a breakdown of the Northern Plains economy by NAICS sector and type of economic activity. Industries related to beef are found within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors (Table 30).

Table 30: Regional Contributions by 2-Digit NAICS - Northern Plains (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	41,218	145,581	1,577	11,625
21	Mining, Quarrying, and Oil and Gas Extraction	7,460	28,007	1,846	5,057
22	Utilities	8,829	7,427	882	4,052
23	Construction	23,513	154,813	5,936	10,826
31-33	Manufacturing*	88,289	170,810	9,952	20,606
42	Wholesale Trade	22,496	93,725	6,213	14,938
44-45	Retail Trade	19,867	251,638	6,618	12,199
48-49	Transportation and Warehousing	21,912	101,734	5,895	12,412
51	Information	12,609	35,652	2,326	5,212
52	Finance and Insurance	37,265	145,204	7,875	20,842
53	Real Estate and Rental and Leasing	34,812	93,433	950	22,781
54	Professional, Scientific, and Technical Services	17,304	126,395	6,834	9,906
55	Management of Companies and Enterprises	7,252	33,066	3,446	4,132
56	Administrative and Support and Waste Management and Remediation Services	7,784	104,068	3,355	4,899
61	Educational Services	1,945	36,359	976	1,033
62	Health Care and Social Assistance	28,083	276,729	14,144	17,214
71	Arts, Entertainment, and Recreation	2,919	44,210	592	1,245
72	Accommodation and Food Services	10,478	172,785	3,232	5,561
81	Other Services (except Public Administration)	8,829	132,495	3,333	5,808
92	Public Administration	32,244	342,811	21,471	25,937
	Totals	**435,107**	**2,496,943**	**107,454**	**216,286**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

[16] See NAICS 2 Digit Sector Codes for definitions and examples: https://classcodes.com/naics-2-digit-sector-codes/ . A brief summary of definitions is provided in Appendix C.

In 2016, *Manufacturing* represented the largest share of gross sales (20.3%) generated by industries across the Northern Plains, with *Public Administration* holding the largest share of jobs (13.7%), employee compensation (20.0%) and value added (12.0%). It's no surprise that a sector such as *Public Administration* would represent a large share of jobs and employee compensation as the overall role of this sector is to offer services (as opposed to *Manufacturing* which primarily generates of goods for sale), resulting in a high share of employment versus sales for the sector (Table 31).

Table 31: Share of Contributions by 2-Digit NAICS - Northern Plains (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting*	9.5%	5.8%	1.5%	5.4%
21	Mining, Quarrying, and Oil and Gas Extraction	1.7%	1.1%	1.7%	2.3%
22	Utilities	2.0%	0.3%	0.8%	1.9%
23	Construction	5.4%	6.2%	5.5%	5.0%
31-33	Manufacturing*	20.3%	6.8%	9.3%	9.5%
42	Wholesale Trade	5.2%	3.8%	5.8%	6.9%
44-45	Retail Trade	4.6%	10.1%	6.2%	5.6%
48-49	Transportation and Warehousing	5.0%	4.1%	5.5%	5.7%
51	Information	2.9%	1.4%	2.2%	2.4%
52	Finance and Insurance	8.6%	5.8%	7.3%	9.6%
53	Real Estate and Rental and Leasing	8.0%	3.7%	0.9%	10.5%
54	Professional, Scientific, and Technical Services	4.0%	5.1%	6.4%	4.6%
55	Management of Companies and Enterprises	1.7%	1.3%	3.2%	1.9%
56	Administrative and Support and Waste Management and Remediation Services	1.8%	4.2%	3.1%	2.3%
61	Educational Services	0.4%	1.5%	0.9%	0.5%
62	Health Care and Social Assistance	6.5%	11.1%	13.2%	8.0%
71	Arts, Entertainment, and Recreation	0.7%	1.8%	0.6%	0.6%
72	Accommodation and Food Services	2.4%	6.9%	3.0%	2.6%
81	Other Services (except Public Administration)	2.0%	5.3%	3.1%	2.7%
92	Public Administration	7.4%	13.7%	20.0%	12.0%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018

*Contain industries related to beef production. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

Next, we examine the contribution of the beef industry alone across the *entire* regional economy. At this level, on-farm beef cattle production and post-farm cattle harvest and beef processing activity represents 7.6% of regional sales, 3.4% of employment, and 1.7% of employee compensation, and 2.7% of total value added (Table 32).

Table 32: Share of Beef Contributions to the Regional Economy - Northern Plains (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region
Cow-Calf	5,089	1.17%	20,729	0.83%	123	0.11%	1,190	0.55%
Stocker-Background	62	0.01%	253	0.01%	1	0.00%	15	0.01%
Feed Lot	8,746	2.01%	35,619	1.43%	211	0.20%	2,045	0.95%
On-farm Beef Cattle Production	***13,898***	***3.19%***	***56,601***	***2.27%***	***336***	***0.31%***	***3,249***	***1.50%***
Cattle Harvest	16,079	3.70%	23,299	0.93%	1,239	1.15%	2,125	0.98%
Beef Processing	2,898	0.67%	5,674	0.23%	274	0.25%	365	0.17%
Beef By-products	148	0.03%	290	0.01%	22	0.02%	25	0.01%
Post-farm Harvest and Processing	***19,125***	***4.40%***	***29,262***	***1.17%***	***1,535***	***1.43%***	***2,515***	***1.16%***
Beef Industry Total	**33,022**	**7.59%**	**85,863**	**3.44%**	**1,871**	**1.74%**	**5,764**	**2.67%**

A better presentation of the beef industry's importance to the regional economy is demonstrated by the relative contribution to its own 2-digit NAICS sector. On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* sector. Within this sector, on-farm beef cattle production represented 33.7% of sales, 38.9% of jobs, 21.3% of employee compensation and 28.0% of total value added (Figure 12).

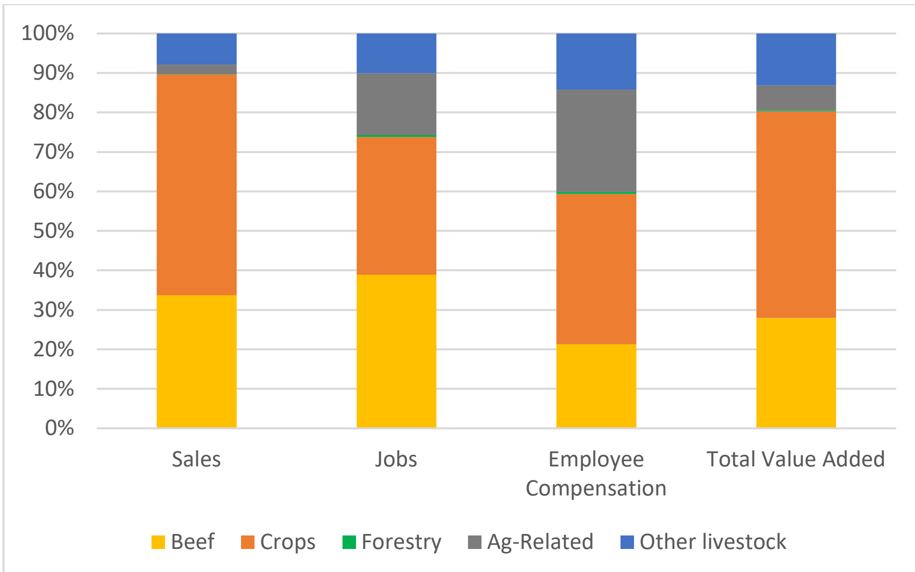


Figure 12: Share of Contributions to Agriculture, Forestry, Fishing and Hunting - Northern Plains (2016)

Table 33 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Nebraska is one of the top cattle producing states in the country. Therefore, it's no surprise that on-farm beef cattle production ranked 1st in terms of sales, jobs, and total value added among *Agriculture, Forestry, Fishing and Hunting* industries across the region. Support activities for agriculture and forestry rank highest in terms of employee compensation as a result of higher wages being earned among workers providing support services. Grain farming also ranked high for the region, largely driven by corn production across Nebraska and South Dakota, and wheat production for North Dakota (ERS, 2020d).

Table 33: Top Ten Agriculture, Forestry, Fishing, and Hunting Industries by Sales - Northern Plains (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
On-farm beef cattle production	1	1	2	1
Grain farming	2	2	3	3
Oilseed farming	3	5	8	2
Animal production, except cattle and poultry and eggs	4	4	5	4
Support activities for agriculture and forestry	5	3	1	5
Dairy cattle and milk production	6	8	9	7
All other crop farming	7	6	4	6
Vegetable and melon farming	8	7	7	8
Poultry and egg production	9	13	11	10
Sugarcane and sugar beet farming	10	9	6	9

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. Within this sector beef industry activities represented 21.7% of sales, 17.1% of jobs, and 15.4% of employee compensation and 12.2% of total value added. Compared to other regions, beef makes up a greater share of manufacturing activity within the Northern Plains. This significance is even more pronounced across agricultural manufacturing within the region. The agriculture related industries in *Manufacturing* made up 46.1% of *Manufacturing* sales, 38.7% of *Manufacturing* jobs, 35.0% *Manufacturing* employee compensation and 30.1% of *Manufacturing* value added. In terms of agriculture-related manufacturing, post-farm cattle harvest and beef processing represented 47.0% of total sales, 44.2% of jobs, 44.1% of employee compensation and 40.6% of total value added (Figure 13).

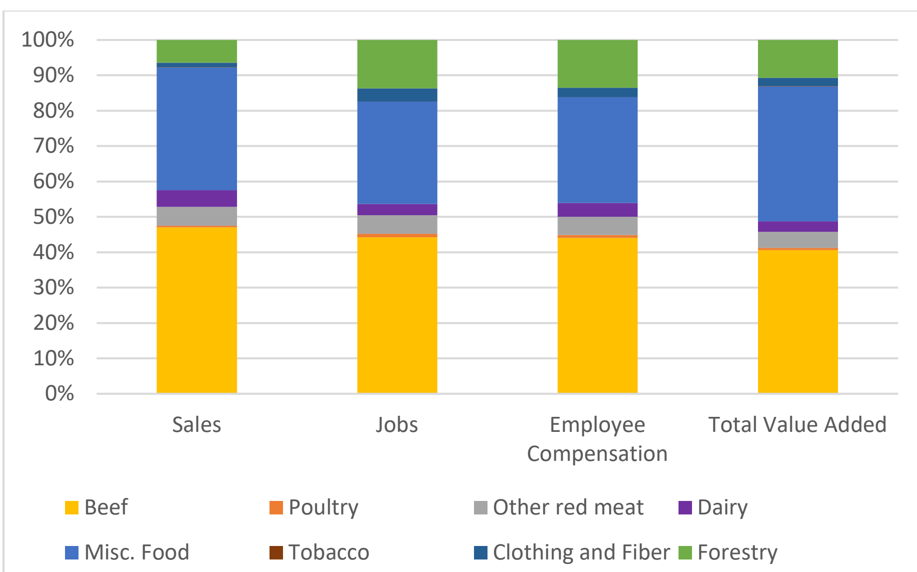


Figure 13: Share of Contributions to Agriculture-Related Manufacturing - Northern Plains (2016)

Table 34 shows the top ten agriculture-related manufacturing industries, ranked in terms of sales. Across all 88 industries, post-farm cattle harvest and beef processing ranked 1st in sales, jobs, employee compensation, and total value added. The tri-state region is home to scores of processing facilities, that range from big name (JBS and IBP/Tyson) to small scale and custom facilities (USDA APHIS, 2020; ND.gov, 2020). With Nebraska being one of the top cattle producing states in the US, this production is accompanied by the presence of several beef harvest and processing facilities located throughout the state, thus driving economic activity within the region.

Table 34: Top Ten Agriculture-Related Manufacturing Industries by Sales - Northern Plains (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Post-farm cattle harvest and beef processing	1	1	1	1
Soybean and other oilseed processing	2	23	16	11
Dog and cat food manufacturing	3	6	5	2
Red meat (except beef) harvest and processing	4	3	2	4
Other animal food manufacturing	5	7	7	7
Cheese manufacturing	6	10	10	18
Paperboard container manufacturing	7	5	4	8
Flour milling	8	22	14	12
Beet sugar manufacturing	9	9	8	6
Bread and bakery product, except frozen, manufacturing	10	2	3	3

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity (export AND local) generated within the beef industry itself across the Northern Plains?**

In 2016, the Northern Plains beef industry generated more than $33.0 billion in gross sales, representing almost 86,000 jobs. In addition to gross sales and jobs, almost $5.8 billion was added to the economy through employee compensation, proprietary income, returns to capital, and indirect business taxes provided by the operation of on-farm beef production and post-farm harvest and processing firms (Table 35).

On-farm production of beef cattle represented $13.9 billion of total gross sales with cow-calf, stocker/backgrounding, and feedlot producers contributing $5.1 billion, $62 million, and $8.7 billion, respectively. These sales generated around 56,600 jobs, resulting in the payment of $336 million in employee compensation and almost $3.2 billion in total value being added to the regional economy (Table 35).

Sales from the post-farm harvest and processing sector made up the remaining $19.1 billion in gross sales with beef and dairy cattle harvest, beef processing, and beef by-products contributing $16.1, $2.9, and $0.1 billion respectively. From these sales, over 29,200 jobs were generated, representing $1.5 billion in employee compensation and almost $2.5 billion in total value being added to the regional economy (Table 35).

Table 35: Gross Economic Contributions of Beef - Northern Plains (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	5,089	20,729	123	1,190
Stocker/Backgrounding	62	253	1	15
Feedlot	8,746	35,619	211	2,045
On-farm Production Total	**13,898**	**56,601**	**336**	**3,249**
Cattle Harvest	16,081	23,299	1,239	2,125
Beef Processing	2,897	5,674	274	365
Beef By-products	148	290	22	25
Post-farm Harvest & Processing Total	**19,126**	**29,262**	**1,535**	**2,515**
BEEF INDUSTRY TOTAL	***33,023***	***85,863***	***1,871***	***5,764***

Beef Export Contributions

Here, we consider: **How much value is the beef industry responsible for generating across the entire Northern Plains economy through the production of beef goods for export outside of the region?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the economic activity (in terms of sales, jobs, employee compensation and value added) that is generated within the beef industry as a result of beef exports. In 2016, the Northern Plains beef industry generated almost $22.0 billion in direct beef export sales (Table 36).

Of the beef industry's direct beef export value, on-farm beef cattle production represented $4.6 billion of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $1.6 billion, $18 million, and $3.0 billion, respectively. These sales represent almost 19,000 jobs and generated around $112 million in employee compensation and $1.1 billion in total value added across the region (Table 36).

Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($17.3 billion), with beef harvest, beef processing, and beef by-products contributing $14.7 billion, $2.5 billion, and $139 million, respectively. These sales represent around 26,400 jobs, $1.4 billion in employee compensation and $2.3 billion in total value added across the region (Table 36).

Table 36: Direct Beef Export Contributions - Northern Plains (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	1,609	6,554	39	376
Stocker/Backgrounding	18	73	0	4
Feedlot	3,019	12,296	73	706
On-farm Production Total	**4,646**	**18,923**	**112**	**1,086**
Slaughtering	14,746	21,365	1,137	1,949
Carcass Processing	2,463	4,824	233	310
Rendering and By-Products	139	272	20	23
Post-farm Harvest & Processing Total	**17,349**	**26,461**	**1,390**	**2,282**
BEEF INDUSTRY TOTAL	***21,995***	***45,385***	***1,502***	***3,369***

Indirect Beef Export Contributions

While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or vaccination services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms, the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the “feed store” or retail sector. However, with economic base analysis, the value credited to the beef industry, as it is exports from beef that are ultimately responsible for generating these sales. This economic activity is referred to as indirect beef export contributions.

In 2016, regional beef exports were indirectly responsible for generating $25.1 billion in sales across other local industries. These indirect beef export sales equate to around 133,800 jobs, $4.1 billion in employee compensation and almost $10.6 billion in total value added to other parts of the economy (Table 37). Of this indirect beef export value, on-farm beef cattle production represented $4.0 billion in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $1.4, $0.2, and $2.5 billion, respectively. These sales represent almost 22,370 jobs, resulting in the payment of $778 million in employee compensation and $1.9 billion in total value added within other industries across the region (Table 37). Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($21.1 billion), with beef harvest, beef processing, and beef by-products contributing $18.3 billion, $2.7 billion, and $146 million, respectively. These indirect sales represent over 111,400 jobs, and generated $3.3 billion in employee compensation and almost $8.7 billion in total value added in other industries across the region (Table 37).

Table 37: Indirect Beef Export Contributions - Northern Plains (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	1,442	8,011	275	669
Stocker/Backgrounding	19	104	3	8
Feedlot	2,541	14,252	499	1,199
On-farm Production Total	**4,002**	**22,367**	**778**	**1,877**
Cattle Harvest	18,262	97,894	2,813	7,589
Beef Processing	2,690	12,722	434	1,034
Beef By-products	146	819	35	69
Post-farm Harvest & Processing Total	**21,098**	**111,435**	**3,282**	**8,693**
BEEF INDUSTRY TOTAL	***25,100***	***133,802***	***4,060***	***10,570***

The level of these indirect contributions varies across industries. Table 38 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production[17].

For example, the table indicates that on-farm beef cattle production heavily depends of input purchases from wholesalers in order to raise cattle. Of all of the wholesale expenditures required for on-farm beef cattle production, approximately $502 million goes toward producing beef that are exported from the region. In turn, this $502 million in wholesale purchases is responsible for generating 2,095 jobs and $910 million in value added within the wholesale sector.

In 2016, Nebraska and South Dakota ranked in the top ten states for corn cash receipts, with North Dakota ranking #1 in wheat (USDA ERS, 2020d) Since the beef industry relies on the grain farming and other animal food manufacturing to support beef animal growth, the presence of a large grain industry allows them to purchase grain from local producers as is evidenced by the value of the grain industry's indirect export contributions to the beef industry.

Looking at the industries indirectly affected by post-farm cattle harvest and beef processing, it's no surprise to see on-farm beef cattle production topping the list. This is because cattle purchased from local producers represent the primary input for post-farm beef exports (Table 38). As will be repeated across many of the regions, Truck transportation and wholesale trade are important intra-industry collaborators with beef.

[17] Note that sales, jobs, employee compensation and value added accrued to a given industry due to beef exports may be greater here than at the US level. This is because the export base for a region of the US is greater than for the US level. The export base for the US level includes only foreign countries. The export base for a regional (e.g., Southern Plains) level include both foreign countries as well as regions of the US except the Southern Plains.

Table 38: Top Industries by Indirect Beef Export Contributions - Northern Plains (2016)

Sales	**On-farm Production**	Wholesale trade	$502,889,000
		Grain farming	$293,800,000
		Other animal food manufacturing	$254,178,000
		Truck transportation	$241,468,000
		Real estate	$203,771,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$7,444,982,000
		Truck transportation	$1,822,853,000
		Wholesale trade	$1,371,393,000
		Animal production, except cattle and poultry and eggs	$929,365,000
		Owner-occupied dwellings	$615,389,000
Jobs	**On-farm Production**	Wholesale trade	2,095
		Support activities for agriculture and forestry	1,677
		Truck transportation	1,412
		Real estate	1,145
		All other crop farming	1,086
	Post-farm Harvest and Processing	On-farm beef cattle production	30,321
		Truck transportation	10,656
		Animal production, except cattle and poultry and eggs	5,916
		Wholesale trade	5,714
		Real estate	3,036
Value Added	**On-farm Production**	Wholesale trade	$333,928,000
		Real estate	$137,826,000
		Truck transportation	$113,678,000
		Owner-occupied dwellings	$108,074,000
		Monetary authorities and depository credit intermediation	$92,259,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$1,740,735,000
		Wholesale trade	$910,630,000
		Truck transportation	$858,157,000
		Animal production, except cattle and poultry and eggs	$601,208,000
		Owner-occupied dwellings	$399,366,000

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries while also providing beef products for local consumption?**

In addition to bringing new money into the region through the direct sale of beef exports, the beef industry also plays a supporting role within the regional economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, non-beef businesses and consumers across the region purchased $11.0 billion worth of goods from the Northern Plains beef industry. The presence of the beef industry in the region not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the region by supporting the production of exports across other industries. These export support and local consumption sales combined were responsible for generating almost 40,500 jobs, $369 million in employee compensation and $2.4 billion in total value added. (Table 39).

Table 39: Export Support and Local Consumption Contributions - Northern Plains (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	3,480	14,175	84	814
Stocker/Backgrounding	44	180	1	10
Feedlot	5,727	23,323	138	1,339
On-farm Production Total	**9,251**	**37,678**	**224**	**2,163**
Slaughtering	1,334	1,933	103	176
Carcass Processing	434	850	41	55
Rendering and By-Products	9	17	1	1
Post-farm Harvest & Processing Total	**1,777**	**2,801**	**145**	**232**
BEEF INDUSTRY TOTAL	***11,028***	***40,478***	***369***	***2,396***

The level of these export support and local consumption contributions varies across industries. Table 40 presents the top industries in terms of economic activity generated within the beef industry, as a result of sales to local businesses and other local consumers.

The households and government spending industries represent the bulk of local consumption activity occurring within the region[18]. The link between on-farm and post-farm export activity can be seen as on-farm beef cattle producers sold $7.4 billion to post-farm cattle harvest and beef processing to support their production of exports (Table 40). Table 40 also suggests that the beef industry contributes greatly to sales, jobs, compensation and value added as beef products are used in the manufacturing of pet foods.

Table 40: Top Industries by Export Support and Local Consumption Contribution - Northern Plains (2016)

Sales	**On-farm Production**	Post-farm Harvest & Processing	$7,444,982,000
		Other red meat processing	$762,781,000
		Households	$121,589,000
		Dog and cat food manufacturing	$104,803,000
		Grain farming	$92,483,000
	Post-farm Harvest & Processing	Dog and cat food manufacturing	$298,811,000
		Households	$291,879,000
		Other red meat processing	$159,213,000
		Government spending	$72,669,000
		Leather and hide tanning and finishing	$41,543,000
Jobs	**On-farm Production**	Post-farm Harvest & Processing	30,321
		Other red meat processing	3,107
		Households	495
		Dog and cat food manufacturing	427
		Grain farming	377
	Post-farm Harvest & Processing	Dog and cat food manufacturing	508
		Households	466
		Other red meat processing	243
		Government spending	116
		Leather and hide tanning and finishing	67
Value Added	**On-farm Production**	Post-farm Harvest & Processing	$1,740,735,000
		Other red meat processing	$178,348,200
		Households	$28,429,000
		Dog and cat food manufacturing	$24,504,000
		Grain farming	$21,624,000
	Post-farm Harvest & Processing	Dog and cat food manufacturing	$38,579,000
		Households	$38,109,000
		Other red meat processing	$20,930,000
		Government spending	$9,489,000
		Leather and hide tanning and finishing	$5,419,000

[18] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

MIDWEST: (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Wisconsin)

Industry Overview

To understand the broad contributors to the economy, results were first analyzed at the 2-digit North American Industry Classification System (NAICS) level.[19] Table 41 shows a breakdown of the Midwest economy by NAICS sector and type of economic activity. Industries related to beef are found within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors (Table 41).

Table 41: Regional Contributions by 2-Digit NAICS - Midwest (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	106,217	670,945	7,105	32,398
21	Mining, Quarrying, and Oil and Gas Extraction	19,971	87,678	2,783	8,910
22	Utilities	114,659	103,263	14,109	44,733
23	Construction	241,259	1,499,045	60,740	115,083
31-33	Manufacturing*	1,536,506	3,048,046	228,685	458,350
42	Wholesale Trade	273,569	1,149,198	88,790	180,893
44-45	Retail Trade	236,048	2,916,296	81,181	148,010
48-49	Transportation and Warehousing	184,867	1,128,364	55,113	91,865
51	Information	186,794	441,851	33,372	79,198
52	Finance and Insurance	398,012	1,559,272	109,815	218,301
53	Real Estate and Rental and Leasing	493,954	1,181,690	16,944	332,829
54	Professional, Scientific, and Technical Services	333,600	2,093,362	145,776	211,826
55	Management of Companies and Enterprises	107,113	440,086	54,898	65,594
56	Administrative and Support and Waste Management and Remediation Services	130,352	1,829,011	60,957	84,859
61	Educational Services	39,267	646,560	23,027	24,936
62	Health Care and Social Assistance	362,246	3,546,433	185,438	224,840
71	Arts, Entertainment, and Recreation	46,723	587,618	12,285	26,408
72	Accommodation and Food Services	141,745	2,252,076	46,726	78,153
81	Other Services (except Public Administration)	120,470	1,893,377	54,760	80,019
92	Public Administration	300,497	3,402,502	230,861	277,865
	Totals	**5,373,869**	**30,476,673**	**1,513,366**	**2,785,070**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

[19] See NAICS 2 Digit Sector Codes for definitions and examples: https://classcodes.com/naics-2-digit-sector-codes/ . A brief summary of definitions is provided in Appendix C.

The *Manufacturing* sector represented the largest share of gross sales (28.6%) and total value added (16.5%) generated by industries across the Midwest in 2016. The *Health Care and Social Assistance* held the largest share of jobs (11.6%) with *Public Administration* paying out the most in employee compensation (15.3%) Again, it's no surprise that service based sectors would represent a large share of jobs and employee compensation as the overall role of these sectors is to offer services (as opposed to *Manufacturing* which primarily generates of goods for sale), resulting in a high share of employment versus sales for the sector (Table 42).

Table 42: Share of Contributions by 2-Digit NAICS - Midwest (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting*	2.0%	2.2%	0.5%	1.2%
21	Mining, Quarrying, and Oil and Gas Extraction	0.4%	0.3%	0.2%	0.3%
22	Utilities	2.1%	0.3%	0.9%	1.6%
23	Construction	4.5%	4.9%	4.0%	4.1%
31-33	Manufacturing*	28.6%	10.0%	15.1%	16.5%
42	Wholesale Trade	5.1%	3.8%	5.9%	6.5%
44-45	Retail Trade	4.4%	9.6%	5.4%	5.3%
48-49	Transportation and Warehousing	3.4%	3.7%	3.6%	3.3%
51	Information	3.5%	1.4%	2.2%	2.8%
52	Finance and Insurance	7.4%	5.1%	7.3%	7.8%
53	Real Estate and Rental and Leasing	9.2%	3.9%	1.1%	12.0%
54	Professional, Scientific, and Technical Services	6.2%	6.9%	9.6%	7.6%
55	Management of Companies and Enterprises	2.0%	1.4%	3.6%	2.4%
56	Administrative and Support and Waste Management and Remediation Services	2.4%	6.0%	4.0%	3.0%
61	Educational Services	0.7%	2.1%	1.5%	0.9%
62	Health Care and Social Assistance	6.7%	11.6%	12.3%	8.1%
71	Arts, Entertainment, and Recreation	0.9%	1.9%	0.8%	0.9%
72	Accommodation and Food Services	2.6%	7.4%	3.1%	2.8%
81	Other Services (except Public Administration)	2.2%	6.2%	3.6%	2.9%
92	Public Administration	5.6%	11.2%	15.3%	10.0%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018
*Contain industries related to beef production. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

Next, we examine the contribution of the beef industry alone across the <u>*entire*</u> regional economy. At this level, on-farm beef cattle production and post-farm cattle harvest and beef processing activity represents 0.6% of regional sales, 0.4% of employment, 0.2% of employee compensation and 0.2% of total value added (Table 43).

Table 43: Share of Beef Contributions to the Regional Economy - Midwest (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region
Cow-Calf	3,697	0.07%	39,200	0.13%	81	0.01%	1,131	0.04%
Stocker-Background	1,482	0.03%	15,716	0.05%	33	0.00%	453	0.02%
Feed Lot	3,240	0.06%	34,357	0.11%	71	0.00%	991	0.04%
On-farm Beef Cattle Production	***8,419***	***0.16%***	***89,273***	***0.29%***	***185***	***0.01%***	***2,575***	***0.09%***
Cattle Harvest	14,022	0.26%	20,018	0.07%	1,056	0.07%	2,031	0.07%
Beef Processing	10,894	0.20%	20,483	0.07%	1,221	0.08%	1,753	0.06%
Beef By-products	197	0.00%	386	0.00%	27	0.00%	33	0.00%
Post-farm Harvest and Processing	***25,113***	***0.47%***	***40,887***	***0.13%***	***2,304***	***0.15%***	***3,817***	***0.14%***
Beef Industry Total	**33,532**	**0.62%**	**130,159**	**0.43%**	**2,489**	**0.16%**	**6,392**	**0.23%**

A better presentation of the beef industry's importance to the regional economy is demonstrated by the relative contribution to its own 2-digit NAICS sector. On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* sector. Within this sector, on-farm beef cattle production represented 7.9% of sales, 13.3% of jobs, 2.6% of employee compensation and 7.9% of total value added (Figure 14).

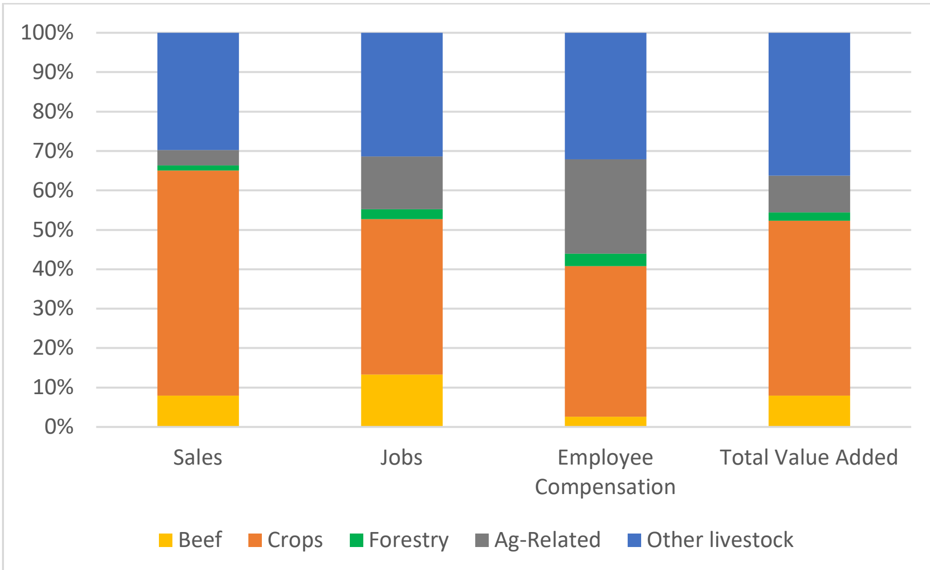


Figure 14: Share of Contributions to Agriculture, Forestry, Fishing and Hunting - Midwest (2016)

Table 44 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Across all 19 industries, on-farm beef cattle production ranked 4th in terms of sales, 3rd in jobs, 10th in employee compensation and 5th in total value added. This region includes several of the top states for grain and soybean farming. Iowa, Minnesota, Illinois, and Indiana are also among the top 5 states for hog cash receipts, putting those industries ahead of beef cattle production in the region (ERS, 2020d).

Table 44: Top Ten Agriculture, Forestry, Fishing, and Hunting Industries by Sales - Midwest (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Grain farming	1	2	5	3
Oilseed farming	2	5	13	1
Animal production, except cattle and poultry and eggs	3	1	2	2
On-farm beef cattle production	4	3	10	5
Dairy cattle and milk production	5	6	4	4
Poultry and egg production	6	11	6	8
Support activities for agriculture and forestry	7	4	1	6
Greenhouse, nursery, and floriculture production	8	9	3	7
Vegetable and melon farming	9	12	8	9
Commercial logging	10	10	11	11

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. Within this sector, these beef industry activities represented 1.6% of sales, 1.3% of jobs, and 1.0% of employee compensation and 0.8% of total value added. While the value of beef product manufacturing may appear relatively small, the aggregate *Manufacturing* sector is made up of hundreds of industries, covering all forms of manufacturing - from the production of beef products, to cars, to pesticides and pharmaceuticals. Because of this, it may be more valuable to consider the beef industry relative only to industries that manufacture agricultural goods. The agriculture related industries in *Manufacturing* made up 23.4% of *Manufacturing* sales, 21.6% of *Manufacturing* jobs, 17.1% *Manufacturing* employee compensation and 16.5% of *Manufacturing* value added. From this perspective, post-farm cattle harvest and beef processing represented 7.0% of total sales, 6.2% of jobs, 5.9% of employee compensation and 5.0% of total value added across agriculture-related manufacturing industries (Figure 15).

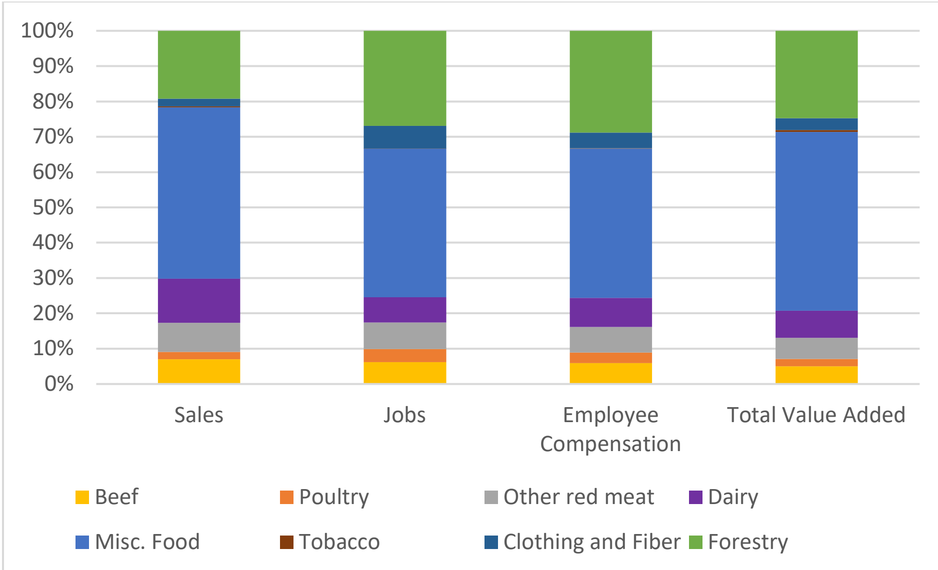


Figure 15: Share of Contributions to Agriculture-Related Manufacturing - Midwest (2016)

Table 45 shows the top ten agriculture-related manufacturing industries, ranked in terms of sales. Across all 88 industries, on-farm beef cattle production ranked 2nd in terms of sales, 3rd in jobs, 4th in employee compensation and 4th in total value added, with support activities for agriculture and forestry ranking highest in terms of employee compensation. The red meat (except) beef harvest and processing led the rankings due to the large pork processing industry in the region (USDA APHIS, 2020). International Paper and Georgia Pacific both have a strong presence in the region that contributes to the high ranking of paperboard container manufacturing in the region (Table 45).

Table 45: Top Ten Agriculture-Related Manufacturing Industries by Sales - Midwest (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Red meat (except beef) harvest and processing	1	2	2	1
Cattle harvest and beef processing	2	3	4	4
Wet corn milling	3	16	7	5
Cheese manufacturing	4	6	5	10
Paperboard container manufacturing	5	4	1	2
Soybean and other oilseed processing	6	43	36	31
Other animal food manufacturing	7	18	16	13
Bottled and canned soft drinks & water	8	12	11	9
Paper mills	9	11	6	7
Dog and cat food manufacturing	10	23	18	6

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity (export AND local) generated within the beef industry itself across the Midwest?**

In 2016, the Midwest beef industry generated more than $33.5 billion in gross sales, representing over 130,100 jobs. In addition to gross sales and jobs, $6.4 billion was added to the economy through employee compensation, proprietary income, returns to capital, and indirect business taxes provided by the operation of on-farm beef production and post-farm harvest and processing firms (Table 46).

On-farm production of beef cattle represented $8.4 billion of total gross sales with cow-calf, stocker/backgrounding, and feedlot producers contributing $3.7, $1.4, and $3.2 billion, respectively. These sales generated around 89,300 jobs, resulting in the payment of $185 million in employee compensation and almost $2.6 billion in total value being added to the regional economy (Table 46).

Sales from the post-farm harvest and processing sector made up the remaining $25.1 billion in gross sales with beef and dairy cattle harvest, beef processing, and beef by-products contributing $14.0, $10.9, and $0.2 billion respectively. From these sales, almost 40,900 jobs were generated, representing $2.3 billion in employee compensation and almost $3.8 billion in total value being added to the regional economy (Table 46).

Table 46:Gross Economic Contributions of Beef - Midwest (2016)

	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	3,697	39,200	81	1,131
Stocker/Backgrounding	1,482	15,717	33	453
Feedlot	3,240	34,357	71	991
On-farm Production Total	**8,420**	**89,274**	**185**	**2,575**
Cattle Harvest	14,022	20,017	1,056	2,031
Beef Processing	10,895	20,483	1,221	1,753
Beef By-products	197	386	27	33
Post-farm Harvest & Processing Total	**25,114**	**40,886**	**2,304**	**3,817**
BEEF INDUSTRY TOTAL	***33,533***	***130,161***	***2,489***	***6,392***

__Export Base Contributions to the Regional Economy__

Here, we consider: **How much value is the beef industry responsible for generating across the entire Midwest economy through the production of beef goods for export outside of the region?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the economic activity (in terms of sales, jobs, employee compensation and value added) that is generated within the beef industry as a result of beef exports. In 2016, the Midwest beef industry generated almost $16.6 billion in direct beef export sales (Table 47).

Of the beef industry's direct beef export value, on-farm beef cattle production represented $856 million of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $376, $148 million, and $333 million, respectively. These sales represent almost 9,100 jobs and generated around $19 million in employee compensation and $262 million in total value added across the region (Table 47).

Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($15.7 billion), with beef harvest, beef processing, and beef by-products contributing $8.9 billion, $6.6 billion, and $125 million, respectively. These sales represent around 25,500 jobs, $1.4 billion in employee compensation and $2.4 billion in total value added across the region (Table 47).

Table 47: Direct Beef Export Contributions - Midwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	376	3,982	8	115
Stocker/Backgrounding	148	1,564	3	45
Feedlot	333	3,533	7	102
On-farm Production Total	**856**	**9,079**	**19**	**262**
Cattle Harvest	8,963	12,796	675	1,298
Beef Processing	6,643	12,489	744	1,069
Beef By-products	125	247	17	21
Post-farm Harvest & Processing Total	**15,732**	**25,532**	**1,437**	**2,388**
BEEF INDUSTRY TOTAL	***16,588***	***34,611***	***1,456***	***2,650***

Indirect Beef Export Contributions

While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or vaccination services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms, the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the "feed store" or retail sector. However, with economic base analysis, the value credited to the beef industry, as it is exports from beef that are ultimately responsible for generating these sales. This economic activity is referred to as indirect beef export contributions.

In 2016, regional beef exports were indirectly responsible for generating $20.7 billion in sales across other local industries. These indirect beef export sales equate to around 137,556 jobs, $4.0 billion in employee compensation and almost $9.3 billion in total value added to other parts of the economy (Table 48).Of this indirect beef export value, on-farm beef cattle production represented $906 million in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $390, $161, and $355 million, respectively. These sales represent 5,310 jobs, resulting in the payment of $194 million in employee compensation and $422 million in total value added within other industries across the region (Table 48).

Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($19.8 billion), with beef harvest, beef processing, and beef by-products contributing $11.5 billion, $8.2 billion, and $172 million, respectively. These indirect sales represent over 132,200 jobs, and generated $3.8 billion in employee compensation and over $8.8 billion in total value added in other industries across the region (Table 48).

Table 48: Indirect Beef Export Contributions - Midwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	390	2,273	84	182
Stocker/Backgrounding	161	952	34	74
Feedlot	355	2,084	76	165
On-farm Production Total	**906**	**5,310**	**194**	**422**
Cattle Harvest	11,480	84,117	2,189	5,303
Beef Processing	8,163	47,167	1,609	3,451
Beef By-products	172	963	44	81
Post-farm Harvest & Processing Total	**19,815**	**132,246**	**3,842**	**8,836**
BEEF INDUSTRY TOTAL	***20,720***	***137,556***	***4,036***	***9,258***

The level of these indirect contributions varies across industries. Table 49 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production[20].

For example, the table indicates that on-farm beef cattle production heavily depends of input purchases from wholesalers in order to raise cattle. Of all of the wholesale expenditures required for on-farm beef cattle production, approximately $96 million goes toward producing beef that are exported from the region. In turn, this $96 million in wholesale purchases is responsible for generating 404 jobs and $63.7 million in value added within the wholesale sector. Similarly, other firms located in the region, such as ADM, Cargill, and Land O'Lakes supply the on-farm beef cattle production operations with needed inputs for animal growth (BizVibe.com, 2020).

Looking at the industries indirectly affected by post-farm cattle harvest and beef processing, it's no surprise to see on-farm beef cattle production topping the list. This is because cattle purchased from local producers represent the primary input for post-farm beef exports (Table 49). Other animal products, such as those from the large pork industry in the region, can be added as additional ingredients in the processing of beef. This explains the large contributions of the Animal production, except cattle and poultry and egg industry to post-farm harvest and processing activities.

[20] Note that sales, jobs, employee compensation and value added accrued to a given industry due to beef exports may be greater here than at the US level. This is because the export base for a region of the US is greater than for the US level. The export base for the US level includes only foreign countries. The export base for a regional (e.g., Southern Plains) level include both foreign countries as well as regions of the US except the Southern Plains.

Table 49:Top Industries by Export Base Contributions to Beef - Midwest (2016)

TOP INDUSTRIES – EXPORT BASE CONTRIBUTIONS			
Sales	On-farm Production	Wholesale trade	$96,275,000
		Other animal food manufacturing	$78,100,000
		Grain farming	$56,616,000
		Real estate	$45,906,000
		Truck transportation	$42,719,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$2,492,411,000
		Animal production, except cattle and poultry and eggs	$1,957,186,000
		Truck transportation	$1,254,693,000
		Wholesale trade	$1,223,161,000
		Other red meat processing	$1,101,276,000
Jobs	On-farm Production	Support activities for agriculture and forestry	407
		Wholesale trade	404
		Truck transportation	261
		Dairy cattle ranching and farming	243
		Real estate	229
	Post-farm Harvest and Processing	On-farm beef cattle production	26,427
		Animal production, except cattle and poultry and eggs	20,591
		Truck transportation	7,657
		Dairy cattle ranching and farming	6,720
		Wholesale trade	5,138
Value Added	On-farm Production	Wholesale trade	$63,660,000
		Real estate	$32,693,000
		Owner-occupied dwellings	$21,935,000
		Truck transportation	$19,117,000
		Support activities for agriculture and forestry	$14,689,000
	Post-farm Harvest and Processing	Animal production, except cattle and poultry and eggs	$955,717,000
		Wholesale trade	$808,796,000
		On-farm beef cattle production	$762,279,000
		Truck transportation	$561,476,000
		Owner-occupied dwellings	$411,872,000

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries while also providing beef products for local consumption?**

In addition to bringing new money into the region through the direct sale of beef exports, the beef industry also plays a supporting role within the regional economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, non-beef businesses and consumers across the region purchased $16.9 billion in goods from the Midwestern beef industry. Beef's presence in the region not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the region by supporting the production of exports across other industries. These export support and local consumption sales combined were responsible for generating around 95,550 jobs, $1.0 billion in employee compensation and $3.7 billion in total value added. (Table 50).

Table 50:Export Support and Local Consumption Contributions - Midwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	3,322	35,218	73	1,016
Stocker/Backgrounding	1,335	14,152	29	408
Feedlot	2,907	30,824	64	889
On-farm Production Total	**7,563**	**80,195**	**166**	**2,313**
Cattle Harvest	5,059	7,222	381	733
Beef Processing	4,252	7,994	476	684
Beef By-products	71	140	10	12
Post-farm Harvest & Processing Total	**9,382**	**15,355**	**867**	**1,429**
BEEF INDUSTRY TOTAL	***16,945***	***95,550***	***1,033***	***3,742***

The level of these export support and local consumption contributions varies across industries. Table 51 presents the top industries in terms of economic activity generated within the beef industry, as a result of sales to local businesses and other local consumers.

The households and government spending industries represent the bulk of local consumption activity occurring within the region[21]. The link between on-farm and post-farm export activity can

[21] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than

be seen as on-farm beef cattle producers sold $2.8 billion to post-farm cattle harvest and beef processing to support their production of exports (Table 51). Table 51 also suggests that the beef industry contributes greatly to sales, jobs, compensation and value added as beef products are used in the manufacturing of pet foods. The region is home to two of the top five pet food manufacturers, Nestle Purina Petcare and Diamond Pet Foods (Henneberry, 2020).

Table 51: Top Industries by Export Support and Local Consumption Contribution - Midwest (2016)

Sales	**On-farm Production**	Other red meat processing	$2,786,536,000
		Post-farm Harvest & Processing	$2,492,411,000
		Households	$858,417,000
		Dog and cat food manufacturing	$194,805,000
		Government spending	$170,365,000
	Post-farm Harvest & Processing	Households	$3,023,183,000
		Other red meat processing	$1,285,970,000
		Dog and cat food manufacturing	$880,919,000
		Government spending	$598,237,000
		Other animal food manufacturing	$152,441,000
Jobs	**On-farm Production**	Other red meat processing	29,546
		Post-farm Harvest & Processing	26,427
		Households	9,102
		Dog and cat food manufacturing	2,066
		Government spending	1,806
	Post-farm Harvest & Processing	Households	4,989
		Other red meat processing	2,015
		Dog and cat food manufacturing	1,547
		Government spending	987
		Other animal food manufacturing	267
Value Added	**On-farm Production**	Other red meat processing	$852,234,000
		Post-farm Harvest & Processing	$762,278,600
		Households	$262,538,000
		Dog and cat food manufacturing	$59,579,000
		Government spending	$52,104,000
	Post-farm Harvest & Processing	Households	$461,846,000
		Other red meat processing	$192,660,000
		Dog and cat food manufacturing	$137,886,000
		Government spending	$91,365,000
		Other animal food manufacturing	$23,842,000

from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

NORTHWEST: (Alaska, Idaho, Montana, Oregon, Washington, Wyoming)

Industry Overview

To understand the broad contributors of the beef industry to the regional economy, results were first analyzed at the 2-digit North American Industry Classification System (NAICS) level.[22] Table 52 shows a breakdown of the Northwest economy by NAICS sector and type of economic activity. . Industries related to beef may be found within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors (Table 52).

Table 52: Regional Contributions by 2-Digit NAICS - Northwest (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	35,543	351,631	7,720	16,897
21	Mining, Quarrying, and Oil and Gas Extraction	27,483	72,305	5,227	17,801
22	Utilities	23,389	21,338	2,460	10,296
23	Construction	86,399	526,910	22,066	43,904
31-33	Manufacturing*	336,514	631,640	50,126	110,815
42	Wholesale Trade	70,284	303,151	21,602	45,836
44-45	Retail Trade	91,487	918,406	32,838	63,349
48-49	Transportation and Warehousing	59,906	289,730	15,305	32,154
51	Information	105,042	205,476	26,593	56,019
52	Finance and Insurance	74,747	341,652	20,218	35,337
53	Real Estate and Rental and Leasing	171,246	425,076	5,305	116,851
54	Professional, Scientific, and Technical Services	101,287	664,994	40,504	63,522
55	Management of Companies and Enterprises	25,385	105,038	12,797	15,475
56	Administrative and Support and Waste Management and Remediation Services	39,221	454,998	17,069	25,973
61	Educational Services	8,181	166,653	4,377	4,766
62	Health Care and Social Assistance	101,558	978,968	51,724	64,445
71	Arts, Entertainment, and Recreation	15,022	214,525	3,547	7,661
72	Accommodation and Food Services	47,592	702,640	16,136	27,858
81	Other Services (except Public Administration)	34,303	524,830	15,869	23,370
92	Public Administration	146,214	1,313,166	100,329	125,132
	Totals	**1,600,802**	**9,213,126**	**471,814**	**907,464**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

[22] See NAICS 2 Digit Sector Codes for definitions and examples: https://classcodes.com/naics-2-digit-sector-codes/ . A brief summary of definitions is provided in Appendix C.

In 2016, *Manufacturing* sector represented the largest share of gross sales (21.0%) generated by industries across the Northwest, with *Public Administration* holding the largest share of jobs (14.3%), employee compensation (21.3%), and total value added (13.8%). Again, it's no surprise that a sector such as *Public Administration* would represent a large share of jobs and employee compensation as the overall role of this sector is to offer services (as opposed to *Manufacturing* which primarily generates of goods for sale), resulting in a high share of employment versus sales for the sector (Table 53).

Table 53: Share of Contributions by 2-Digit NAICS - Northwest (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting*	2.2%	3.8%	1.6%	1.9%
21	Mining, Quarrying, and Oil and Gas Extraction	1.7%	0.8%	1.1%	2.0%
22	Utilities	1.5%	0.2%	0.5%	1.1%
23	Construction	5.4%	5.7%	4.7%	4.8%
31-33	Manufacturing*	21.0%	6.9%	10.6%	12.2%
42	Wholesale Trade	4.4%	3.3%	4.6%	5.1%
44-45	Retail Trade	5.7%	10.0%	7.0%	7.0%
48-49	Transportation and Warehousing	3.7%	3.1%	3.2%	3.5%
51	Information	6.6%	2.2%	5.6%	6.2%
52	Finance and Insurance	4.7%	3.7%	4.3%	3.9%
53	Real Estate and Rental and Leasing	10.7%	4.6%	1.1%	12.9%
54	Professional, Scientific, and Technical Services	6.3%	7.2%	8.6%	7.0%
55	Management of Companies and Enterprises	1.6%	1.1%	2.7%	1.7%
56	Administrative and Support and Waste Management and Remediation Services	2.5%	4.9%	3.6%	2.9%
61	Educational Services	0.5%	1.8%	0.9%	0.5%
62	Health Care and Social Assistance	6.3%	10.6%	11.0%	7.1%
71	Arts, Entertainment, and Recreation	0.9%	2.3%	0.8%	0.8%
72	Accommodation and Food Services	3.0%	7.6%	3.4%	3.1%
81	Other Services (except Public Administration)	2.1%	5.7%	3.4%	2.6%
92	Public Administration	9.1%	14.3%	21.3%	13.8%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

Next, we examine the contribution of the beef industry alone across the *entire* regional economy. At this level, on-farm beef cattle production and post-farm cattle harvest and beef processing activity represents 0.6% of regional sales, 0.5% of employment, 0.1% of employee compensation and 0.2% of total value added (Table 54)

Table 54: Share of Beef Contributions to the Regional Economy - Northwest (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region
Cow-Calf	3,094	0.19%	22,801	0.25%	88	0.02%	796	0.09%
Stocker-Background	275	0.02%	2,024	0.02%	8	0.00%	71	0.01%
Feed Lot	1,447	0.09%	10,661	0.12%	41	0.01%	372	0.04%
On-farm Beef Cattle Production	***4,815***	***0.30%***	***35,486***	***0.39%***	***137***	***0.03%***	***1,239***	***0.14%***
Cattle Harvest	2,793	0.17%	4,088	0.04%	181	0.04%	344	0.04%
Beef Processing	1,774	0.11%	3,448	0.04%	160	0.03%	235	0.03%
Beef By-products	95	0.01%	183	0.00%	13	0.00%	17	0.00%
Post-farm Harvest and Processing	***4,661***	***0.29%***	***7,719***	***0.08%***	***355***	***0.08%***	***596***	***0.07%***
Beef Industry Total	**9,476**	**0.59%**	**43,205**	**0.47%**	**492**	**0.10%**	**1,835**	**0.20%**

A better presentation of the beef industry's importance to the regional economy is demonstrated by the relative contribution to its own 2-digit NAICS sector. On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* sector. Within this sector, on-farm beef production represented 13.5% of sales, 10.1% of jobs, 1.8% of employee compensation, and 7.3% of total value added (Figure 16).

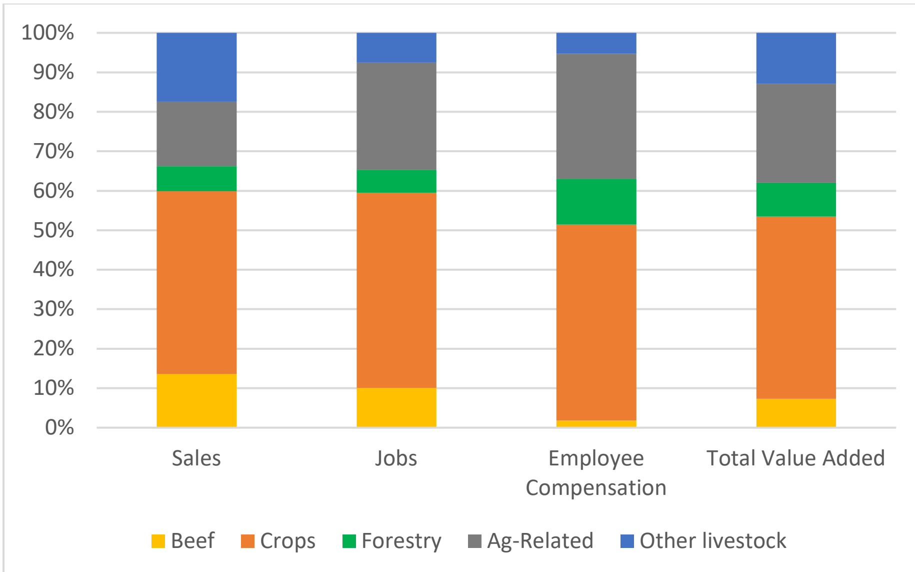


Figure 16: Share of Contributions to Agriculture, Forestry, Fishing, and Hunting - Northwest (2016)

Table 55 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Across all 19 industries, on-farm beef cattle production ranked 1st in terms of sales, 4th in jobs, 9th in employee compensation, and 5th in total value added. Fruit farming (led by Washington's extensive apple and cherry industries as well as Oregon's extensive blackberry, blueberry and strawberry industries) (USDA ERS, 2020d) showed the highest value added, with support activities for agriculture and forestry ranking highest in jobs and employee compensation (Table 55).

Table 55: Top Ten Agriculture, Forestry, Fishing, and Hunting Industries by Sales - Northwest (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
On-farm beef cattle production	1	4	9	5
Fruit farming	2	2	2	1
Dairy cattle and milk production	3	10	7	8
Grain farming	4	9	13	11
Support activities for agriculture and forestry	5	1	1	2
All other crop farming	6	3	3	3
Vegetable and melon farming	7	7	5	4
Commercial logging	8	6	4	7
Commercial fishing	9	5	8	6
Greenhouse, nursery, and floriculture production	10	8	6	9

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. Within this sector, post-farm cattle harvest and beef processing activity represented 1.4% of sales, 1.2% of jobs, 0.7% of employee compensation and 0.5% of total value added. While the value of beef product manufacturing may appear relatively small, the aggregate *Manufacturing* sector is made up of hundreds of industries, covering all forms of manufacturing - from the production of beef products, to cars, to pesticides and pharmaceuticals. Because of this, it may be more valuable to consider the beef industry relative only to industries that manufacture agricultural goods. The agriculture related industries in *Manufacturing* made up 26.0% of *Manufacturing* sales, 32.9% of *Manufacturing* jobs, 21.8% *Manufacturing* employee compensation and 17.2% of *Manufacturing* value added. From this perspective, post-farm cattle harvest and beef processing represented 5.3% of total sales, 3.7% of jobs, 3.2% of employee compensation and 3.1% of total value added across agriculture-related manufacturing industries (Figure 17).

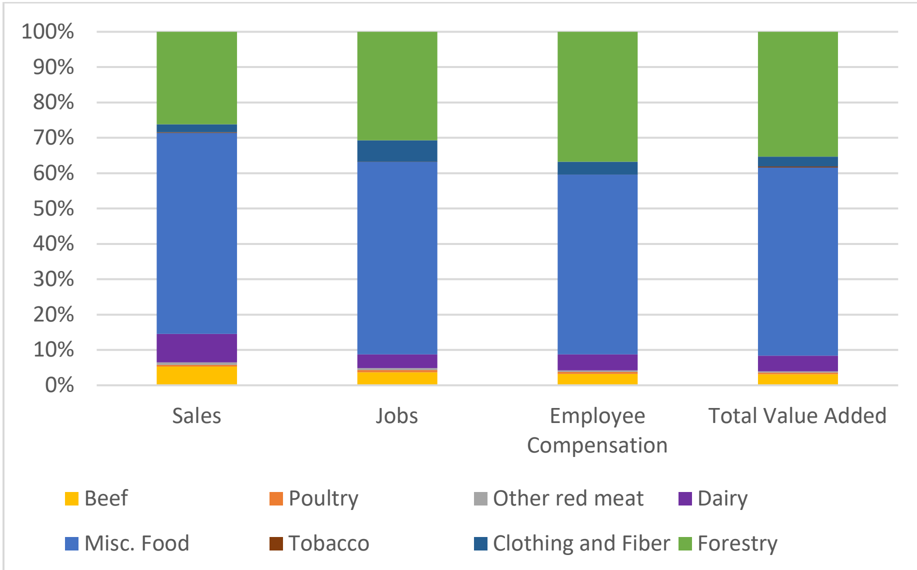


Figure 17: Share of Contributions to Agriculture-Related Manufacturing - Northwest (2016)

Table 56 shows the top ten agriculture-related manufacturing industries, ranked in terms of sales. Across all 88 industries, post-farm cattle harvest and beef processing ranked 4th in sales, 7th in jobs and employee compensation, and 8th in total value added. As mentioned above, the region is a top producer of applies and berries, all primary ingredients in the production of frozen fruit and juice manufacturing . Alaska and Washington rank 1st and 3rd in the nation in US seafood landings, helping it secure the top spot in agricultural manufacturing (Statista, 2020). Similarly, Washington, Idaho and Oregon rank among the top sawmill states in the nation.

Table 56: Top Ten Agriculture-Related Manufacturing Industries by Sales - Northwest (2016)

Industry	Sales	Jobs	Employee Compensation	Total Value Added
Frozen fruits, juices and vegetables manufacturing	1	4	3	3
Seafood product preparation and packaging	2	2	1	1
Sawmills	3	3	2	2
Cattle harvest and beef processing	4	7	7	8
Paper mills	5	9	5	5
Breweries	6	8	13	6
Cheese manufacturing	7	18	19	21
Bottled and canned soft drinks & water	8	19	12	9
Bread and bakery product, except frozen, manufacturing	9	1	4	4
Wineries	10	5	8	10

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity (export AND local) generated within the beef industry itself across the Northwest?**

In 2016, the Northwest beef industry generated more than $9.5 billion in gross sales, representing 43,205 jobs. In addition to gross sales and jobs, $1.8 billion was added to the economy through employee compensation, proprietary income, returns to capital, and indirect business taxes provided by the operation of on-farm beef production and post-farm harvest and processing firms (Table 57).

On-farm production of beef cattle represented $4.8 billion of total gross sales with cow-calf, stocker/backgrounding, and feedlot producers contributing $3.0 billion, $275 million, and $1.4 billion, respectively. These sales generated around 35,500 jobs, resulting in the payment of $137 million in employee compensation and almost $1.2 billion in total value being added to the regional economy (Table 57).

Sales from the post-farm harvest and processing sector made up the remaining $4.7 billion in gross sales with beef and dairy cattle harvest, beef processing, and beef by-products contributing $2.8 billion, $1.8 billion, and $95 million respectively. From these sales, over 7,700 jobs were generated, representing $355 million in employee compensation and almost $600 million in total value being added to the regional economy (Table 57).

Table 57:Gross Economic Contributions of Beef - Northwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	3,094	22,802	88	796
Stocker/Backgrounding	275	2,024	8	71
Feedlot	1,447	10,661	41	372
On-farm Production Total	**4,815**	**35,486**	**137**	**1,239**
Cattle Harvest	2,793	4,088	181	344
Beef Processing	1,774	3,448	160	235
Beef By-products	95	183	13	17
Post-farm Harvest & Processing Total	**4,661**	**7,719**	**355**	**596**
BEEF INDUSTRY TOTAL	***9,477***	***43,205***	***492***	***1,835***

Beef Export Contributions

Here, we consider: **How much value is the beef industry responsible for generating across the entire Northwestern economy through the production of beef goods for export outside of the region?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the economic activity (in terms of sales, jobs, employee compensation and value added) that is generated within the beef industry as a result of beef exports. The Northwest beef industry generated $5.3 billion in direct beef export sales (Table 58).

Of the beef industry's direct beef export value, on-farm beef cattle production represented $2.8 billion of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $1.8 billion, $149 million, and $827 million, respectively. These sales represent over 20,400 jobs and generated around $79 million in employee compensation and $712 million in total value added across the region (Table 58).

Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($2.5 billion), with beef harvest, beef processing, and beef by-products contributing $1.7 billion, $0.8 billion, and $64 million, respectively. These sales represent around 4,120 jobs, $189 million in employee compensation and $323 million in total value added across the region (Table 58).

Table 58: Direct Beef Export Contributions - Northwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	1,793	13,213	51	461
Stocker/Backgrounding	149	1,095	4	38
Feedlot	827	6,098	24	213
On-farm Production Total	**2,769**	**20,406**	**79**	**712**
Cattle Harvest	1,659	2,429	108	205
Beef Processing	806	1,567	73	107
Beef By-products	64	123	9	11
Post-farm Harvest & Processing Total	**2,529**	**4,119**	**189**	**323**
BEEF INDUSTRY TOTAL	***5,298***	***24,525***	***268***	***1,035***

Indirect Beef Export Contributions

While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or vaccination services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms, the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the “feed store” or retail sector. However, with economic base analysis, the value is credited to the beef industry, as it is beef exports that are responsible for generating these sales. This economic activity is referred to as indirect beef export contributions.

In 2016, regional beef exports were indirectly responsible for generating $6.8 billion in sales across other local industries. These indirect beef export sales equate to around 43,187 jobs, $1.3 billion in employee compensation and almost $3.1 billion in total value added to other parts of the economy (Table 59).

Of this indirect beef export value, on-farm beef cattle production represented $3.3 billion in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $2.0, $0.2, and $1.1 billion, respectively. These sales represent over 20,300 jobs, resulting in the payment of $722 million in employee compensation and $1.5 billion in total value added within other industries across the region (Table 59).

Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($3.5 billion), with beef harvest, beef processing, and beef by-products contributing $2.6 billion, $0.9 billion, and $71 million, respectively. These indirect sales represent over 22,800 jobs, and generated $625 million in employee compensation and $1.5 billion in total value added in other industries across the region (Table 59).

Table 59: Indirect Beef Export Contributions - Northwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	1,998	12,320	451	953
Stocker/Backgrounding	205	1,286	43	94
Feedlot	1,074	6,707	228	496
On-farm Production Total	**3,277**	**20,313**	**722**	**1,543**
Cattle Harvest	2,586	17,445	447	1,134
Beef Processing	851	5,029	161	366
Beef By-products	71	401	18	35
Post-farm Harvest & Processing Total	**3,508**	**22,875**	**625**	**1,536**
BEEF INDUSTRY TOTAL	***6,785***	***43,187***	***1,347***	***3,078***

The level of these indirect contributions varies across industries. Table 60 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production[23].

For example, the table indicates that on-farm beef cattle production heavily depends of input purchases from wholesalers in order to raise cattle. Of all of the wholesale expenditures required for on-farm beef cattle production, approximately $326 million goes toward producing beef that are exported from the region. In turn, this $326 million in wholesale purchases is responsible for generating 1,409 jobs and $213 million in value added within the wholesale sector.

Looking at the industries indirectly affected by post-farm cattle harvest and beef processing, it’s no surprise to see on-farm beef cattle production topping the list. This is because cattle purchased from local producers represent the primary input for post-farm beef exports (Table 60).

[23] Note that sales, jobs, employee compensation and value added accrued to a given industry due to beef exports may be greater here than at the US level. This is because the export base for a region of the US is greater than for the US level. The export base for the US level includes only foreign countries. The export base for a regional (e.g., Southern Plains) level include both foreign countries as well as regions of the US except the Southern Plains.

Table 60: Top Industries by Export Base Contributions to Beef - Northwest (2016)

Sales	**On-farm Production**	Wholesale trade	$326,636,000
		Other animal food manufacturing	$260,255,000
		Real estate	$189,176,000
		Support activities for agriculture and forestry	$182,317,000
		Grain farming	$162,902,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$886,327,000
		Truck transportation	$219,179,000
		Wholesale trade	$214,173,000
		Animal production, except cattle and poultry and eggs	$193,000,000
		Dairy cattle ranching and farming	$164,300,000
Jobs	**On-farm Production**	Support activities for agriculture and forestry	3,618
		Wholesale trade	1,409
		All other crop farming	1,053
		Dairy cattle ranching and farming	927
		Real estate	881
	Post-farm Harvest and Processing	On-farm beef cattle production	6,532
		Animal production, except cattle and poultry and eggs	1,945
		Support activities for agriculture and forestry	1,325
		Truck transportation	1,316
		Dairy cattle ranching and farming	1,211
Value Added	**On-farm Production**	Wholesale trade	$213,020,000
		Support activities for agriculture and forestry	$138,543,000
		Real estate	$138,412,000
		Owner-occupied dwellings	$81,946,000
		Truck transportation	$62,950,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$228,020,000
		Wholesale trade	$139,675,000
		Animal production, except cattle and poultry and eggs	$131,276,000
		Truck transportation	$100,017,000
		Real estate	$86,526,000

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries while also providing beef products for local consumption?**

In addition to bringing new money into the region through the direct sale of beef exports, the beef industry also plays a supporting role within the regional economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, non-beef businesses and consumers across the region purchased $4.2 billion worth of goods from the Northwest beef industry. The presence of the beef industry in the region not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the region by supporting the production of exports across other industries. These export support and local consumption sales combined were responsible for generating almost 18,700 jobs, $224 million in employee compensation and $800 million in total value added. (Table 61).

Table 61: Export Support and Local Consumption Contributions - Northwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	1,301	9,589	37	335
Stocker/Backgrounding	126	929	4	32
Feedlot	619	4,563	18	159
On-farm Production Total	**2,046**	**15,080**	**58**	**526**
Cattle Harvest	1,133	1,659	74	140
Beef Processing	967	1,881	87	128
Beef By-products	31	60	4	6
Post-farm Harvest & Processing Total	**2,132**	**3,600**	**165**	**273**
BEEF INDUSTRY TOTAL	***4,178***	***18,680***	***224***	***800***

The level of these export support and local consumption contributions varies across industries. Table 62 presents the top industries in terms of economic activity generated within the beef industry, as a result of sales to local businesses and other local consumers.

The households and government spending industries represent the bulk of local consumption activity occurring within the region[24]. The link between on-farm and post-farm export activity can be seen as on-farm beef cattle producers sold $886 million to post-farm cattle harvest and beef processing to support their production of exports (Table 62). Aircraft manufacturing (Boeing, Space, Blue Origin, etc) and software publishers (e.g., Microsoft) represent a significant share of value generated across the regional economy (WSDC, 2020). Because of this, those industries show strong consumption interactions with the beef industry (and most other industries within the region).

Table 62: Top Industries by Export Support and Local Consumption Contribution - Northwest (2016)

Sales	**On-farm Production**	Post-farm Harvest & Processing	$886,327,000
		Households	$309,889,000
		Other red meat processing	$81,349,000
		Dairy cattle ranching and farming	$80,880,000
		Government spending	$78,438,000
	Post-farm Harvest & Processing	Households	$923,687,000
		Government spending	$232,984,000
		Aircraft manufacturing	$58,222,000
		Dog and cat food manufacturing	$48,514,000
		Software publishers	$46,462,000
Jobs	**On-farm Production**	Post-farm Harvest & Processing	6,532
		Households	2,284
		Other red meat processing	600
		Dairy cattle ranching and farming	596
		Government spending	578
	Post-farm Harvest & Processing	Households	1,568
		Government spending	395
		Aircraft manufacturing	99
		Dog and cat food manufacturing	88
		Software publishers	79
Value Added	**On-farm Production**	Post-farm Harvest & Processing	$228,020,000
		Households	$79,723,400
		Other red meat processing	$20,928,000
		Dairy cattle ranching and farming	$20,808,000
		Government spending	$20,179,000
	Post-farm Harvest & Processing	Households	$118,469,000
		Government spending	$29,875,000
		Aircraft manufacturing	$7,464,000
		Dog and cat food manufacturing	$6,309,000
		Software publishers	$5,956,000

[24] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

SOUTHWEST: (Arizona, California, Colorado, Hawaii, Nevada, New Mexico, Utah)

Industry Overview

To understand the broad contributors of the beef industry to the regional economy, results were first analyzed at the 2-digit North American Industry Classification System (NAICS) level.[25] Table 63 shows a breakdown of the Southwest economy by NAICS sector and type of economic activity. Industries related to beef are within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors (Table 63).

Table 63: Regional Contributions by 2-Digit NAICS - Southwest (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	76,565	725,114	20,405	39,215
21	Mining, Quarrying, and Oil and Gas Extraction	56,161	193,852	12,060	35,329
22	Utilities	97,567	100,350	14,826	44,763
23	Construction	322,513	1,897,584	83,918	168,488
31-33	Manufacturing*	967,987	1,943,742	175,702	347,258
42	Wholesale Trade	294,058	1,226,459	93,474	195,152
44-45	Retail Trade	302,823	3,243,078	103,465	205,027
48-49	Transportation and Warehousing	200,400	1,186,328	56,526	104,993
51	Information	457,579	858,498	108,512	254,989
52	Finance and Insurance	397,703	1,695,962	116,428	204,712
53	Real Estate and Rental and Leasing	752,398	1,845,703	31,535	526,690
54	Professional, Scientific, and Technical Services	519,391	3,112,243	239,223	342,250
55	Management of Companies and Enterprises	97,199	388,634	49,765	60,534
56	Administrative and Support and Waste Management and Remediation Services	176,105	2,395,914	86,246	114,604
61	Educational Services	47,633	738,726	28,646	32,728
62	Health Care and Social Assistance	382,229	3,815,773	198,851	246,848
71	Arts, Entertainment, and Recreation	91,488	957,961	27,461	57,433
72	Accommodation and Food Services	223,054	3,002,333	79,899	135,545
81	Other Services (except Public Administration)	146,324	2,183,681	62,887	102,569
92	Public Administration	549,841	4,402,015	388,138	490,377
	Totals	**6,159,020**	**35,913,949**	**1,977,967**	**3,709,504**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

[25] See NAICS 2 Digit Sector Codes for definitions and examples: https://classcodes.com/naics-2-digit-sector-codes/ . A brief summary of definitions is provided in Appendix C.

The *Manufacturing* sector represented the largest share of gross sales (15.7%) generated by industries across the Southwest in 2016. The *Public Administration* sector held the largest share of jobs (12.3%) and employee compensation (19.6%). Again, it's no surprise that a sector such as *Public Administration* would represent a large share of jobs and employee compensation as the overall role of this sector is to offer services (as opposed to *Manufacturing* which primarily generates of goods for sale), resulting in a high share of employment versus sales for the sector. *Real Estate and Rental and Leasing* had the largest share of total value added (14.2%), likely as a result of high property and tax values found across the region (Table 64).

Table 64: Share of Contributions by 2-Digit NAICS - Southwest (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting*	1.2%	2.0%	1.0%	1.1%
21	Mining, Quarrying, and Oil and Gas Extraction	0.9%	0.5%	0.6%	1.0%
22	Utilities	1.6%	0.3%	0.7%	1.2%
23	Construction	5.2%	5.3%	4.2%	4.5%
31-33	Manufacturing*	15.7%	5.4%	8.9%	9.4%
42	Wholesale Trade	4.8%	3.4%	4.7%	5.3%
44-45	Retail Trade	4.9%	9.0%	5.2%	5.5%
48-49	Transportation and Warehousing	3.3%	3.3%	2.9%	2.8%
51	Information	7.4%	2.4%	5.5%	6.9%
52	Finance and Insurance	6.5%	4.7%	5.9%	5.5%
53	Real Estate and Rental and Leasing	12.2%	5.1%	1.6%	14.2%
54	Professional, Scientific, and Technical Services	8.4%	8.7%	12.1%	9.2%
55	Management of Companies and Enterprises	1.6%	1.1%	2.5%	1.6%
56	Administrative and Support and Waste Management and Remediation Services	2.9%	6.7%	4.4%	3.1%
61	Educational Services	0.8%	2.1%	1.4%	0.9%
62	Health Care and Social Assistance	6.2%	10.6%	10.1%	6.7%
71	Arts, Entertainment, and Recreation	1.5%	2.7%	1.4%	1.5%
72	Accommodation and Food Services	3.6%	8.4%	4.0%	3.7%
81	Other Services (except Public Administration)	2.4%	6.1%	3.2%	2.8%
92	Public Administration	8.9%	12.3%	19.6%	13.2%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

Next, we examine the contribution of the beef industry alone across the *entire* regional economy. At this level, on-farm beef cattle production and post-farm cattle harvest and beef processing activity represents 0.3% of regional sales, 0.2% of employment, and 0.1% of employee compensation and 0.1% of total value added (Table 65)

Table 65: Share of Beef Contributions to the Regional Economy - Southwest (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region
Cow-Calf	2,323	0.04%	17,542	0.05%	61	0.00%	364	0.01%
Stocker-Background	40	0.00%	304	0.00%	1	0.00%	6	0.00%
Feed Lot	2,804	0.05%	21,165	0.06%	73	0.00%	439	0.01%
On-farm Beef Cattle Production	***5,168***	***0.08%***	***39,011***	***0.11%***	***135***	***0.01%***	***809***	***0.02%***
Cattle Harvest	9,570	0.16%	13,783	0.04%	694	0.04%	1,314	0.04%
Beef Processing	4,252	0.07%	8,058	0.02%	443	0.02%	656	0.02%
Beef By-products	397	0.01%	771	0.00%	58	0.00%	70	0.00%
Post-farm Harvest and Processing	***14,220***	***0.23%***	***22,612***	***0.06%***	***1,196***	***0.06%***	***2,040***	***0.05%***
Beef Industry Total	**19,387**	**0.31%**	**61,623**	**0.17%**	**1,331**	**0.07%**	**2,849**	**0.08%**

A better presentation of the beef industry's importance to the regional economy is demonstrated by the relative contribution to its own 2-digit NAICS sector. On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* sector. Within this sector, on-farm beef production represented 6.7% of sales, 5.4% of jobs, 0.7% of employee compensation, and 0.8% of total value added (Figure 18).

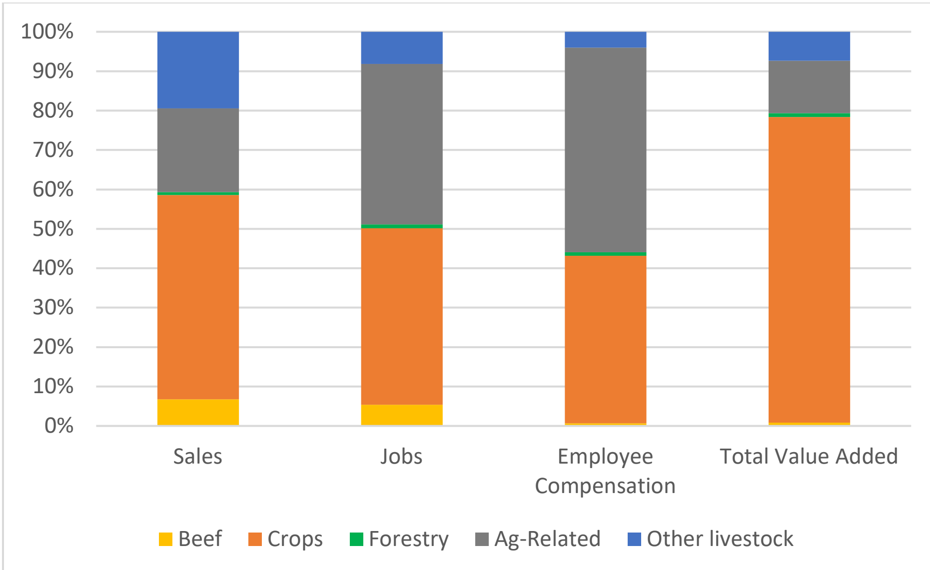


Figure 18: Share of Contributions for Agriculture, Forestry, Fishing, and Hunting - Southwest (2016)

Table 66 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Across all 19 industries, on-farm beef cattle production ranked 6th in terms of sales, jobs, 3rd in jobs, and 8th in employee compensation and 8th in total value added. Given California's high levels of crop production, it's unsurprising that support activities for agriculture and forestry (which includes among other things services related to vineyard and orchard cultivation, planting crops, plowing, pollinating, weed control services, etc.) ranked the highest for each economic activity in the region.

Table 66: Top Ten Agriculture, Forestry, Fishing, and Hunting Industries by Sales - Southwest (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Support activities for agriculture and forestry	1	1	1	1
Fruit farming	2	2	2	2
Vegetable and melon farming	3	6	4	3
Dairy cattle and milk production	4	8	7	5
Tree nut farming	5	5	3	4
On-farm beef cattle production	6	3	8	8
Greenhouse, nursery, and floriculture production	7	7	5	6
All other crop farming	8	4	6	7
Grain farming	9	11	15	13
Poultry and egg production	10	15	12	11

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. Within this sector, post-farm cattle harvest and beef processing activity represented 1.5% of sales, 1.2% of jobs, 0.7% of employee compensation and 0.6% of total value added. While the value of beef product manufacturing may appear relatively small, the aggregate *Manufacturing* sector is made up of hundreds of industries, covering all forms of manufacturing - from the production of beef products, to cars, to pesticides and pharmaceuticals. Because of this, it may be more valuable to consider the beef industry relative only to industries that manufacture agricultural goods. The agriculture related industries in *Manufacturing* made up 22.2% of *Manufacturing* sales, 26.8% of *Manufacturing* jobs, 15.7% *Manufacturing* employee compensation and 14.6% of *Manufacturing* value added. From this perspective, post-farm cattle harvest and beef processing represented 6.6% of total sales, 4.3% of jobs, 4.3% of employee compensation and 3.9% of total value added across agriculture-related manufacturing industries (Figure 19).

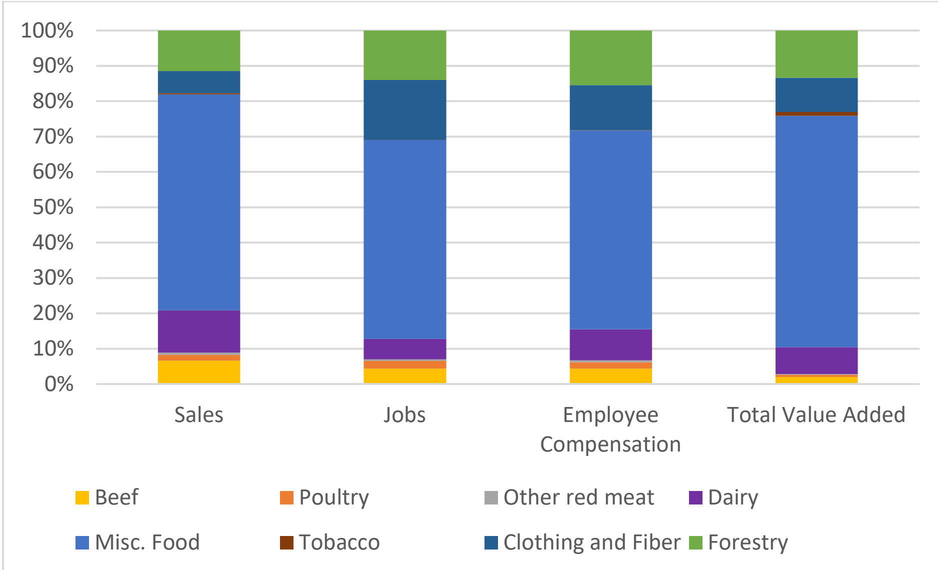


Figure 19: Share of Contributions to Agriculture-Related Manufacturing - Southwest (2016)

Across the eighty-eight agricultural manufacturing industries within the *Manufacturing* sector, post-farm cattle harvest and beef processing ranked 3rd in sales, 4th in jobs, 6th in employee compensation, and 6th in total value added. The bottling industry has grown significantly in recent years in Arizona and New Mexico, among other southwestern locations, pushing it into the number one spot for sales. Similarly, King's Hawaiian, Bimbo, Boulin Holdings, and many regional brands contribute to the strength of the Bread and bakery product, except frozen, manufacturing in the Southwest. Napa Valley and the surrounding areas boost wineries to the second spot (Table 67).

Table 67: Top Ten Agriculture-Related Manufacturing Industries by Sales - Southwest (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Bottled and canned soft drinks & water	1	6	4	4
Wineries	2	2	2	1
Cattle harvest and beef processing	3	4	6	6
Bread and bakery product, except frozen, manufacturing	4	1	1	2
Breweries	5	9	7	3
Fluid milk manufacturing	6	11	5	7
Cheese manufacturing	7	13	12	12
Paperboard container manufacturing	8	7	3	5
Canned fruits and vegetables manufacturing	9	8	9	9
All other food manufacturing	10	5	8	10

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity (export AND local) generated within the beef industry itself across the Southwest?**

In 2016, the Southwest beef industry generated more than $19.4 billion in gross sales, representing 61,623 jobs. In addition to gross sales and jobs, $2.8 billion was added to the economy through employee compensation, proprietary income, returns to capital, and indirect business taxes provided by the operation of on-farm beef production and post-farm harvest and processing firms (Table 68).

On-farm production of beef cattle represented $5.2 billion of total gross sales with cow-calf, stocker/backgrounding, and feedlot producers contributing $2.3 billion, $40 million, and $2.8 billion, respectively. These sales generated over 39,000 jobs, resulting in the payment of $135 million in employee compensation and almost $809 million in total value being added to the regional economy (Table 68).

Sales from the post-farm harvest and processing sector made up the remaining $14.2 billion in gross sales with beef and dairy cattle harvest, beef processing, and beef by-products contributing $9.6, $4.3, and $0.4 billion respectively. From these sales, over 22,600 jobs were generated, representing $1.2 billion in employee compensation and over $2.0 billion in total value being added to the regional economy (Table 68).

Table 68: Gross Economic Contributions of Beef - Southwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	2,324	17,542	61	364
Stocker/Backgrounding	40	304	1	6
Feedlot	2,804	21,165	73	439
On-farm Production Total	**5,168**	**39,012**	**135**	**809**
Cattle Harvest	9,571	13,783	694	1,314
Beef Processing	4,252	8,058	443	656
Beef By-products	397	771	58	70
Post-farm Harvest & Processing Total	**14,220**	**22,612**	**1,196**	**2,040**
BEEF INDUSTRY TOTAL	***19,388***	***61,623***	***1,331***	***2,849***

Beef Export Contributions

Here, we consider: **How much value is the beef industry responsible for generating across the entire Southwest economy through the production of beef goods for export outside of the region?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the economic activity (in terms of sales, jobs, employee compensation and value added) that is generated within the beef industry as a result of beef exports. In 2016, the Southwest beef industry generated almost $7.0 billion in direct beef export sales (Table 69).

Of the beef industry's direct beef export value, on-farm beef cattle production represented $1.3 billion of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $0.6 billion, $9 million, and $0.7 billion, respectively. These sales represent over 9,600 jobs and generated around $33 million in employee compensation and $199 million in total value added across the region (Table 69).

Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($5.7billion), with beef harvest, beef processing, and beef by-products contributing $4.5 billion, $1.0 billion, and $159 million, respectively. These sales represent around 8,800 jobs, $460 million in employee compensation and $810 million in total value added across the region (Table 69).

Table 69: Direct Export Base Contributions of Beef - Southwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	558	4,214	15	87
Stocker/Backgrounding	9	71	0	1
Feedlot	705	5,320	18	110
On-farm Production Total	**1,273**	**9,606**	**33**	**199**
Cattle Harvest	4,547	6,549	330	624
Beef Processing	1,025	1,942	107	158
Beef By-products	159	308	23	28
Post-farm Harvest & Processing Total	**5,730**	**8,798**	**460**	**810**
BEEF INDUSTRY TOTAL	***7,003***	***18,404***	***493***	***1,010***

Indirect Beef Export Contributions

While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or vaccination services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms, the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the "feed store" or retail sector. However, with economic base analysis, the value credited to the beef industry, as it is exports from beef that are ultimately responsible for generating these sales. This activity is called indirect beef export contributions.

In 2016, regional beef exports were indirectly responsible for generating $10.1 billion in sales across other local industries. These indirect beef export sales equate to over 64,000 jobs, $2.1 billion in employee compensation and more than $4.4 billion in total value added to other parts of the economy (Table 70).

Of this indirect beef export value, on-farm beef cattle production represented $1.8 billion in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $787, $15, and $996 million, respectively. These sales represent almost 10,730 jobs, resulting in the payment of $426 million in employee compensation and $871 million in total value added within other industries across the region.

Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($8.3 billion), with beef harvest, beef processing, and beef by-products contributing $6.9 billion, $1.2 billion, and $204 million, respectively. These indirect sales represent over 53,300 jobs, and generated $1.6 billion in employee compensation and $3.5 billion in total value added in other industries across the region (Table 70).

Table 70: Indirect Beef Export Contributions - Southwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	787	4,698	187	381
Stocker/Backgrounding	15	90	3	7
Feedlot	996	5,942	236	482
On-farm Production Total	**1,798**	**10,730**	**426**	**871**
Cattle Harvest	6,933	45,482	1,326	2,937
Beef Processing	1,199	6,724	246	510
Beef By-products	204	1,098	52	101
Post-farm Harvest & Processing Total	**8,336**	**53,304**	**1,624**	**3,549**
BEEF INDUSTRY TOTAL	***10,134***	***64,035***	***2,051***	***4,419***

The level of these indirect contributions varies across industries. Table 71 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production[26].

For example, the table indicates that on-farm beef cattle production heavily depends of input purchases from wholesalers in order to raise cattle. Of all of the wholesale expenditures required for on-farm beef cattle production, approximately $196 million goes toward producing beef that are exported from the region. In turn, this $196 million in wholesale purchases is responsible for generating 818 jobs and $130 million in value added within the wholesale sector.

Looking at the industries indirectly affected by post-farm cattle harvest and beef processing, it's no surprise to see on-farm beef cattle production topping the list. This is because cattle purchased from local producers represent the primary input for post-farm beef exports (Table 71). Similarly culled dairy steers and retired dairy cows from one of the nation's largest dairy regions provide inputs to the post-farm harvest and processing industry (USDA ERS, 2020d).

[26] Note that sales, jobs, employee compensation and value added accrued to a given industry due to beef exports may be greater here than at the US level. This is because the export base for a region of the US is greater than for the US level. The export base for the US level includes only foreign countries. The export base for a regional (e.g., Southern Plains) level include both foreign countries as well as regions of the US except the Southern Plains.

Table 71: Top Industries by Export Base Contributions of Beef - Southwest (2016)

Sales	**On-farm Production**	Wholesale trade	$196,046,000
		Other animal food manufacturing	$144,957,000
		Dairy cattle ranching and farming	$118,667,000
		Support activities for agriculture and forestry	$96,699,000
		Real estate	$96,311,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$1,508,557,000
		Dairy cattle ranching and farming	$847,871,000
		Truck transportation	$582,448,000
		Wholesale trade	$564,312,000
		Animal production, except cattle and poultry and eggs	$301,315,000
Jobs	**On-farm Production**	Support activities for agriculture and forestry	1,755
		Dairy cattle ranching and farming	896
		Wholesale trade	818
		All other crop farming	474
		Truck transportation	467
	Post-farm Harvest and Processing	On-farm beef cattle production	11,387
		Dairy cattle ranching and farming	6,401
		Truck transportation	3,553
		Animal production, except cattle and poultry and eggs	3,453
		Support activities for agriculture and forestry	2,980
Value Added	**On-farm Production**	Wholesale trade	$130,106,000
		Support activities for agriculture and forestry	$75,468,000
		Real estate	$73,029,000
		Owner-occupied dwellings	$41,131,000
		Truck transportation	$34,249,000
	Post-farm Harvest and Processing	Wholesale trade	$374,506,000
		Truck transportation	$260,777,000
		On-farm beef cattle production	$236,216,000
		Real estate	$212,746,000
		Animal production, except cattle and poultry and eggs	$187,038,000

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries while also providing beef products for local consumption?**

In addition to bringing new money into the region through the direct sale of beef exports, the beef industry also plays a supporting role within the regional economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, non-beef businesses and consumers across the region purchased $12.4 billion worth of goods from the Southwest beef industry. The presence of the beef industry in the region not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the region by supporting the production of exports across other industries. These export support and local consumption sales combined were responsible for generating almost 43,220 jobs, $838 million in employee compensation and $1.8 billion in total value added. (Table 72).

Table 72: Export Support and Local Compensation Contributions - Southwest (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	1,765	13,328	46	276
Stocker/Backgrounding	31	233	1	5
Feedlot	2,099	15,845	55	329
On-farm Production Total	**3,896**	**29,406**	**102**	**610**
Cattle Harvest	5,023	7,235	364	690
Beef Processing	3,228	6,116	336	498
Beef By-products	239	463	35	42
Post-farm Harvest & Processing Total	**8,490**	**13,814**	**736**	**1,230**
BEEF INDUSTRY TOTAL	***12,385***	***43,220***	***838***	***1,840***

The level of these export support and local consumption contributions varies across industries. Table 73 presents the top industries in terms of economic activity generated within the beef industry, as a result of sales to local businesses and other local consumers.

The households and government spending industries represent the bulk of local consumption activity occurring within the region[27]. The link between on-farm and post-farm export activity can be seen as on-farm beef cattle producers sold $1.5 billion to post-farm cattle harvest and beef processing to support their production of exports (Table 73). Scientific research and development and custom computer programming services with firms such as Google and others in Silicon Valley represent a significant share of value generated across the regional economy. Because of this, those industries show strong consumption interactions with the beef industry (and most other industries across the region).

Table 73:Top Industries by Export Support and Local Consumption Contribution - Southwest (2016)

Sales	On-farm Production	Post-farm Harvest & Processing	$1,508,557,000
		Households	$852,555,000
		Government spending	$237,550,000
		Other red meat processing	$119,558,000
		Dairy cattle ranching and farming	$94,773,000
	Post-farm Harvest & Processing	Households	$3,558,767,000
		Government spending	$988,161,000
		Dog and cat food manufacturing	$306,846,000
		Scientific research and development services	$227,957,000
		Custom computer programming services	$150,185,000
Jobs	On-farm Production	Post-farm Harvest & Processing	11,387
		Households	6,436
		Government spending	1,793
		Other red meat processing	902
		Dairy cattle ranching and farming	715
	Post-farm Harvest & Processing	Households	5,798
		Government spending	1,608
		Dog and cat food manufacturing	537
		Scientific research and development services	371
		Custom computer programming services	244
Value Added	On-farm Production	Post-farm Harvest & Processing	$236,216,000
		Households	$133,496,700
		Government spending	$37,197,000
		Other red meat processing	$18,721,000
		Dairy cattle ranching and farming	$14,840,000
	Post-farm Harvest & Processing	Households	$515,298,000
		Government spending	$143,020,000
		Dog and cat food manufacturing	$45,670,000
		Scientific research and development services	$32,980,000
		Custom computer programming services	$21,719,000

[27] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

SOUTHEAST: (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia)

Industry Overview

To understand the broad contributors of the beef industry to the regional economy, results were first analyzed at the 2-digit North American Industry Classification System (NAICS) level.[28] Table 74 shows a breakdown of the Southeast economy by NAICS sector and type of economic activity. Industries related to beef are found within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors.

Table 74: Regional Contributions by 2-Digit NAICS - Southeast (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	76,740	813,653	10,862	29,275
21	Mining, Quarrying, and Oil and Gas Extraction	43,631	192,141	7,653	21,942
22	Utilities	151,093	136,446	16,479	62,228
23	Construction	401,011	2,622,019	90,110	180,562
31-33	Manufacturing*	1,598,106	3,121,576	211,521	477,946
42	Wholesale Trade	359,903	1,540,914	110,700	235,638
44-45	Retail Trade	370,410	4,614,759	129,874	233,974
48-49	Transportation and Warehousing	281,885	1,664,948	82,017	134,597
51	Information	330,868	708,563	54,993	143,554
52	Finance and Insurance	476,448	2,088,410	127,048	240,051
53	Real Estate and Rental and Leasing	761,990	2,082,893	30,166	503,690
54	Professional, Scientific, and Technical Services	483,233	3,266,728	211,598	302,836
55	Management of Companies and Enterprises	124,807	540,807	59,519	73,786
56	Administrative and Support and Waste Management and Remediation Services	229,259	3,351,481	100,234	145,478
61	Educational Services	47,803	834,935	27,888	30,688
62	Health Care and Social Assistance	481,346	4,659,180	237,273	299,277
71	Arts, Entertainment, and Recreation	70,958	956,483	20,508	38,386
72	Accommodation and Food Services	247,079	3,804,955	80,604	136,586
81	Other Services (except Public Administration)	184,855	3,072,493	80,660	120,952
92	Public Administration	586,332	5,984,014	415,304	526,251
	Totals	**7,307,757**	**46,057,397**	**2,105,013**	**3,937,696**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

[28] See NAICS 2 Digit Sector Codes for definitions and examples: https://classcodes.com/naics-2-digit-sector-codes/ . A brief summary of definitions is provided in Appendix C.

The *Manufacturing* sector represented the largest share of gross sales (21.9%) generated by industries across the Southeast in 2016. The *Public Administration* sector held the largest share of jobs (13.0%), employee compensation (19.7%), and total value added (13.4%) Again, it's no surprise that a sector such as *Public Administration* would represent a large share of jobs and employee compensation as the overall role of this sector is to offer services (as opposed to *Manufacturing* which primarily generates of goods for sale), resulting in a high share of employment versus sales for the sector. As employee compensation is a component of value added is likely driving the large share of value added shown for *Public Administration* as well (Table 75).

Table 75: Share of Contributions by 2-Digit NAICS - Southeast (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting*	1.1%	1.8%	0.5%	0.7%
21	Mining, Quarrying, and Oil and Gas Extraction	0.6%	0.4%	0.4%	0.6%
22	Utilities	2.1%	0.3%	0.8%	1.6%
23	Construction	5.5%	5.7%	4.3%	4.6%
31-33	Manufacturing*	21.9%	6.8%	10.0%	12.1%
42	Wholesale Trade	4.9%	3.3%	5.3%	6.0%
44-45	Retail Trade	5.1%	10.0%	6.2%	5.9%
48-49	Transportation and Warehousing	3.9%	3.6%	3.9%	3.4%
51	Information	4.5%	1.5%	2.6%	3.6%
52	Finance and Insurance	6.5%	4.5%	6.0%	6.1%
53	Real Estate and Rental and Leasing	10.4%	4.5%	1.4%	12.8%
54	Professional, Scientific, and Technical Services	6.6%	7.1%	10.1%	7.7%
55	Management of Companies and Enterprises	1.7%	1.2%	2.8%	1.9%
56	Administrative and Support and Waste Management and Remediation Services	3.1%	7.3%	4.8%	3.7%
61	Educational Services	0.7%	1.8%	1.3%	0.8%
62	Health Care and Social Assistance	6.6%	10.1%	11.3%	7.6%
71	Arts, Entertainment, and Recreation	1.0%	2.1%	1.0%	1.0%
72	Accommodation and Food Services	3.4%	8.3%	3.8%	3.5%
81	Other Services (except Public Administration)	2.5%	6.7%	3.8%	3.1%
92	Public Administration	8.0%	13.0%	19.7%	13.4%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

Next, we examine the contribution of the beef industry alone across the *entire* regional economy. At this level, on-farm beef cattle production and post-farm cattle harvest and beef processing activity represents 0.2% of regional sales, 0.2% of employment, 0.04% of employee compensation, and 0.06% of total value added (Table 76)

Table 76: Share of Beef Contributions to the Regional Economy - Southeast (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	**% of Region**	**Beef Industry**	**% of Region**	**Beef Industry**	**% of Region**	**Beef Industry**	**% of Region**
Cow-Calf	2,995	0.04%	63,443	0.14%	58	0.00%	818	0.02%
Stocker-Background	1,219	0.02%	25,829	0.06%	24	0.00%	333	0.01%
Feed Lot	56	0.00%	1,197	0.00%	1	0.00%	15	0.00%
On-farm Beef Cattle Production	***4,270***	***0.06%***	***90,468***	***0.20%***	***82***	***0.00%***	***1,166***	***0.03%***
Cattle Harvest	4,610	0.06%	6,549	0.01%	314	0.01%	688	0.02%
Beef Processing	3,787	0.05%	7,256	0.02%	355	0.02%	548	0.01%
Beef By-products	695	0.01%	1,371	0.00%	92	0.00%	113	0.00%
Post-farm Harvest and Processing	***9,091***	***0.12%***	***15,176***	***0.03%***	***761***	***0.04%***	***1,349***	***0.03%***
Beef Industry Total	**13,362**	**0.18%**	**105,645**	**0.23%**	**843**	**0.04%**	**2,515**	**0.06%**

A better presentation of the beef industry's importance to the regional economy is demonstrated by the relative contribution to its own 2-digit NAICS sector. On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* sector. Within this sector, on-farm production represented 5.6% of sales, 11.1% of jobs, 0.8% of employee compensation, and 4.0% of total value added (Figure 20).

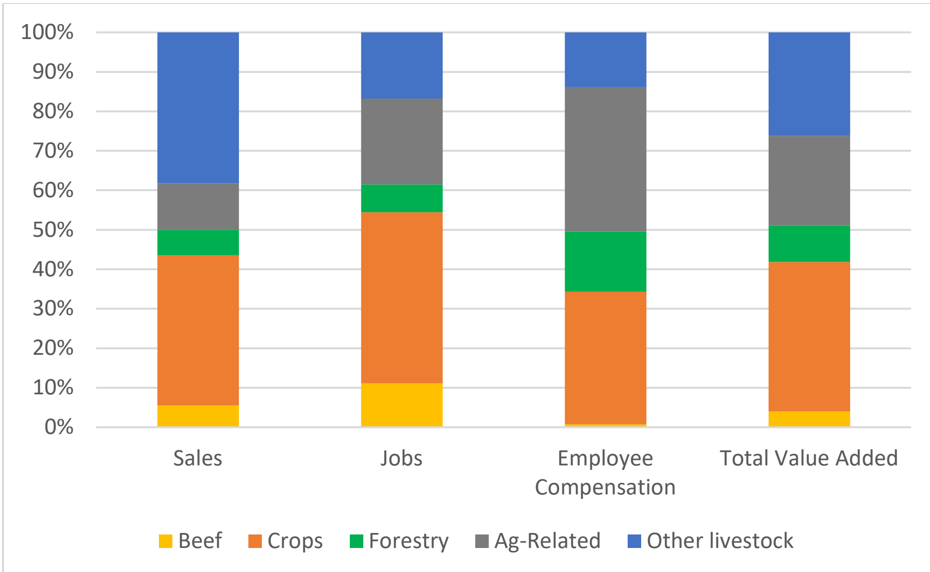


Figure 20: Share of Contributions to Agriculture, Forestry, Fishing, and Hunting - Southeast (2016)

Table 77 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Across all 19 industries, on-farm beef cattle production ranked 6th in terms of sales, 3rd in jobs, 15th in employee compensation, and 11th in total value added. The region hosts the nations' top poultry production states, thus the poultry and egg production ranked highest in sales with support activities for agriculture and forestry ranking highest in jobs, employee compensation and value added.

Table 77: Top Ten Agriculture, Forestry, Fishing, and Hunting Industries by Sales - Southeast (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Poultry and egg production	1	5	3	2
Support activities for agriculture and forestry	2	1	1	1
Grain farming	3	7	14	13
Oilseed farming	4	11	19	5
Commercial logging	5	6	2	4
On-farm beef cattle production	6	3	15	11
Animal production, except cattle and poultry and eggs	7	4	10	3
All other crop farming	8	2	5	8
Greenhouse, nursery, and floriculture production	9	9	4	6
Vegetable and melon farming	10	12	8	7

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. Within this sector, post-farm cattle harvest and beef processing activity represented 0.6% of sales, 0.5% of jobs, 0.4% of employee compensation and 0.3% of total value added. While the value of beef product manufacturing may appear relatively small, the aggregate *Manufacturing* sector is made up of hundreds of industries, covering all forms of manufacturing - from the production of beef products, to cars, to pesticides and pharmaceuticals. Because of this, it may be more valuable to consider the beef industry relative only to industries that manufacture agricultural goods. The agriculture related industries in *Manufacturing* made up 28.2% of *Manufacturing* sales, 30.6% of *Manufacturing* jobs, 24.6% *Manufacturing* employee compensation and 27.7% of *Manufacturing* value added. From this perspective, post-farm cattle harvest and beef processing represented 2.0% of total sales, 1.6% of jobs, 1.5% of employee compensation and 1.0% of total value added across agriculture-related manufacturing industries (Figure 21).

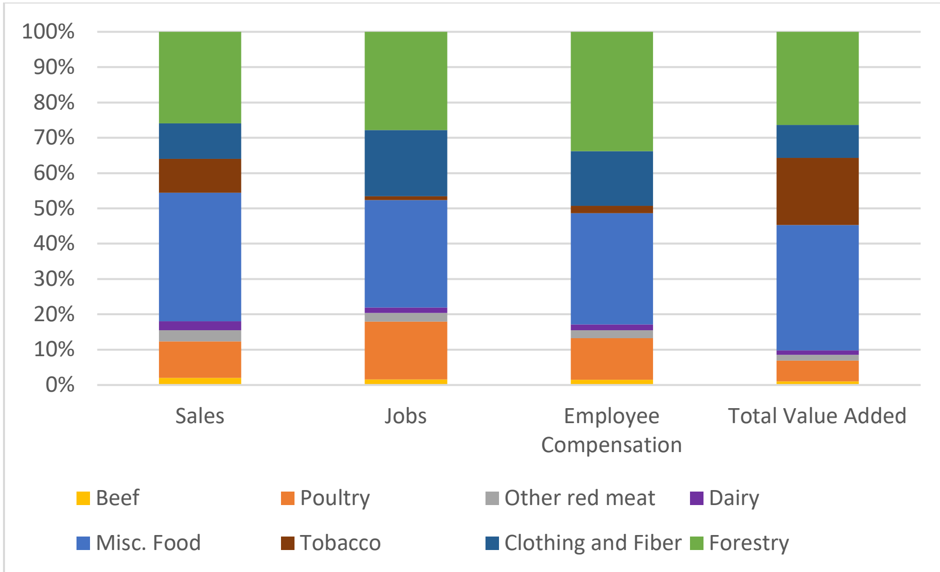


Figure 21: Share of Contributions to Agriculture-Related Manufacturing - Southeast (2016)

Across the eighty-eight agricultural manufacturing industries within the *Manufacturing* sector, post-farm cattle harvest and beef processing ranked 15th in sales, 15th in jobs, 19th in employee compensation, and 21st in total value added (Table 78). As mentioned above agricultural manufacturing is dominated by poultry processing, as the nation's leading poultry states (Georgia, Arkansas, North Carolina, Alabama and Mississippi) are all in the region. The region also hosts the tobacco producing states. In addition, the southeast, like the northwest, is heavily engaged in wood production and manufacturing with hundreds of mills peppered across the states.

Table 78: Top Ten Agriculture-Related Manufacturing Industries by Sales - Southeast (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Poultry processing	1	1	1	3
Tobacco product manufacturing	2	25	14	1
Paper mills	3	8	4	4
Bottled and canned soft drinks & water	4	7	7	9
Flavoring syrup and concentrate manufacturing	5	44	9	2
Paperboard container manufacturing	6	4	3	8
Paperboard mills	7	12	5	6
Red meat (except beef) harvest and processing	8	9	11	15
Bread and bakery product, except frozen, manufacturing	9	2	2	7
Sawmills	10	3	6	12
Carpet and rug mills	11	5	8	13
Distilleries	12	37	20	5
Fiber, yarn, and thread mills	13	6	10	18
Other animal food manufacturing	14	35	38	32
Cattle harvest and beef processing	15	15	19	21

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity (export AND local) generated within the beef industry itself across the Southeast?**

In 2016, the Southeast beef industry generated more than $13.4 billion in gross sales, representing 105,645 jobs. In addition to gross sales and jobs, $2.5 billion was added to the economy through employee compensation, proprietary income, returns to capital, and indirect business taxes provided by the operation of on-farm beef production and post-farm harvest and processing firms (Table 79).

On-farm production of beef cattle represented $4.3 billion of total gross sales with cow-calf, stocker/backgrounding, and feedlot producers contributing $3.0 billion, $1.2 billion, and $56 million, respectively. These sales generated around 90,469 jobs, resulting in the payment of $82 million in employee compensation and almost $1.2 billion in total value being added to the regional economy (Table 79).

Sales from the post-farm harvest and processing sector made up the remaining $9.1 billion in gross sales with beef and dairy cattle harvest, beef processing, and beef by-products contributing $4.6, $3.8, and $0.7 billion respectively. From these sales, over 15,000 jobs were generated, representing $761 billion in employee compensation and almost $1.3 billion in total value being added to the regional economy (Table 79).

Table 79: Gross Economic Contributions of Beef - Southeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	2,995	63,443	58	818
Stocker/Backgrounding	1,219	25,829	24	333
Feedlot	56	1,197	1	15
On-farm Production Total	**4,270**	**90,469**	**82**	**1,166**
Cattle Harvest	4,611	6,549	314	688
Beef Processing	3,787	7,256	355	548
Beef By-products	695	1,371	92	113
Post-farm Harvest & Processing Total	**9,092**	**15,176**	**761**	**1,349**
BEEF INDUSTRY TOTAL	***13,363***	***105,645***	***843***	***2,515***

Beef Export Contributions

Here, we consider: **How much value is the beef industry responsible for generating across the entire Southeast economy through the production of beef goods for export outside of the region?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the economic activity (in terms of sales, jobs, employee compensation and value added) that is generated within the beef industry as a result of beef exports. In 2016, the Southeast beef industry generated almost $4.7 billion in direct beef export sales (Table 80).

Of the beef industry's direct beef export value, on-farm beef cattle production represented $352 million of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $250, $97, and $5 million, respectively. These sales represent almost 7,450 jobs and generated around $7 million in employee compensation and $96 billion in total value added across the region (Table 80).

Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($4.3 billion), with beef harvest, beef processing, and beef by-products contributing $2.4 billion, $1.4 billion, and $427 million, respectively. These sales represent around 7,055 jobs, $357 million in employee compensation and $641 million in total value added across the region (Table 80).

Table 80: Direct Beef Export Contributions - Southeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	250	5,292	5	68
Stocker/Backgrounding	97	2,062	2	27
Feedlot	5	96	0	1
On-farm Production Total	**352**	**7,450**	**7**	**96**
Cattle Harvest	2,444	3,471	166	365
Beef Processing	1,431	2,741	134	207
Beef By-products	427	843	57	69
Post-farm Harvest & Processing Total	**4,301**	**7,055**	**357**	**641**
BEEF INDUSTRY TOTAL	***4,653***	***14,504***	***364***	***737***

Indirect Beef Export Contributions
While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or vaccination services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms, the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the "feed store" or retail sector. However, with economic base analysis, the value credited to the beef industry, as it is exports from beef that are ultimately responsible for generating these sales. This economic activity is referred to as indirect beef export contributions.

In 2016, regional beef exports were indirectly responsible for generating $5.3 billion in sales across other local industries. These indirect beef export sales equate to around 48,300 jobs, $1.1 billion in employee compensation and almost $2.5 billion in total value added to other parts of the economy (Table 81).

Of this indirect beef export value, on-farm beef cattle production represented $356 million in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $247, $105, and $5 million, respectively. These sales represent 2,720 jobs, resulting in the payment of $85 million in employee compensation and $177 million in total value added within other industries across the region (Table 81).

Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($5.0 billion), with beef harvest, beef processing, and beef by-products contributing $2.9 billion, $1.5 billion, and $585 million, respectively. These indirect sales represent almost 46,000 jobs, and generated $994 million in employee compensation and almost $2.3 billion in total value added in other industries across the region (Table 81).

Table 81: Indirect Export Contributions of Beef - Southeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	247	1,840	59	123
Stocker/Backgrounding	105	837	24	51
Feedlot	5	43	1	2
On-farm Production Total	**356**	**2,720**	**85**	**177**
Cattle Harvest	2,892	30,773	553	1,377
Beef Processing	1,495	11,369	295	653
Beef By-products	585	3,457	146	273
Post-farm Harvest & Processing Total	**4,972**	**45,599**	**994**	**2,304**
BEEF INDUSTRY TOTAL	***5,329***	***48,319***	***1,079***	***2,480***

The level of these indirect contributions varies across industries. Table 82 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production[29].

For example, the table indicates that on-farm beef cattle production heavily depends of input purchases from wholesalers in order to raise cattle. Of all of the wholesale expenditures required for on-farm beef cattle production, approximately $39 million goes toward producing beef that are exported from the region. In turn, this $39 million in wholesale purchases is responsible for generating 166 jobs and $25 million in value added within the wholesale sector.

Looking at the industries indirectly affected by post-farm cattle harvest and beef processing, it's no surprise to see on-farm beef cattle production topping the list. This is because cattle purchased from local producers represent the primary input for post-farm beef exports (Table 82).

[29] Note that sales, jobs, employee compensation and value added accrued to a given industry due to beef exports may be greater here than at the US level. This is because the export base for a region of the US is greater than for the US level. The export base for the US level includes only foreign countries. The export base for a regional (e.g., Southern Plains) level include both foreign countries as well as regions of the US except the Southern Plains.

Table 82: Top Industries by Export Base Contributions to Beef - Southeast (2016)

Sales	**On-farm Production**	Wholesale trade	$38,758,000
		Other animal food manufacturing	$22,460,000
		Real estate	$19,930,000
		Support activities for agriculture and forestry	$19,669,000
		Truck transportation	$16,990,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$734,191,000
		Truck transportation	$418,563,000
		Animal production, except cattle and poultry and eggs	$410,483,000
		Wholesale trade	$297,925,000
		Other red meat processing	$210,619,000
Jobs	**On-farm Production**	Support activities for agriculture and forestry	427
		All other crop farming	197
		Wholesale trade	166
		Truck transportation	110
		Real estate	108
	Post-farm Harvest and Processing	On-farm beef cattle production	15,555
		Animal production, except cattle and poultry and eggs	6,775
		Truck transportation	2,701
		Wholesale trade	1,276
		Support activities for agriculture and forestry	1,161
Value Added	**On-farm Production**	Wholesale trade	$25,376,000
		Support activities for agriculture and forestry	$14,502,000
		Real estate	$13,728,000
		Owner-occupied dwellings	$9,535,000
		Truck transportation	$7,064,000
	Post-farm Harvest and Processing	Animal production, except cattle and poultry and eggs	$254,535,000
		On-farm beef cattle production	$200,446,000
		Wholesale trade	$195,059,000
		Truck transportation	$174,018,000
		Owner-occupied dwellings	$109,117,000

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries while also providing beef products for local consumption?**

In addition to bringing new money into the region through the direct sale of beef exports, the beef industry also plays a supporting role within the regional economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, non-beef businesses and consumers across the region purchased $8.7 billion worth of goods from the Southeast beef industry. The presence of the beef industry in the region not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the region by supporting the production of exports across other industries. These export support and local consumption sales combined were responsible for generating over 91,100 jobs, $479 million in employee compensation and $1.8 billion in total value added. (Table 83).

Table 83: Export Support and Local Contributions - Southeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	2,745	58,152	53	749
Stocker/Backgrounding	1,122	23,767	22	306
Feedlot	52	1,101	1	14
On-farm Production Total	**3,919**	**83,020**	**76**	**1,070**
Cattle Harvest	2,167	3,078	148	323
Beef Processing	2,356	4,515	221	341
Beef By-products	268	528	35	43
Post-farm Harvest & Processing Total	**4,791**	**8,121**	**404**	**708**
BEEF INDUSTRY TOTAL	***8,710***	***91,141***	***479***	***1,778***

The level of these export support and local consumption contributions varies across industries. Table 84 presents the top industries in terms of economic activity generated within the beef industry, as a result of sales to local businesses and other local consumers.

The households and government spending industries represent the bulk of local consumption activity occurring within the region[30]. The link between on-farm and post-farm export activity can

[30] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than

be seen as on-farm beef cattle producers sold $734 million to post-farm cattle harvest and beef processing to support their production of exports. The other red meat processing, the poultry processing and dog and cat food manufacturing industries have a strong presence in the region and heavily utilize inputs from the beef industry to make and export their products from the region.

Table 84:Top Industries by Export Support and Local Consumption Contribution - Southeast (2016)

Sales	**On-farm Production**	Other red meat processing	$1,307,002,000
		Households	$920,447,000
		Post-farm Harvest & Processing	$734,191,000
		Government spending	$198,480,000
		Poultry processing	$72,959,000
	Post-farm Harvest & Processing	Households	$2,260,956,000
		Government spending	$485,008,000
		Poultry processing	$203,922,000
		Dog and cat food manufacturing	$190,832,000
		Other red meat processing	$167,700,000
Jobs	**On-farm Production**	Other red meat processing	27,690
		Households	19,501
		Post-farm Harvest & Processing	15,555
		Government spending	4,205
		Poultry processing	1,546
	Post-farm Harvest & Processing	Households	3,829
		Government spending	820
		Poultry processing	356
		Dog and cat food manufacturing	346
		Other red meat processing	279
Value Added	**On-farm Production**	Other red meat processing	$356,832,000
		Households	$251,296,200
		Post-farm Harvest & Processing	$200,446,000
		Government spending	$54,188,000
		Poultry processing	$19,919,000
	Post-farm Harvest & Processing	Households	$333,534,000
		Government spending	$71,559,000
		Poultry processing	$29,971,000
		Dog and cat food manufacturing	$27,811,000
		Other red meat processing	$25,331,000

from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

NORTHEAST: (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia)

Industry Overview

To understand the broad contributors of the beef industry to the regional economy, results were first analyzed at the 2-digit North American Industry Classification System (NAICS) level.[31] Table 85 shows a breakdown of the Northeast economy by NAICS sector and type of economic activity. . Industries related to beef may be found within the *Agriculture, Forestry, Fishing and Hunting* (for on-farm beef cattle production) and *Manufacturing* (for post-farm cattle and beef processing) sectors (Table 85).

Table 85: Regional Contribution by 2-Digit NAICS - Northeast (2016)

2-Digit Code	NAICS Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Value Added (million $'s)
11	Agriculture, Forestry, Fishing and Hunting*	33,645	430,181	5,312	13,012
21	Mining, Quarrying, and Oil and Gas Extraction	43,225	144,277	5,842	24,612
22	Utilities	167,649	145,376	20,569	75,230
23	Construction	401,559	2,387,497	101,667	199,935
31-33	Manufacturing*	1,317,354	2,854,368	224,815	423,125
42	Wholesale Trade	396,760	1,585,782	133,215	268,876
44-45	Retail Trade	373,903	4,370,526	137,332	243,038
48-49	Transportation and Warehousing	235,162	1,602,729	73,438	120,923
51	Information	457,944	861,349	88,130	260,357
52	Finance and Insurance	858,983	2,718,990	286,424	541,536
53	Real Estate and Rental and Leasing	928,816	2,190,951	39,678	642,019
54	Professional, Scientific, and Technical Services	687,890	3,948,681	313,801	456,828
55	Management of Companies and Enterprises	188,803	707,666	100,588	122,039
56	Administrative and Support and Waste Management and Remediation Services	215,569	2,644,541	100,872	146,827
61	Educational Services	107,417	1,458,293	66,895	74,028
62	Health Care and Social Assistance	650,673	6,232,566	343,576	414,737
71	Arts, Entertainment, and Recreation	92,959	1,106,022	26,620	55,327
72	Accommodation and Food Services	235,257	3,431,596	86,557	140,682
81	Other Services (except Public Administration)	186,059	2,826,269	88,270	128,344
92	Public Administration	637,318	5,317,284	466,063	589,920
	Totals	**8,216,945**	**46,964,943**	**2,709,664**	**4,941,394**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

[31] See NAICS 2 Digit Sector Codes for definitions and examples: https://classcodes.com/naics-2-digit-sector-codes/ . A brief summary of definitions is provided in Appendix C.

The *Manufacturing* sector represented the largest share of gross sales (16.0%) generated by industries across the Northeast in 2016, with the *Healthcare and Social Assistance* sector holding the largest share of jobs (13.3%), *Public Administration* for employee compensation (17.2%), and *Real Estate and Rental and Leasing* for total value added (13.0%) (Table 86).

Table 86: Share of Contributions by 2-Digit NAICS - Northeast (2016)

2-Digit Code	NAICS Sector	Sales	Jobs	Employee Compensation	Value Added
11	Agriculture, Forestry, Fishing and Hunting*	0.4%	0.9%	0.2%	0.3%
21	Mining, Quarrying, and Oil and Gas Extraction	0.5%	0.3%	0.2%	0.5%
22	Utilities	2.0%	0.3%	0.8%	1.5%
23	Construction	4.9%	5.1%	3.8%	4.0%
31-33	Manufacturing*	16.0%	6.1%	8.3%	8.6%
42	Wholesale Trade	4.8%	3.4%	4.9%	5.4%
44-45	Retail Trade	4.6%	9.3%	5.1%	4.9%
48-49	Transportation and Warehousing	2.9%	3.4%	2.7%	2.4%
51	Information	5.6%	1.8%	3.3%	5.3%
52	Finance and Insurance	10.5%	5.8%	10.6%	11.0%
53	Real Estate and Rental and Leasing	11.3%	4.7%	1.5%	13.0%
54	Professional, Scientific, and Technical Services	8.4%	8.4%	11.6%	9.2%
55	Management of Companies and Enterprises	2.3%	1.5%	3.7%	2.5%
56	Administrative and Support and Waste Management and Remediation Services	2.6%	5.6%	3.7%	3.0%
61	Educational Services	1.3%	3.1%	2.5%	1.5%
62	Health Care and Social Assistance	7.9%	13.3%	12.7%	8.4%
71	Arts, Entertainment, and Recreation	1.1%	2.4%	1.0%	1.1%
72	Accommodation and Food Services	2.9%	7.3%	3.2%	2.8%
81	Other Services (except Public Administration)	2.3%	6.0%	3.3%	2.6%
92	Public Administration	7.8%	11.3%	17.2%	11.9%
	Totals	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IMPLAN, 2018
*Contain industries related to the beef industry. On-farm beef cattle production industries are included within *Agriculture, Forestry, Fishing and Hunting*. Post-farm cattle harvest and beef processing industries are included under *Manufacturing.*

Next, we examine the contribution of the beef industry alone across the *entire* regional economy. At this level, on-farm beef cattle production and post-farm cattle harvest and beef processing activity represents 0.2% of regional sales, 0.1% of employment, 0.05% of employee compensation, and 0.4% of total value added (Table 87).

Table 87: Share of Beef Contributions to the Regional Economy - Northeast (2016)

Industry	Sales (million $'s)		Jobs		Employee Compensation (million $'s)		Total Value Added (million $'s)	
	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region	Beef Industry	% of Region
Cow-Calf	789	0.01%	18,314	0.04%	23	0.00%	185	0.00%
Stocker-Background	298	0.00%	6,906	0.01%	9	0.00%	70	0.00%
Feed Lot	173	0.00%	4,010	0.01%	5	0.00%	41	0.00%
On-farm Beef Cattle Production	***1,259***	***0.02%***	***29,230***	***0.06%***	***36***	***0.00%***	***296***	***0.01%***
Cattle Harvest	5,076	0.06%	7,277	0.02%	382	0.01%	717	0.01%
Beef Processing	7,079	0.09%	13,253	0.03%	782	0.03%	1,163	0.02%
Beef By-products	293	0.00%	580	0.00%	39	0.00%	47	0.00%
Post-farm Harvest and Processing	***12,447***	***0.15%***	***21,110***	***0.04%***	***1,204***	***0.04%***	***1,927***	***0.04%***
Beef Industry Total	**13,707**	**0.17%**	**50,340**	**0.11%**	**1,240**	**0.05%**	**2,223**	**0.04%**

A better presentation of the beef industry's importance to the regional economy is demonstrated by the relative contribution to its own 2-digit NAICS sector. On-farm beef cattle production falls under the *Agriculture, Forestry, Fishing and Hunting* sector. Within this sector, on-farm beef cattle production represented 3.7% of sales, 6.8% of jobs, 0.7% of employee compensation and 2.3% of total value added (Figure 22).

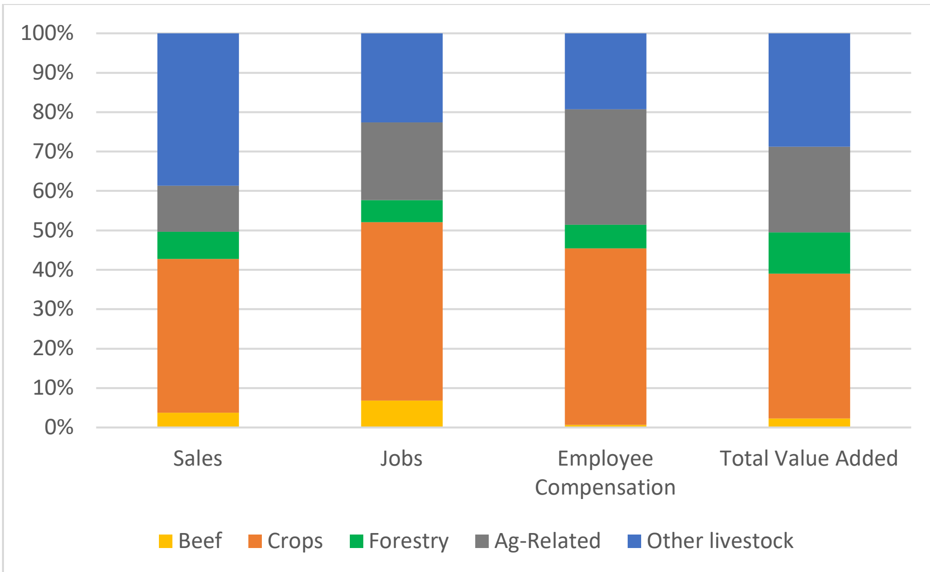


Figure 22: Share of Contributions to Agriculture, Forestry, Fishing, and Hunting - Northeast (2016)

Table 88 shows the top ten *Agriculture, Forestry, Fishing, and Hunting* industries, ranked in terms of sales. Across all 19 industries, on-farm beef cattle production ranked 8th in sales, 3rd in jobs, 12th in employee compensation, and 11th in total value added. Dairy farms dominate the agricultural landscape across most of the Northeast, leading the region in sales and total value added. Poultry production is highly concentrated in the Delaware and Maryland area, putting it in the number two spot. Support activities for the dairy and poultry operations provide the leading source of jobs and employee compensation in the region.

Table 88: Top Ten Agriculture, Forestry, Fishing and Hunting Industries by Sales - Northeast (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Dairy cattle and milk production	1	7	3	2
Poultry and egg production	2	11	5	6
Grain farming	3	8	11	9
Oilseed farming	4	13	13	4
Greenhouse, nursery, and floriculture production	5	4	2	7
Support activities for agriculture and forestry	6	1	1	5
Commercial logging	7	10	8	1
On-farm beef cattle production	8	3	12	11
Commercial fishing	9	9	7	3
Animal production, except cattle and poultry and eggs	10	6	10	2

Post-farm cattle harvest and beef processing activities fall within the 2-digit NAICS *Manufacturing* sector. Within this sector, post-farm cattle harvest and beef processing activity represented 0.9% of sales, 0.7% of jobs, and 0.5% of employee compensation and 0.5% of total value added. While the value of beef product manufacturing may appear relatively small, the aggregate *Manufacturing* sector is made up of hundreds of industries, covering all forms of manufacturing - from the production of beef products, to cars, to pesticides and pharmaceuticals. Because of this, it may be more valuable to consider the beef industry relative only to industries that manufacture agricultural goods. The agriculture related industries in *Manufacturing* made up 22.3% of *Manufacturing* sales, 23.7% of *Manufacturing* jobs, 17.0% *Manufacturing* employee compensation and 17.5% of *Manufacturing* value added. From this perspective, post-farm cattle harvest and beef processing represented 4.2% of total sales, 3.1% of jobs, 3.1% of employee compensation and 2.6% of total value added across agriculture-related manufacturing industries (Figure 23).

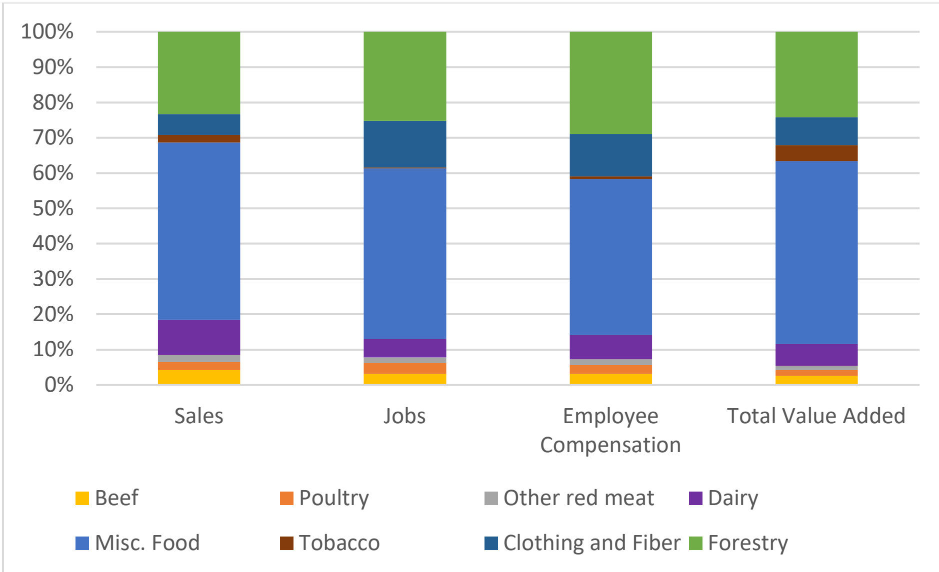


Figure 23: Share of Contributions to Agriculture-Related Manufacturing - Northeast (2016)

Table 89 shows the top ten agriculture-related manufacturing industries, ranked in terms of sales. Across all 88 industries, post-farm cattle harvest and beef processing ranked 5th in terms of sales, 3rd in jobs, 7th in employee compensation, and 13th in total value added. Pepperidge Farm and other brands owned by the Campbell Soup Company as well as scores of regional brand manufacturing help the bread and bakery product, except frozen, manufacturing secure the top spot among the agriculture-related manufacturing industries. International Paper manufacturing plants in five of the Northeast states, along with others, provide sufficient jobs and employee compensation to earn the second spot.

Table 89: Top Ten Agriculture-Related Manufacturing Industries by Sales - Northeast (2016)

Industry:	Sales	Jobs	Employee Compensation	Total Value Added
Bread and bakery product, except frozen, manufacturing	1	1	1	1
Bottled and canned soft drinks & water	2	6	4	5
Paperboard container manufacturing	3	2	2	3
Fluid milk manufacturing	4	8	6	12
Cattle harvest and beef processing	5	3	7	13
Paper mills	6	10	3	7
Breweries	7	13	11	2
Sanitary paper product manufacturing	8	20	10	6
Other snack food manufacturing	9	14	13	8
Canned fruits and vegetables manufacturing	10	11	8	15

Gross Economic Contributions

Here we consider: **What is the actual value of economic activity (export AND local) generated within the beef industry itself across the Northeast?**

In 2016, the Northeastern beef industry generated more than $13.7 billion in gross sales, representing over 50,300 jobs. In addition to gross sales and jobs, $2.2 billion was added to the economy through employee compensation, proprietary income, returns to capital, and indirect business taxes provided by the operation of on-farm beef production and post-farm harvest and processing firms (Table 90).

On-farm production of beef cattle represented $1.3 billion of total gross sales with cow-calf, stocker/backgrounding, and feedlot producers contributing $789, $298, and $173 million, respectively. These sales generated around 29,200 jobs, resulting in the payment of $36 million in employee compensation and almost $300 million in total value being added to the regional economy (Table 90).

Sales from the post-farm harvest and processing sector made up the remaining $12.4 billion in gross sales with beef and dairy cattle harvest, beef processing, and beef by-products contributing $5.1, $7.1, and $0.3 billion respectively. From these sales, over 21,100 jobs were generated, representing $1.2 billion in employee compensation and over $1.9 billion in total value being added to the regional economy (Table 90).

Table 90: Gross Economic Contributions of Beef - Northeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	789	18,315	23	185
Stocker/Backgrounding	298	6,906	9	70
Feedlot	173	4,010	5	41
On-farm Production Total	**1,259**	**29,231**	**36**	**296**
Cattle Harvest	5,076	7,277	382	717
Beef Processing	7,079	13,253	782	1,163
Beef By-products	293	580	39	47
Post-farm Harvest & Processing Total	**12,448**	**21,110**	**1,204**	**1,927**
BEEF INDUSTRY TOTAL	***13,707***	***50,341***	***1,240***	***2,223***

Beef Export Contributions

Here, we consider: **How much value is the beef industry responsible for generating across the entire Northeast economy through the production of beef goods for export outside of the region?**

Beef export contributions measure economic activity across all sectors (that is, the beef sector as well as other sectors) that the industry touches as it creates beef products for export. As a result, the value from beef exports can considered in two ways: 1) value generated within the beef industry through the export of beef products (direct beef export contributions), and 2) value generated within other local industries providing materials and services for the production of beef exports (indirect beef export contributions).

Direct Beef Export Contributions

Direct beef export contributions represent the economic activity (in terms of sales, jobs, employee compensation and value added) that is generated within the beef industry as a result of beef exports. In 2016, the Northeast beef industry generated almost $4.4 billion in direct beef export sales (Table 91).

Of the beef industry's direct beef export value, on-farm beef cattle production represented $53 million of gross sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $33, $12, and $7 million, respectively. These sales represent almost 1,234 jobs and generated around $2 million in employee compensation and $12 million in total value added across the region (Table 91). Sales from post-farm cattle harvest and beef processing made up the majority of direct beef export sales ($4.3 billion), with beef harvest, beef processing, and beef by-products contributing $1.9 billion, $2.3 billion, and $121 million, respectively. These sales represent around 7,260 jobs, $413 million in employee compensation and $665 million in total value added across the region (Table 91).

Table 91: Direct Export Base Contributions of Beef - Northeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	33	777	1	8
Stocker/Backgrounding	12	288	0	3
Feedlot	7	169	0	2
On-farm Production Total	**53**	**1,234**	**2**	**12**
Cattle Harvest	1,889	2,708	142	267
Beef Processing	2,306	4,317	255	379
Beef By-products	121	238	16	19
Post-farm Harvest & Processing Total	**4,315**	**7,264**	**413**	**665**
BEEF INDUSTRY TOTAL	***4,369***	***8,498***	***415***	***678***

Indirect Beef Export Contributions

While beef exports generate value within the beef industry itself, production of these exports requires the use of inputs from other industries. For on-farm beef cattle production, these purchases may come in the form of things like animal feed, breeding services, or vaccination services. Inputs for post-farm cattle harvest and processing may include items such as processing machinery and packaging materials.

When beef businesses purchase their inputs from local industries, this generates additional economic activity within the region. For example, suppose a feedlot purchases grain from a feed store. In gross terms, the value of this transaction (and the associated jobs, compensation, and value added) would be counted in the "feed store" or retail sector. However, with economic base analysis, the value credited to the beef industry, as it is exports from beef that are ultimately responsible for generating these sales. This economic activity is referred to as indirect beef export contributions.

In 2016, regional beef exports were indirectly responsible for generating $3.8 billion in sales across other local industries. These indirect beef export sales equate to around 34,050 jobs, $902 million in employee compensation and almost $1.9 billion in total value added to other parts of the economy (Table 92).

Of this indirect beef export value, on-farm beef cattle production represented $54 million in sales with cow-calf, stocker/backgrounding, and feedlot operations contributing $33, $13, and $8 million, respectively. These sales represent almost 390 jobs, resulting in the payment of $13 million in employee compensation and $28 million in total value added within other industries across the region (Table 92).

Sales from post-farm cattle harvest and beef processing made up the majority of indirect beef export value ($3.8 billion), with beef harvest, beef processing, and beef by-products contributing $1.7 billion, $1.9 billion, and $140 million, respectively. These indirect sales represent over 33,660 jobs, and generated $888 million in employee compensation and almost $1.9 billion in total value added in other industries across the region (Table 92).

Table 92: Indirect Export Contributions of Beef - Northeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	33	236	8	17
Stocker/Backgrounding	13	95	3	7
Feedlot	8	57	2	4
On-farm Production Total	**54**	**388**	**13**	**28**
Cattle Harvest	1,727	18,984	390	859
Beef Processing	1,899	13,905	460	926
Beef By-products	140	772	39	73
Post-farm Harvest & Processing Total	**3,766**	**33,661**	**888**	**1,858**
BEEF INDUSTRY TOTAL	***3,820***	***34,049***	***902***	***1,886***

The level of these indirect contributions varies across industries. Table 93 presents the top industries in terms of economic activity generated as a result of on-farm production and post-farm harvesting and processing activity for beef export production[32].

For example, the table indicates that on-farm beef cattle production heavily depends of input purchases from wholesalers in order to raise cattle. Of all of the wholesale expenditures required for on-farm beef cattle production, approximately $6.6 million goes toward producing beef that are exported from the region. In turn, this $6.6 million in wholesale purchases is responsible for generating 27 jobs and $191 million in value added within the wholesale sector.

Looking at the industries indirectly affected by post-farm cattle harvest and beef processing, it's no surprise to see on-farm beef cattle production topping the list. This is because cattle purchased from local producers represent the primary input for post-farm beef exports (Table 93). As found with most other regional analyses in this report, beef export provides sales, jobs and value added in wholesale trade, other animal production, real estate, truck transportation and other industries.

[32] Note that sales, jobs, employee compensation and value added accrued to a given industry due to beef exports may be greater here than at the US level. This is because the export base for a region of the US is greater than for the US level. The export base for the US level includes only foreign countries. The export base for a regional (e.g., Southern Plains) level include both foreign countries as well as regions of the US except the Southern Plains.

Table 93: Top Industries by Export Base Contributions to Beef - Northeast (2016)

Sales	On-farm Production	Wholesale trade	$6,637,000
		Other animal food manufacturing	$5,022,000
		Real estate	$3,190,000
		Support activities for agriculture and forestry	$2,571,000
		Truck transportation	$2,270,000
	Post-farm Harvest and Processing	On-farm beef cattle production	$327,406,000
		Wholesale trade	$282,950,000
		Animal production, except cattle and poultry and eggs	$228,905,000
		Truck transportation	$228,059,000
		Dairy cattle ranching and farming	$167,301,000
Jobs	On-farm Production	Support activities for agriculture and forestry	64
		Dairy cattle ranching and farming	43
		Wholesale trade	27
		All other crop farming	18
		Real estate	14
	Post-farm Harvest and Processing	On-farm beef cattle production	7,600
		Animal production, except cattle and poultry and eggs	5,861
		Dairy cattle ranching and farming	3,883
		Truck transportation	1,367
		Wholesale trade	1,131
Value Added	On-farm Production	Wholesale trade	$4,498,000
		Real estate	$2,384,000
		Support activities for agriculture and forestry	$1,794,000
		Owner-occupied dwellings	$1,265,000
		Monetary authorities and depository credit intermediation	$1,110,000
	Post-farm Harvest and Processing	Wholesale trade	$191,750,000
		Animal production, except cattle and poultry and eggs	$137,872,000
		Truck transportation	$104,257,000
		Real estate	$98,394,000
		Owner-occupied dwellings	$89,214,000

Export Support and Local Consumption Contributions

Here we consider: **How does the beef industry support the production of exports made by other local industries while also providing beef products for local consumption?**

In addition to bringing new money into the region through the direct sale of beef exports, the beef industry also plays a supporting role within the regional economy by providing beef products to local purchasers. These products may be fully consumed within the region (i.e. households purchasing beef products), or used as intermediary inputs for the production of exports for other industries (i.e. leather from the beef by-product sector being sold to furniture manufacturers). By supplying local businesses and households with inputs and finished goods, the beef industry prevents money from leaving the local economy, as businesses would otherwise have to import these goods from outside of the region.

In 2016, Northeastern non-beef businesses and consumers purchased $9.3 billion worth of goods from the local beef industry. The Northeastern beef industry not only allowed those dollars to remain in circulation throughout the economy, but also helped in bringing new dollars into the region by supporting the production of exports across other industries. These export support and local consumption sales combined were responsible for generating around 41,800 jobs, $825 million in employee compensation and $1.5 billion in total value added. (Table 94).

Table 94: Local Support Contributions of Beef - Northeast (2016)

Sector	Sales (million $'s)	Jobs	Employee Compensation (million $'s)	Total Value Added (million $'s)
Cow-Calf	756	17,538	22	178
Stocker/Backgrounding	285	6,618	8	67
Feedlot	165	3,841	5	39
On-farm Production Total	**1,206**	**27,997**	**35**	**283**
Cattle Harvest	3,187	4,569	240	450
Beef Processing	4,773	8,936	528	784
Beef By-products	173	341	23	28
Post-farm Harvest & Processing Total	**8,132**	**13,846**	**790**	**1,262**
BEEF INDUSTRY TOTAL	***9,339***	***41,843***	***825***	***1,546***

The level of these export support and local consumption contributions varies across industries. Table 95 presents the top industries in terms of economic activity generated within the beef industry, as a result of sales to local businesses and other local consumers.

The households and government spending industries represent the bulk of local consumption activity occurring within the region[33]. The link between on-farm and post-farm export activity can

[33] Households appear to be buying a lot of beef because the retail sectors in the input-output model are margined which makes it appear that households are buying beef directly from the producer rather than from the grocery. The same is true for government – the accounts give the appearance of the government buying beef directly from producers rather than a food service.

be seen as on-farm beef cattle producers sold $327 million to post-farm cattle harvest and beef processing to support their production of exports (Table 95). Scientific research and development services represent a significant share of value generated across the regional economy. Because of this, that industry shows strong consumption interactions with the beef industry (and most other industries across the region). That is the large number of sports, entertainment and art businesses, Wall Street and other investment firms that are concentrated in the region, offer beef dishes in their food services to their employees.

Table 95:Top Industries by Export Support and Local Consumption Contribution - Northeast (2016)

Sales	**On-farm Production**	Households	$328,384,000
		Post-farm Harvest & Processing	$327,406,000
		Other red meat processing	$116,501,000
		Government spending	$81,235,000
		Dog and cat food manufacturing	$27,868,000
	Post-farm Harvest & Processing	Households	$3,478,526,000
		Government spending	$857,756,000
		Dog and cat food manufacturing	$370,665,000
		Scientific research and development services	$205,788,000
		Other red meat processing	$149,530,000
Jobs	**On-farm Production**	Households	7,622
		Post-farm Harvest & Processing	7,600
		Other red meat processing	2,704
		Government spending	1,886
		Dog and cat food manufacturing	647
	Post-farm Harvest & Processing	Households	5,938
		Government spending	1,463
		Dog and cat food manufacturing	668
		Scientific research and development services	351
		Other red meat processing	242
Value Added	**On-farm Production**	Households	$77,160,000
		Post-farm Harvest & Processing	$76,930,000
		Other red meat processing	$27,374,000
		Government spending	$19,088,000
		Dog and cat food manufacturing	$6,548,000
	Post-farm Harvest & Processing	Households	$540,895,000
		Government spending	$133,310,000
		Dog and cat food manufacturing	$59,559,000
		Scientific research and development services	$31,970,000
		Other red meat processing	$22,567,000

Conclusion

Economic contributions from the US beef industry extend across the entire nation. In 2016, US on-farm beef cattle production and post-farm harvest and processing generated $167 billion in gross sales. These sales supported nearly 721,500 beef industry jobs, which paid workers more than $10.8 billion in employee compensation. Overall, the beef industry was responsible for generating over $30.0 billion in total value added to the national economy in 2016. In addition to this economic activity in the beef sector, exports from the beef industry generated $44.3 billion in sales which supported 291,743 jobs, paid $8.6 billion in employee compensation and $19.9 billion in added value to other sectors in the economy. All other things equal, without the existence of the beef industry and its exports, industries and consumers in the US economy would be reliant on imports from other countries to meet both consumption and production needs. The loss to the economy without the existence of the beef industry in 2016 could have amounted to $200 billion less sales, one million less jobs and $50billion less value added.

The beef industry is classified under two of the two-digit North American Industry Classification System (NAICS) sectors. On-farm production is part of *Agriculture, Forestry, Fishing, and Hunting.* The *Agriculture, Forestry, Fishing, and Hunting* industry made up 1.3% of sales, 1.9% of jobs, 0.6% employee compensation and 0.9% of value added in the US economy. Within this sector, on-farm beef cattle industry ranked #2 in sales, jobs, and value added among all nineteen industries, making up 13.4% of sales, 15.0% of jobs, 2.3% of employee compensation, and 8.6% of total value added generated by the *Agriculture, Forestry, Fishing, and Hunting* sector.

Post-farm harvest and processing is part of the *Manufacturing* sectors. *Manufacturing* is comprised of 331 industries, thus we limit our focus to those 98 industries in the *Manufacturing* sector that are related to agriculture. The agriculture related industries in *Manufacturing* made up 23.7% of *Manufacturing* sales, 25.8% of *Manufacturing* jobs, 18.5% *Manufacturing* employee compensation and 18.6% of *Manufacturing* value added in the US economy. The post-farm cattle harvest and beef processing industry ranked #1 in sales and #3 in jobs and total value added across all 98 agriculture-related manufacturing industries, representing 7.0% of sales, 5.3% of jobs, 5.1% of employee compensation, and 4.2% of total value added generated by the sector.

At the regional level, the beef industry plays a more substantial role in bolstering the economy across certain areas of the country. In terms of a share of the regional economy, the beef industry contributed the greatest in the Northern Plains region. In the Northern Plains, the beef industry represented 7.6% of total regional sales, 3.4% of jobs, 1.7% of employee compensation, and 2.7% of value added generated across the region in 2016. On-farm beef cattle production ranked #1 in sales, jobs and value added in the *Agriculture, Forestry, Fishing, and Hunting* sector, making up 33.7% of sales, 21.3% of employee compensation and 28.0% of total value added within this sector in the Northern Plains. Off-farm beef harvesting and processing ranked #1 across sales, jobs, employee compensation and value added, representing 47.0% of agriculture-related manufacturing sales, 44.2% of jobs, 44.1% of employee compensation, and 40.6% of value added in the Northern Plains.

In terms of actual dollars of sales, employee compensation and value added as well as number of jobs, the beef industry contributed the highest within the Southern Plains region. On farm beef cattle production ranked #1 in sales, jobs, and value added within the *Agriculture, Forestry, Fishing, and Hunting* sector. The off-farm harvest and processing sector ranked #1 in all economic activity areas (sales, jobs, employee contribution and value added) across all agriculture-related manufacturing industries. T

The beef industry also made notable contributions to the agriculture sector in other regions, with on-farm beef cattle production ranking #1 in sales across the Northwest's *Agriculture, Forestry, Fishing, and Hunting* sector and post-farm cattle harvest and processing ranking 2nd, 3rd, and 4th in agriculture-related manufacturing sales across the Midwest, Southwest, and Northwest, respectively.

As is the case with most agricultural and manufacturing industries, the beef industry is generally considered a primary producer of exported goods (i.e. a base industry). As a result, the beef industry is a major contributor to regional economic growth across the US. This growth is found in new dollars brought into the region through the export of beef cattle and beef products out of the region where it is produced. In 2016, the US beef industry generated $18.0 billion in direct exports, bringing money into the national economy from countries such as Japan, South Korea, Mexico, and Canada (USDA ERS, 2020c). These exports equate to almost 29,000 jobs, $1.5 billion in employee compensation, and $2.6 billion in total value added within the US beef industry.

Although exports generate value within the beef industry alone, the production of beef exports requires the purchase of inputs from other industries. In 2016, the value generated across other industries as a result of beef exports (i.e. indirect beef export contributions) totaled $44.3 billion in sales, over 291,700 jobs, $8.6 billion in employee compensation, and $19.9 billion in total value added. The top industries indirectly affected by beef exports were wholesalers, grain and feed producers, real estate, trucking, and those performing support activities for cattle production. Without the beef industry, these industries would lose sales, jobs, and value added.

While the beef industry is a driver in economic growth through exports, it also plays a supporting role by providing goods to local businesses and other consumers (i.e. export support and local consumption contributions). In doing so, the industry was able to meet a percentage of local demand for beef products, preventing a loss of dollars from the economy as these goods would otherwise need to be imported. In 2016, the US beef industry prevented the loss of over $149 billion in sales from the national economy by supplying local businesses and other consumers with high-quality beef products made in the USA. This represented over 692,500 beef industry jobs, $9.4 billion in employee compensation, and $27.4 billion in total value added to the US economy. Much of this value represents purchases made by households and government agencies for local consumption. However, the beef industry also played a role in supporting the production of exports by providing inputs to other industries, thus indirectly helping to bring new dollars into the economy.

Across the US, a large portion of sales for the on-farm beef cattle industry went toward supplying inputs to the post-farm cattle harvest and processing industry. Notable other export support contributions were made to firms specializing in the production of other red meat products and the wholesale industry. The size and scope of research and technology in the US resulted in large support contributions being made to seemingly unrelated industries such as scientific research and development services and custom computer programming providing beef products for consumption as well as some inputs into their own products and services. As expected, the beef industry interacts with large industry clusters at the regional level. In the Northwest and Southwest regions, those interactions often happen with research and development, custom computer programming services, and software development industries. While in the Midwest region, strong interactions are seen with animal food (e.g., livestock feed as well as pet) manufacturing.

In addition to generating economic activity, like all types of production, the beef industry is also associated with a variety of environmental impacts. Interestingly the share of economic contributions within a region tended to mirror the share of environmental contributions. For example, the Southern Plains region exhibits higher levels of environmental impacts across most categories, however, this region also generates greater economic contributions across each type of economic activity.

Overall, the US beef industry consists of a series of complex interactions with broad impacts spanning a variety of areas. As a result of these interactions, the US beef industry is able to supply consumers, both domestic and abroad, with high quality beef and value added beef products, while in the process, also generating significant contributions in the form of sales, jobs, employee compensation and value added to regional economies and the nation as a whole.

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Appendices:

Appendix A: Methods for Estimating Beef Sub-Industry Sales

To analyze the US beef industry at the regional sub-industry level, it was necessary to disaggregate existing economic data. The original national and state-level datasets obtained from IMPLAN represented data for the year 2016 and each contained four industries related to the production and processing of beef products (IMPLAN, 2018). These industries were identified as:

1. Sector 11: Beef Cattle Ranching and Farming
2. Sector 89: Animal, Except Poultry, Slaughtering
3. Sector 90: Meat Processed from Carcasses
4. Sector 91: Rendering and Meat By-Product Processing

For the purposes of this study, each of these industries were disaggregated into various sub-industries using methods described in the following sections.

Sector 11: Beef Cattle Ranching and Farming

In this study, the IMPLAN's Beef cattle ranching and farming sector was divided into four sub-industries related to the production of beef cattle. These industries are:

- Cow-Calf Operations
- Stocker-Background Operations
- Feedlot Cattle Operations
- Dairy Cattle Operations

In order to determine the economic contributions for these industries, values of sales (i.e. output) for each industry were required. Discussions with experts in the field of agricultural statistics revealed that straightforward data showing sales values for each of these sub-industries are unavailable through traditional channels (i.e. USDA NASS, USDA AMS, etc.). Because of this, alternative methods for estimating state-level sales for each of these cattle production sub-industries were developed.

This estimation began through the use of data collected by Dr. C. Alan Rotz of the USDA Agricultural Research Service (Rotz, 2018). Dr. Rotz had previously conducted a nation-wide survey of beef cattle producers, combining data from the survey with data obtained from USDA NASS and other sources to estimate of the number of cattle found within several types of cattle operations for each state. Table A1 provides an example of this state-level breakdown.

Table AA: Example of State-Level Breakdown of Cattle Production by Operation Type

Head of Cattle by Operation Type - Kansas (2013-2017)			
Operation Type	**Cows (# of head)**	**Stocker-Background (# of head)**	**Finished (# of head)**
Cow-Calf	411,939		
Cow-Calf/Stocker	722,700	556,479	
Cow-Calf/Finish	310,761	239,286	233,304
Stocker/Background		2,478,421	
Finish			3,962,582
Dairy Cows	44,711		
Holstein Finish		430,078	419,589
NATIONAL TOTAL	**1,490,111**	**3,704,265**	**4,615,474**

Source: Rotz, 2018

Because these operation-types differ slightly from our sub-industries for analysis, and because the value of cattle differs throughout these different stages, a value of cattle had to be estimated for each of our sub-industries. This value was estimated in two stages: 1) estimate a dollar value for each state's beef cattle sub-industry, and 2) control these values to IMPLAN's total sales value for sector 11. Methods for completing these tasks are described in the following sections.

Estimate the Value of Beef Cattle Production Sub-Industries

Data from several sources were used to estimate the value of beef cattle production sub-industries for each state. Methods used to value each sub-industry are given below in the following sections.

Cow-Calf Cattle Operations

For the purposes of our study, any operation involved in cow-calf cattle ranching and farming is included within our cow-calf sector. Therefore, the cow-calf sector in our study encompasses the value of: cow-calf, cow-calf/stocker, and cow-calf/finish operations as designated under "operation type" in Table A1.

Using Table A1 as an example, the average annual number of cows attributed to cow-calf operations were summed, resulting in a total of 1,445,400 head of cows (calves) on cow-calf operations in Kansas. Similarly, the number of stocker/background cattle attributable to cow-calf operations were summed, resulting in a total of 795,765 stocker/background cattle found on cow-calf operations in Kansas. Finally, the number of cattle finished on cow-calf operations was used in its own category, with 233,304 cattle being finished on cow-calf operations in Kansas.

Although an average annual total of 2,474,469 head of cattle were estimated as being on cow-calf operations in Kansas from 2013-2017, the value (i.e. price per lb) of cattle within the Cows, Stocker/Background, and Finished categories differ, making it necessary to estimate a value for each of these categories. This value estimation was accomplished through the following series of steps:

1. **Estimate the total live weight of the cattle in each category**:
   a. Determine an average live weight value per head for each category (e.g. cows (calves), stocker/background, finished)
      i. Cows (calves) - for the cows (calves) category, the majority of value would be coming from the sale of calves. Here, we assume that each cow has (or will) produce a calf that has value upon sale. We also assume the sex ratio of calves to be 1:1. Because of this, the value for the cows (calves) category was determined using the average live weight of calves sold during 2016, as reported in various cattle auction reports published by the USDA's Agricultural Marketing Service and accessed through their "custom reports" tool (USDA AMS, 2018).
      ii. The average live weight values used for the stocker/background and feedlot categories were obtained from regional survey data (Asem-Hiablie et al., 2016; Asem-Hiablie et al., 2017; and Asem-Hiablie et al., 2018)
      iii. Multiply the head of cattle in each category by the average live weight for each category.

2. **Estimate a dollar value of the cattle in each category**.
   a. From advice and instruction obtained from a USDA Agricultural Marketing Service representative, their custom reports tool was used to estimate an average dollar value per pound for cattle sold from each category (USDA AMS, 2018). The year 2016 was chosen in order to correlate our later calculations, which involve the use of IMPLAN data for 2016.

b. The "Average Price" value was used to calculate an average price per pound for calves sold in 2016. The prices listed by AMS are in $/cwt, therefore that value was divided by 100 to obtain $/lb.
c. Multiply the estimated live weight of cattle in each category by the corresponding average price per pound to obtain a total dollar value for each category.

3. **Sum the values estimated for each category to get a total cow-calf sub-industry value**.
    a. This value was not used as the final sector value in our analysis, instead it will be used to estimate a percentage of value coming from the Cow-Calf industry for each state (see Table A2).

Stocker-Background Operations

To estimate a value for the Stocker-Background Ranching and Farming sub-industry, the process is similar to that of the Cow-Calf sector, but undoubtedly simpler as this involves only the "Stocker/Background" operation type from the Rotz data. As with the cow-calf sector, this head count value had to be converted into a dollar value using a few steps. First, the total live weight of stocker/background cattle for each state was estimated using regional live weight values for stocker/background (determined in the previous section).This value was multiplied by the head of cattle found in each state to obtain a total live weight estimate. Second the dollar value of the stocker-background sub-industry was estimated using an average price per pound for stocker/background determined in the previous section. This price was multiplied by the live weight of cattle in the Stockers and Backgrounding industry to obtain a total dollar value for this industry for each state. This value was not used as the final sector value in our analysis, instead it will be used to estimate a percentage of value coming from the Stockers and Backgrounding industry for each state (see Table A2).

Feedlot Cattle Operations

To estimate a value for the Feedlot Cattle Ranching and Farming sub-industry, the process is similar to that of the Stocker-Background sub-industry, but using values from the "Finish" operation type found in the Rotz data.

As with the cow-calf sector, this head count value had to be converted into a dollar value using average regional live weight values and average price per pound. As above, this value was not used as the final sector value in our analysis, instead it will be used to estimate a percentage of value coming from the Feedlot industry for each state (see Table A2).

Dairy Cattle Operations

For the purposes of our study, the Beef from Dairy Cattle Ranching and Farming sub-industry encompasses the value of: dairy cows and Holstein finish as designated under "operation type" in the Rotz data.

Using Table A1 as an example, the average annual number of cows going into the beef cattle market from dairy cow operations were 44,711 head in Kansas. The number of Holstein cattle stocked/backgrounded was 430,078 head. And, the number of Holstein cattle finished was 419,589 head. Although an average annual total of 894,378 head of cattle were estimated as being coming from dairy-related operations in Kansas from 2013-2017, the value of cattle within the Dairy Cows, Holstein Stocker/Background, and Holstein Finished categories differ, making it necessary to estimate a value for each of these categories. Once a value was estimated for each category, the values were summed to give a total value for the overall Beef from Dairy Cattle sector.

This was accomplished through the following series of steps:

1. **Estimate the total live weight of the cattle in each category**.
    a. Determine an average live weight value per head for each category (e.g. dairy cows, Holstein stocker/background, Holstein finished)
        i. Dairy Cows – for the dairy cows category, this value would be coming from culled dairy cattle. The number of culled dairy cattle was multiplied by an average live weight value to get a total live weight estimate.
        ii. The average live weight values used for the stocker/background and feedlot categories were obtained from regional survey data (Asem-Hiablie et al., 2015; Asem-Hiablie et al., 2016; Asem-Hiablie et al., 2017; and Asem-Hiablie et al., 2018)
2. Multiply the head of cattle in each category by the average live weight for each category.
3. **Estimate a dollar value of the cattle in each category**.
    a. For the Dairy Cows category, regional average prices for culled dairy carcasses were estimated from data obtained from the USDA Agricultural Marketing Service (USDA AMS, 2018).
    b. The USDA Agricultural Marketing Service custom tool was used to estimate an average dollar value per pound for cattle sold from the Holstein stocker/background and Holstein finished categories (USDA AMS, 2018). The year 2016 was chosen in order to correlate our later calculations, which involve the use of IMPLAN data for 2016.
    c. Multiply the estimated live weight of cattle in each category by the corresponding average price per pound to obtain a total dollar value for each category.
    d. Sum the values estimated for each category to get a total Dairy Cattle Ranching and Farming sub-industry value. This value was not used as the final sector value in our analysis, instead it will be used to estimate a percentage of value coming from the Dairy Cattle Ranching and Farming industry for each state (see Table A2).

Controlling Beef Cattle Production Sub-Industry Values to IMPLAN Sales

As our sub-industry values are essentially rough estimates, often utilizing average national values to obtain state-level estimates, we felt IMPLAN's overall cattle sector value to be a better estimate of the cattle industry than the sum of our sub-industries. Because of this, our sub-industry values were used simply to breakdown IMPLAN's Beef Cattle Ranching and Farming industry (sector 11) value into the sub-industry components. Further, because of difficulties, in estimating agricultural employment, IMPLAN (the primary source of employment data for this study) has developed methods that attempt to account for some of these issues, making these estimates preferred over those available from other sources (IMPLAN, 2019).

This was accomplished using the following steps:

1. **Calculate the percentage of total value represented by each sub-sector**.
    a. Sum the values of the sub-sectors for each state
    b. Divide the value from each sub-sector by the total

2. **Distribute IMPLAN's sector 11 total value into sub-sectors**.
    a. Multiply the percentages calculated in step 1 by the total sector 11 value. This should generate a value for each sub-sector that, when summed, will equal IMPLAN's sector 11 value. The results of this analysis are shown in Table A2.

Table AB: Estimated Sales Value for On-farm Beef Cattle Production Sub-Industries

REGION	Cow-Calf	Stockers and Backgrounding	Feedlot	Beef from Dairy Cattle
Southern Plains	$6,536,000,000	$3,618,000,000	$7,940,000,000	$1,383,000,000
Northern Plains	$5,089,000,000	$62,000,000	$8,746,000,000	$439,000,000
Midwest	$3,697,000,000	$1,482,000,000	$3,240,000,000	$2,141,000,000
Northwest	$3,094,000,000	$275,000,000	$1,447,000,000	$893,000,000
Southwest	$2,323,000,000	$40,000,000	$2,804,000,000	$2,905,000,000
Southeast	$2,995,000,000	$1,219,000,000	$56,000,000	$90,000,000
Northeast	$789,000,000	$298,000,000	$173,000,000	$643,000,000

Sector 89: Animal, Except Poultry, Slaughtering

In this study, the total sales value for IMPLAN sector 89: Animal, Except Poultry, Slaughter industry for each state was divided into three sub-industries:

1. Beef Cattle Harvest (includes steers, heifers, other cows, and bulls)
2. Dairy Cattle Harvest (includes veal)
3. Other Red Meat Harvest (includes pork and lamb/mutton)

Methods for obtaining these values are described as follows:

The USDA NASS publishes annual slaughter data containing a state-level breakdown of dressed pounds of red meat slaughtered in each state (USDA NASS, 2017). Unfortunately, due to non-disclosure issues, state-level slaughter data by type of red meat are not available. To determine the total slaughter value of each of the red meat sub-sectors, the following steps were used:

1. **Determine the dressed weight percent for the red meat categories**.
   a. National average dressed weight values were collected for cattle, calves and vealers, hogs, sheep.
   b. National average live weight values were collected for cattle, calves and vealers, hogs, sheep.
   c. Average dressed weight value was divided by the average live weight value to obtain average dressed weight percentages for cattle, calves and vealers, hogs, sheep.
2. **Determine the dressed weight of red meat slaughtered for the red meat categories**.
   a. USDA NASS publishes live weight slaughter values for beef, veal, pork, and lamb/mutton for most states (although there are some non-disclosures). These data were collected for 2016.
   b. The live weight values for each category were multiplied by the national average dressed weight percentages estimated previously.
   c. As some values were non-disclosed for several states, these non-disclosed values were estimated using state-level data showing total pounds of dressed red meat for each state.
   d. The dressed slaughter values were then summed.
   e. The values from each red meat category were then divided by the total summed value to get the proportion of each type of meat, making up the total value.
   f. These percentages were then multiplied by the total red meat slaughter value to get dressed weights for each state for: Beef, Veal, Pork and Lamb/Mutton

3. **Determine the dressed weight of beef for various categories (e.g. steers, heifers, dairy cows, other cows, bulls)**.
   a. USDA NASS publishes head counts of cattle slaughtered for: steers, dairy cows, other cows, and bulls.
   b. USDA NASS also publishes average dressed weights for steers, heifers, dairy cows, other cows, and bulls.
   c. The head counts for each category and state were multiplied by the corresponding average dressed weight to get an estimate of dressed weight for each cattle category.

d. The dressed weight estimates were summed to obtain a dressed weight total for the categories.
e. Each category was divided by the estimated total to determine what percent each cattle category contributed to the total weight.
f. These percentages were then multiplied by the total dressed weight value for beef, which was estimated using methods described in the previous section, to give dressed weight estimates for each cattle category that are controlled to the total beef estimate.

4. **Estimate a price value for meat slaughtered in each of the beef categories**.
    a. Obtained price data from USDA AMS for steers, heifers, dairy cows, other cows, bulls, veal, pork, and lamb/mutton.
    b. Multiplied the dressed weight estimates for each category by the average price per pound for each category to get a price value for meat slaughtered in each category for each state.
    c. These price values were then summed to get a total dollar value estimate for red meat slaughtered in each state.
    d. The price values for each meat category were divided by the total value to get a percentage of value for each category.

5. **Control estimated red meat values to IMPLAN's sector 89**.
    a. Multiply the IMPLAN total sales value for sector 89 for each state by the price value percentages calculated for each category, as described in the previous section. This gives an sales value for each red meat category that is controlled to IMPLAN's total sales.

6. **Split sector 89 sales into the three designated sub-sectors as shown here**:
    a. Beef Cattle Harvest = Steers + Heifers + Other Cows + Bulls
    b. Dairy Cattle Harvest = Dairy Cows + Veal
    c. Other Red Meat Harvest = Pork + Lamb/Mutton

7. **State-level values were summed for each region**. The results are shown in Table A3.

Table AC: Estimated Sales Values for Animal, Except Poultry, Slaughtering Sub-Sectors

REGION	Beef Cattle Harvest	Dairy Cattle Harvest	Other Red Meat Harvest
Southern Plains	$17,488,000,000	$551,000,000	$473,000,000
Northern Plains	$15,439,000,000	$640,000,000	$1,472,000,000
Midwest	$7,833,000,000	$6,190,000,000	$14,384,000,000
Northwest	$2,459,000,000	$333,000,000	$163,000,000
Southwest	$7,480,000,000	$2,090,000,000	$650,000,000
Southeast	$3,478,000,000	$1,132,000,000	$9,003,000,000
Northeast	$2,677,000,000	$2,399,000,000	$1,026,000,000

Sector 90: Meat Processed from Carcasses

In this study, the total sales value for the Meat Processed from Carcasses industry for each state was divided into three sub-industries:

1. Beef Cattle Processing
2. Dairy Cattle Processing
3. Other Red Meat Processing

Unfortunately, there are no regionally reported values for these fields. Therefore, sub-sector sales for this sector were estimated as follows:

1. **Estimate carcass yields of meat cuts from beef, pork, and lamb**.
    a. Determine the dressed weight percentage for the various retail cuts.
        i. Beef Carcass Yields – yields were based off of a publication produced by the Oklahoma Department of Agriculture, Food, and Forestry's Food Safety Division (ODA, 2018a). Weights for retail cuts are based on the slaughter of a 1,000 pound steer. The weights were used to determine the percentage of weight attributable to the various cuts, given either live, or dressed, starting weights. Needs Title

        ii. Pork Carcass Yields - yields were based off of a publication produced by the Oklahoma Department of Agriculture, Food, and Forestry's Food Safety Division (ODA, 2018b). Weights for retail cuts are based on the slaughter of a 250 pound hog. These weights were used to determine the percentage of weight attributable to the various cuts, given either live, or dressed, starting weights.

        iii. Lamb Carcass Yields – yields were based off of the USDA Estimated National Lamb Carcass Cutout report (LM_XL502), published by the Agricultural Marketing Service.

    b. Multiply the carcass yield percentages by the dressed carcass weights estimated in the sector 89 calculations for each type of meat to determine the total weight of retail cuts coming from each state.

2. **Estimate the total dollar value of meat cuts for beef, pork, veal, and lamb in each state**.
    a. Determine the average price of meat cuts for beef, pork, veal and lamb.
        i. Beef Prices – average cutout prices for beef cuts were estimated using values published by the USDA AMS in their National Weekly Boxed Beef Cutout and Boxed Beef Cuts report. Since prices vary between choice versus select cuts, the following methods were used to estimate overall national prices:
            1. Determine the percentage of beef falling under either the "Prime/Choice" or "Select/Other" categories. For 2016, this equated to roughly 70 and 30 percent, respectively.

2. Determine the average price for "Choice" graded retail cuts.
3. Determine the average price for "Select" graded retail cuts.
4. Multiply the prices by the choice/select percentages and sum to get a weighted average national price for retail beef cuts.

ii. Pork Prices - average cutout prices for pork cuts were estimated using values published by the USDA AMS in their National Weekly Pork Carcass Output report. Weekly national values for 2016 were collected and averaged.

iii. Lamb Prices - average cutout prices for lamb cuts were estimated using values published by the USDA AMS in their USDA Estimated National Lamb Carcass Cutout report. Weekly national values for 2016 were collected and averaged.

b. Multiply the total weights of the various meat cuts for each state by the national average prices to obtain a total price value for the different cuts.

c. Sum the price values for all of the cuts to get a total value for meat processed from carcasses for each type of meat (e.g. beef, beef from dairy, veal, pork, lamb/mutton).

3. **Control the carcass values to IMPLAN's Meat Processed from Carcasses industry total value**
   a. Sum the estimated dollar values for the different red meat categories (beef, beef from dairy, veal, pork, and lamb/mutton).
   b. Divide the various meat values by the summed total to find a value percentage of each meat type.
   c. Multiply the percentages by the total sales value for IMPLAN sector 90. This gives an sales value for each red meat category that is controlled to IMPLAN's total sales.

4. **Split sector IMPLAN's Meat Processed from Carcasses industry output into the following three sub-industries**:
   a. Beef Cattle Processing = Beef
   b. Dairy Cattle Processing = Dairy Cows + Veal
   c. Other Red Meat Processing = Pork + Lamb/Mutton

5. **State-level values were summed for each region**. The results are presented in Table A4.

Table AD: Estimated Sales Value for Meat Processed from Carcasses Sub-Industries

REGION	Beef Cattle Processing	Dairy Cattle Processing	Other Red Meat Processing
Southern Plains	$7,748,000,000	$234,000,000	$2,158,000,000
Northern Plains	$2,852,000,000	$45,000,000	$637,000,000
Midwest	$8,032,000,000	$2,862,000,000	$14,735,000,000
Northwest	$1,560,000,000	$214,000,000	$437,000,000
Southwest	$3,138,000,000	$1,114,000,000	$786,000,000
Southeast	$2,990,000,000	$797,000,000	$4,300,000,000
Northeast	$4,420,000,000	$2,659,000,000	$4,725,000,000

Sector 91: Rendering and Meat By-Product Processing

In this study, the total sales value for IMPLAN's Rendering and Meat By-Product Processing industry for each state was divided into three sub-industries:

1. Beef Cattle By-Products
2. Dairy Cattle By-Products
3. Other Red Meat By-Products

Unfortunately, there are no regionally reported values for these fields. Therefore, sub-sector sales for this sector were estimated as follows:

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1. **Estimate the by-product percentage for each type of meat**.
    a. Data from USDA AMS drop value reports were used to estimate the percentage of by-products coming from beef cattle, dairy cows, and pork carcasses in 2016 (USDA AMS, 2018). (*drop values for lamb and veal were not available, therefore these values were assumed negligible and not included in the study)
    b. Use the dressed weight percentages estimated in the Rendering and Meat By-Product Processing section to convert our dressed weight values of meat slaughter into to live weight values for each type of meat.
    c. Multiply the live weight values for each state by the by-product percentage to get an estimate of total by-products.

2. **Determine the dollar value of by-products for each type of meat**.
    a. Data from USDA AMS drop value reports were used to estimate the average price of by-products coming from beef cattle, dairy cows, and pork carcasses in 2016 (USDA AMS, 2018). (*drop values for lamb and veal were not available, therefore these values were assumed negligible and not included in the study; beef cattle values were also used for dairy cows)
    b. Multiply the total weights of by products for each state by the national average prices to obtain a total price value for each type of meat.
    c. Sum the price values for all of the meats to get a total value for by-products from carcasses for each type of meat (e.g. beef, beef from dairy, pork).

3. **Control the by-product values to IMPLAN's Rendering and By-Product Processing industry total value**.
    a. Sum the estimated dollar values for the different red meat categories (beef, beef from dairy, pork).
    b. Divide the various meat values by the summed total to find a value percentage of each meat type.
    c. Multiply the percentages by the total sales value for IMPLAN's Rendering and By-Product Processing industry. This gives a sales value for each red meat category that is controlled to IMPLAN's total sales.

4. **Split IMPLAN's Rendering and By-Product Processing industry sales into the three designated sub-sectors as shown here**:
    a. Beef Cattle Rendering and By-Product Processing = Beef
    b. Dairy Cattle Rendering and By-Product Processing = Dairy Cows
    c. Other Red Meat Rendering and By-Product Processing = Pork

5. **State-level values were summed for each region**. The results are presented in Table A5.

Table AE: Estimated Sales Value for Rendering and Meat By-Product Processing

REGION	Beef Cattle By-Products	Dairy Cattle By-Products	Other Red Meat By-Products
Southern Plains	$380,000,000	$11,000,000	$62,000,000
Northern Plains	$148,000,000	$0	$27,000,000
Midwest	$165,000,000	$31,000,000	$579,000,000
Northwest	$87,000,000	$8,000,000	$15,000,000
Southwest	$302,000,000	$95,000,000	$98,000,000
Southeast	$603,000,000	$92,000,000	$1,245,000,000
Northeast	$225,000,000	$69,000,000	$182,000,000

Appendix B: Methods for Performing Economic Base Analysis

Economic base analysis of the beef industry required: 1) Building modified Symmetric Input-Output Tables (SIOTs); and 2) Using Automated Social Accounting Matrix (ASAM) software to analyze the contributions of the beef industry.

Building Modified SIOTs for the Beef Industry

Building modified SIOTs for the beef industry involved: 1) extracting the Supply and Use Input-Output Tables (SUIOTs) from each IMPLAN regional model; 2) dis-aggregating industries and commodities related to beef cattle production and processing and inserting the dis-aggregated industries and commodities into each of seven regional SUIOTs; and 3) deriving Symmetric Input-Output Tables (SIOTs) from the modified SUIOTs.

Extracting the SUIOT from IMPLAN

The regional supply and use input-output table (SUIOT) of an IMPLAN model is stored in the IMPLAN model's Access database, in a table called **RegionalSAMBalancesIndustryDetail**. IMPLAN models were built for each of the seven study regions, and the US as a whole. The SUIOTs were extracted for each of these models and saved as a Microsoft Access files to be modified within the Access software. Data from these tables were modified by dis-aggregating industries and commodities as discussed in the following section.

Dis-aggregating Industries and Commodities in the SUIOT

In each of the regional IMPLAN SUIOTs, four industries were dis-aggregated into a total of thirteen new industries according to the scheme presented in Table A6.

Table AF: Dis-aggregations of IMPLAN Industries 11, 89, 90 and 91

Original IMPLAN Industry	Dis-aggregated Industries
11-Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming	537 - Cow-calf ranching 538 - Stocker-Background cattle ranching 539 - FeedLot cattle ranching 540 - Dairy cows ranching
89 - Animal, except poultry, slaughtering	541 - Beef cattle slaughter 542 - Dairy cattle slaughter (including veal) 543 - Other red meat slaughter
90 - Meat processed from carcasses	544 - Processing beef cattle carcasses 545 - Processing dairy cattle carcasses (including veal) 546 - Processing other red meat from carcasses
91 - Rendering and meat byproduct processing	547 - Rendering beef cattle carcasses 548 - Rendering dairy cattle carcasses 549 - Rendering other red meat carcasses

In addition, four commodities were dis-aggregated into a total of thirteen new commodities according to the scheme presented in Table A7.

Table AG: Dis-aggregations of IMPLAN Commodities 3011, 3089, 3090 and 3091

Original IMPLAN Commodity	Dis-aggregated Commodities
3011-Beef	3537 - Beef from cow-calf operations
	3538 - Beef from stocker-background operations
	3539 - Beef from feedlot operations
	3540 - Beef from dairy operations
3089 - Animal, except poultry, carcasses	3541 - Beef cattle carcasses
	3542 - Dairy cattle carcasses (including veal)
	3543 - Other red meat carcasses
3090 - Processed meat from carcasses	3544 - Processed beef cattle carcasses
	3545 - Processed dairy cattle carcasses (including veal)
	3546 - Processed other red meat carcasses
3091 - Rendered meat and meat byproducts	3547 - Rendered meat and byproducts from beef cattle carcasses
	3548 - Rendered meat and byproducts from dairy cattle carcasses
	3549 - Rendered meat and byproducts from other red meat carcasses

With these dis-aggregations, the total number of industries and commodities in the modified SUIOTs increased from 536 to 549. The original industries that were dis-aggregated (industries 11, 89, 90 and 91) remain in the modified SUIOTs but are “empty”. Similarly, the original commodities that were dis-aggregated (commodities 3011, 3089, 3090 and 3091) remain in the modified SUIOTs but are “empty”.

Figure A1 is a schematic of an IMPLAN regional Social Accounting Matrix (SAM) using Supply-Use Input-Output Table (SUIOT) format.

		REGION 1					RoW
		1 Industries	2 Commodities	3 Factors	4 Institutions	5 Dom Trade	6 RoW
REGION 1	1 Industries		MAKE			Domestic Exports	Foreign Exports
	2 Commod-ities	USE			Final Demands		
	3 Factors	VA					
	4 Institutions		Institution Sales	Disburse-ments	Transfers	Trade	Trade
	5 Domestic Trade	Domestic Imports			Domestic Imports		
RoW	6 RoW	Foreign Imports			Foreign Imports		

Figure A1: Regional Supply-Use Input-Output Table (SUIOT)

Standard IMPLAN SUIOT tables contain 536 industries and 536 commodities. Dis-aggregating (or "splitting") any one of these industries involves (a) adding columns to the USE, VA, Domestic Imports, and Foreign Imports sub-matrices, and (b) adding rows to the MAKE, Domestic Exports and Foreign Exports sub-matrices. This is illustrated in Figure A2.

		REGION 1						RoW
		1 Industries	1a Add Industries	2 Commodities	3 Factors	4 Institutions	5 Dom Trade	6 RoW
REGION 1	1 Industries			MAKE			Domestic Exports	Foreign Exports
	1a Add Industries							
	2 Commod-ities	USE				Final Demands		
	3 Factors	VA						
	4 Institutions			Institution Sales	Disburse-ments	Transfers	Trade	Trade
	5 Domestic Trade	Domestic Imports				Domestic Imports		
RoW	6 RoW	Foreign Imports				Foreign Imports		

Figure A2: Adding Dis-aggregated Industries to SUIOT

Dis-aggregating (or "splitting") any one of the commodities in an SUIOT involves (a) adding ***rows*** to the USE and Final Demand sub-matrices, and (b) adding ***columns*** to the MAKE and Institution Sales sub-matrices as illustrated in Figure A3.

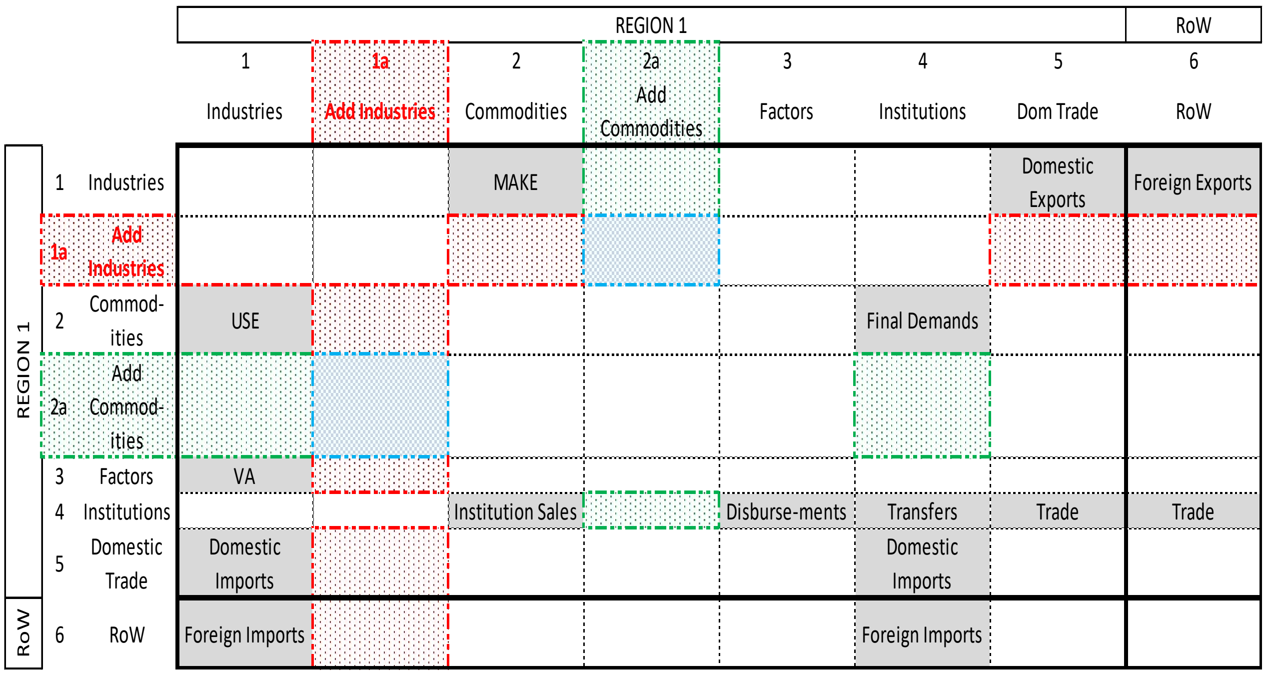

Figure A3: Adding Dis-aggregated Commodities to SUIOT

Building the Modified SIOT

Input-output multipliers are derived from Inter-Industry sub-matrix of Symmetric Input-Output Tables (SIOT) illustrated in Figure A4.

			REGION 1				RoW
			1 Industries	2 Factors	3 Institutions	4 Dom Trade	5 RoW
REGION 1	1	Industries	Inter-Industry		Final Demand	Domestic Exports	Foreign Exports
	2	Factors	VA				
	3	Institutions		Disburse-ments	Transfers	Trade	Trade
	4	Domestic Trade	Domestic Imports		Domestic Imports		
RoW	5	RoW	Foreign Imports		Foreign Imports		

Figure A4: Regional Symmetric Input-Output (SIOT)

The Inter-Industry sub-matrix of an SIOT is derived from the USE and MAKE sub-matrices of an SUIOT using the "market-share hypothesis". The commodity dimension is "hidden" when transforming the USE and MAKE sub-matrices of an SUIOT into the Inter-Industry sub-matrix of an SIOT. For this reason, a regional SUIOT with both dis-aggregated industries and commodities will result in a regional SIOT that displays only dis-aggregated industries, as in Figure A5.

			REGION 1					RoW
			1 Industries	1a Add Industries	2 Factors	3 Institutions	4 Dom Trade	5 RoW
REGION 1	1	Industries	Inter-Industry			Final Demand	Domestic Exports	Foreign Exports
	1a	Add Industries						
	2	Factors	VA					
	3	Institutions			Disburse-ments	Transfers	Trade	Trade
	4	Domestic Trade	Domestic Imports			Domestic Imports		
RoW	5	RoW	Foreign Imports			Foreign Imports		

Figure A5: Regional SIOT with Dis-aggregated Industries

The modified SIOTs with dis-aggregated industries and commodities were loaded into the Access database tables called **RegionalSAMBalancesIxIIndustryDetail**.

Using ASAM to Analyze Beef Industry Contributions

ASAM is an Excel spreadsheet model that loads an IMPLAN SIOT from the Access database table called **RegionalSAMBalancesIxIIndustryDetail**, computes the Leontief inverse multipliers and displays various descriptive statistics about the Input-Output model. Seven ASAM models were produced, one for each of the modified SIOTs (Watson, 2010-2011).

Once the regional SIOT's were modified, these were loaded into the seven Automated Social Accounting Matrices (ASAMs) which functioned to derive I-O multipliers and descriptive statistics industries in each region. These regional statistics were then used to estimate the economic contribution of beef cattle production and beef processing.

Appendix C: Two-digit NAICS Sector Definitions

NAICS Sector		Description
11	Agriculture, Forestry, Fishing and Hunting	Establishments primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals from a farm, ranch, or their natural habitats.
21	Mining, Quarrying, and Oil and Gas Extraction	Establishments that extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas.
22	Utilities	Establishments engaged in the provision of the following utility services: electric power, natural gas, steam supply, water supply, and sewage removal.
23	Construction	Establishments primarily engaged in the construction of buildings or engineering projects (e.g., highways and utility systems).
31-33	Manufacturing	Establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products.
42	Wholesale Trade	Establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise.
44-45	Retail Trade	Establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise.
48-49	Transportation and Warehousing	Industries providing transportation of passengers and cargo, warehousing and storage for goods, scenic and sightseeing transportation, and support activities related to modes of transportation.
51	Information	Establishments engaged in the producing and distribution of information and cultural products, providing the means to transmit or distribute information and cultural products, as well as the processing of data.
52	Finance and Insurance	Establishments primarily engaged in financial transactions (transactions involving the creation, liquidation, or change in ownership of financial assets) and/or in facilitating financial transactions.
53	Real Estate and Rental and Leasing	Establishments primarily engaged in renting, leasing, or otherwise allowing the use of tangible or intangible assets, and establishments providing related services.
54	Professional, Scientific, and Technical Services	Establishments that specialize in performing professional, scientific, and technical activities for others.

55	Management of Companies and Enterprises	Establishments that hold the securities of (or other equity interests in) companies and enterprises for the purpose of owning a controlling interest or influencing management decisions or establishments (except government establishments) that administer, oversee, and manage establishments of the company or enterprise and that normally undertake the strategic or organizational planning and decision making role of the company or enterprise. Establishments that administer, oversee, and manage may hold the securities of the company or enterprise.
56	Administrative and Support and Waste Management and Remediation Services	Establishments performing routine support activities for the day-to-day operations of other organizations. Activities performed include: office administration, hiring and placing of personnel, document preparation and similar clerical services, solicitation, collection, security and surveillance services, cleaning, and waste disposal services.
61	Educational Services	Establishments that provide instruction and training in a wide variety of subjects. This instruction and training is provided by specialized establishments, such as schools, colleges, universities, and training centers.
62	Health Care and Social Assistance	Establishments providing health care and social assistance for individuals.
71	Arts, Entertainment, and Recreation	Establishments that operate facilities or provide services to meet varied cultural, entertainment, and recreational interests of their patrons.
72	Accommodation and Food Services	Establishments providing customers with lodging and/or preparing meals, snacks, and beverages for immediate consumption.
81	Other Services (except Public Administration)	Establishments engaged in providing services not specifically provided for elsewhere in the classification system. Establishments in this sector are primarily engaged in activities such as equipment and machinery repairing, promoting or administering religious activities, grantmaking, advocacy, and providing drycleaning and laundry services, personal care services, death care services, pet care services, photofinishing services, temporary parking services, and dating services.
92	Public Administration	Establishments of federal, state, and local government agencies that administer, oversee, and manage public programs and have executive, legislative, or judicial authority over other institutions within a given area.
Source:	https://classcodes.com/naics-2-digit-sector-codes/	

Appendix D: Table of Analyzed Industries

The following table shows industries all industries included within the analysis, as well as their corresponding IMPLAN and NAICS codes. IMPLAN industries 11, 89, 90, and 91 were divided into sub-industries related to beef production. Those industries were provided an individual IMPLAN code and can be found at the end of the table.

Industries falling under the Agriculture, Forestry, Fishing, and Hunting NAICS sector are highlighted in green. Those considered to be “ag-related” manufacturing industries are highlighted in yellow.

IMPLAN Industry Code	Industry Name	2-digit NAICS
1	Oilseed farming	11
2	Grain farming	11
3	Vegetable and melon farming	11
4	Fruit farming	11
5	Tree nut farming	11
6	Greenhouse, nursery, and floriculture production	11
7	Tobacco farming	11
8	Cotton farming	11
9	Sugarcane and sugar beet farming	11
10	All other crop farming	11
11	Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming	11
12	Dairy cattle and milk production	11
13	Poultry and egg production	11
14	Animal production, except cattle and poultry and eggs	11
15	Forestry, forest products, and timber tract production	11
16	Commercial logging	11
17	Commercial fishing	11
18	Commercial hunting and trapping	11
19	Support activities for agriculture and forestry	11
20	Extraction of natural gas and crude petroleum	21
21	Extraction of natural gas liquids	21
22	Coal mining	21
23	Iron ore mining	21
24	Gold ore mining	21
25	Silver ore mining	21
26	Lead and zinc ore mining	21
27	Copper ore mining	21

IMPLAN Industry Code	Industry Name	2-digit NAICS
28	Uranium-radium-vanadium ore mining	21
29	Other metal ore mining	21
30	Stone mining and quarrying	21
31	Sand and gravel mining	21
32	Other clay, ceramic, refractory minerals mining	21
33	Potash, soda, and borate mineral mining	21
34	Phosphate rock mining	21
35	Other chemical and fertilizer mineral mining	21
36	Other nonmetallic minerals	21
37	Drilling oil and gas wells	21
38	Support activities for oil and gas operations	21
39	Metal mining services	21
40	Other nonmetallic minerals services	21
41	Electric power generation - Hydroelectric	22
42	Electric power generation - Fossil fuel	22
43	Electric power generation - Nuclear	22
44	Electric power generation - Solar	22
45	Electric power generation - Wind	22
46	Electric power generation - Geothermal	22
47	Electric power generation - Biomass	22
48	Electric power generation - All other	22
49	Electric power transmission and distribution	22
50	Natural gas distribution	22
51	Water, sewage and other systems	22
52	Construction of new health care structures	23
53	Construction of new manufacturing structures	23
54	Construction of new power and communication structures	23
55	Construction of new educational and vocational structures	23
56	Construction of new highways and streets	23
57	Construction of new commercial structures, including farm structures	23
58	Construction of other new nonresidential structures	23
59	Construction of new single-family residential structures	23
60	Construction of new multifamily residential structures	23
61	Construction of other new residential structures	23
62	Maintenance and repair construction of nonresidential structures	23
63	Maintenance and repair construction of residential structures	23
64	Maintenance and repair construction of highways, streets, bridges, and tunnels	23
65	Dog and cat food manufacturing	31
66	Other animal food manufacturing	31

IMPLAN Industry Code	Industry Name	2-digit NAICS
67	Flour milling	31
68	Rice milling	31
69	Malt manufacturing	31
70	Wet corn milling	31
71	Soybean and other oilseed processing	31
72	Fats and oils refining and blending	31
73	Breakfast cereal manufacturing	31
74	Beet sugar manufacturing	31
75	Sugar cane mills and refining	31
76	Nonchocolate confectionery manufacturing	31
77	Chocolate and confectionery manufacturing from cacao beans	31
78	Confectionery manufacturing from purchased chocolate	31
79	Frozen fruits, juices and vegetables manufacturing	31
80	Frozen specialties manufacturing	31
81	Canned fruits and vegetables manufacturing	31
82	Canned specialties	31
83	Dehydrated food products manufacturing	31
84	Fluid milk manufacturing	31
85	Creamery butter manufacturing	31
86	Cheese manufacturing	31
87	Dry, condensed, and evaporated dairy product manufacturing	31
88	Ice cream and frozen dessert manufacturing	31
89	Animal, except poultry, slaughtering	31
90	Meat processed from carcasses	31
91	Rendering and meat byproduct processing	31
92	Poultry processing	31
93	Seafood product preparation and packaging	31
94	Bread and bakery product, except frozen, manufacturing	31
95	Frozen cakes and other pastries manufacturing	31
96	Cookie and cracker manufacturing	31
97	Dry pasta, mixes, and dough manufacturing	31
98	Tortilla manufacturing	31
99	Roasted nuts and peanut butter manufacturing	31
100	Other snack food manufacturing	31
101	Coffee and tea manufacturing	31
102	Flavoring syrup and concentrate manufacturing	31
103	Mayonnaise, dressing, and sauce manufacturing	31
104	Spice and extract manufacturing	31
105	All other food manufacturing	31

IMPLAN Industry Code	Industry Name	2-digit NAICS
106	Bottled and canned soft drinks & water	31
107	Manufactured ice	31
108	Breweries	31
109	Wineries	31
110	Distilleries	31
111	Tobacco product manufacturing	31
112	Fiber, yarn, and thread mills	31
113	Broadwoven fabric mills	31
114	Narrow fabric mills and schiffli machine embroidery	31
115	Nonwoven fabric mills	31
116	Knit fabric mills	31
117	Textile and fabric finishing mills	31
118	Fabric coating mills	31
119	Carpet and rug mills	31
120	Curtain and linen mills	31
121	Textile bag and canvas mills	31
122	Rope, cordage, twine, tire cord and tire fabric mills	31
123	Other textile product mills	31
124	Hosiery and sock mills	31
125	Other apparel knitting mills	31
126	Cut and sew apparel contractors	31
127	Mens and boys cut and sew apparel manufacturing	31
128	Womens and girls cut and sew apparel manufacturing	31
129	Other cut and sew apparel manufacturing	31
130	Apparel accessories and other apparel manufacturing	31
131	Leather and hide tanning and finishing	31
132	Footwear manufacturing	31
133	Other leather and allied product manufacturing	31
134	Sawmills	32
135	Wood preservation	32
136	Veneer and plywood manufacturing	32
137	Engineered wood member and truss manufacturing	32
138	Reconstituted wood product manufacturing	32
139	Wood windows and door manufacturing	32
140	Cut stock, resawing lumber, and planing	32
141	Other millwork, including flooring	32
142	Wood container and pallet manufacturing	32
143	Manufactured home (mobile home) manufacturing	32
144	Prefabricated wood building manufacturing	32

IMPLAN Industry Code	Industry Name	2-digit NAICS
145	All other miscellaneous wood product manufacturing	32
146	Pulp mills	32
147	Paper mills	32
148	Paperboard mills	32
149	Paperboard container manufacturing	32
150	Paper bag and coated and treated paper manufacturing	32
151	Stationery product manufacturing	32
152	Sanitary paper product manufacturing	32
153	All other converted paper product manufacturing	32
154	Printing	32
155	Support activities for printing	32
156	Petroleum refineries	32
157	Asphalt paving mixture and block manufacturing	32
158	Asphalt shingle and coating materials manufacturing	32
159	Petroleum lubricating oil and grease manufacturing	32
160	All other petroleum and coal products manufacturing	32
161	Petrochemical manufacturing	32
162	Industrial gas manufacturing	32
163	Synthetic dye and pigment manufacturing	32
164	Other basic inorganic chemical manufacturing	32
165	Other basic organic chemical manufacturing	32
166	Plastics material and resin manufacturing	32
167	Synthetic rubber manufacturing	32
168	Artificial and synthetic fibers and filaments manufacturing	32
169	Nitrogenous fertilizer manufacturing	32
170	Phosphatic fertilizer manufacturing	32
171	Fertilizer mixing	32
172	Pesticide and other agricultural chemical manufacturing	32
173	Medicinal and botanical manufacturing	32
174	Pharmaceutical preparation manufacturing	32
175	In-vitro diagnostic substance manufacturing	32
176	Biological product (except diagnostic) manufacturing	32
177	Paint and coating manufacturing	32
178	Adhesive manufacturing	32
179	Soap and other detergent manufacturing	32
180	Polish and other sanitation good manufacturing	32
181	Surface active agent manufacturing	32
182	Toilet preparation manufacturing	32
183	Printing ink manufacturing	32

IMPLAN Industry Code	Industry Name	2-digit NAICS
184	Explosives manufacturing	32
185	Custom compounding of purchased resins	32
186	Photographic film and chemical manufacturing	32
187	Other miscellaneous chemical product manufacturing	32
188	Plastics packaging materials and unlaminated film and sheet manufacturing	32
189	Unlaminated plastics profile shape manufacturing	32
190	Plastics pipe and pipe fitting manufacturing	32
191	Laminated plastics plate, sheet (except packaging), and shape manufacturing	32
192	Polystyrene foam product manufacturing	32
193	Urethane and other foam product (except polystyrene) manufacturing	32
194	Plastics bottle manufacturing	32
195	Other plastics product manufacturing	32
196	Tire manufacturing	32
197	Rubber and plastics hoses and belting manufacturing	32
198	Other rubber product manufacturing	32
199	Pottery, ceramics, and plumbing fixture manufacturing	32
200	Brick, tile, and other structural clay product manufacturing	32
201	Flat glass manufacturing	32
202	Other pressed and blown glass and glassware manufacturing	32
203	Glass container manufacturing	32
204	Glass product manufacturing made of purchased glass	32
205	Cement manufacturing	32
206	Ready-mix concrete manufacturing	32
207	Concrete block and brick manufacturing	32
208	Concrete pipe manufacturing	32
209	Other concrete product manufacturing	32
210	Lime manufacturing	32
211	Gypsum product manufacturing	32
212	Abrasive product manufacturing	32
213	Cut stone and stone product manufacturing	32
214	Ground or treated mineral and earth manufacturing	32
215	Mineral wool manufacturing	32
216	Miscellaneous nonmetallic mineral products manufacturing	32
217	Iron and steel mills and ferroalloy manufacturing	33
218	Iron, steel pipe and tube manufacturing from purchased steel	33
219	Rolled steel shape manufacturing	33
220	Steel wire drawing	33
221	Alumina refining and primary aluminum production	33
222	Secondary smelting and alloying of aluminum	33

IMPLAN Industry Code	Industry Name	2-digit NAICS
223	Aluminum sheet, plate, and foil manufacturing	33
224	Other aluminum rolling, drawing and extruding	33
225	Nonferrous metal (exc aluminum) smelting and refining	33
226	Copper rolling, drawing, extruding and alloying	33
227	Nonferrous metal, except copper and aluminum, shaping	33
228	Secondary processing of other nonferrous metals	33
229	Ferrous metal foundries	33
230	Nonferrous metal foundries	33
231	Iron and steel forging	33
232	Nonferrous forging	33
233	Custom roll forming	33
234	Crown and closure manufacturing and metal stamping	33
235	Cutlery, utensil, pot, and pan manufacturing	33
236	Handtool manufacturing	33
237	Prefabricated metal buildings and components manufacturing	33
238	Fabricated structural metal manufacturing	33
239	Plate work manufacturing	33
240	Metal window and door manufacturing	33
241	Sheet metal work manufacturing	33
242	Ornamental and architectural metal work manufacturing	33
243	Power boiler and heat exchanger manufacturing	33
244	Metal tank (heavy gauge) manufacturing	33
245	Metal cans manufacturing	33
246	Metal barrels, drums and pails manufacturing	33
247	Hardware manufacturing	33
248	Spring and wire product manufacturing	33
249	Machine shops	33
250	Turned product and screw, nut, and bolt manufacturing	33
251	Metal heat treating	33
252	Metal coating and nonprecious engraving	33
253	Electroplating, anodizing, and coloring metal	33
254	Valve and fittings, other than plumbing, manufacturing	33
255	Plumbing fixture fitting and trim manufacturing	33
256	Ball and roller bearing manufacturing	33
257	Small arms ammunition manufacturing	33
258	Ammunition, except for small arms, manufacturing	33
259	Small arms, ordnance, and accessories manufacturing	33
260	Fabricated pipe and pipe fitting manufacturing	33
261	Other fabricated metal manufacturing	33

IMPLAN Industry Code	Industry Name	2-digit NAICS
262	Farm machinery and equipment manufacturing	33
263	Lawn and garden equipment manufacturing	33
264	Construction machinery manufacturing	33
265	Mining machinery and equipment manufacturing	33
266	Oil and gas field machinery and equipment manufacturing	33
267	Food product machinery manufacturing	33
268	Semiconductor machinery manufacturing	33
269	Sawmill, woodworking, and paper machinery	33
270	Printing machinery and equipment manufacturing	33
271	All other industrial machinery manufacturing	33
272	Optical instrument and lens manufacturing	33
273	Photographic and photocopying equipment manufacturing	33
274	Other commercial service industry machinery manufacturing	33
275	Air purification and ventilation equipment manufacturing	33
276	Heating equipment (except warm air furnaces) manufacturing	33
277	Air conditioning, refrigeration, and warm air heating equipment manufacturing	33
278	Industrial mold manufacturing	33
279	Special tool, die, jig, and fixture manufacturing	33
280	Cutting tool and machine tool accessory manufacturing	33
281	Machine tool manufacturing	33
282	Rolling mill and other metalworking machinery manufacturing	33
283	Turbine and turbine generator set units manufacturing	33
284	Speed changer, industrial high-speed drive, and gear manufacturing	33
285	Mechanical power transmission equipment manufacturing	33
286	Other engine equipment manufacturing	33
287	Pump and pumping equipment manufacturing	33
288	Air and gas compressor manufacturing	33
289	Measuring and dispensing pump manufacturing	33
290	Elevator and moving stairway manufacturing	33
291	Conveyor and conveying equipment manufacturing	33
292	Overhead cranes, hoists, and monorail systems manufacturing	33
293	Industrial truck, trailer, and stacker manufacturing	33
294	Power-driven handtool manufacturing	33
295	Welding and soldering equipment manufacturing	33
296	Packaging machinery manufacturing	33
297	Industrial process furnace and oven manufacturing	33
298	Fluid power cylinder and actuator manufacturing	33
299	Fluid power pump and motor manufacturing	33
300	Scales, balances, and miscellaneous general purpose machinery manufacturing	33

IMPLAN Industry Code	Industry Name	2-digit NAICS
301	Electronic computer manufacturing	33
302	Computer storage device manufacturing	33
303	Computer terminals and other computer peripheral equipment manufacturing	33
304	Telephone apparatus manufacturing	33
305	Broadcast and wireless communications equipment manufacturing	33
306	Other communications equipment manufacturing	33
307	Audio and video equipment manufacturing	33
308	Bare printed circuit board manufacturing	33
309	Semiconductor and related device manufacturing	33
310	Capacitor, resistor, coil, transformer, and other inductor manufacturing	33
311	Electronic connector manufacturing	33
312	Printed circuit assembly (electronic assembly) manufacturing	33
313	Other electronic component manufacturing	33
314	Electromedical and electrotherapeutic apparatus manufacturing	33
315	Search, detection, and navigation instruments manufacturing	33
316	Automatic environmental control manufacturing	33
317	Industrial process variable instruments manufacturing	33
318	Totalizing fluid meter and counting device manufacturing	33
319	Electricity and signal testing instruments manufacturing	33
320	Analytical laboratory instrument manufacturing	33
321	Irradiation apparatus manufacturing	33
322	Watch, clock, and other measuring and controlling device manufacturing	33
323	Blank magnetic and optical recording media manufacturing	33
324	Software and other prerecorded and record reproducing	33
325	Electric lamp bulb and part manufacturing	33
326	Lighting fixture manufacturing	33
327	Small electrical appliance manufacturing	33
328	Household cooking appliance manufacturing	33
329	Household refrigerator and home freezer manufacturing	33
330	Household laundry equipment manufacturing	33
331	Other major household appliance manufacturing	33
332	Power, distribution, and specialty transformer manufacturing	33
333	Motor and generator manufacturing	33
334	Switchgear and switchboard apparatus manufacturing	33
335	Relay and industrial control manufacturing	33
336	Storage battery manufacturing	33
337	Primary battery manufacturing	33
338	Fiber optic cable manufacturing	33
339	Other communication and energy wire manufacturing	33

IMPLAN Industry Code	Industry Name	2-digit NAICS
340	Wiring device manufacturing	33
341	Carbon and graphite product manufacturing	33
342	All other miscellaneous electrical equipment and component manufacturing	33
343	Automobile manufacturing	33
344	Light truck and utility vehicle manufacturing	33
345	Heavy duty truck manufacturing	33
346	Motor vehicle body manufacturing	33
347	Truck trailer manufacturing	33
348	Motor home manufacturing	33
349	Travel trailer and camper manufacturing	33
350	Motor vehicle gasoline engine and engine parts manufacturing	33
351	Motor vehicle electrical and electronic equipment manufacturing	33
352	Motor vehicle steering, suspension component (except spring), and brake systems manufacturing	33
353	Motor vehicle transmission and power train parts manufacturing	33
354	Motor vehicle seating and interior trim manufacturing	33
355	Motor vehicle metal stamping	33
356	Other motor vehicle parts manufacturing	33
357	Aircraft manufacturing	33
358	Aircraft engine and engine parts manufacturing	33
359	Other aircraft parts and auxiliary equipment manufacturing	33
360	Guided missile and space vehicle manufacturing	33
361	Propulsion units and parts for space vehicles and guided missiles manufacturing	33
362	Railroad rolling stock manufacturing	33
363	Ship building and repairing	33
364	Boat building	33
365	Motorcycle, bicycle, and parts manufacturing	33
366	Military armored vehicle, tank, and tank component manufacturing	33
367	All other transportation equipment manufacturing	33
368	Wood kitchen cabinet and countertop manufacturing	33
369	Upholstered household furniture manufacturing	33
370	Nonupholstered wood household furniture manufacturing	33
371	Other household nonupholstered furniture manufacturing	33
372	Institutional furniture manufacturing	33
373	Wood office furniture manufacturing	33
374	Custom architectural woodwork and millwork	33
375	Office furniture, except wood, manufacturing	33
376	Showcase, partition, shelving, and locker manufacturing	33
377	Mattress manufacturing	33

IMPLAN Industry Code	Industry Name	2-digit NAICS
378	Blind and shade manufacturing	33
379	Surgical and medical instrument manufacturing	33
380	Surgical appliance and supplies manufacturing	33
381	Dental equipment and supplies manufacturing	33
382	Ophthalmic goods manufacturing	33
383	Dental laboratories	33
384	Jewelry and silverware manufacturing	33
385	Sporting and athletic goods manufacturing	33
386	Doll, toy, and game manufacturing	33
387	Office supplies (except paper) manufacturing	33
388	Sign manufacturing	33
389	Gasket, packing, and sealing device manufacturing	33
390	Musical instrument manufacturing	33
391	Fasteners, buttons, needles, and pins manufacturing	33
392	Broom, brush, and mop manufacturing	33
393	Burial casket manufacturing	33
394	All other miscellaneous manufacturing	33
395	Wholesale trade	42
396	Retail - Motor vehicle and parts dealers	44
397	Retail - Furniture and home furnishings stores	44
398	Retail - Electronics and appliance stores	44
399	Retail - Building material and garden equipment and supplies stores	44
400	Retail - Food and beverage stores	44
401	Retail - Health and personal care stores	44
402	Retail - Gasoline stores	44
403	Retail - Clothing and clothing accessories stores	44
404	Retail - Sporting goods, hobby, musical instrument and book stores	45
405	Retail - General merchandise stores	45
406	Retail - Miscellaneous store retailers	45
407	Retail - Nonstore retailers	45
408	Air transportation	48
409	Rail transportation	48
410	Water transportation	48
411	Truck transportation	48
412	Transit and ground passenger transportation	48
413	Pipeline transportation	48
414	Scenic and sightseeing transportation and support activities for transportation	48
415	Couriers and messengers	49
416	Warehousing and storage	49

IMPLAN Industry Code	Industry Name	2-digit NAICS
417	Newspaper publishers	51
418	Periodical publishers	51
419	Book publishers	51
420	Directory, mailing list, and other publishers	51
421	Greeting card publishing	51
422	Software publishers	51
423	Motion picture and video industries	51
424	Sound recording industries	51
425	Radio and television broadcasting	51
426	Cable and other subscription programming	51
427	Wired telecommunications carriers	51
428	Wireless telecommunications carriers (except satellite)	51
429	Satellite, telecommunications resellers, and all other telecommunications	51
430	Data processing, hosting, and related services	51
431	News syndicates, libraries, archives and all other information services	51
432	Internet publishing and broadcasting and web search portals	51
433	Monetary authorities and depository credit intermediation	52
434	Nondepository credit intermediation and related activities	52
435	Securities and commodity contracts intermediation and brokerage	52
436	Other financial investment activities	52
437	Insurance carriers	52
438	Insurance agencies, brokerages, and related activities	52
439	Funds, trusts, and other financial vehicles	52
440	Real estate	53
441	Owner-occupied dwellings	53
442	Automotive equipment rental and leasing	53
443	General and consumer goods rental except video tapes and discs	53
444	Video tape and disc rental	53
445	Commercial and industrial machinery and equipment rental and leasing	53
446	Lessors of nonfinancial intangible assets	53
447	Legal services	54
448	Accounting, tax preparation, bookkeeping, and payroll services	54
449	Architectural, engineering, and related services	54
450	Specialized design services	54
451	Custom computer programming services	54
452	Computer systems design services	54
453	Other computer related services, including facilities management	54
454	Management consulting services	54
455	Environmental and other technical consulting services	54

IMPLAN Industry Code	Industry Name	2-digit NAICS
456	Scientific research and development services	54
457	Advertising, public relations, and related services	54
458	Photographic services	54
459	Veterinary services	54
460	Marketing research and all other miscellaneous professional, scientific, and technical services	54
461	Management of companies and enterprises	55
462	Office administrative services	56
463	Facilities support services	56
464	Employment services	56
465	Business support services	56
466	Travel arrangement and reservation services	56
467	Investigation and security services	56
468	Services to buildings	56
469	Landscape and horticultural services	56
470	Other support services	56
471	Waste management and remediation services	56
472	Elementary and secondary schools	61
473	Junior colleges, colleges, universities, and professional schools	61
474	Other educational services	61
475	Offices of physicians	62
476	Offices of dentists	62
477	Offices of other health practitioners	62
478	Outpatient care centers	62
479	Medical and diagnostic laboratories	62
480	Home health care services	62
481	Other ambulatory health care services	62
482	Hospitals	62
483	Nursing and community care facilities	62
484	Residential mental retardation, mental health, substance abuse and other facilities	62
485	Individual and family services	62
486	Community food, housing, and other relief services, including rehabilitation services	62
487	Child day care services	62
488	Performing arts companies	71
489	Commercial Sports Except Racing	71
490	Racing and Track Operation	71
491	Promoters of performing arts and sports and agents for public figures	71
492	Independent artists, writers, and performers	71
493	Museums, historical sites, zoos, and parks	71

IMPLAN Industry Code	Industry Name	2-digit NAICS
494	Amusement parks and arcades	71
495	Gambling industries (except casino hotels)	71
496	Other amusement and recreation industries	71
497	Fitness and recreational sports centers	71
498	Bowling centers	71
499	Hotels and motels, including casino hotels	72
500	Other accommodations	72
501	Full-service restaurants	72
502	Limited-service restaurants	72
503	All other food and drinking places	72
504	Automotive repair and maintenance, except car washes	81
505	Car washes	81
506	Electronic and precision equipment repair and maintenance	81
507	Commercial and industrial machinery and equipment repair and maintenance	81
508	Personal and household goods repair and maintenance	81
509	Personal care services	81
510	Death care services	81
511	Dry-cleaning and laundry services	81
512	Other personal services	81
513	Religious organizations	81
514	Grantmaking, giving, and social advocacy organizations	81
515	Business and professional associations	81
516	Labor and civic organizations	81
517	Private households	81
518	Postal service	49
519	Federal electric utilities	99
520	Other federal government enterprises	99
521	State government passenger transit	99
522	State government electric utilities	99
523	Other state government enterprises	99
524	Local government passenger transit	99
525	Local government electric utilities	99
526	Other local government enterprises	99
527	* Not an industry (Used and secondhand goods)	N/A
528	* Not an industry (Scrap)	N/A
529	* Not an industry (Rest of world adjustment)	N/A
530	* Not an industry (Noncomparable foreign imports)	N/A
531	* Employment and payroll of state govt, non-education	N/A
532	* Employment and payroll of state govt, education	N/A

IMPLAN Industry Code	Industry Name	2-digit NAICS
533	* Employment and payroll of local govt, non-education	N/A
534	* Employment and payroll of local govt, education	N/A
535	* Employment and payroll of federal govt, non-military	N/A
536	* Employment and payroll of federal govt, military	N/A
537	Cow-calf operations	11
538	Stocker-background operations	11
539	Feedlot operations	11
540	Dairy cattle operations	11
541	Beef cattle harvest	11
542	Dairy cattle harvest	11
543	Other red meat slaughtering	11
544	Processing beef cattle carcasses	11
545	Processing dairy cattle carcasses	11
546	Processing other red meat carcasses	11
547	Rendering beef cattle carcasses	11
548	Rendering dairy cattle carcasses	11
549	Rendering other red meat carcasses	11