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U.S. Sheep Industry
Economic Contribution Analysis

Prepared for: The American Sheep Industry Association

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Executive Summary

An **Industry Contribution Analysis** was conducted for the U.S. sheep industry. The analysis focused on three different sectors of the sheep industry, the Production sector, the Processing and Manufacturing sector, and the Retail Meat sector. The 2021 data year was used for the analysis with results reported in 2021 dollars.

Production Sector

The **Direct Contribution** of the Production sector of the U.S. sheep industry to the national economy in 2021 was estimated at:

- 4,994 direct jobs
- $650.3 million dollars in direct output (sales)
- $261.3 million in direct labor income
- $433.1 million in direct value added
- $65.0 million in direct local, state, and federal taxes

The **Total Contribution** of the Production sector, including direct, indirect, and induced effects, was estimated at:

- 8,492 total jobs
- $1.4 billion in total output
- $494.0 million in total labor income
- $833.2 million in total value added
- $151.4 million in total local, state, and federal taxes

Processing and Manufacturing Sector

The **Direct Contribution** of the Processing and Manufacturing sector of the U.S. sheep industry to the national economy in 2021 was estimated at:

- 2,939 direct jobs
- $1.4 billion dollars in direct output
- $188.3 million in direct labor income
- $330.9 million in direct value added
- $63.4 million in direct local, state, and federal taxes

The **Total Contribution** of the Processing and Manufacturing sector, including direct, indirect, and induced effects, was estimated at:

- 14,153 total jobs
- $3.7 billion in total output
- $854.3 million in labor income
- $1.4 billion in in value added
- $273.4 million in local, state, and federal taxes

Retail Meat Sector

The ***Direct Contribution*** of the Retail Meat sector of the U.S. sheep Industry to the national economy in 2021 was estimated at:

- 14,267 direct jobs
- $1.2 billion in direct output (sales)
- $504.0 million in direct labor income
- $737.5 million in direct value added
- $171.3 million in direct local, state, and federal taxes

The Total Contribution of the Retail Meat sector, including direct, indirect, and induced effects, was estimated at:

- 22,660 total jobs
- $3.1 billion in total output
- $1.1 billion in labor income
- $1.7 billion in in value added
- $383.6 million in local, state, and federal taxes

> ➢ *It is important to note that the economic contributions of each individual sector are NOT additive due to the inter-industry linkages that occur when the outputs from one sector serve as inputs for another sector. The Processing and Manufacturing sector provides the best overall valuation of the sheep industry's contribution to the national economy – capturing a broad spectrum of outputs and quantifying strong linkages to the Production sector.*

> ➢ *The results of this study should be taken as conservative estimates of the economic contribution(s) of the U.S. sheep industry to the national economy due to the limitations imposed by data availability and accessibility.*

Introduction

Historically, the sheep industry has played an important role in supporting the economic viability and vitality of rural America. Many rural communities, businesses, and amenities depend upon the support and contribution of a strong agricultural sector to survive. The purpose of this report is to examine the economic contribution of the U.S. sheep industry at the national level, and by implication, the effects of the production sector of the industry on rural economies. The study isolates and analyzes the economic *contribution* of the sheep industry's Production, Processing and Manufacturing, and Retail Meat sectors.[1]

From an economic vantage, 2021 was a year of transition and adjustment, and thus affords relevant context for the analysis presented here. Since 2020, the U.S. economy in general, and the U.S. sheep industry in particular, have faced numerous challenges and changes. Precipitated largely by the effects and aftereffects of the 2020 nation-wide shutdown, the national economy has undergone a period of economic downturn characterized by periods of increased market volatility and rapidly increasing inflation. Agricultural interests in particular have realized the direct effects of high inflation in the form of higher interest rates and higher input costs. In late July of 2020, the country's second largest lamb packing plant shut down – compounding the challenges and uncertainty facing the sheep industry. The opening of two new packing plants for lamb - one in late 2020 and the other in 2021- helped relieve some of this pressure. However, changes in the structure of the lamb packing industry have had lingering effects on price reporting with commensurate losses in market transparency and market efficiency. The 2020 loss and sluggish recovery of the high-value fine-dining market for lamb, was countered by increased retail (grocery) lamb sales and record high prices. The continued decline in sheep and lamb inventories was countered by record high levels of imported lamb and mutton. Taken together, changes in market conditions and industry infrastructure helped shape the economic situation and outlook, and the economic contribution of the U.S. sheep industry in 2021.

Industry Trends and Highlights

The long-term downward trend in the U.S. breeding sheep and lambs inventory continued in 2021. The USDA's National Agricultural Statistics Service (NASS) reported the January 1, 2021 breeding sheep inventory at 3.78 million head[2] – down 4.1 percent from five years earlier, down 7.1 percent from 2011, and down 23.7 percent from 2001 (Figure 1). The 2021 lamb crop was reported at 3.16 million head – down 3.2 percent from 2016, and down 9.5 percent from 2011 (Figure 2). The 2017 Census of Agriculture reported 101,387 U.S farms and ranches with sheep and lambs (Figure 3).[3] Of those, 69.5 percent had less than 25 head of sheep and lambs, 93.3 percent had less than 100 head, and only 6.7 percent of operations had 100 head or more of sheep and lambs.

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[1] Due to data limitations, the Retail sector analysis was confined to lamb.
[2] Includes replacement lambs under one year of age.
[3] The USDA's National Agriculture Statistics Service Census of Agriculture is conducted every five years. Results of the 2022 Census are set to be released in 2024.

Figure 1 Breeding Sheep (million head)
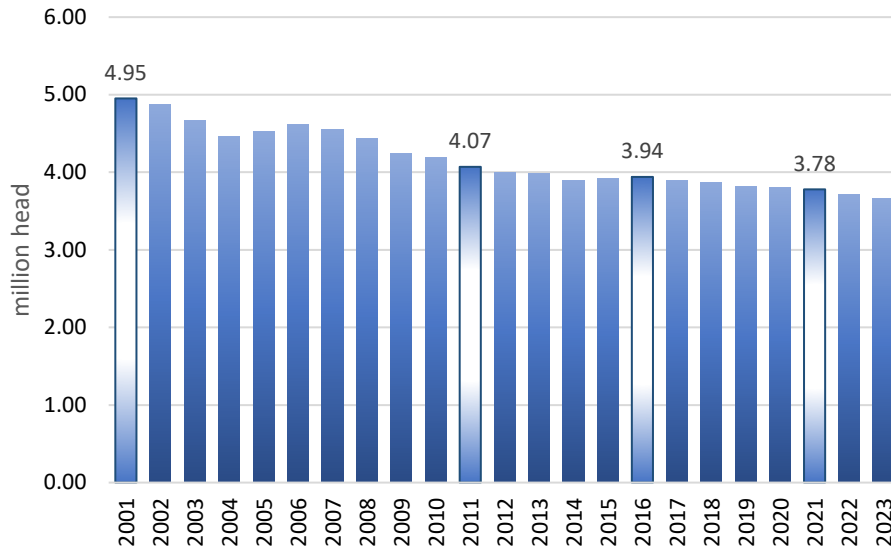
Source: USDA/NASS; Data compiled by the Livestock Marketing Information Center

Figure 2 Lamb Crop (million head)
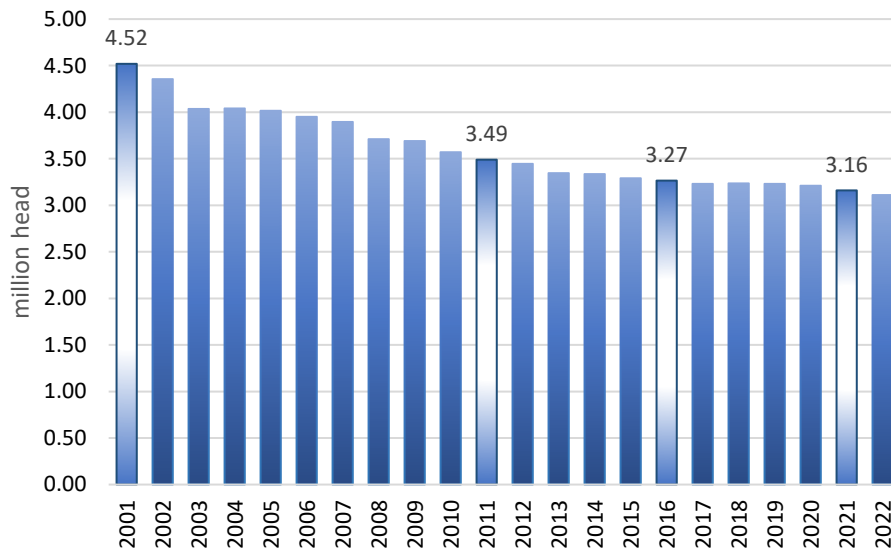
Source: USDA/NASS; Data compiled by the Livestock Marketing Information Center

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Figure 3 Percent Farms by Flock Size
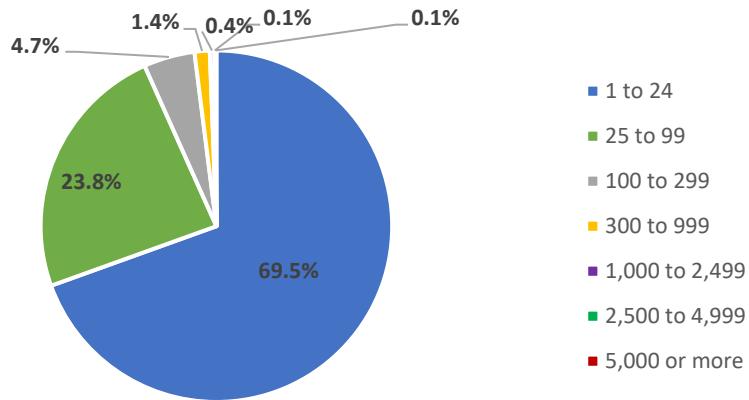
Source: USDA/NASS 2017 Census of Agriculture

Commercial lamb and mutton production was reported at 138.3 million pounds in 2021 – 7.5 percent below the pre-pandemic five-year average (2015-2019) of 149.5 million pounds (Figure 4). Slaughter lamb prices reached record highs in 2021 – with the annual average Negotiated Live slaughter lamb price 46.5 percent higher than the five-year pre-pandemic annual average (Figure 5). The lamb carcass cutout (gross value) averaged $588.36 per cwt in 2021 – 58 percent higher than the pre-pandemic five-year average (Figure 6).

Figure 4 Commercial Lamb and Mutton Production (million pounds)
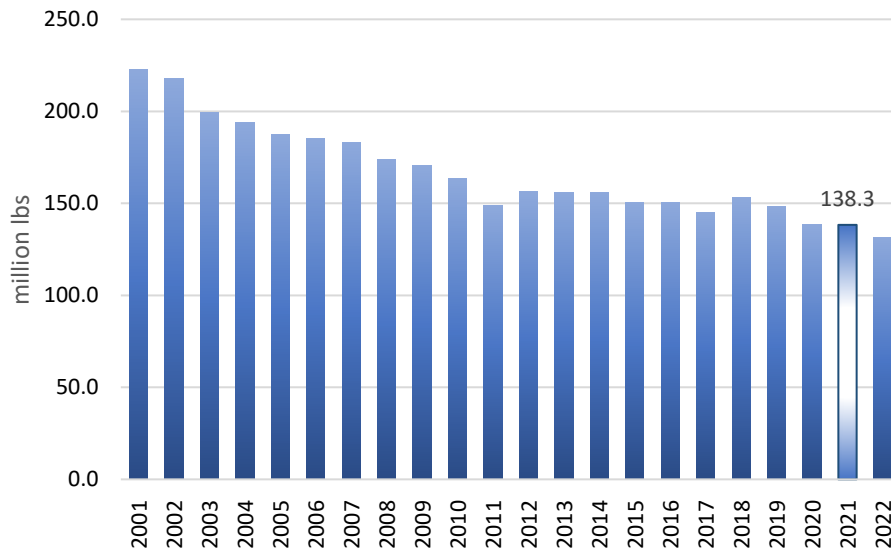
Source: USDA/NASS; Data compiled by the Livestock Marketing Information Center

Figure 5 Negotiated Live Slaughter Lamb Prices (monthly average, $/cwt)
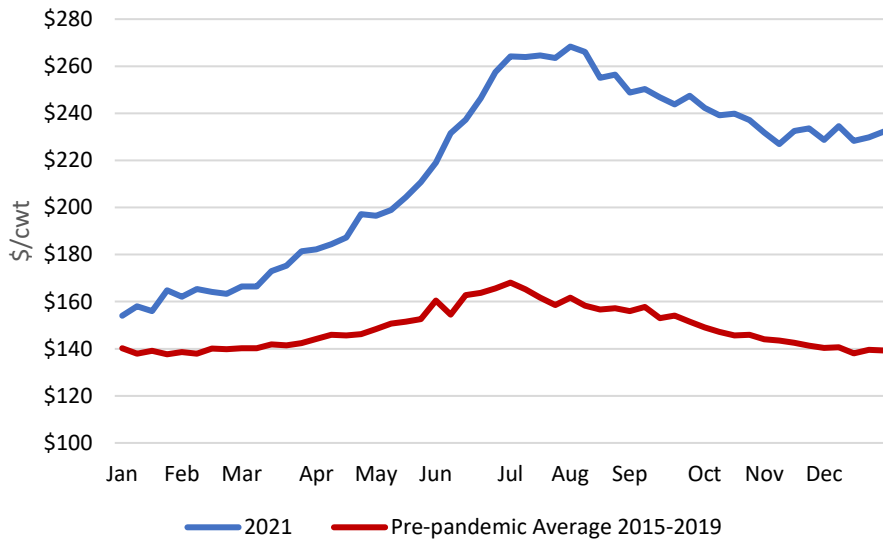
Source: USDA/AMS; Data compiled by the Livestock Marketing Information Center

Figure 6 National Lamb Cutout Value (gross value, monthly average, $/cwt)
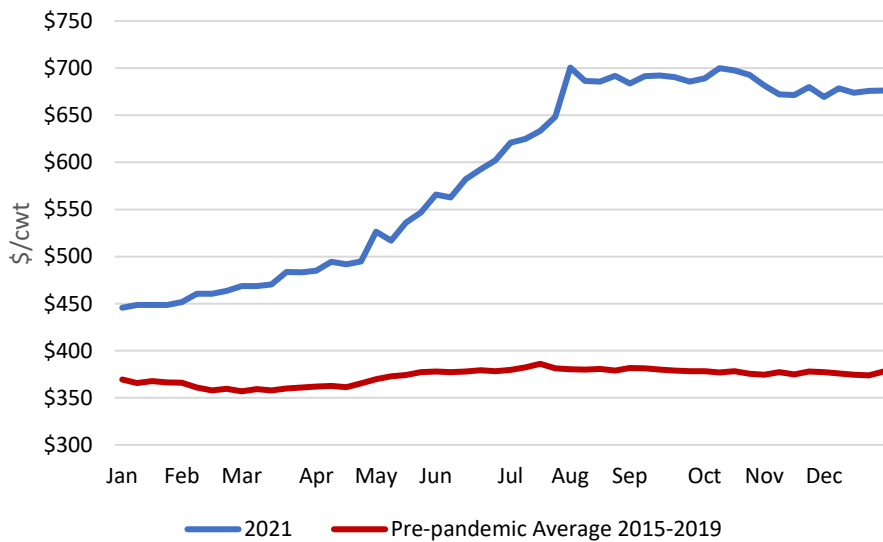
Source: USDA/AMS; Data compiled by the Livestock Marketing Information Center

Driven by strong U.S. market prices, lamb and mutton imports were record high in 2021 – accounting for 72 percent of annual supply (Figure 7). On a carcass weight basis, lamb imports commanded 67.8 percent of the wholesale market share for lamb[4].

Figure 7 Lamb & Mutton Imports as a Percentage of Total Annual Supply
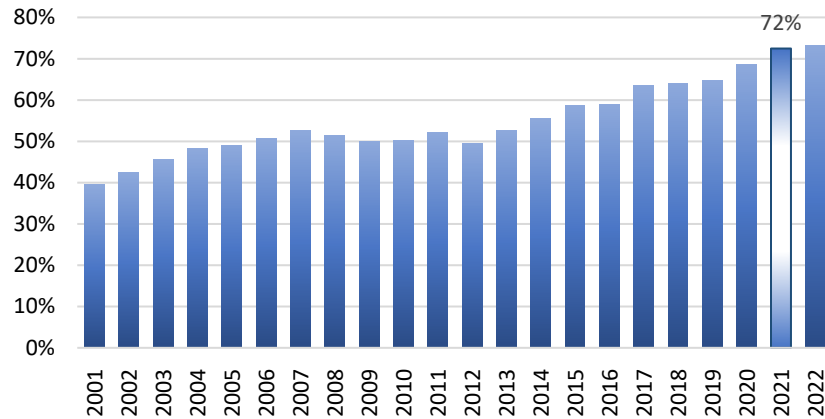
Source: USDA/ERS, USDA/FAS, USDA/NASS, LMIC

Greasy wool production was 22.45 million pounds in 2021 – down 2.6 percent from the previous year, and down 10.6 percent from the pre-pandemic five-year average. Declines in wool production reflect not only declines in the number of breeding sheep, but also declines in the percentage of wool-breeds relative to hair-breeds in the national flock.

Figure 8 U.S. Wool Production (million pounds, greasy)
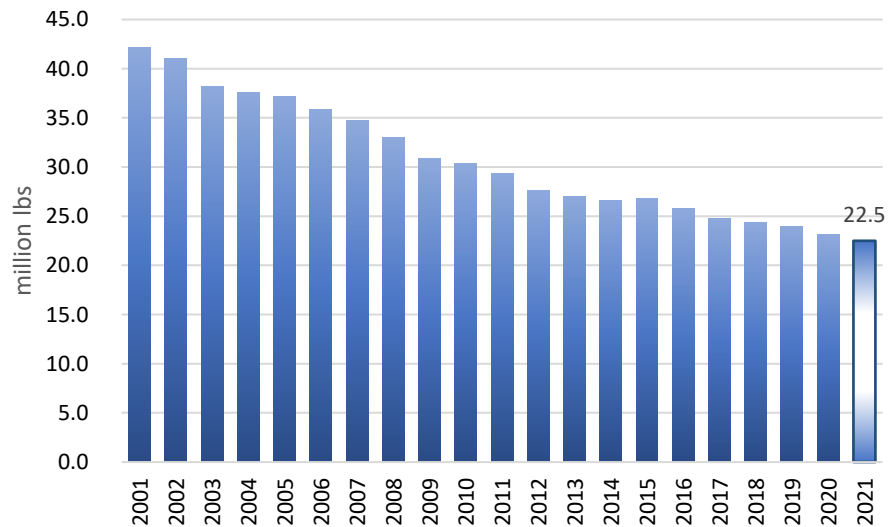
Source: USDA/NASS

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[4] In this context, annual supply is equal to U.S. commercial lamb and mutton production plus lamb and mutton imports net of adjustments for exports and cold storage.

In contrast to lamb and mutton imports, imported wool as a percentage of annual supply (clean) has declined significantly since 2001[5] (Figure 9). In 2001, imported wool was 61 percent of annual supply and only 36 percent in 2021. The average annual price per pound of raw domestic wool has trended higher over the past 20-year period – with the average price per pound in 2021 69 percent higher than in 2001 (Figure 10).

Figure 9 U.S. Wool & Imported Wool as a Percentage of Annual Supply (clean)
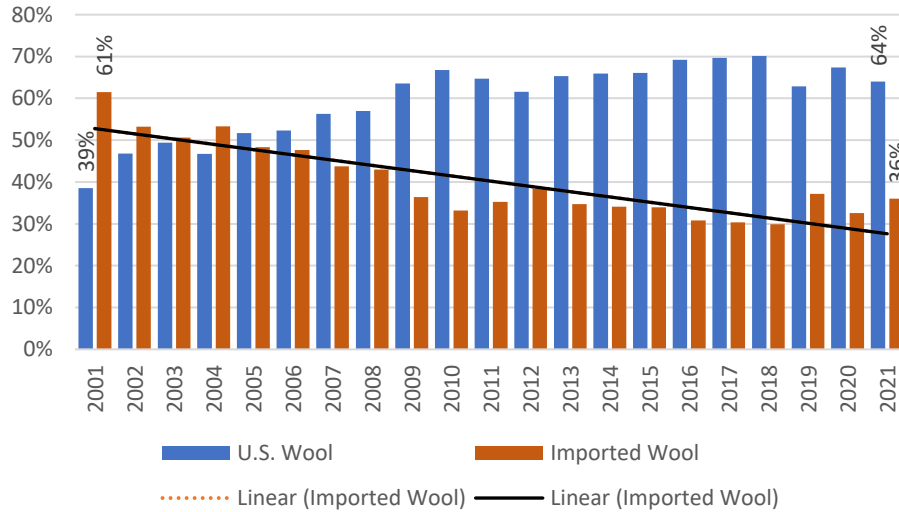
Source: Compiled by USDA/ERS

Figure 10 U.S. Annual Average U.S. Wool Price Per Pound (greasy)
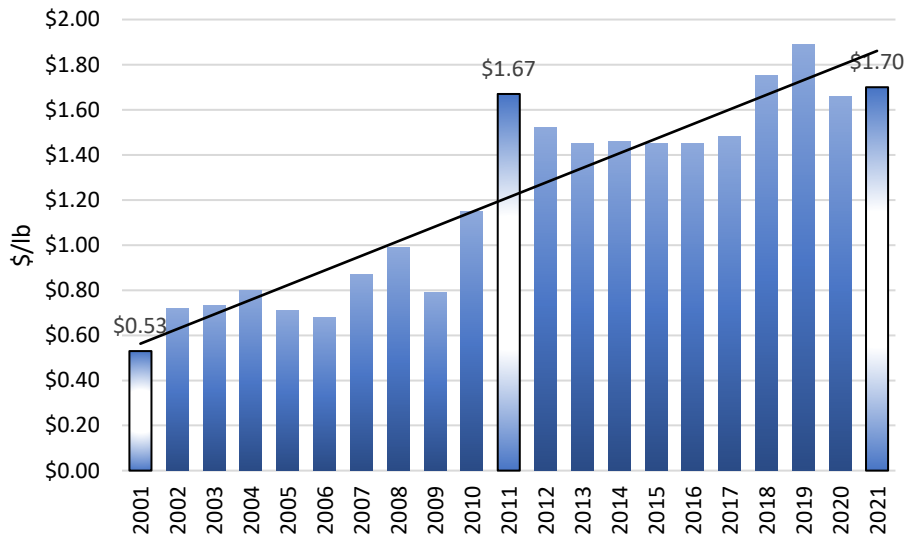
Source: USDA/NASS

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[5] In this context, annual supply is equal to U.S. production plus imports (clean wool basis), net of adjustments for exports and beginning and ending stocks.

Industry Contribution Analysis

Production in any given industry is linked to other industries – i.e., production in one industry depends on suppliers in other industries for inputs (*backward linkages*), while incomes earned in the production and supplier industries are then spent on goods and services provided by still other industries (*forward linkages*). In the sheep industry, for example, backward linkages involve other industries that supply feed, fuel, fertilizer, veterinary and shearing services, etc. Forward linkages occur when farmers and ranchers, their employees, their suppliers, and their suppliers' employees spend earnings backlinked to the sheep industry on groceries and dining, apparel, housing, health care, and other consumer goods and services. An increase or decrease in output and/or jobs in industries with strong backward and forward linkages can have substantial ripple effects throughout the broader economy.

An **Industry Contribution Analysis (ICA)** is a particular type of economic analysis that identifies how the current or past state of an industry is linked to and *contributes* to other industries in the local, regional, or national economy and at what level. An ICA is a descriptive analysis that tracks the gross economic activity of an industry as dollars cycle through the broader economy and highlights those economic benefits that would be lost if the industry downsizes or ceases to exist.

Economic contribution analyses are used by policy makers, and by industry leaders and advocates to inform and guide policy and funding decisions in areas such as commodity support and risk management programs, disaster relief programs, infrastructure support and development, as well as industry-supported research, education, and outreach initiatives.

Methodology

To capture the economic contribution of the U.S. sheep industry the Impact Analysis and Planning (IMPLAN) input-output (I-O) economic modeling system was used. I-O essentially shows how production in one industry supports demand for production in other industries through supply chain spending by businesses and household spending by workers. The IMPLAN I-O system is widely recognized and has been applied to contribution analyses across a variety of industries and across a range of agricultural interests.

In the context of this report, "U.S. sheep industry" is used in a broad sense to include and follow products produced from sheep as they flow from farms and ranches, through processing and manufacturing, to finished products and final consumers.

Based largely on the U.S. Bureau of Economic Analysis benchmark I-O accounts and the USDA Census of Agriculture, IMPLAN currently utilizes a 546-industry classification scheme to categorize industries according to the type of products produced or services provided. Some IMPLAN-defined industries are more aggregated than others. For example, sheep farming and ranching - including meat, wool, and milk production - is categorized under the broad classification of "Animal production" which also includes pig farming, goat farming, alpaca production, deer and elk production, etc. Whereas, beef cattle ranching and farming, dairy cattle and milk production, and poultry and egg production are each classified as unique IMPLAN industries. Aggregated industries share similar production functions, i.e., where an industry spends, and in what proportions, to generate each dollar of output.

For this study, three separate Industry Contribution Analyses were conducted using the IMPLAN system. ICAs were conducted for the Production sector, the Processing and Manufacturing sector, and the Retail Meat sector of the sheep industry. The retail sector was confined to lamb due to data limitations at the retail level.

An advantage of modeling each sector individually is that it avoids potential double-counting issues that can occur when the outputs of one sector serve as inputs for another. *HOWEVER*, a disadvantage of modeling each sector separately is that the results are *NOT* additive, i.e., the results of each sector's analysis *CANNOT* be summed to provide a single overall measure of economic activity due to inter-industry linkages. The Processing and Manufacturing sector provides the best overall accounting and valuation of the sheep industry's economic contribution to the national economy - capturing not only a broad spectrum of sheep industry outputs, but also capturing the value of Production inputs through strong backward linkages.

Terminology

IMPLAN estimates four key economic indicators – *output, value added, labor income, and employment*. Each of these four economic indicators are expressed in terms of four types of effects - *direct, indirect, induced, and total effects.*

Output – Output is the annual value of an industry's production, or sales value.

Value Added – Value Added is a subset of Output. Value Added is the difference between Output and the cost of the intermediate inputs used in the production process. Value Added can be viewed as an industry's contribution to the Gross Domestic Product (GDP).

Labor Income – Labor Income is a subset of Value Added. Labor Income is the sum of Employee Compensation and Proprietor Income.[6]

Employment (Jobs) –Employment is an annual average industry-specific mix of full-time, part-time, and seasonal employment or jobs supported by the industry being analyzed. Employment includes both employees and proprietors. [7]

Direct Effects – Direct Effects represent the initial effects or the initial economic activity that can be attributed directly to the industry being analyzed. For example, Direct Output for the Production sector of the sheep industry is the sales value of slaughter lambs, greasy wool, milk, etc.

Indirect Effects – Indirect Effects represent business-to-business transactions in the supply chain of the industry being analyzed. Indirect Effects stem from the backward linkages of the industry being analyzed to other industries from which it purchases the inputs needed to produce its product(s).

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[6] Labor Income represents the combined cost of total payroll paid to employees (i.e., wages and salaries, benefits, payroll taxes) and payments received by proprietors (i.e., self-employed individuals and/or unincorporated businesses) in a given year.

[7] Employment in IMPLAN is not the same as full-time equivalent jobs (FTE). For example, in IMPLAN, one job in the production sector of the sheep industry is approximately 0.857 FTEs.

Induced Effects – Induced Effects represent household spending of labor income (direct and indirect wage and salary worker and proprietor income) on household goods and services (adjusted for taxes and savings).

Total Effects – Total Effects are the sum of the direct, indirect, and induced effects.

Data

This study was conducted at the national level. The 2021 data year was used for the analysis with results reported in 2021 dollars.

The input data are national aggregates and averages. When available, secondary data was obtained from sources that include the USDA Agricultural Marketing Service (AMS), USDA National Agricultural Statistical Service (NASS), USDA Foreign Agricultural Service, Global Agricultural Trade System (GATS), the Livestock Marketing Information Center (LMIC), etc. Utilizing secondary data sources helps establish a consistent framework such that future updates can be more readily accomplished and valid year-to-year comparisons can be made.

When secondary data were not available - e.g., due to lapses in price reporting (formula carcass prices), policy changes with respect to information release (the U.S. military's use of American wool), prices not collected on a routine basis (raw sheep milk prices), or price information that is not readily accessible (domestic versus imported retail lamb prices) - values were estimated based on historical relationships, various reports, releases, and publications, input from industry experts, etc.

Values that could not be reasonably estimated or quantified were omitted from the study. For example, the Retail sector analysis was limited to lamb as the final retail values of consumer products made from American wool, pelts, and lanolin for example, are difficult to track. American wool is blended with imported wool, as well as other fibers – both natural and manmade – to produce a wide-array of wool-based consumer products. Lanolin is blended with other ingredients in the production of cosmetic and pharmaceutical products. The value of sheep grazing services for weed control and fire mitigation is also difficult to quantify. In addition, the value of club lamb sales as a separate line item were omitted from the study in part because many livestock shows and sales were canceled in 2021 due to the lingering effects of COVID-19, and in part because the production function for club lambs differs from that of commercial slaughter lambs, suggesting a source of potential bias.

➢ *The results of this study should be taken as conservative estimates of the economic contribution(s) of the U.S. sheep industry to the national economy due to the limitations imposed by data availability and accessibility*.

Industry Contribution Analysis: Production Sector Results

In 2021, the ***direct contribution*** of the Production sector of the U.S. sheep industry to the national economy was an estimated **$650.3 million dollars in Direct Output**. The direct contribution of the Production sector included:

- 4,994 direct jobs
- $261.3 million in direct labor income
- $433.1 million in direct value added
- $65.0 million in direct local, state, and federal taxes

In 2021, the ***total contribution*** of the Production sector of the U.S. sheep industry to the national economy, was an estimated **$1.4 billion in Total Output.** The total contribution of the Production sector included:

- 8,492 total jobs
- $494.0 million in total labor income
- $833.2 million in total value added
- $151.4 million in total local, state, and federal taxes

The ICA model of the Production sector of the sheep industry included the value of slaughter sheep and lambs, the value of live sheep exports, raw wool value, pelt value in the form of pelt credits, and the value of raw fluid milk. Table 1 shows the estimated values used to model the Production sector.

Table 1 Production Sector: Value of Production

Product	Value ($)
Slaughter Lambs	$568,476,307
Slaughter Sheep (cull ewes and rams)	$26,593,164
Live Sheep Exports	$3,028,000
Wool	$38,177,000
Pelts	$3,911,263
Dairy (fluid milk)	$10,092,163
Total	*$650,277,897*

Table 2. summarizes the major economic indicators for the Production sector by direct, indirect, and induced effects. The *total product value*, **$650,277,897**, shown in Table 1 above, is equivalent to the *direct output value* shown in Table 2 below.

Table 2 Production Sector: Overview of Economic Indicators

Effect	Employment	Labor Income	Value Added	Output
Direct	4,994	$261,311,353	$433,080,674	*$650,277,897*
Indirect	1,139	$79,293,650	$129,637,390	$303,282,366
Induced	2,359	$153,415,618	$269,770,508	$474,488,758
Total	8,492	$494,020,621	$833,216,572	$1,428,049,021

Interpretation:

Direct Employment - The 4,994 Direct Employment estimate is the number of jobs supported by $650.3M in Direct Output (total value of production). Initially, the Direct Employment estimate might appear low given that IMPLAN defines employment in terms of both wage and salary labor and owner-operator labor and that the most recent Census of Agriculture available at this writing reported 101,387 farms and ranches with sheep and lambs in 2017. Recall, however, that employment in IMPLAN is not the same as the number of workers employed and that in 2017, only 6.7 percent of farms and ranches with sheep and lambs had 100 or more head. This indicates that very few farmers and ranchers engage in sheep production full-time and few depend on the sheep enterprise as their sole or primary source of income. Of the 4,994 Direct Employment estimate, 21 percent was wage and salary labor and 79 percent owner-operator labor.

Indirect Employment – The Indirect Employment estimate shows that with $650.3M in Direct Output, 1,139 jobs were supported in business-to-business transactions, including feed and farm supply stores, livestock transportation services, etc.

Induced Employment – In turn, an estimated Induced Employment of 2,359 jobs were supported through household spending by both direct and indirect income earners in 2021.

Direct Labor Income - For 2021, Direct Labor Income for the Production sector of the sheep industry was estimated at $261.3M – which included an estimated $42.8M in employee compensation and $218.5M in proprietor income. The estimated *average* compensation per direct wage and salary job (all direct employees – including managers, ag labor, accountants, mechanics, etc.) was estimated at $41,667.85. The estimated *average* proprietor income per owner/operator was an estimated $55,092.82. Average employee compensation for agricultural workers was estimated at $34,532.74 ($27,426.96 wage and salary income plus $7,105.78 in benefits). Average wage and salary income per hour was estimated at $14.68 plus $3.80 per hour average supplements to wages and salaries, or $18.48 per hour average employee compensation. For agricultural workers, the annual average number of hours worked in 2021 was estimated at 1,868.5 hours.

Wage rates for H-2A guest workers in 2021 ranged from $11.81 to $16.34 per hour among states - with a median rate of $14.72 per hour. The average monthly rate for herders for range operations in the H-2A program in 2021 was $1,727.75 per month ($20,733.00 annual equivalent, net of housing, groceries, supplies, and other amenities).

Indirect Labor Income – In 2021, an estimated $79.3M in Indirect Labor Income went to those business owners and employees that supplied the inputs needed by the Production sector of the sheep industry to produce, lambs, wool, and milk.

Induced Labor Income – Household spending of wages and salaries and proprietor income earned directly through the Production sector and indirectly through upstream business-to-business transactions, supported an estimated $153.4M in Induced Labor Income in various other downstream industries.

Direct, Indirect, and Induced Value Added – Value Added includes Labor Income, Taxes on Production, and Other Property Income. The Production sector of the sheep industry contributed an estimated

$433.1M, $129.6M, and $269.8M, respectively, in Direct Value Added, Indirect Value Added through business-to-business transactions, and Induced Value Added through household spending.

Direct, Indirect, and Induced Output – Direct Output is the total value of production, $650.3M, estimated for the Production sector. As a result of business-to-business transactions stemming from input purchases, $303.3M in Indirect Output was supported by the Production sector in 2021. In turn, $474.5M of Induced Output was supported through spending by the employees and owner-operators/proprietors of sheep farms and ranches and their suppliers.

The estimated **Total Economic Activity** supported by the Production sector of the sheep industry by industry type is shown in Table 3. Not surprisingly, the top industries in terms of Employment, Labor Income, Value Added, and Output were agriculture-related industries, followed by service industries, manufacturing, and wholesale and retail industries.

Table 3 Production Sector: Total Economic Activity by Industry Classification

	Employment	Labor Income	Value Added	Output
Agriculture	5407	$281,631,075	$455,676,789	$699,834,694
Services	2070	$137,197,145	$236,323,447	$393,138,273
Manufacturing	196	$16,702,991	$36,075,326	$146,272,504
Wholesale and Retail	524	$34,916,257	$68,688,471	$114,396,323
Transport Related	209	$14,030,893	$17,520,543	$35,191,641
Utilities	13	$2,685,659	$8,223,759	$16,977,051
Other	36	$3,699,037	$4,676,857	$9,352,236
Construction	29	$1,951,910	$2,801,714	$6,998,862
Mining, Minerals, and Oil	8	$1,205,653	$3,229,666	$5,887,438
Total	8492	$494,020,621	$833,216,572	$1,428,049,021

Both Indirect and Induced spending associated with the Production sector of the sheep industry helps support jobs and vital infrastructure in rural farming and ranching communities nation-wide. When jobs are lost in the production sector of the sheep industry, industries that provide inputs (indirect) also suffer losses, as do those industries supported by household (induced) spending.

The top ten industries supported *indirectly* through business-to-business transactions and spending on inputs used for sheep production are shown in Table 4. Not surprisingly, livestock feed manufacturing, grain farming, truck transportation, and support activities for agriculture were among the top industries *indirectly* supported by sheep farmers and ranchers throughout the country.

The top ten industries supported by household spending (*induced spending*) of income earned either directly or indirectly through sheep production are shown in Table 5. Induced household spending supported by the production sector of the sheep industry is not unlike consumer spending supported by other sectors of the sheep industry and by consumer spending in general nation-wide. Owner-occupied dwellings, real estate, hospitals and doctor's offices, insurance carriers and financial services, as well as retailers and restaurants, were among the top industries supported by induced spending.

Table 4 Indirect Output: Top 10 Industries Supported by Spending on Inputs

Industry
Animal/Livestock feed manufacturing
Nondurable goods merchant wholesalers
Grain farming
Real estate
Truck transportation
Support activities for agriculture and forestry
Soybean and other oilseed processing
Oilseed farming
Petroleum refineries
Beef cattle ranching/farming

Table 5 Induced Output: Top 10 Industries Supported by Household Spending

Industry
Owner-occupied dwellings
Hospitals
Real estate
Insurance carriers, except direct life
Monetary authorities and depository credit intermediation
Offices of physicians
Financial investment activities
Limited-service restaurants
Non-store retailers[8]
Tenant-occupied housing

Table 6. shows the estimated direct, indirect, and induced effects of the Production sector on local, state, and federal taxes.[9] In 2021, an estimated $151.4M dollars in total tax revenue was sustained by economic activity in the Production sector of the sheep industry, including $23.2M in local, $33.7M in state, and $94.4M in federal taxes.

Table 6 Production Sector: Tax Effects

Effect	Local	State	Federal	Total
Direct	$4,335,370	$11,475,327	$49,227,600	$65,038,297
Indirect	$6,397,199	$7,472,132	$14,978,746	$28,848,077
Induced	$12,509,504	$14,731,536	$30,239,194	$57,480,233
Total	$23,242,072	$33,678,995	$94,445,540	$151,366,607

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[8] Includes feed and farm supply stores, lumber yards and fencing dealers, hardware stores, automotive supplies and parts dealers, butcher shops, general stores, superstores, clothing stores, etc.
[9] Local here includes county, sub-county special district, and sub-county general taxes.

Industry Contribution Analysis: Processing and Manufacturing Sector Results

In 2021, the Processing and Manufacturing sector of the U.S. sheep industry contributed an estimated **$1.4 billion dollars in Direct Output** to the national economy. The direct contribution of the Processing and Manufacturing sector included:

- 2,939 direct jobs
- $188.3 million in direct labor income
- $330.9 million in direct value added
- $63.4 million in direct local, state, and federal taxes

In 2021, the total contribution of the Processing and Manufacturing sector of the U.S. sheep industry to the U.S. economy was an estimated **$3.7 billion in Total Output.** The total contribution of the Processing and Manufacturing sector included:

- 14,153 total jobs
- $854.3 million in labor income
- $1.4 billion in in value added
- $273.4 million in local, state, and federal taxes

A Multi-Industry Contribution Analysis (MICA) was conducted for the Processing and Manufacturing sector of the U.S. sheep industry. A MICA model simply extends the ICA model to include the outputs from a group of industries within a given sector. A number of distinct industries were included in the MICA model of the Processing and Manufacturing sector of the sheep industry. These industries included slaughter, meat processing, rendering, dog food manufacturing, leather and hide tanning, wool and shearling merchant wholesalers, wool processing and textile mills, military dress uniform cut and sew contractors, and cheese manufacturing (Table 7).

Table 7 Processing and Manufacturing Sector: Value of Production

Industry	Value ($)
Lamb Slaughter and Processing[a]	$640,478,275
Mutton Slaughter and Processing[a]	$33,520,032
Offal Exports	$955,000
Dog Food Manufacturing (rendered by-products)	$526,980,391
Pelt Exports	$6,852,000
Finished Shearling Wholesale	$3,750,000
Wool Exports	$22,135,100
Wool: Mill Use[b]	$19,632,540
Wool: Military Mill Use and Dress Uniform Manufacturing[b]	$107,797,677
Wool Grease/Lanolin Exports	$4,994,000
Cheese Manufacturing	$22,589,644
Total	***$1,389,684,659***

[a] Includes export value; [b] Wool mill output serves as inputs for cut and sew contractors. To avoid double counting, non-military mill uses, and military mill uses were treated separately.

Tables 8 summarizes the major economic indicators for the Processing and Manufacturing sector by direct, indirect, and induced effects.

Table 8 Processing and Manufacturing Sector: Overview of Economic Indicators

Effect	Employment	Labor Income	Value Added	Output
Direct	2,939	$188,278,582	$330,866,751	*$1,389,684,659*
Indirect	7,226	$407,289,505	$646,173,514	$1,558,732,815
Induced	3,988	$258,699,747	$455,256,123	$792,882,907
Total	14,153	$854,267,834	$1,432,296,388	$3,741,300,381

Table 9. shows the estimated direct, indirect, and induced effects of the Processing and Manufacturing sector on county, state, and federal taxes.

Table 9 Processing and Manufacturing Sector: Tax Effects

Effect	Local	State	Federal	Total
Direct	$10,001,731	$13,738,807	$39,635,796	$63,376,334
Indirect	$11,228,707	$20,842,149	$81,809,342	$113,880,198
Induced	$20,513,734	$24,375,209	$51,254,176	$96,143,119
Total	$41,744,172	$58,956,165	$172,699,314	$273,399,651

The top ten indirect industries supported by spending on inputs for the Processing and Manufacturing sector are shown in Table 10.

Table 10 Indirect Output: Top 10 Industries Supported by Spending on Inputs

Industry
Livestock production
Truck transportation
Grain farming
Real estate
Metal cans manufacturing (pet food)
Animal/Livestock feed manufacturing
Management of companies and enterprises
Wholesale - Grocery and related product wholesalers
Petroleum refineries
Soybean and other oilseed processing

The top ten industries supported by induced household spending from Labor Income for the Processing and Manufacturing sector are shown in Table 11. Again, the top industries supported by consumer spending are highly consistent across industries and sectors.

Table 11 Induced Output: Top 10 Industries Supported by Household Spending

Industry
Owner-occupied dwellings
Hospitals
Real estate
Insurance carriers
Monetary authorities and depository credit intermediation
Offices of physicians
Limited-service restaurants
Financial investment activities
Retail – Non-store retailers
Tenant-occupied housing

Industry Contribution Analysis: Retail Meat Sector Results

In 2021, the Retail Sales Value of American Lamb (supermarket sales plus restaurant sales) contributed an estimated **$1.2 billion dollars in Direct Output** to the national economy. The direct contribution of the Retail Meat sector included:

- 14,267 direct jobs
- $504.0 million in direct labor income
- $737.5 million in direct value added
- $171.3 million in direct local, state, and federal taxes

In 2021, the total contribution of Retail Sales of American Lamb (supermarket sales plus restaurant sales) to the U.S. economy was an estimated **$3.1 billion in Total Output**. The total contribution of the Retail Meat sector included:

- 22,660 total jobs
- $1.1 billion in labor income
- $1.7 billion in in value added
- $383.6 million in local, state, and federal taxes

The U.S. sheep industry retail sector analysis was limited to retail sales of American lamb due to data limitations for retail sales of products made from U.S. wool, pelts, and dairy. A MICA model was applied that included IMPLAN industries: "Retail food and beverage stores" (supermarkets and grocery stores) and "Full-service restaurants". This type of retail model is not specific to individual retail products or commodities, (e.g., lamb, beef, pork, fruit, vegetables, etc.). Rather, the total retail value (total revenue or Direct Output) is used to estimate Employment, Labor Income, Value Added, and Output supported by the product or commodity of interest (American lamb). Table 12 summarizes the estimated total revenue or sales value of the Retail Meat sector.

Table 12 Retail Meat Sector: Sales Value

Industry	Value
Retail food and beverage stores	$517,661,551
Full-service restaurants	$714,614,497
Total	*$1,232,276,048*

Table 13 summarizes the major economic indicators for the Retail Meat sector by direct, indirect, and induced effects. Tables 14 & 15, summarize the major economic indicators by Retail food and beverage stores, and by Full-service restaurant contributions. Table 16 shows the estimated direct, indirect, and induced effects of the Retail Meat sector on local, state, and federal taxes.

Table 13 Retail Meat Sector: Overview of Economic Indicators

Effect	Employment	Labor Income	Value Added	Output
Direct	14,267	$503,962,940	$737,500,520	*$1,232,276,048*
Indirect	3,534	$266,925,039	$428,760,015	$840,106,930
Induced	4,859	$325,310,395	$577,327,502	$1,015,367,231
Total	22,660	$1,096,198,374	$1,743,588,038	$3,087,750,209

Table 14 Retail Food and Beverage Stores Subsector: Overview of Economic Indicators

Effect	Employment	Labor Income	Value Added	Output
Direct	5,813	$224,702,297	$320,747,855	$517,661,551
Indirect	1,556	$108,992,887	$174,464,148	$335,874,441
Induced	2,103	$140,814,832	$249,902,578	$439,512,324
Total	9,472	$474,510,016	$745,114,581	$1,293,048,316

Table 15 Full-Service Restaurants Subsector: Overview of Economic Indicators

Effect	Employment	Labor Income	Value Added	Output
Direct	8,454	$279,260,643	$416,752,665	$714,614,497
Indirect	1,978	$157,932,152	$254,295,867	$504,232,489
Induced	2,756	$184,495,563	$327,424,925	$575,854,907
Total	13,188	$621,688,358	$998,473,457	$1,794,701,893

Table 16 Retail Meat Sector: Tax Effects

Effect	Local	State	Federal	Total
Direct	$32,915,034	$40,215,728	$98,189,379	$171,320,142
Indirect	$15,685,850	$20,308,909	$53,452,694	$89,447,453
Induced	$27,060,459	$31,725,877	$64,049,967	$122,836,302
Total	$75,661,343	$92,250,514	$215,692,040	$383,603,898

The top ten indirect industries supported by spending on inputs for the Retail Meat sector are shown in Table 17. The top ten industries supported by induced household spending from labor income for the Retail Meat sector are shown in Table 18. Note that at the retail level, the top indirect (upstream) industries and the top induced (downstream) industries supported are all service-based industries.

Table 17 Indirect Output: Top 10 Industries Supported by Spending on Inputs

Industry
Real estate
Management of companies and enterprises
Warehousing and storage
Electric power transmission and distribution
Internet publishing and broadcasting and web search portals
Employment services
Monetary authorities and depository credit intermediation
Accounting, tax preparation, bookkeeping, and payroll services
Advertising, public relations, and related services
Insurance carriers, except direct life

Table 18 Induced Output: Top 10 Industries Supported by Household Spending

Industry
Owner-occupied dwellings
Hospitals
Other real estate
Insurance carriers, except direct life
Monetary authorities and depository credit intermediation
Offices of physicians
Limited-service restaurants
Other financial investment activities
Tenant-occupied housing
Retail – Non-store retailers

Issues and Opportunities

➢ One of the fallouts of a shrinking industry is that data collection and reporting have become more difficult. A diminishing sampling pool creates both statistical and confidentiality concerns. Data availability was *the* greatest challenge in the development of the IMPLAN models used as the basis for this report.

➢ Structural changes in the lamb packing industry have resulted in the effective cessation of price reporting for a significant portion of slaughter lambs. USDA/AMS has not reported price information for slaughter lamb formula purchases since July 2020 due to Livestock Mandatory Reporting (LMR) confidentiality guidelines. The absence of formula price reporting has resulted in a loss of market transparency and price discovery in the commercial lamb market.

➢ Alternatives that would allow critical slaughter lamb price information to be published need to be developed and implemented. This information is essential for price discovery, production and marketing decisions, and for sound economic analysis. The Livestock Mandatory Reporting Act of 1999 *mandates* price reporting for live cattle and swine and *authorizes* – but does not require – price reporting for lamb purchases. Amending the statute to *require* price reporting for lambs as it does for cattle and swine would improve market transparency, price discovery and economic analysis of the commercial slaughter lamb market.

➢ The ability to track and quantify values of other sheep industry outputs such as wool, pelts, lanolin, and other by-products through to their final consumer products would result in improved estimates of the total economic contribution of the U.S. sheep industry as well as providing additional industry insights.

➢ IMPLAN is a highly customizable analysis system. If the appropriate data are available, can be collected, or estimated, analyses can be customized to target specific regions, states, or counties of interest.

➢ The IMPLAN system can also be used to model the potential economic impact of changes in direct output (e.g., increases/decreases in lamb or wool production), or of proposed infrastructure development projects using an Industry Impact Analysis (IIA) model. An IIA is a type of economic analysis that *predicts* how a proposed or anticipated *change* in one industry will affect, or i*mpact*, other industries in the broader economy.

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