AN ECONOMIC EVALUATION OF EMPLOYMENT AND WAGES IN CONNECTICUT'S AGRICULTURAL INDUSTRY

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PREPARED BY

Rigoberto A. Lopez
Christopher Laughton
Joan Nichols
Luis Seoane

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About the Authors:

Rigoberto A. Lopez and Luis Seoane are, respectively, professor and PhD Student in the Department of Agricultural and Resource Economics at UConn, Christopher Laughton is the Director of Knowledge at Farm Credit East, and Joan Nichols is the director of the Connecticut Farm Bureau.

Executive Summary

Although labor has been deemed to be in chronic shortage for agricultural employers in the U.S., the shortage is more severe in Connecticut as competition from non-agricultural sectors is more intense than in the rest of the country. In this study, we define agriculture as encompassing crop and livestock production, forest products, and the processing of the state's agricultural production. Because these subsectors are labor-intensive, labor is a critical input for their future economic growth.

The purpose of this study is to ascertain and document the state of employment, salaries, and skills in the Connecticut agricultural sector. More specifically, this study has three objectives: (1) identify employment, skills, and salary trends within the industry and relative to other relevant sectors of the state economy, (2) identify constraints in the labor market that may adversely impact future growth, and (3) provide policy recommendations to mitigate bottlenecks and to guide workforce development in Connecticut's agricultural industry labor market.

Using an input-output model of the agricultural and Connecticut economy for 2015-2021 and IMPLAN Occupational database observations by subsector and occupational codes, we estimate and compare salaries, skills, and employment location to comparable and competing sectors in the economy.

The analysis reveal that agricultural labor contracted in most subsectors during the period studied but grew modestly in selected sectors, such as in greenhouse, nursery, and floriculture, fruit and vegetable processing, ice cream manufacturing, remaining approximately flat for the whole agricultural industry. The location quotients for labor indicate that relative to the rest of the country, Connecticut has a favorable location for the greenhouse, nursery, and floriculture sector, tobacco, and ice cream manufacturing but it is at a relative disadvantage for the other sectors. Wages in agricultural production were found to be significantly lower than for construction laborers with similar skill qualifications and those for workers in agricultural processing. Agricultural

processing workers also have higher substantially higher wages than those for cooks and food preparers in the state---a sector identified to have comparable skills.

Further insights are provided into education, experience, and skills needs in the subsectors of the state agricultural industry. Job experience, skills, and job training are usually acquired in the first two years on the job. This also reflects the typical short tenure of workers in these industries. In spite of lower wages, a greater proportion of agricultural production workers have more post-secondary education than agricultural processing workers.

Constraints affecting state's the agricultural workforce include insufficient numbers of younger workers entering the industry to replace those leaving through attrition and aging-out. There are both limitations in the vocational training offered for those seeking work in the sector, as well as apparently insufficient demand from students to expand these offerings.

Ultimately, a resolution of the worker shortage in Connecticut's agricultural industry will require concerted efforts by the industry itself to make employment in the sector more attractive, as well as increased support by educational and training institutions to offer advanced skills training in these fields, thereby increasing workers earning potential. Without improvement in the number of available employees for agricultural businesses, growth and continued development of these important sectors will be limited. At present, with a tight labor market in Connecticut and the U.S., however, future growth of Connecticut's agriculture depends on how the private and public sectors respond to the challenges involved.

1. Introduction

The agricultural industry in Connecticut plays an important role as a driver of the state's economy. It contributes $5.2 billion to the state's economy and supports more than 29,000 jobs statewide (Lopez, Jelliffe, and Laughton, 2020).[1] Although in the U.S. there has been a chronic shortage of agricultural labor (Mercer, 2014), the shortage is more acute in Connecticut, particularly since the COVID pandemic.

This study was initiated at the recognition by agricultural stakeholders in Connecticut that labor is becoming an increasingly severe constraint and bottleneck to future growth of the agricultural sector, not just in availability of workers but also in the diversity of skills needed. Consequently, this study was done in collaboration among UConn extension, Farm Credit East, and the Connecticut Farm Bureau in 2022. The overall objective of this study is to evaluate employment, skills, and wages in the Connecticut green industry, which consists of ornamental horticultural production by nurseries, greenhouses, and sod farms, landscape maintenance and construction, and arboricultural services. To this end, three specific objectives were pursued:

- Identify employment, skills, and salary trends within the industry and relative to other relevant sectors of the state economy, broken down by occupation and employment location quotients in relation to national levels.
- Identify constraints in the labor market that may adversely impact future growth.
- Provide policy recommendations to mitigate bottlenecks and to guide workforce development in Connecticut's agricultural industry labor market.

Using an input-output model of the Connecticut economy and data from the IMPLAN Occupational Database, we measure employment, salaries, and identify occupational skills in the sector between 2018 and 2021, the latest data available for employment. Importantly, we compare these to other

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[1] In that study, the agricultural industry is defined as including agricultural production as well as agricultural, forest, and fishery/seafood processing. In an earlier study, excluding forestry processing, the economics impact was estimated at $4 billion in sales and 22,000 jobs statewide (Lopez et al., 2017). For our purposes here, we definal agricultural labor as those applying in the latter study, also found in Appendix A.

comparable sectors in the economy that may compete for similarly qualified labor in a state which is the fourth most densely populated in the country. Finally, we explore implications and potential labor force development policies that may be implemented to mitigate labor shortages in the sector.

2. Data, Scope, and Methodology

This report quantifies the latest trends observed in the level of employment and wages, as well as quantifies the level of education, experience, knowledge, and skills required by the agricultural and primary agricultural processing in the state of Connecticut, based on IMPLAN definitions described in Appendix A. They include 26 agricultural subsectors.

The source of information is IMPLAN 2022. The IMPLAN software has a thorough and extensive economic database from more than 90 sources. We analyze the following metrics:

- **Output** represents the value of industry production; these are annual production estimates and are in producer prices. For manufacturers this would be sales plus/minus change in inventory, while for retail and wholesale trade, output = gross margin and not gross sales, which includes the value of the goods sold.

- **Employment** represents the number of positions in the economy, not the number of employed persons. As many people have more than one job, there are always more jobs in the economy than employed persons. It includes wage and salary employment and proprietors[2].

- **Employment location quotient or concentration of employment** denotes the share of a sector's employment in the total state employment relative to the share of that sector in the national employment. Thus, a location quotient greater than one indicates relative concentration of that sector in the state, indicating relative specialization.

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[2] Jobs are not full-time equivalencies in input-output models, they are, however, annualized counts per industry, includes full-time, part-time, and seasonal employment. Thus, 1 job lasting 12 months = 2 jobs lasting 6 months each = 3 jobs lasting 4 months each. A job can be either full-time or part-time. Similarly, a job that lasts one quarter of the year would be 1/4 (0.25) jobs.

- **Average hourly wages for employees** are the total payroll cost of the employee including wages and salaries, all benefits (e.g., health, retirement), and payroll taxes divided by the hours worked.

- **Average annual wage** is the total payroll cost of the employee including wages and salaries, all benefits (e.g., health, retirement), and payroll taxes divided by the number of positions in the economy.

- **Education Required, Work Experience Required, and On-the-Job Training,** is measured as the percent of employees that exhibit the given competency for each sector. Formal education categories are defined in Appendix C.

- **Ability, Knowledge, and Skills,** a measure of the relative size of a competency when compared to the total sum of like competencies; how important this competency is compared to other like competencies for each sector. [3]

3. Results and Discussion

Since the onset of the COVID-19 pandemic in 2020, the state of Connecticut has suffered the slowdown or stoppage of a significant number of activities, resulting in a reduction of total output of approximately $23 billion dollars or around 5% (Table 1). Meanwhile, the agricultural industry and primary agricultural processing have increased their production by $40 million or around 2%, though with heterogeneous results across its different subsectors (Table 1). Commercial logging, sawmills, support activities for agriculture and forestry and wineries, saw a significant decrease in activity, while greenhouse, nursery, and floriculture production, ice cream and frozen dessert manufacturing and fruit and vegetable canning, pickling, and drying, flourished.

The state of Connecticut shows a loss of 110,000 jobs or around 5%, in contrast to the resilience observed in the agricultural and primary agricultural processing sectors, that mostly

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[3] For more detail of how ability, knowledge and skills are measured, visito
https://support.implan.com/hc/en-us/articles/360051197853-Occupation-Data-Details

maintain their pre-pandemic level of employment (Table 2). Due to their resilience, these industries have increased their importance in the state of Connecticut. In comparison with the national level, Connecticut seems remarkably specialized in agricultural and forest production, with greenhouse, nursery, and floriculture production as the driver, while the food processing sector lacks behind the national level in relative concentration (Table 3).

Figure 1 superimposes concentration of employment in the vertical axis and sales growth in the horizontal axis. Concentration of employment in Connecticut is measured by employment in a subsector relative to employment in the state over concentration of employment for that subsector in the U.S. relative to overall U.S. employment. Thus, a score greater than 1 indicates relative concentration or specialization in Connecticut for a given subsector. The horizontal axis is simply a subsector's sales growth between 2015 and 2021, where a positive number indicates that the sector is expanding. From a performance perspective, four categories of the agricultural subsectors are displayed:

1) Subsectors that are both relative concentrated in employment and expanding in sales in Connecticut. They include the greenhouse, nursery, and floriculture industry and ice cream manufacturing. These sectors present strengths and opportunities for agricultural growth as well as employment generation.

2) Subsectors that are concentrated in employment but that are contracting in sales. They only include one sector: tobacco farming, reflecting a sector that has been historically concentrated in Connecticut but that at the same time has been declining. Given its history, this sector represents one where no future growth is expected.

3) Subsectors that are less concentrated in employment but that are growing in sales. These represent possible future areas of employment and growth. These include 10 out of 26 sectors analyzed, such product preparation and packaging, wineries, fruit farming, fruit and vegetables canning, pickling, and drying, meat manufacturing from carcasses, and dairy

cattle and milk production. Except for the latter two, they are mostly composed of plant-based agriculture, and represent emerging strengths and opportunities.

4) Subsectors that are less concentrated in employment than the national average and whose sales are declining. These include cattle ranching and farming, poultry and egg production, poultry processing, non-poultry animal production, fluid milk and butter manufacturing, cheese manufacturing, animal slaughtering, vegetable and melon farming, commercial fishing, seafood, and support activities for agriculture and forestry. They include half of the subsectors considered (13 out of 26) and consist mostly of animal production. Unless some major innovations that favor Connecticut emerge, these represent limited prospects for agricultural and employment growth.

The annual salaries and salaries per hour are very heterogeneous between the different components in the industries looked at (2020). While the annual average wage for these industries collectively is around $43,000 dollars and the wage per hour is $21.10 (Tables 4 and 5), the processing industry exceeds this average with $65,000 dollars and $31.80 dollars respectively, while agricultural and forest production is significantly below with $38,000 dollars and $18.90. Agricultural and forest production wages generally fall well below the average of other comparable skilled professions, such as construction laborers. Wages observed inside this sub-sector are heterogeneous with variation of more than 5 times.

As shown in Table 6, the levels of education required in agricultural and forest production as well as primary agricultural processing. The level of education in agricultural and forest production is significantly higher than in primary processing and in construction laborers, with 40% of the jobs requiring college education versus 19% in primary agricultural processing where a high school degree is more prevalent. The educational level required also differs significantly among sectors. For instance, for meat from carcasses processing only 13% of the work force is required to have

some college courses or more, while this percentage is increased to 44% for the dairy cattle and milk production workforce.

Tables 7 and 8 provide an insight of the experience necessary for job holders. The work experience required in agricultural and forest production is lower than that required in primary agricultural processing on average, and on-the-job training seems to be very similar between both subsectors. Approximately 74% of workers are hired no to less than two-year experience and 96% of them receive on-the-job training in the first two years. This point to a transient aspect or short duration of agricultural workers in the state. Tables 9 and 10 list the top 10 abilities, skills, and knowledge areas required for the jobs in the state's agriculture, with no particular feature being dominant other than these jobs require a combination of communication, technical, and soft skills sought by employers.

1. Policy Recommendations

The Connecticut agricultural industry is facing real challenges in attracting new workers, as well as in developing and retaining those workers once they are employed in the sector. This challenge is significant and is limiting the growth of the industry in the state. This section attempts to address possible solutions to these challenges and to suggest actions policy makers, educational institutions, and ultimately the various sectors of the agricultural industry itself might take to address them.

The pipeline of potential workers for the industry is constrained by the lack of available training in a "chicken-and-egg" scenario. Despite the existence of vocational high schools, as well as university-level agricultural programs at the University of Connecticut and elsewhere, there remain insufficient educational programs available to meet demand for workers for employment in agriculture, which limits the opportunities for students interested in agriculture. However, educational administrators argue that the lack of programs is a result of low levels of interest from

students. Resolving this dilemma may require greater investment on the part of educational institutions as well as greater demand from students.

While previous sections noted that agricultural production wages trail relative to comparable industry sectors, such as construction laborers, this should not be interpreted as suggesting that there are no "good jobs" in agricultural production. On the contrary, with thousands employed in the sector, there are certainly many higher paying positions available for higher-skilled, supervisory, and managerial workers. Having expanded training opportunities available, ranging from technical high school programs to community college and post-secondary technical programs, to associate and bachelor's degree programs at universities, will enable those interested in the agricultural industry to enter the field at a higher skill level. This will both increase their earning and promotion potential, as well as help staff higher-skilled positions within the industry, which are often difficult for companies to fill. In addition, wages in the agricultural processing sector are higher than those for cooks and food preparers—a sector of comparable education and skills. However, as of now, the number of jobs in agricultural processing is less than 1/5 of the jobs in agricultural production.

Still, the agricultural production sector has a large proportion of its employment at lower-skill levels or entry-level positions, which skews the average wages offered downward relative to other employers in the economy. Filling these entry level positions is a significant challenge for agricultural producers, as it is for other agricultural and service-sector employers. To fill these positions, some agricultural industry employers, and employers in other areas of the country, have turned to foreign work visa programs such as H-2 visas. These are temporary, non-immigrant visas that allow workers from selected countries to legally come and work on a temporary basis in the United States. Agricultural sectors, such as production greenhouses and nurseries, can bring workers in under the H-2A program, which though costly, does not have a cap on the number of visas that can be issued. Retail and service sectors of the agricultural industry are limited, however, to H-2B visas, which have an annual ceiling on the number of visas that can be issued, severely limiting their availability. The limitations, costs, and regulatory risk associated with these

temporary work visas means that they are an imperfect solution to the agricultural industry's labor issues. In addition, it should be noted that given the fixed costs and transactional difficulties of utilizing these programs, larger, commercial farmers are more likely to use them rather than the majority of farmers in Connecticut who operate small farms.

It should be noted that the ultimate responsibility for filling these positions lies with the agricultural industry itself. There are several factors that have made many agricultural industry jobs less desirable to workers than other available positions within the economy and which, as unemployment has continueds to fall and the labor market has continued to tightens, which ill make staffing more challenging. For example, the seasonality of employment and low wages may make agricultural production positions hard to fill. Nevertheless, employers have several options to make the industry more attractive to workers. Because many entry-level positions in the sector require lower levels of education than other fields, this could provide those with lower educational attainment a valuable entry point into the agricultural industry workforce. For their part, agricultural industry employers could do more to offer their lower-skilled employees' opportunities for professional growth and development, creating pathways from within their ranks to higher-responsibility positions in the industry. The industry could also do more to partner with educational institutions of various levels, offering work placement, internship, and apprenticeship collaborations. Finally, the issue of pay scale cannot be ignored. While employee decisions about whether to seek employment or remain in a job are complex and involve more than just remuneration, earnings ultimately are one of the top concerns. Industry employers may need to increase wage rates to attract and retain high-potential and high-performing employees to make them competitive with other industries competing for the same pool of workers.

This study grew out of a concern about a lack of labor availability in Connecticut's agricultural sectors and an interest in fostering employment opportunities, workforce development, and economic growth. Given the tight labor market in the state, particularly since the COVID-19 pandemic, without investment in workforce development and labor-saving technology, labor

constraints will *de facto* become economic growth constraints for the industry. The alleviation of labor constraints may not be an easy task, but it is an important goal to promote a more robust agricultural industry and to stimulate the contribution of this industry to the economy. The future growth of Connecticut's agricultural industry will in part depend on how employers and policy makers respond to these challenges.

Table 1 – Statewide sales by sector

Activity	Millions of dollars [1]			
	2018	**2019**	**2020**	**2021**
Agricultural and forest production				
Oilseed farming	0	0	0	0
Grain farming	11	11	13	18
Vegetable and melon farming	34	32	39	39
Fruit farming	22	21	19	23
Tree nut farming	0	0	0	0
Greenhouse, nursery, & floriculture production	293	301	333	333
Tobacco farming	21	18	15	19
All other crop farming	18	19	20	20
Cattle ranching and farming	18	12	16	15
Dairy cattle and milk production	73	82	79	83
Poultry and egg production	46	35	40	39
Animal prod., except cattle and poultry & eggs	31	28	25	25
Commercial logging	57	45	28	25
Sawmills	60	67	48	64
Wood preservation	17	-	-	-
Commercial fishing	28	21	15	34
Commercial hunting and trapping	-	-	4	1
Support activities for agriculture and forestry	58	58	38	50
Total for agricultural and forest production	**787**	**750**	**734**	**791**
Primary agricultural processing				
Fruits and vegetables canning, pickling, and drying	183	192	220	236
Fluid milk & butter manufacturing	337	369	356	340
Cheese manufacturing	149	131	143	163
Ice cream and frozen dessert manufacturing	192	185	212	232
Animal, except poultry, slaughtering & processing	82	67	71	69
Meat processed from carcasses	158	153	166	170
Poultry processing	11	17	16	17
Seafood product preparation and packaging	45	42	41	44
Wineries	124	106	94	104
Total for primary agricultural processing	**1,281**	**1,263**	**1,318**	**1,374**
Total for the agricultural industry	**2,068**	**2,013**	**2,052**	**2,164**
Aquaculture*	11	10	9	9
Total State of Connecticut (Billions $)	**462**	**479**	**456**	**489**

Note: Source IMPLAN. The figure of Aquaculture is based on the percentage of Aquaculture Sales in Connecticut as reported by the US Census Bureau 2017, pro-rated to IMPLAN sector "Animal production, except cattle and poultry and eggs."

(1) Millions of dollars are reported at their nominal value without any further adjustments for all subsectors. Total State of Connecticut is reported in billions.

Table 2 – Number of jobs by sector

Activity	Number of jobs [1]			
	2018	**2019**	**2020**	**2021**
Oilseed farming	1	1	1	2
Grain farming	101	93	105	144
Vegetable and melon farming	568	482	554	507
Fruit farming	525	479	430	447
Tree nut farming	1	0	1	1
Greenhouse, nursery, and floriculture prod.	4,657	4,502	4,746	4,546
Tobacco farming	450	383	300	394
All other crop farming	1,753	1,803	1,809	1,680
Cattle ranching and farming	375	238	296	280
Dairy cattle and milk production	319	329	310	318
Poultry and egg production	171	119	130	126
Animal prod., except cattle & poultry and eggs	696	588	485	505
Commercial logging	689	503	514	323
Sawmills	228	234	193	190
Wood preservation	27	-	-	-
Commercial fishing	452	491	418	608
Commercial hunting and trapping	-	-	28	47
Support activities for agriculture and forestry	1,369	1,578	1,399	1,439
Total for agricultural and forest production	**12,381**	**11,821**	**11,720**	**11,556**
Fruits and vegetables canning, pickling, and drying	366	364	358	373
Fluid milk & butter manufacturing	447	457	428	437
Cheese manufacturing	167	150	150	158
Ice cream and frozen dessert manufacturing	455	505	541	586
Animal, except poultry, slaughtering & processing	137	124	122	121
Meat processed from carcasses	305	331	337	341
Poultry processing	32	57	51	51
Seafood product preparation and packaging	108	97	93	93
Wineries	412	387	329	397
Total for primary agricultural processing	**2,429**	**2,473**	**2,409**	**2,558**
Total for the agricultural industry	**14,810**	**14,294**	**14,129**	**14,114**
Aquaculture*	239	202	167	174
Total State of Connecticut (Millions)	**2.347**	**2.333**	**2.207**	**2.209**

The rows from "Oilseed farming" through "Total for agricultural and forest production" are grouped under the side label **Agricultural and forest production**. *The rows from "Fruits and vegetables canning, pickling, and drying" through "Total for primary agricultural processing" are grouped under the side label* **Primary agricultural processing**.

Note: Source IMPLAN. The figure of Aquaculture is based on the percentage of Aquaculture Sales in Connecticut as reported by the US Census Bureau 2017, pro-rated to IMPLAN sector "Animal production, except cattle and poultry and eggs."

(1) Includes proprietors and employees. The values are reported in the number of jobs for all subsectors and in millions of jobs for the Total State of Connecticut.

Table 3 – Employment concentration by sector

Activity	Location Quotient [1]		
	2018	2019	2020
Agricultural and forest production			
Oilseed farming	0.00	0.00	0.00
Grain farming	0.03	0.03	0.04
Vegetable and melon farming	0.34	0.29	0.36
Fruit farming	0.27	0.24	0.23
Tree nut farming	0.00	0.00	0.00
Greenhouse, nursery, and floriculture production	2.43	2.37	2.64
Tobacco farming	2.19	1.87	1.55
All other crop farming	0.26	0.27	0.28
Cattle ranching and farming	0.06	0.04	0.05
Dairy cattle and milk production	0.33	0.34	0.34
Poultry and egg production	0.14	0.10	0.12
Animal production, except cattle, poultry and eggs	0.22	0.19	0.16
Commercial logging	0.45	0.33	0.35
Sawmills	0.20	0.21	0.18
Wood preservation	0.20	-	-
Commercial fishing	0.49	0.54	0.48
Commercial hunting and trapping	-	-	0.14
Support activities for agriculture and forestry	0.17	0.19	0.18
Total for agricultural and forest production	**1.64**	**1.60**	**1.85**
Construction Laborers [2]	**0.74**	**0.75**	**0.75**
Primary agricultural processing			
Fruits and vegetables canning, pickling, and drying	0.50	0.50	0.46
Fluid milk & butter manufacturing	0.68	0.72	0.70
Cheese manufacturing	0.28	0.25	0.26
Ice cream and frozen dessert manufacturing	1.75	1.95	2.21
Animal, except poultry, slaughtering	0.04	0.04	0.04
Meat processed from carcasses	0.07	0.06	0.07
Poultry processing	0.01	0.02	0.02
Seafood product preparation and packaging	0.24	0.22	0.22
Wineries	0.46	0.43	0.39
Total for primary agricultural processing	**0.68**	**0.74**	**0.81**
Cooks and Food Preparation Workers [2]	**0.96**	**0.96**	**0.94**
Total for the agricultural industry	**1.36**	**1.34**	**1.54**

Note: Source IMPLAN. The annual state level figures have been compared against the national level figures (2020). Location quotient compares the relative concentration of activity in a determined industry for a specific area to the concentration in the same industry for the entire U.S.A. (1) Includes proprietors and employees (1) As defined by 2019 Standard Occupational Classification

Table 4 – Annual average labor income by sector

Activity	Average Annual Income (Thousands of dollars [1])		
	2018	2019	2020
Agricultural and forest production			
Oilseed farming	-	-	-
Grain farming	44.89	43.65	34.73
Vegetable and melon farming	33.10	32.16	25.24
Fruit farming	25.57	26.00	18.70
Tree nut farming	30.00	32.50	21.77
Greenhouse, nursery, and floriculture production	36.92	34.57	28.51
Tobacco farming	36.25	36.41	31.57
All other crop farming	40.57	36.72	32.61
Cattle ranching and farming	40.97	39.15	32.35
Dairy cattle and milk production	34.24	32.88	27.32
Poultry and egg production	60.11	55.22	44.74
Animal production, except cattle and poultry and eggs	42.44	41.86	34.07
Commercial logging	98.19	98.80	103.25
Sawmills	60.19	60.90	65.92
Wood preservation	80.04	-	-
Commercial fishing	103.00	74.23	107.02
Commercial hunting and trapping	-	-	-
Support activities for agriculture and forestry	38.59	42.49	46.01
Total for agricultural and forest production*	**44.03**	**41.15**	**37.95**
Construction Laborers [2]	**54.90**	**56.98**	**59.97**
Primary agricultural processing			
Fruits and vegetables canning, pickling, and drying	66.50	69.92	72.94
Fluid milk & butter manufacturing	80.20	89.82	81.35
Cheese manufacturing	60.59	67.97	61.86
Ice cream and frozen dessert manufacturing	56.09	58.46	61.73
Animal, except poultry, slaughtering	78.29	81.63	87.99
Meat processed from carcasses	55.20	57.03	61.18
Poultry processing	66.41	70.06	65.83
Seafood product preparation and packaging	73.90	75.84	74.11
Wineries	28.42	30.16	32.23
Total for primary agricultural processing*	**59.78**	**64.01**	**64.68**
Cooks and Food Preparation Workers [2]	**29.85**	**31.29**	**32.90**
Total for the agricultural industry	**46.61**	**45.11**	**42.51**
Aquaculture [1]	42.44	41.86	34.07

Note: Source IMPLAN. *The average for the sector is weighted by the number of employees (1) Annual average wage = Labor income/ number of employees. Dollars are reported at their nominal value, without any further adjustments. (2) as defined by 2019 Standard Occupational Classification (1) The figure of Aquaculture is based on the percentage of Aquaculture Sales in Connecticut as reported by the US Census Bureau 2017, pro-rated to IMPLAN sector "Animal production, except cattle and poultry and eggs"

Table 5 – Wage per hour by sector

Activity	Dollars [1]		
	2018	**2019**	**2020**
Agricultural and forest production			
Oilseed farming	-	-	-
Grain farming	25.5	25.4	20.03
Vegetable and melon farming	19.0	18.9	14.74
Fruit farming	14.7	15.4	10.94
Tree nut farming	17.3	19.3	12.74
Greenhouse, nursery, and floriculture production	21.0	20.2	16.54
Tobacco farming	20.7	21.4	18.34
All other crop farming	23.2	21.6	18.95
Cattle ranching and farming	21.5	20.8	17.08
Dairy cattle and milk production	18.0	17.5	14.42
Poultry and egg production	31.1	28.9	23.39
Animal production, except cattle and poultry and eggs	22.2	22.2	17.96
Commercial logging	50.0	48.6	54.48
Sawmills	28.4	29.5	33.11
Wood preservation	37.7	-	-
Commercial fishing	60.7	44.2	68.54
Commercial hunting and trapping	-	-	-
Support activities for agriculture and forestry	22.9	26.0	27.56
Total for agricultural and forest production*	**22.2**	**21.9**	**18.9**
Construction Laborers [2]	**29.2**	**30.6**	**33.1**
Primary agricultural processing			
Fruits and vegetables canning, pickling, and drying	32.2	34.0	34.1
Fluid milk & butter manufacturing	40.2	45.0	40.7
Cheese manufacturing	30.4	34.1	31.0
Ice cream and frozen dessert manufacturing	28.1	29.3	30.9
Animal, except poultry, slaughtering & processing	37.9	39.5	43.0
Meat processed from carcasses	26.7	27.6	29.9
Poultry processing	32.8	34.8	33.0
Seafood product preparation and packaging	37.5	38.1	37.3
Wineries	16.2	15.8	17.2
Total for primary agricultural processing*	**30.2**	**31.6**	**31.8**
Cooks and Food Preparation Workers [2]	**21.57**	**22.37**	**24.78**
Total for the agricultural industry	**23.5**	**23.6**	**21.1**

Note: Source IMPLAN. *The average for the sector is weighted by the number of employees (1) Wage per hour = Labor income/hours worked. Dollars are reported at their nominal value, without any further adjustments. (2) As defined by 2019 Standard Occupational Classification

Table 6 – Formal education required by sector (2019)

Activity	Less than a High School Diploma	High School Diploma	Post-Secondary Certificate	College or higher
Oilseed farming				
Grain farming	21%	26%	10%	42%
Vegetable and melon farming	22%	29%	9%	39%
Fruit farming	20%	27%	9%	44%
Tree nut farming	20%	27%	9%	44%
Greenhouse, nursery, and floriculture production	18%	31%	9%	42%
Tobacco farming	24%	27%	11%	38%
All other crop farming	24%	27%	11%	38%
Cattle ranching and farming	17%	29%	10%	44%
Dairy cattle and milk production	17%	29%	10%	44%
Poultry and egg production	19%	37%	10%	35%
Animal production, except cattle and poultry and eggs	15%	33%	10%	43%
Commercial logging	35%	45%	7%	13%
Sawmills	17%	56%	11%	17%
Wood preservation	0%	0%	0%	0%
Commercial fishing	9%	25%	7%	60%
Commercial hunting and trapping				
Support activities for agriculture and forestry	20%	30%	9%	41%
Total for agricultural and forest production	**19%**	**31%**	**9%**	**40%**
Construction Laborers [1]	**33%**	**35%**	**28%**	**5%**
Fruits and vegetables canning, pickling, and drying	15%	59%	8%	19%
Fluid milk & butter manufacturing	13%	59%	7%	21%
Cheese manufacturing	13%	59%	7%	21%
Ice cream and frozen dessert manufacturing	13%	59%	7%	21%
Animal, except poultry, slaughtering & processing	30%	51%	6%	13%
Meat processed from carcasses	30%	51%	6%	13%
Poultry processing	30%	51%	6%	13%
Seafood product preparation and packaging	30%	48%	5%	16%
Wineries	15%	54%	6%	24%
Total for primary agricultural processing	**18%**	**56%**	**7%**	**19%**
Cooks and Food Preparation Workers [1]	**24%**	**51%**	**10%**	**15%**
Total for the agricultural industry	**19%**	**39%**	**9%**	**34%**

Agricultural and forest production

Primary agricultural processing

Note: The levels of education required are defined in Appendix C. (1) As defined by 2019 Standard Occupational Classification

Table 7 – Work experience required by sector (2019)

Activity	None	0 < year <= 2	2 < year <= 4	4 < year
Oilseed farming				
Grain farming	27%	42%	18%	14%
Vegetable and melon farming	34%	41%	18%	7%
Fruit farming	36%	39%	20%	6%
Tree nut farming	36%	39%	20%	6%
Greenhouse, nursery, and floriculture production	33%	41%	19%	8%
Tobacco farming	30%	43%	17%	9%
All other crop farming	30%	43%	17%	9%
Cattle ranching and farming	32%	40%	20%	7%
Dairy cattle and milk production	32%	40%	20%	7%
Poultry and egg production	29%	44%	17%	10%
Animal production, except cattle and poultry and eggs	28%	42%	19%	11%
Commercial logging	19%	56%	13%	12%
Sawmills	24%	51%	12%	14%
Wood preservation	0%	0%	0%	0%
Commercial fishing	11%	45%	19%	25%
Commercial hunting and trapping				
Support activities for agriculture and forestry	34%	41%	19%	7%
Total for agricultural and forest production	**32%**	**41%**	**18%**	**8%**
Construction Laborers [1]	**43%**	**55%**	**0%**	**1%**
Fruits and vegetables canning, pickling, and drying	29%	46%	9%	15%
Fluid milk & butter manufacturing	28%	46%	11%	15%
Cheese manufacturing	28%	46%	11%	15%
Ice cream and frozen dessert manufacturing	28%	46%	11%	15%
Animal, except poultry, slaughtering & processing	24%	58%	9%	9%
Meat processed from carcasses	24%	58%	9%	9%
Poultry processing	24%	58%	9%	9%
Seafood product preparation and packaging	23%	60%	7%	10%
Wineries	27%	45%	13%	15%
Total for primary agricultural processing	**27%**	**49%**	**10%**	**14%**
Cooks and Food Preparation Workers [1]	**29%**	**56%**	**12%**	**3%**
Total for the agricultural industry	**30%**	**44%**	**16%**	**10%**

Left-side vertical labels: *Agricultural and forest production*; *Primary agricultural processing*

Note: Source IMPLAN. (1) As defined by 2019 Standard Occupational Classification

Table 8 – On-the-job training required by sector (2019)

	Activity	None	0 < year <= 2	2 < year <= 4	4 < year
Agricultural and forest production	Oilseed farming				
	Grain farming	16%	79%	4%	2%
	Vegetable and melon farming	21%	77%	1%	1%
	Fruit farming	22%	75%	1%	1%
	Tree nut farming	22%	75%	1%	1%
	Greenhouse, nursery, and floriculture production	20%	77%	1%	2%
	Tobacco farming	17%	78%	3%	2%
	All other crop farming	17%	78%	3%	2%
	Cattle ranching and farming	20%	77%	2%	2%
	Dairy cattle and milk production	20%	77%	2%	2%
	Poultry and egg production	16%	80%	2%	2%
	Animal production, except cattle and poultry and eggs	17%	79%	2%	2%
	Commercial logging	4%	91%	2%	3%
	Sawmills	6%	86%	6%	3%
	Wood preservation	0%	0%	0%	0%
	Commercial fishing	10%	80%	8%	2%
	Commercial hunting and trapping				
	Support activities for agriculture and forestry	20%	77%	1%	1%
	Total for agricultural and forest production	**19%**	**78%**	**2%**	**2%**
	Construction Laborers [1]	**29%**	**70%**	**0%**	**1%**
Primary agricultural processing	Fruits and vegetables canning, pickling, and drying	8%	87%	3%	2%
	Fluid milk & butter manufacturing	8%	88%	3%	1%
	Cheese manufacturing	8%	88%	3%	1%
	Ice cream and frozen dessert manufacturing	8%	88%	3%	1%
	Animal, except poultry, slaughtering & processing	8%	86%	5%	1%
	Meat processed from carcasses	8%	86%	5%	1%
	Poultry processing	8%	86%	5%	1%
	Seafood product preparation and packaging	8%	89%	2%	1%
	Wineries	10%	87%	2%	1%
	Total for primary agricultural processing	**8%**	**87%**	**3%**	**1%**
	Cooks and Food Preparation Workers [1]	**7%**	**92%**	**0%**	**1%**
	Total for the agricultural industry	**16%**	**81%**	**2%**	**2%**

Note: Source IMPLAN. (1) As defined by 2019 Standard Occupational Classification

Table 9 – Top ten abilities & skills required in Connecticut's agricultural industry (2019)

Abilities		Skills	
Description	**Share**	**Description**	**Share**
Oral Comprehension	3.34%	Coordination	5.05%
Oral Expression	3.27%	Active Listening	5.04%
Near Vision	3.18%	Monitoring	5.03%
Problem Sensitivity	2.97%	Critical Thinking	5.03%
Control Precision	2.92%	Speaking	4.69%
Speech Recognition	2.82%	Reading Comprehension	4.23%
Multilimb Coordination	2.82%	Social Perceptiveness	4.11%
Trunk Strength	2.78%	Time Management	4.05%
Information Ordering	2.78%	Judgment and Decision Making	4.01%
Static Strength	2.77%	Operation Monitoring	3.98%

Construction Laborers [1]

Abilities		Skills	
Description	**Share**	**Description**	**Share**
Static Strength	3.92%	Coordination	6.21%
Manual Dexterity	3.80%	Active Listening	5.74%
Multilimb Coordination	3.20%	Speaking	5.74%
Trunk Strength	3.19%	Operation and Control	5.74%
Oral Comprehension	2.87%	Operation Monitoring	5.29%
Control Precision	2.87%	Reading Comprehension	4.42%
Arm-Hand Steadiness	2.86%	Critical Thinking	4.42%
Near Vision	2.76%	Complex Problem Solving	4.42%
Oral Expression	2.65%	Monitoring	4.01%
Problem Sensitivity	2.55%	Time Management	3.65%

Cooks and Food Preparation Workers [1]

Abilities		Skills	
Description	**Share**	**Description**	**Share**
Near Vision	3.85%	Active Listening	5.28%
Oral Comprehension	3.47%	Monitoring	5.12%
Manual Dexterity	3.27%	Coordination	5.10%
Information Ordering	3.23%	Time Management	5.00%
Oral Expression	3.21%	Speaking	4.98%
Arm-Hand Steadiness	3.14%	Critical Thinking	4.92%
Speech Recognition	3.12%	Social Perceptiveness	4.86%
Trunk Strength	3.03%	Reading Comprehension	4.34%
Problem Sensitivity	3.01%	Judgment and Decision Making	4.32%
Finger Dexterity	2.95%	Service Orientation	4.30%

Note: Source IMPLAN. (1) As defined by 2019 Standard Occupational Classification

Table 10 – Top ten knowledges required in Connecticut's agricultural industry (2019)

Knowledges

Description	Share
Production and Processing	7.30%
Customer and Personal Service	6.55%
English Language	5.95%
Administration and Management	5.61%
Education and Training	5.28%
Mechanical	5.19%
Mathematics	5.11%
Food Production	4.92%
Public Safety and Security	4.66%
Clerical	4.53%

Construction Laborers [1]

Knowledges

Description	Share
Building and Construction	17.50%
Public Safety and Security	10.08%
Mechanical	9.75%
Customer and Personal Service	6.65%
Education and Training	5.10%
Mathematics	4.53%
Design	4.12%
English Language	3.90%
Administration and Management	3.72%
Engineering and Technology	3.47%

Cooks and Food Preparation Workers [1]

Knowledges

Description	Share
Customer and Personal Service	11.73%
Food Production	8.18%
Administration and Management	7.59%
English Language	6.83%
Production and Processing	5.84%
Education and Training	5.64%
Public Safety and Security	5.39%
Mathematics	5.23%
Sales and Marketing	3.55%
Personnel and Human Resources	3.27%

Note: Source IMPLAN. (1) As defined by 2019 Standard Occupational Classification

Table 11. Top occupations in Connecticut's agricultural industry in 2019

	Occupation	Number of jobs	Percentage of jobs
Agricultural and forest production	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	2901	57.14%
	First-Line Supervisors Farming, Fishing, and Forestry	203	4.01%
	Farmworkers, Farm, Ranch, and Aquacultural Animals	183	3.60%
	Agricultural Equipment Operators	167	3.30%
	Heavy and Tractor-Trailer Truck Drivers	104	2.06%
	Packers and Packagers, Hand	90	1.76%
	Laborers and Freight, Stock, and Material Movers, Hand	79	1.56%
	Office Clerks, General	76	1.50%
	Graders and Sorters, Agricultural Products	72	1.43%
	Landscaping and Groundskeeping Workers	72	1.42%
	Rest	1128	22.23%
Primary agricultural processing	Packaging and Filling Machine Operators and Tenders	277	11.54%
	Food Batchmakers	197	8.22%
	Meat, Poultry, and Fish Cutters and Trimmers	134	5.57%
	Laborers and Freight, Stock, and Material Movers, Hand	133	5.53%
	First-Line Supervisors of Production and Operating Workers	88	3.65%
	Industrial Truck and Tractor Operators	82	3.40%
	Separating and Still Machine Setters, Operators, and Tenders	71	2.94%
	Industrial Machinery Mechanics	64	2.66%
	Slaughterers and Meat Packers	64	2.65%
	Inspectors, Testers, Sorters, Samplers, and Weighers	62	2.58%
	Rest	1231	51.26%

Note: Source IMPLAN. These occupations are defined using the Standard Occupational Classification (SOC) codes found at

https://support.implan.com/hc/en-us/articles/360052254333-Occupation-Data .

Figure 1. Employment concentration vs. sales growth by selected sectors
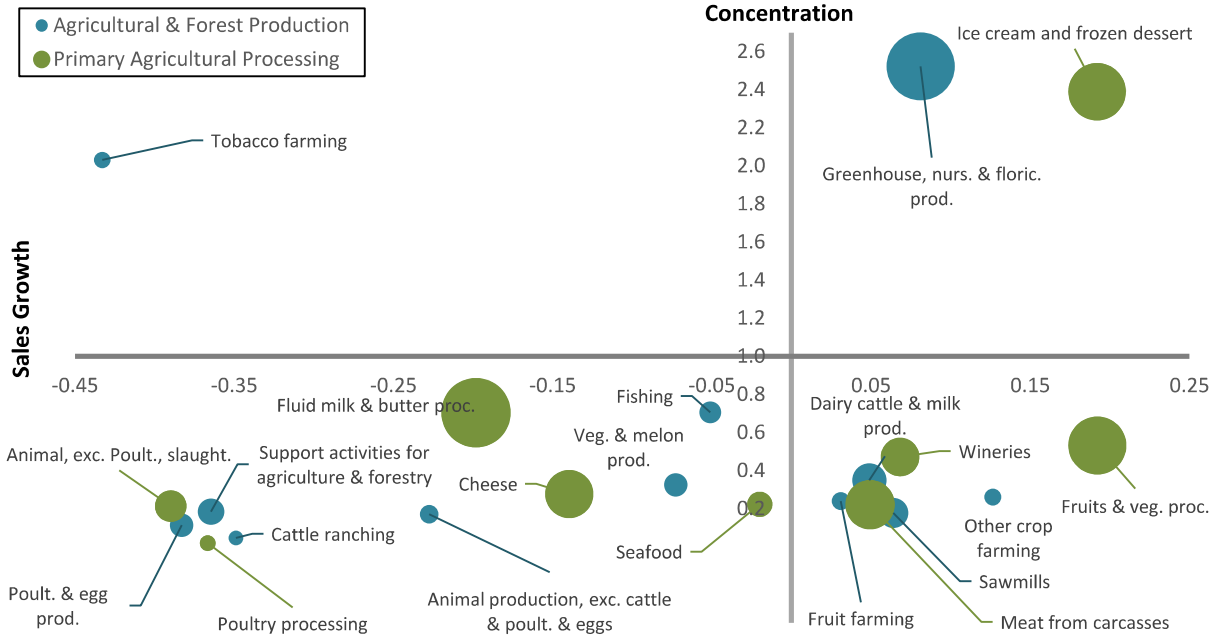
Note: The vertical axis is concentration of employment in Connecticut relative to the U.S. in 2021. The horizontal axis indicates sales growth between 2015 and 2021 in real dollar values, the deflator used is the weighted average of the PPI of the food manufacturing sector (BLS) and an index of Prices Received by Farmers for Agricultural, Crop, and Livestock Production by Month (USDA). Bubble sizes represent sales in 2021. Only subsectors of $10 million or more dollar in sales are depicted in the graph. A full list of results for all subsectors are presented in Appendix B.

Table A1: Description of sectors included in the study.

IMPLAN sector	Sector	Description
Agricultural and forest production		
1	Oilseed farming	Soybean, canola, flaxseed, mustard, oilseeds, rapeseed, safflower, sesame, and sunflower farming
2	Grain farming	Bean cowpea, garbanzo, lentil, lima bean, pea, wheat, corn, popcorn, rice, oilseed and grain combination, barley, broomcorn, buckwheat, milo, oat, rye, sorghum, and wild rice farming.
3	Vegetable and melon farming	Growing root and tuber crops or edible plants and/or producing root and tuber or edible plant seeds
4	Fruit farming	Apple orchards; grape vineyards; strawberry farming; berry (except strawberry) farming
5	Tree nut farming	Growing tree nuts (e.g., pecans, almonds, pistachios)
6	Greenhouse, nursery, and floriculture production	Growing crops of any kind under cover and/or growing nursery stock and flowers
7	Tobacco farming	Tobacco farming, field, and seed production
10	All other crop farming	Hay farming; all other miscellaneous crop farming (e.g., aloe)
11	Cattle ranching and farming	Raising cattle for both milking and meat production
12	Dairy cattle and milk production	Milking dairy cattle
13	Poultry and egg production	Breeding, hatching, and raising poultry for meat or egg production
14	Animal production, except cattle, poultry, and eggs	Pigs and hogs, goats, sheep and lambs, mohair, aquaculture (including finfish and shellfish), frogs, turtles, horses, donkeys and burros, ponies, foxes, fur bearing animals, mink, rabbit, chinchilla, alpaca, birds for sale, bison, pet breeding animals (i.e. dogs, cats, etc.), buffalo, combination livestock, crickets, deer, earthworms, elk, laboratory animal production, snakes, adornment birds (i.e. swans, peacocks), llamas.
16	Commercial logging	Cutting timber; cutting and transporting timber; producing wood chips in the field
17	Commercial fishing	Commercial catching or taking of finfish, shellfish, or miscellaneous marine products from a natural habitat
18	Commercial hunting and trapping	Commercial hunting and trapping; operating commercial game preserves, such as game retreats; operating hunting preserves
19	Support activities for agriculture and forestry	Crop harvesting primarily by machine, soil preparation, farm labor contracting, farm management services
132	Sawmills	Sawing dimension lumber, boards, beams, timbers, poles, ties, shingles, shakes, siding, and wood chips from logs or bolts.
133	Wood preservation	Treating wood sawed, planed, or shaped in other establishments with creosote or other preservatives; and sawing round wood poles, pilings, and posts and treating them with preservatives.

IMPLAN sector	Sector	Description
Primary agricultural processing		
79/80	Fruits and vegetables canning, pickling, and drying	Manufacturing canned, pickled, and dried fruits, vegetables, and specialty foods
82	Cheese manufacturing	Manufacturing cheese products (except cottage cheese) from raw milk and/or processed milk products and/or manufacturing cheese substitutes from soybean and other nondairy substances
84/85	Fluid milk & butter manufacturing	Manufacturing processed milk product, such as pasteurized milk or cream and sour cream and/or manufacturing fluid milk dairy substitutes from soybeans and other nondairy substances; creamery butter manufacturing
86	Ice cream and frozen dessert manufacturing	Manufacturing ice cream, frozen yogurts, frozen ices, sherbets, frozen tofu, and other frozen desserts (except bakery products)
88	Poultry processing	(1) Slaughtering poultry and small game and/or (2) preparing processed poultry and small game meat and meat byproducts
89	Animal, except poultry, slaughtering & processing	Slaughtering animals (except poultry and small game); meat processing from carcasses; rendering and meat byproduct processing
90	Meat processed from carcasses	Processing or preserving meat and meat byproducts (except poultry and small game) from purchased meats. Cutting/ packing of meats (i.e., boxed meats) from purchased meats.
92	Seafood product preparation and packaging	Canning seafood (including soup); smoking, salting, and drying seafood; eviscerating fresh fish by removing heads, fins, scales, bones, and entrails; shucking and packing fresh shellfish; processing marine fats and oils; and freezing seafood
107	Wineries	Growing grapes and manufacturing wines and brandies; manufacturing wines and brandies from grapes and other fruits grown elsewhere; blending wines and brandies

Notes: The following agricultural production sectors were excluded from the analysis because no direct sales were reported for them in 2018-2020: cotton farming, and sugar cane and sugar beet farming. Only the agricultural processing sectors shown in the table above were included in the analysis because these processing activities have strong linkages with agricultural production in the state. Thus, the following food processing industries in Connecticut were excluded from this study even though these industries are active in the state during 2018-2020: (1) other animal food manufacturing, (2) fats and oils refining and blending, (3) breakfast cereal manufacturing, (4) chocolate and confectionery manufacturing from cacao beans, (5) confectionery manufacturing from purchased chocolate, (6) non-chocolate confectionery manufacturing, (7) frozen food manufacturing, (8) bread and bakery product manufacturing, (9) cookie, cracker, and pasta manufacturing, (10) snack food manufacturing, (11) coffee and tea manufacturing, (12) flavoring syrup and concentrate manufacturing, (13) seasoning and dressing manufacturing, (14) all other food manufacturing, (15) soft drink and ice manufacturing, (16) breweries, (17) distilleries, and (18) tobacco product manufacturing (e.g., cigarettes and chewing tobacco). A more detailed description of the sectors can be found at: http://support.implan.com

Appendix B

Details on employment concentration vs. sales growth for all Connecticut ag sectors

	2021		2015-2021	
	Sales Millions $	Concentration	Nominal Sales Growth	Real [1] Sales Growth
Concentration and Sales Growth				
Greenhouse, nursery, and floriculture	333.42	2.52	18%	8%
Ice cream and frozen dessert manufacturing	231.76	2.39	30%	19%
Concentration and Sales Contraction				
Tobacco farming	19.30	2.03	-38%	-43%
No Concentration but Sales Growth				
Oilseed farming	0.38	0.00	17%	7%
Grain farming	17.65	0.05	59%	46%
Fruit farming	22.71	0.24	12%	3%
Tree nut farming	0.04	0.00	81%	65%
All other crop farming	20.35	0.26	23%	13%
Dairy cattle and milk production	83.33	0.35	14%	5%
Sawmills	64.15	0.18	16%	6%
Fruits and vegetables canning, pickling	236.13	0.53	30%	19%
Meat processed from carcasses	170.34	0.22	14%	5%
Wineries	103.93	0.47	17%	7%
No Concentration and Sales Contraction				
Vegetable and melon farming	39.03	0.33	1%	-7%
Commercial fishing	34.02	0.71	4%	-5%
Seafood product preparation and packaging	43.59	0.22	7%	-2%
Cattle ranching and farming	15.49	0.05	-29%	-35%
Poultry and egg production	39.37	0.11	-33%	-38%
Animal production, except cattle & poultry	25.01	0.17	-16%	-23%
Commercial logging	25.04	0.22	-52%	-56%
Commercial hunting and trapping	1.18	0.24	-50%	-54%
Support activities for agriculture	50.05	0.18	-31%	-36%
Fluid milk & butter manufacturing	339.62	0.70	-13%	-20%
Cheese manufacturing	162.67	0.28	-6%	-14%
Animal, except poultry, slaughtering	68.94	0.21	-33%	-39%
Poultry processing	16.52	0.02	-31%	-37%

Note: Source IMPLAN. (1) The deflator used is the weighted average of the PPI of the food manufacturing sector (BLS) and the Prices Received: Indexes for Agricultural, Crop, and Livestock Production by Month, (USDA). Both 2015 and 2021 sales are thus expressed in 2021 values for comparability and for computing growth in real values.

Appendix C

Formal education category description

Education Category Description		
Less than a High School Diploma		
High School Diploma (or GED or High School Equivalence Certificate)		
Post-Secondary Certificate - awarded for training completed after high school (for example, in personnel services, engineering-related technologies, vocational home economics, construction trades, mechanics and repairers, precision production trades)		
College Courses or more	**Some College Courses**	
	Associate Degree (or other 2-year degree)	
	Bachelor's Degree	
	Post-Baccalaureate Certificate - awarded for completion of an organized program of study; designed for people who have completed a Baccalaureate degree but do not meet the requirements for academic degrees carrying the title of Master	
	Master's Degree	
	Post-Master's Certificate - awarded for completion of an organized program of study; designed for people who have completed a master's degree but do not meet the requirements of academic degrees at the doctoral level	
	First Professional Degree - awarded for completion of a program that requires at least 2 years of college work before entrance into the program, includes a total of at least 6 academic years of work to complete, and provides all remaining academic requirements	
	Doctoral Degree	
	Post-Doctoral Training	