The Contribution of Dairy to the Wisconsin Economy

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Support for this work was provided by the Dairy Farmers of Wisconsin, Wisconsin State Cranberry Growers Association, the State of Wisconsin Department of Agriculture, Trade and Consumer Protection and the Economic Development Administration, University Center within the Community Economic Development Program Area within the UW-Madison, Division of Extension. The authors acknowledge Paul Mitchell for his helpful comments. All errors are the responsibility of the authors.

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Executive Summary

This report provides an updated analysis of the dairy industry's contribution to Wisconsin's economy, reflecting the latest data available for 2022. Dairy, encompassing both on-farm activities and processing—which is dominated by cheese production—remains a significant contributor to the Wisconsin economy. In 2022, the dairy industry accounted for $52.84 billion in industrial revenues (6.5% of the state total), supported 120,700 jobs (3.3% of total state employment), generated $7.89 billion in labor income (3.2%), and contributed $13.71 billion to total income (3.4%). Notably, dairy processing is responsible for a significant portion of this economic contribution.

Table of Contents

Introduction

Wisconsin: America's Dairyland. No other state identifies as closely with the dairy industry as Wisconsin, and perhaps no other industry is as integral to large segments of the Wisconsin economy and its culture. As with many industries, however, the nature of the industry – markets, characteristics, policies – is ever changing. Recent years, as many know all too well, have seen a substantial number of dairy farm exits, stemming from tightening economic margins and the scaling up of the typical dairy herd. On the other hand, there continues to be noticeable expansion in the state's dairy-product processing sector. The goal of this study is to underscore the historical trends in the dairy industry, outline and update how dairy contributes to the Wisconsin economy, and outline challenges and prospects for the industry moving forward. Building off the larger Contribution of Agriculture to the Wisconsin Economy: An Update for 2022 by Deller and Hadachek (2024), this report takes a more expanded and focused look at Wisconsin's dairy industry, providing added detail and analysis compared to the agriculture industry-wide report.

To be consistent with prior studies, we define agriculture as composed of two parts: (1) on-farm production or "inside the farm gate" and (2) food processing or "beyond the farm gate". For Wisconsin, these two parts of agriculture are integral to each other and could be considered two halves of the same whole. For the dairy industry, "beyond the farm gate" largely refers to the cheese manufacturing segment of the supply chain. This broad definition of the dairy industry allows us to explore how the two (farm and processing) build off each other and how the success of each depends on the other. The report is composed of several sections including historical trend analysis, economic cluster analysis, and assessment of dairy's contribution to the Wisconsin economy.

The historical analysis shows a continuing decline in the number of dairy farms and on-farm employment in Wisconsin, reflecting a shift toward larger, more efficient operations. Despite this, dairy farm GDP has remained stable due to increased productivity. There has been significant growth in the dairy processing sector, particularly cheese production, which now accounts for nearly 90% of the state's milk use. The expansion of dairy processing has increased employment in this sector, underscoring its importance as a key driver of economic growth and higher-paying jobs in Wisconsin.

The Wisconsin Dairy Industry

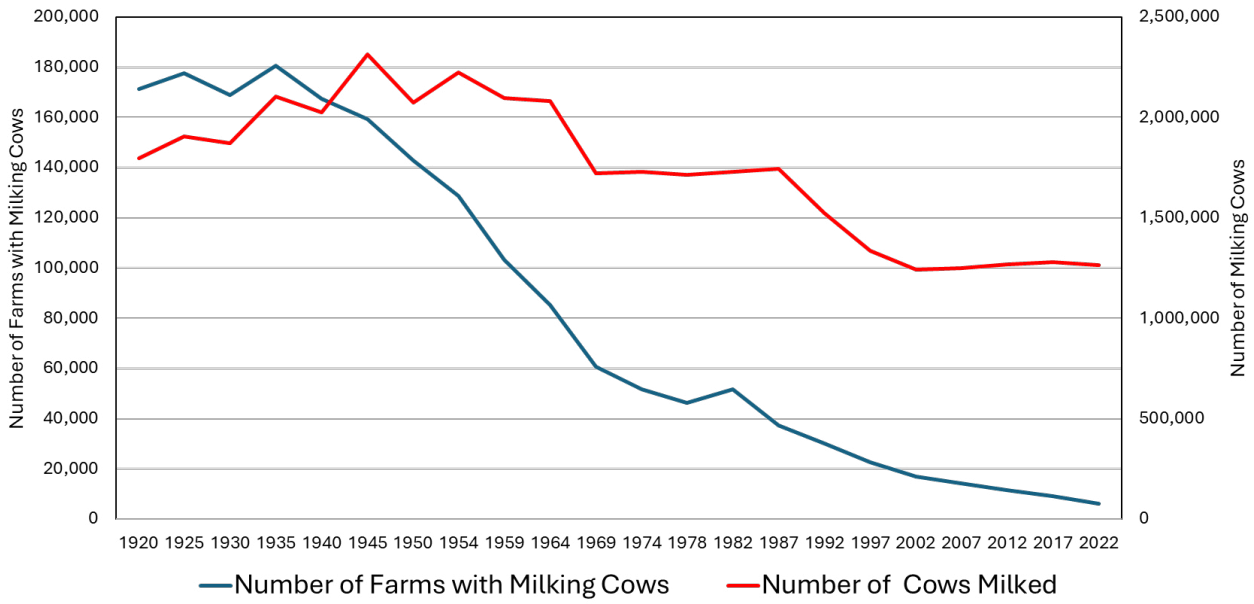
Before considering the contribution of dairy to the Wisconsin economy, it is important to explore general patterns within the industry. For this study, we include three components to this analysis: historical trends, spatial distribution patterns, and economic cluster analysis. Each is considered in turn.

Historical Trends

Based on the Census of Agriculture, over the past 100 years, there has been a steady and continued decline in the number of dairy farms, or more specifically, farms with dairy cows (Figure 1). Between 2017 and 2022, Wisconsin saw a significant decline in the number of dairy farms, from 9,304 to 6,533, a decrease of 29.8%. Over the past 25 years, the state lost 15,366 dairy farms, representing a 70.2% reduction since 1997. This rate of decline is faster than the national average, which experienced a 64.5% decrease in dairy farms over the same period. Despite

the decline in dairy farms, the number of dairy cows in Wisconsin decreased only slightly, from 1,280,395 in 2017 to 1,264,272 in 2022, a reduction of 16,123 head or 1.3%. Indeed, considering longer-term trends, the number of milking cows has been relatively stable over the past two decades (Figure 1). During the same period, total milk production in the state increased by 5.9%, from 30.3 billion pounds to 32.1 billion pounds. National milk production had an increase of 4.4% over the same period.

Figure 1 Wisconsin Dairy Trends

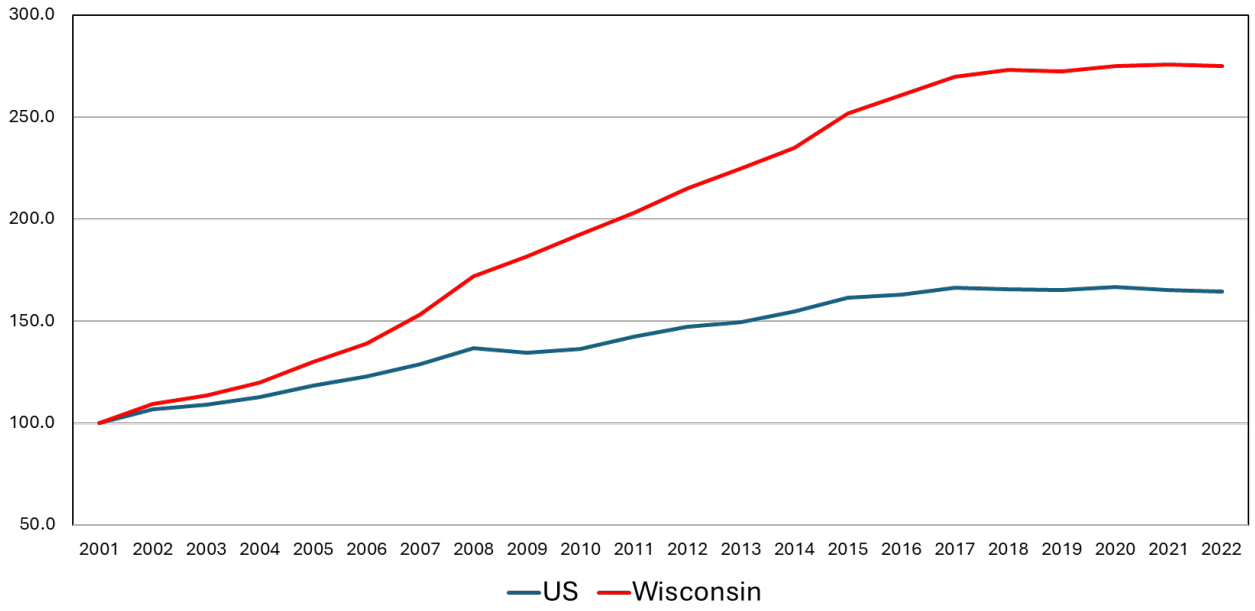


Source: USDA Census of Agriculture

These trends indicate a clear consolidation within the dairy industry, where fewer, larger farms are producing more milk with a relatively stable cow population. For example, from 1920 to just after WWII (1945) the average number of milking cows per farm was about twelve, which increased over each five-year Census period by about six animals. In 2007, the average milking herd size increased to 88 cows. Since 2007, the rate of growth increase in average herd size accelerated, resulting in an average of 203 milking cows in 2022. There are two fundamental drivers of these long-term changes. First, the nature of farming in Wisconsin, and across the nation, fundamentally changed with most farms becoming more specialized in operations. From the 1920s to the 1960s, it was common for most farms in Wisconsin to have at least a handful of milking cows. As farms specialized, owning only a handful of milk cows was not economically viable. Second, as farms specialized, the efficiency gains and increased production capabilities of larger operations drove significant consolidation in dairy farming. This is evident not only in the average milking cow herd size but also in the rising milk production figures despite the decrease in the number of farms and slight decline in cow numbers. This consolidation is attributed to economic pressures, technological advancements, and changing market dynamics that favor larger and more efficient dairy operations.

Tracking dairy farm employment over the long-term, unfortunately, is difficult because of how employment data is collected and reported at the national and state levels. The predominate source of employment data is the Quarterly Census of Employment and Wages (QCEW) which tracks data on employment and wages for workers covered by state and federal unemployment insurance programs. As such, many dairy farmers that are structured as proprietorships are not included in the QCEW. Larger dairy farms (those with paid employees), however, are more likely to be captured in QCEW data. Looking at these QCEW data for Wisconsin (and U.S.) dairy farms, there is strong employment growth from 2001 to 2018, at which point the growth stabilizes (Figure 2). The upward growth in dairy farm employment reflects the growth in larger dairy farms across Wisconsin. Indeed, compared to the U.S., the growth in larger dairy farms is more pronounced. This is likely due to accelerated rates of dairy farm consolidation relative to the rest of the U.S.

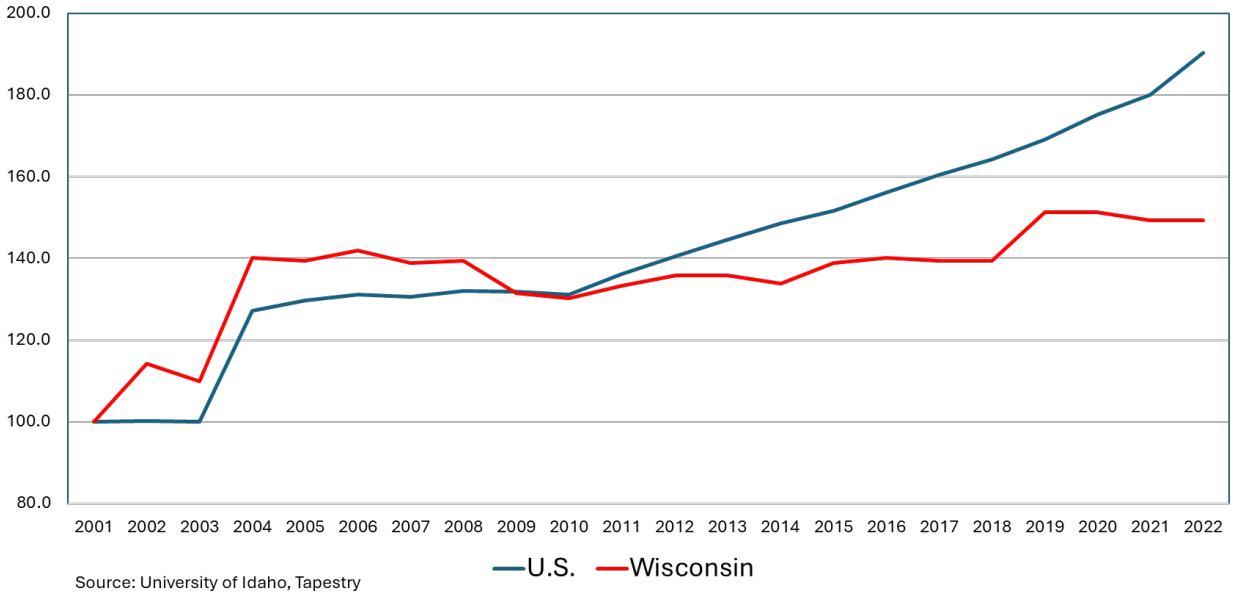
Figure 2 QCEW Dairy Farm Employment



Source: BLS QCEW

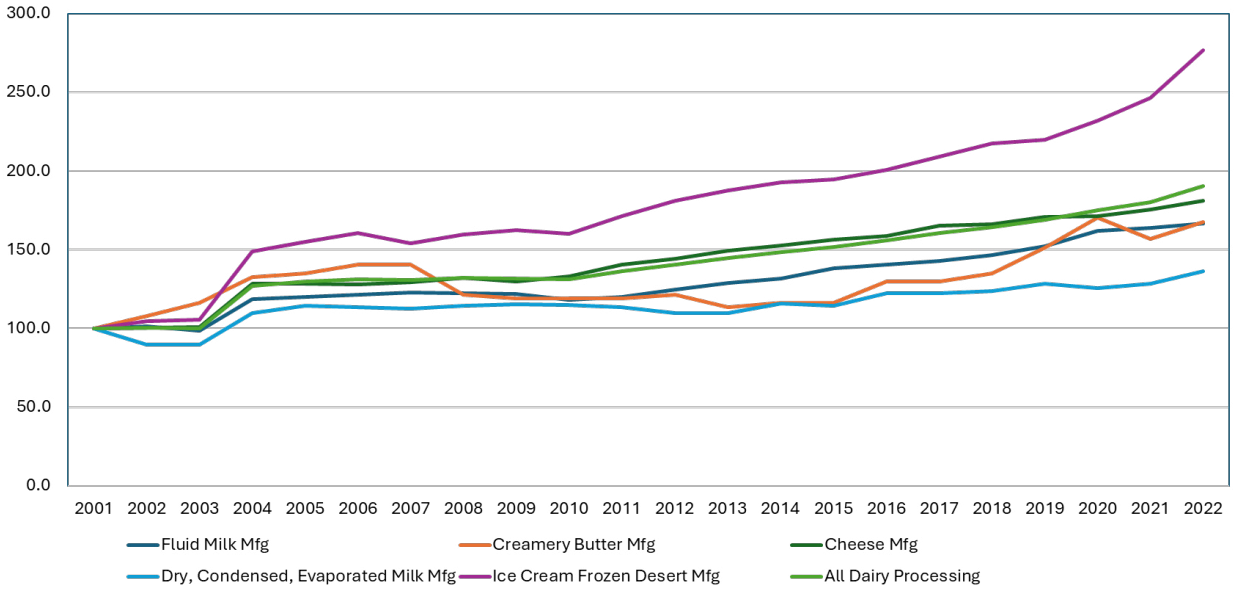
Wisconsin's dairy processing sector has shown resilience and growth, particularly in cheese production, which absorbs nearly 90% of the state's milk. From 2001 to 2022, the number of dairy processing firms in Wisconsin increased from 162 to 242, representing a 49.4% growth (Figure 3). This expansion underscores the increasing importance of value-added processing activities within the state's dairy sector. This reflects changes in how consumers in the U.S. consume milk products: Over time the demand for fluid milk has declined while at the same time the demand for cheese and yogurt has grown. Some have suggested that people no longer drink dairy, rather they eat dairy. When compared to the rest of the nation, however, the growth in Wisconsin dairy processing has been more modest. For the U.S. over this period, there has been growth in nearly all types of dairy processing, with particularly strong growth in ice cream and frozen dessert manufacturing (Figure 4).

Figure 3 All Dairy Processing Establishments Growth Index



Source: University of Idaho, Tapestry

Figure 4 U.S. Dairy Processing Establishments Growth Index

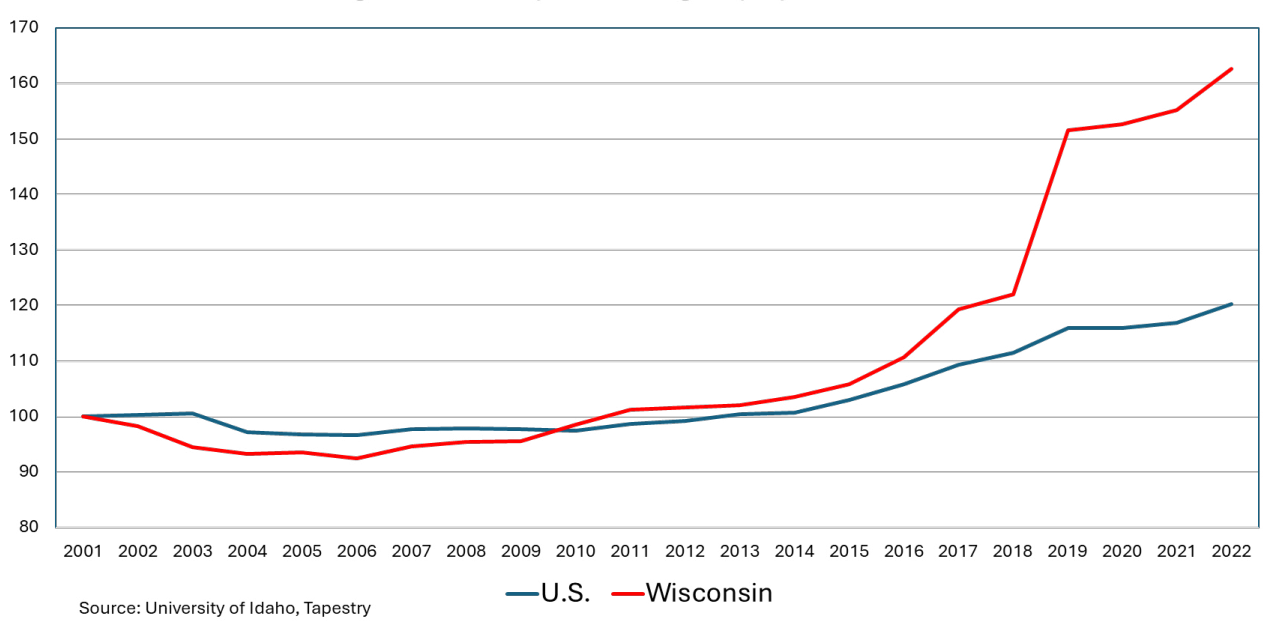


Source: University of Idaho, Tapestry

When considering employment growth in dairy processing, the strength of dairy processing in Wisconsin is more evident, particularly over the last eight years (Figure 5). We can gain additional insights into the growth of dairy processing employment by exploring the individual sectors that comprise dairy processing (Figure 6). Before examining these trends, it is important to note that in Wisconsin dairy processing is dominated by cheese, which in 2022 accounted for 80.1% of employment. Whereas dry, condensed and evaporated milk manufacturing accounted for 10.5%, and each of the remaining three dairy processing sectors accounted for less than five percent of employment: fluid milk (4.1%), butter (3.8%), and ice cream and frozen dessert (1.5%). Here, when examining employment growth across these sectors, it is possible that small changes can appear to be significant gains. Consider, for example, ice cream and frozen dessert manufacturing which largely experienced a downward trend throughout most of the 2001 to 2022 period. But starting in 2020, there was noticeable growth, and the industry went from 228 jobs in 2020 to 416 jobs in 2022, an increase of 82.4%. When one reconsiders that this component of dairy processing accounts for 1.5% of dairy processing employment, this gain could be considered more modest.

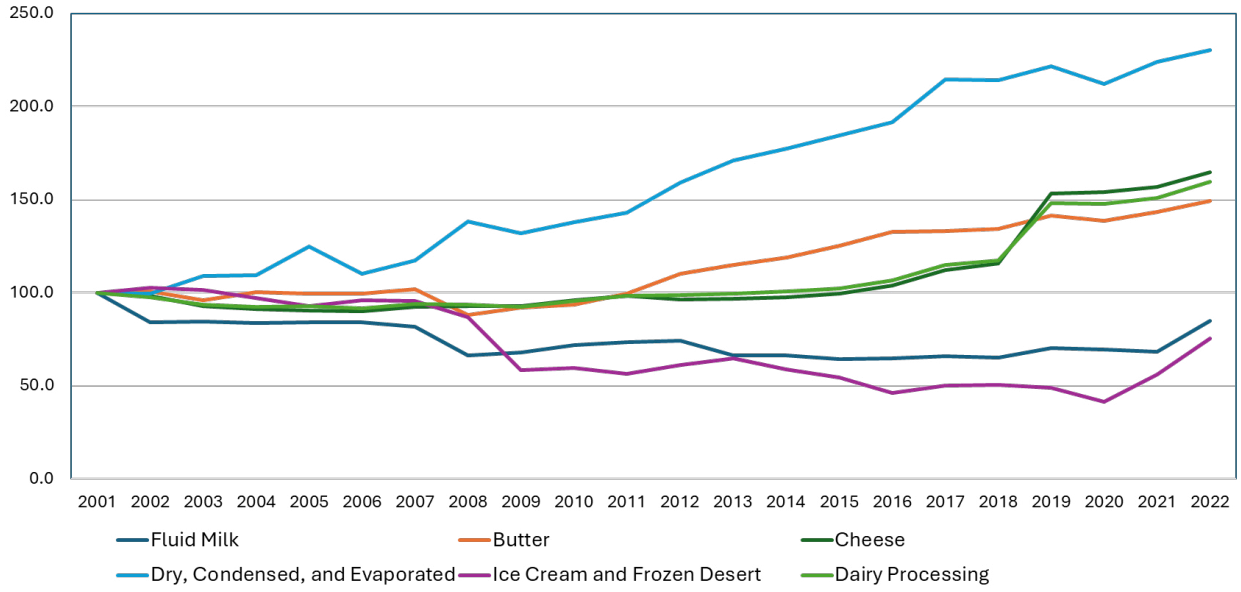
Dry, condensed, and evaporated milk processing experienced steady growth over the 2001 to 2022 period and butter manufacturing employment from about 2011 to 2022. But the noticeable jump in employment in dairy processing observed in Figure 5 mostly came from an increase in cheese production. When looking at on-farm dairy operations along with dairy processing, it is evident that the growth in the Wisconsin dairy industry was driven by growth in dairy processing.

Figure 5 All Dairy Processing Employment Growth Index



Source: University of Idaho, Tapestry

Figure 6 Wisconsin Dairy Processing Employment Growth Index



Source: University of Idaho, Tapestry

Spatial Distribution Patterns

The Wisconsin dairy industry does not function in isolation and is part of a larger national and international market. In 2023, Wisconsin dairy exports into international markets were $518 million with the largest market being Canada ($117 million) followed by China ($96 million). Dairy (cheese, whey, lactose, and milk proteins) accounted for 13% of Wisconsin's $3.9 billion in agricultural product exports into international markets. In addition to international exports, much of Wisconsin's dairy production is exported out of Wisconsin to other U.S. states. While dairy farming is concentrated in rural counties, its economic influence reaches urban areas through dairy processing plants. For instance, this interstate trade supports urban-based cheese manufacturing plants in cities such as Green Bay and Appleton, which depend on rural farms for their milk supply and create high-paying jobs. Data on these flows, however, are more difficult to track as interstate trade is largely open. There are estimates integrated into the regional economic modeling system (IMPLAN) used in this study. While on face value, these trade estimates appear detailed, they are gross estimates and should be interpreted in relative levels. For example, IMPLAN estimates that only 1.9% of dairy farm products (milk) are shipped out of Wisconsin and much of this would be to processors that are located just across state lines. Dairy processing, however, ships significantly more outside of Wisconsin. For example, about 70% of cheese production is shipped out of Wisconsin to other U.S. states, and about an equal share (68%) of dry, condensed and evaporated dairy products are shipped out of Wisconsin.

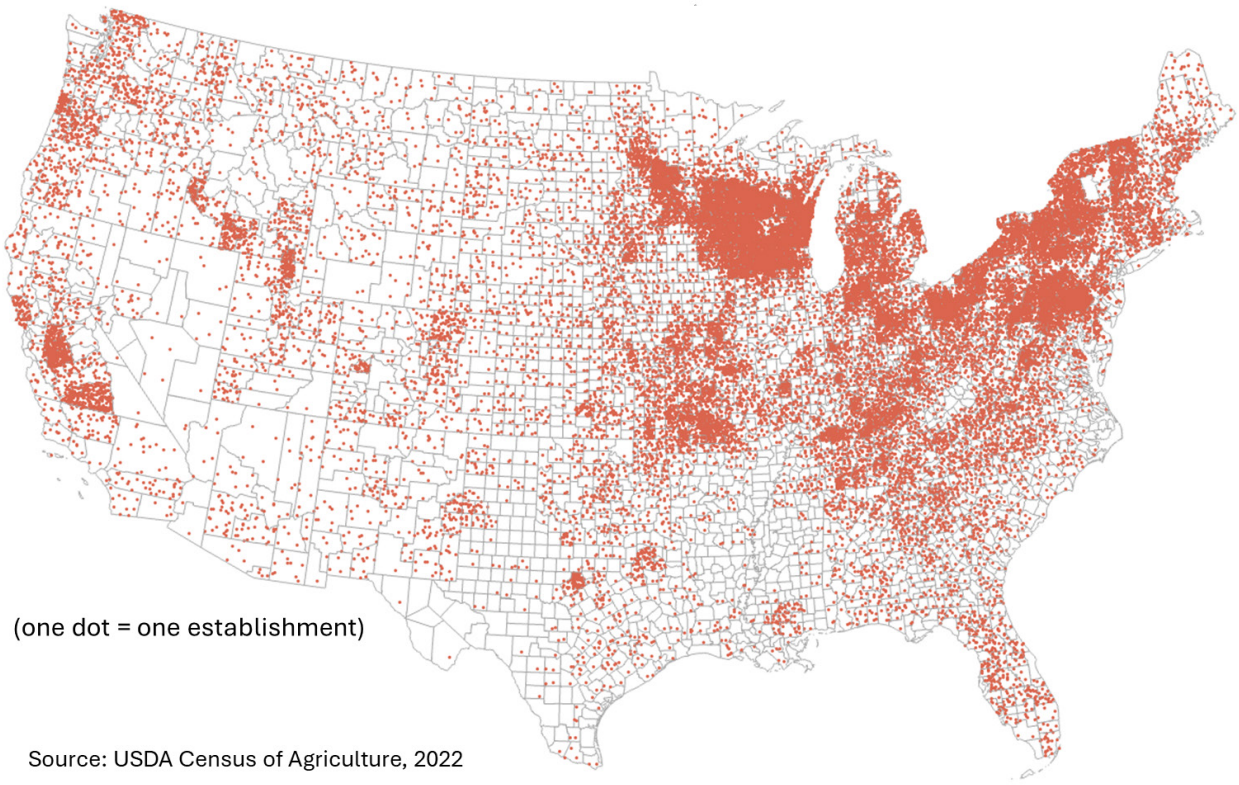
Wisconsin's dairy industry also plays an important role in international trade. The state's growing cheese export market to countries like Canada, Mexico and China has strengthened Wisconsin's position in global markets, driving economic growth through increased

demand for high-quality dairy products. Over recent years, there has been a positive relationship between the percentage growth in dairy exports and farm return on assets (ROA). In years with strong export growth, Wisconsin dairy farms experience improved profitability. This global competitiveness underscores the importance of supporting policies that enhance Wisconsin's dairy exports. Indeed, almost one-quarter of the latter dairy value-added production is shipped to international markets. This flow across state lines is a two-way street with dairy products also flowing into Wisconsin. For example, IMPLAN estimates that nearly $3.2 billion worth of milk is shipped into Wisconsin with much of this flowing to dairy processers (e.g., cheese). Estimates suggest that much of this inflow comes from dairy farms located in Minnesota and to a lesser extent Illinois, Iowa, and Michigan. Some milk, however, is shipped much greater distances. For example, a sizable share of organic milk is shipped in from Texas (Milwaukee Journal Sentinel, March 23, 2018).

One way to better understand the density of Wisconsin dairy within the larger U.S. market is to explore the spatial distribution of dairy farms and businesses. Consider the distribution of dairy farms using 2022 Census of Agriculture data (Figures 7a and 7b). Using a "dot density" map (Figure 7a) two patterns are clear in the data: First, there is at least one dairy farm located in almost every county in the U.S. and second, there are areas with higher density of dairy farms with obvious spatial clusters in Wisconsin. Among the highest density areas in Wisconsin is the East Central region (which runs from Fond Du Lac and Sheboygan to Brown and Door counties) which plays a pivotal role as a major dairy hub. Its combination of geographic advantages, including fertile land and proximity to urban labor markets, makes it ideal for both dairy production and processing. Cities like Green Bay and Appleton provide a skilled workforce for processing plants, while nearby farms supply fresh milk, making this region a central player in Wisconsin's cheese production. The proximity of farms to processing plants reduces transportation costs and improves efficiency, reinforcing the importance of this region in Wisconsin's dairy economy. Aggregating the number of dairy farms into graduated scales a clearer pattern in dairy farm density becomes apparent (Figure 7b). Clearly, there are high concentrations of dairy farms in Wisconsin, as well as parts of Minnesota, Pennsylvania, New York, and the western parts of New England (e.g. Vermont). There are also pockets along the west coast. Note that this mapping is simply a count of the number of dairy farms and does not account for the size of the farm (e.g., number of cows or sales).

While these patterns appear intuitive and expected, we can gain further insights by rigorously testing for spatial patterns using a method referred to as "optimized outlier analysis". Such an analysis for dairy farms is provided in Figure 7c. Looking across the five possible outcomes, finer insights can be gained. For example, there are large swaths of the U.S., in particular the Mountain West and parts of the Corn Belt (e.g., Iowa), where the spatial patterns observed in Figures 7a and 7b are not statistically significant: We can draw no inferences about the spatial patterns in these regions. Large parts of the southern U.S. through much of the Great Plains are classified as "low-low" which means that counties with a relatively low number of dairy farms are adjacent to other counties that have a relatively low number of dairy farms. Note that within this large geographic region, a handful of counties have a relatively large number of dairy farms but are surrounded by counties with few farms. These counties are highlighted in red on the map. Note, for example, there is a small cluster of counties in North Central Florida that has a high concentration of dairy farms.

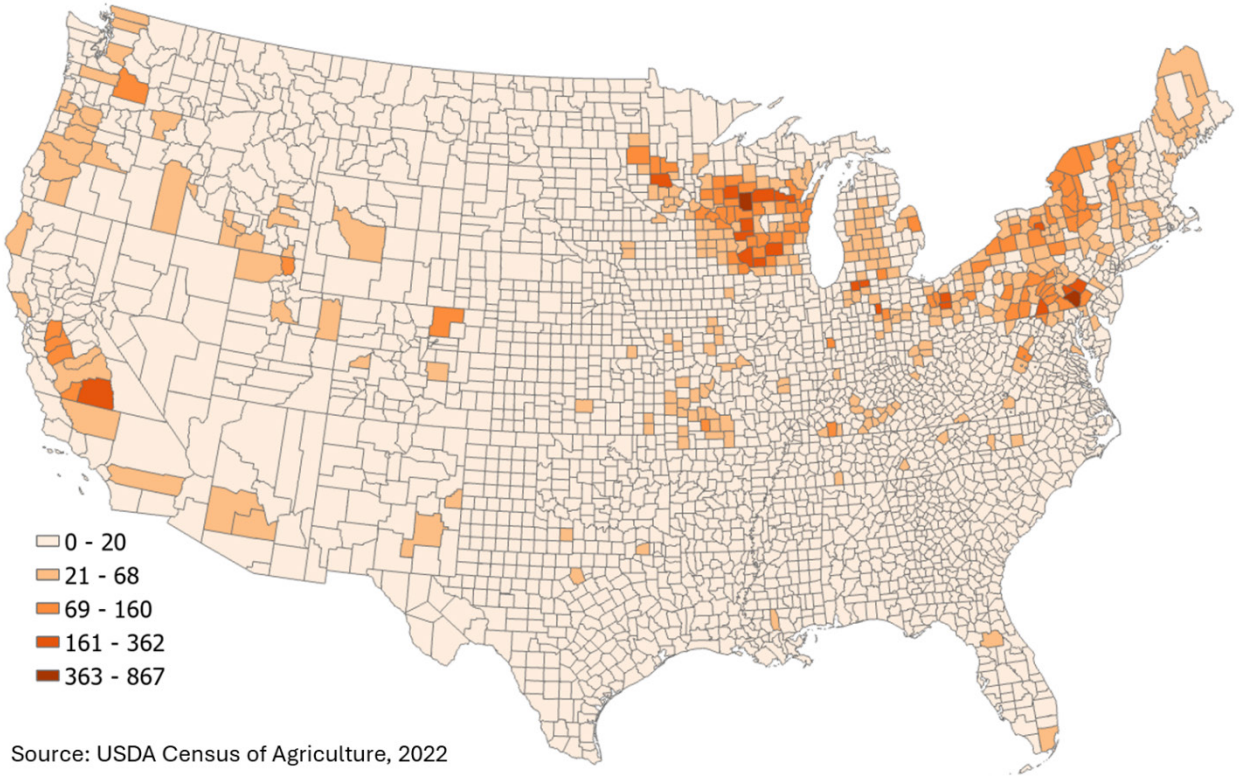
Figure 7a Number of Dairy Farm Operations



(one dot = one establishment)

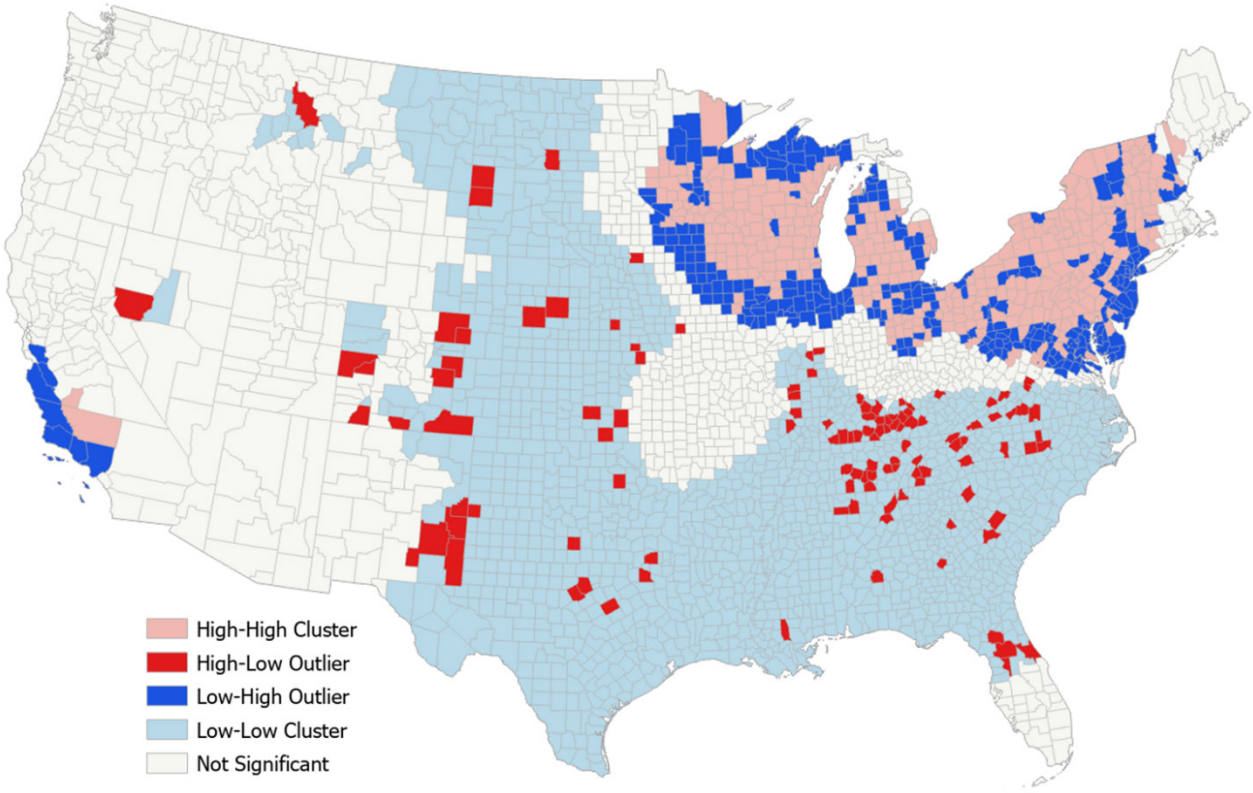
Source: USDA Census of Agriculture, 2022

Figure 7b Density of Dairy Farm Operations



Source: USDA Census of Agriculture, 2022

Figure 7c Number of Dairy Farm Operations Spatial Clustering

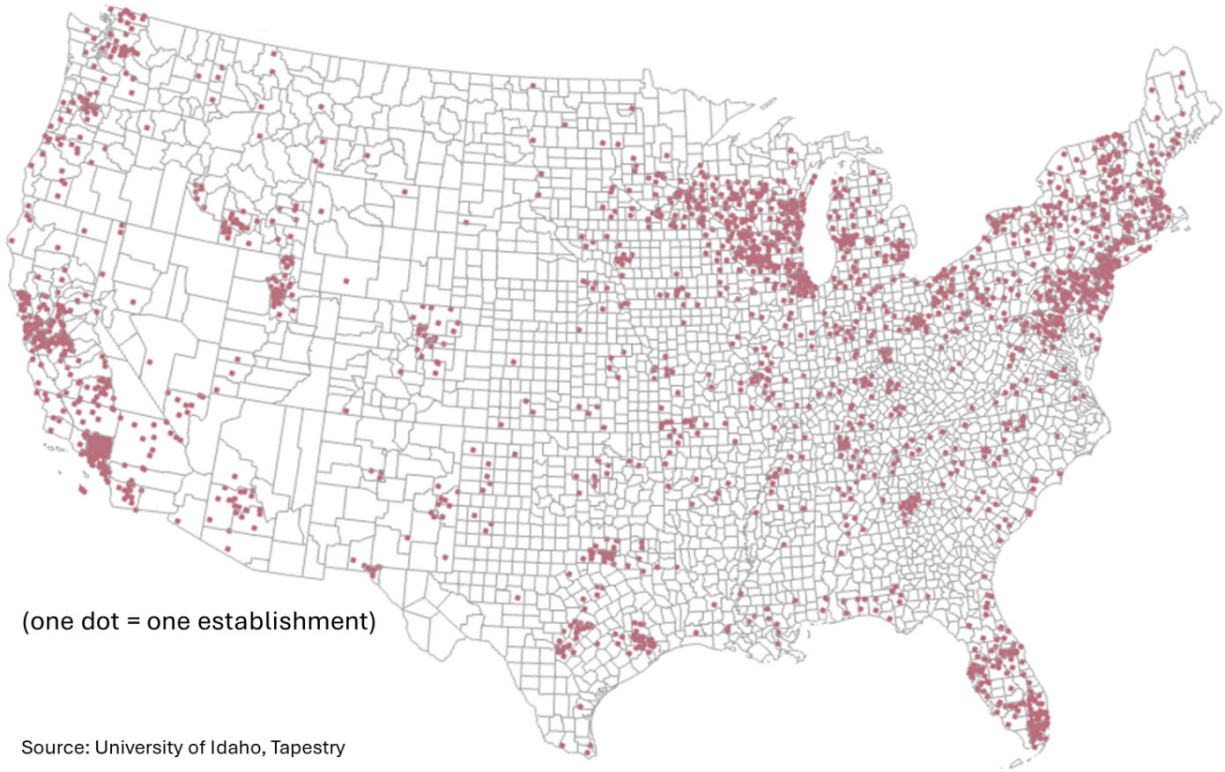


Most Wisconsin counties can be widely characterized with a high concentration of dairy farms adjacent to other counties with a high concentration of dairy farms. These counties are highlighted in a light salmon color. This spatial cluster spreads from eastern Minnesota eastward to parts of the Mid-Atlantic region through western New England (e.g., Vermont). There is one region in California, the Central Valley, particularly in regions like Tulare, Merced, and Stanislaus counties, which are considered a dairy farm spatial hotspot. The final type of county is highlighted in blue and can be best described as counties with relatively low numbers of dairy farms that are adjacent to counties with a high concentration. Note, for example, the large number of counties along the Mid-Atlantic coastal region: These tend to be larger urban population centers where there are some dairy farms but on the edge of dairy farm hotspots. Urban legislators should take note of how Wisconsin's dairy industry impacts not only rural economies but also urban centers. Investments in rural dairy infrastructure, such as improved transportation networks and broadband access, have direct benefits for urban economies. These improvements ensure that urban-based dairy processing firms, particularly in cities like Milwaukee, can operate efficiently, reduce costs, and create higher-paying jobs. Supporting rural dairy development is therefore an investment in the broader state economy.

A complementary analysis for dairy processing businesses (establishments), which includes the different types of dairy processing identified in Figure 4 is provided in Figures 8a, 8b, and 8c. The spatial pattern of dairy processing firms appears to mimic the distribution of dairy farms. This matches economic intuition because of the historical costs associated with transporting milk

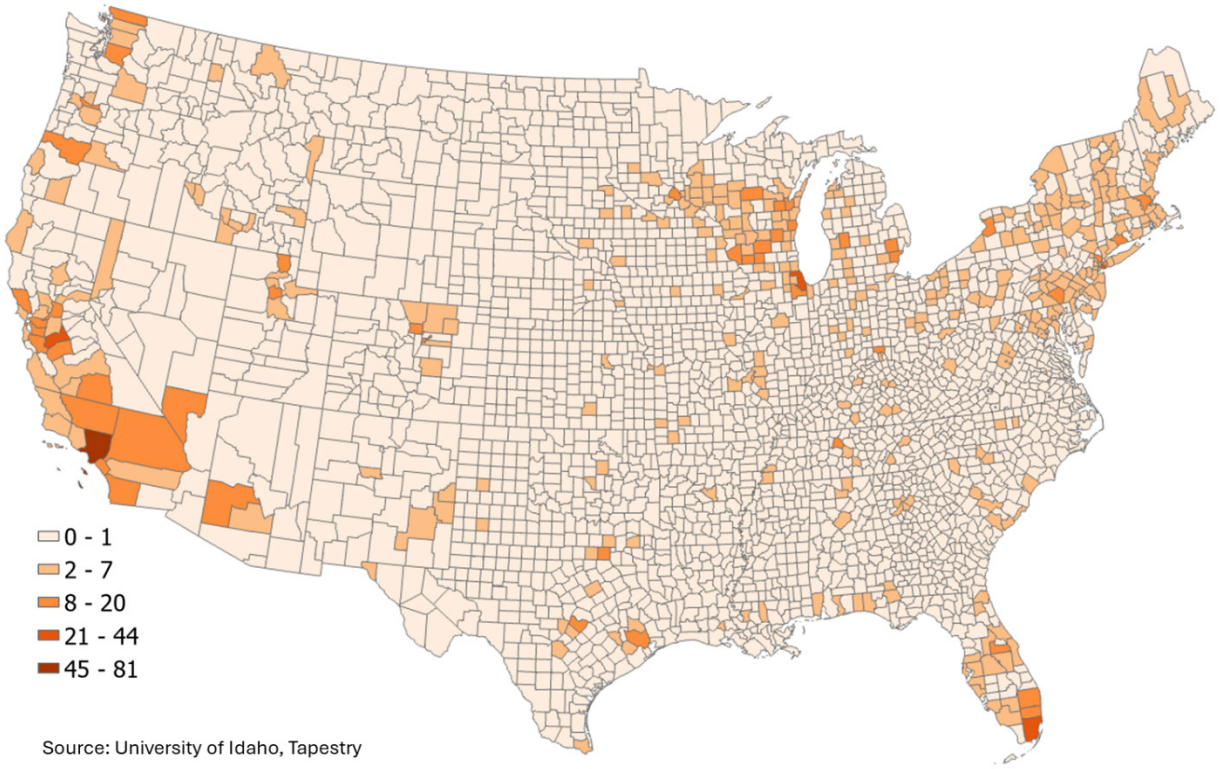
from farms to processors. The economic impact of Wisconsin's dairy industry is not confined to rural areas. Urban economies benefit significantly from dairy-related jobs in processing, logistics, and services. For instance, the dairy industry supports well-paying jobs in metropolitan areas such as Milwaukee and Green Bay, where processing plants and related industries contribute to local economic growth. The demand for value-added dairy products, such as specialty cheeses, further boosts urban employment and supports local businesses. To minimize the costs of shipping bulky and heavy milk, processors selected locations close to high concentrations of dairy farms. But a casual examination of the establishment counts (Figure 8a and 8b) reveals that there appear to be areas with a high concentration of dairy processors, where there is no corresponding concentration of dairy farms, such as much of the lower half of Florida. Turning attention to the "optimized outlier analysis", there is a noticeably larger number of "high-low outliers" (highlighted in red), particularly in the southern U.S.

Figure 8a Number of Dairy Farm Operations



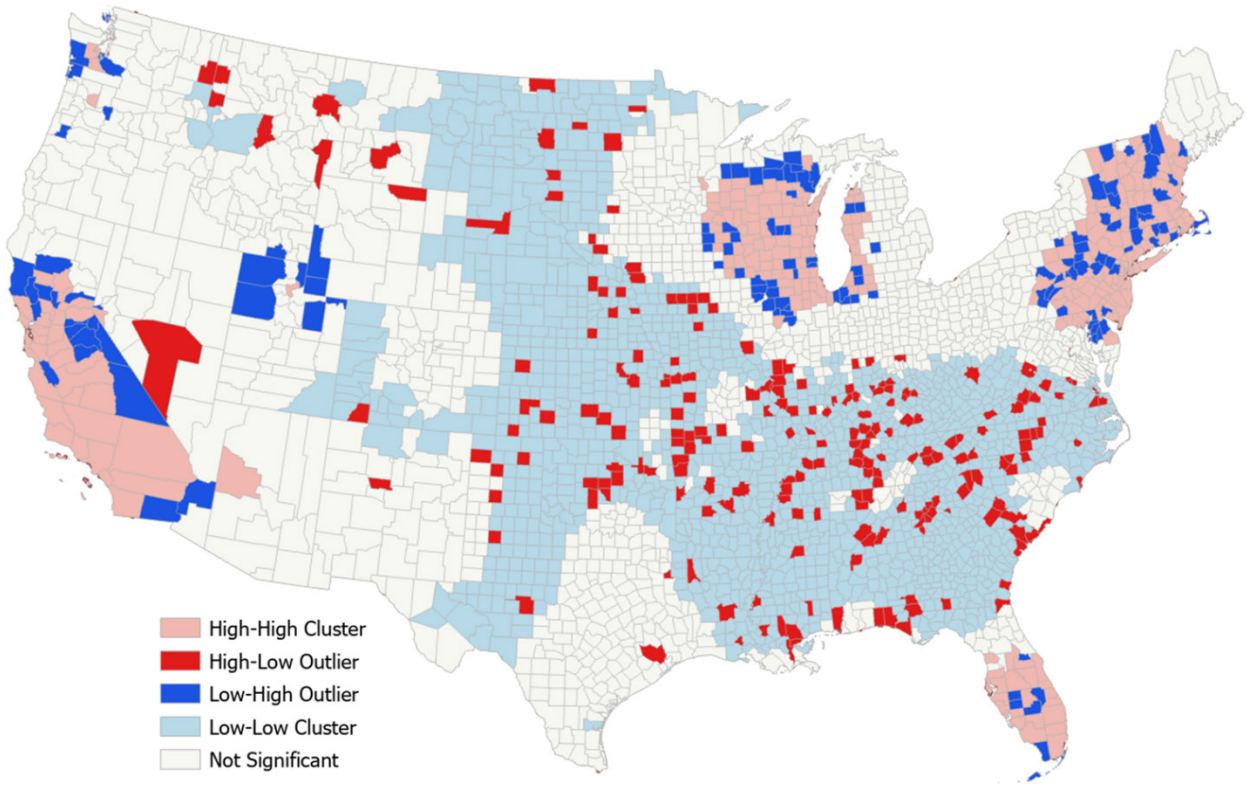
Source: University of Idaho, Tapestry

Figure 8b Density of Dairy Processing Establishments



Source: University of Idaho, Tapestry

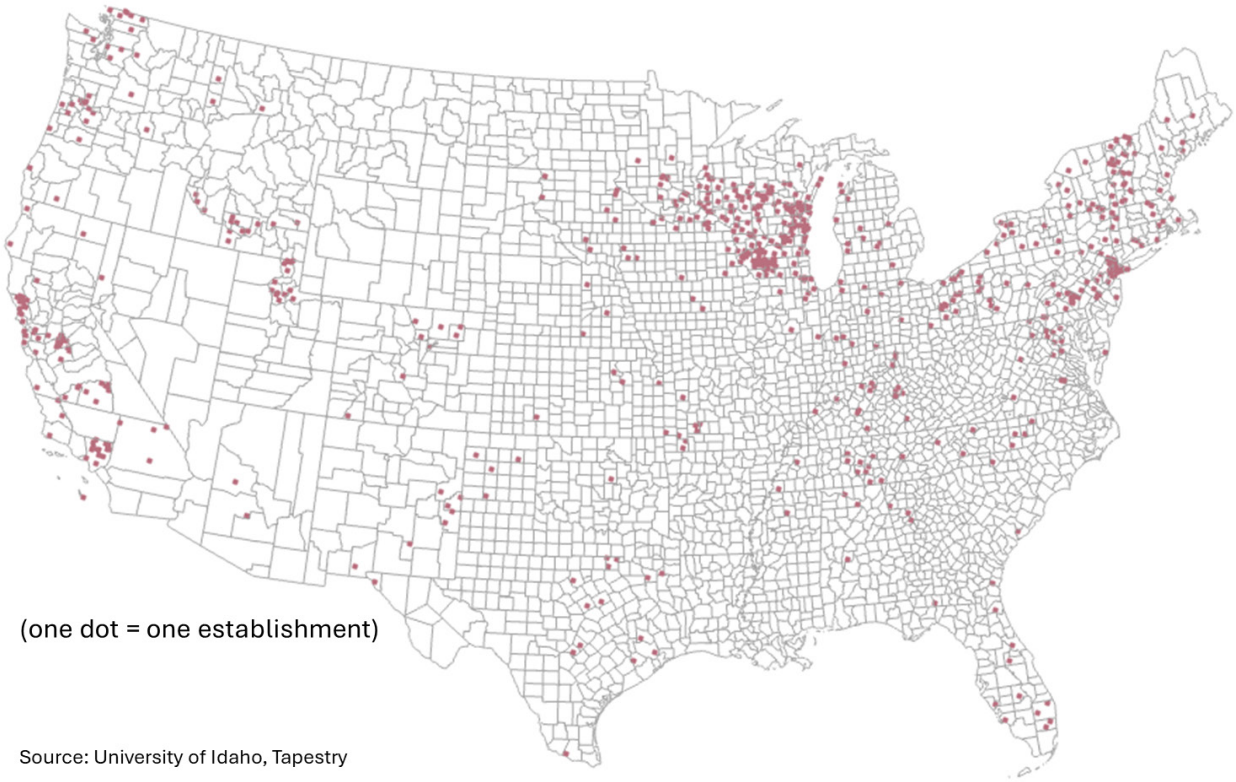
Figure 8c Number of Dairy Processing Establishments Spatial Clustering



There are two reasons for the relatively large number of dairy processing establishments that are geographically distinct from dairy farms. First, advances in transportation technology have lowered the costs of transporting milk. For example, advances in refrigerated transportation technology and the use of evaporated and condensed milk made transporting milk more feasible. The latter significantly reduces the volume and weight of milk used in dairy processing, reducing the need for processors to be near dairy farms. Second, for some types of dairy products, such as fluid milk for drinking and ice cream, proximity to customers takes on a greater importance. The market demands in central and southern Florida for dairy products, coupled with the cluster of dairy farms in north central Florida, explains the location patterns observed in Florida. Also, many of the "high-low outliers" (red) tend to be larger more urban counties where the density of customer markets matter. In summary, there are four regions across the U.S. that could be considered dairy processing clusters: southern Florida, much of California, the upper Mid-Atlantic states through New England (excluding Maine), and Wisconsin.

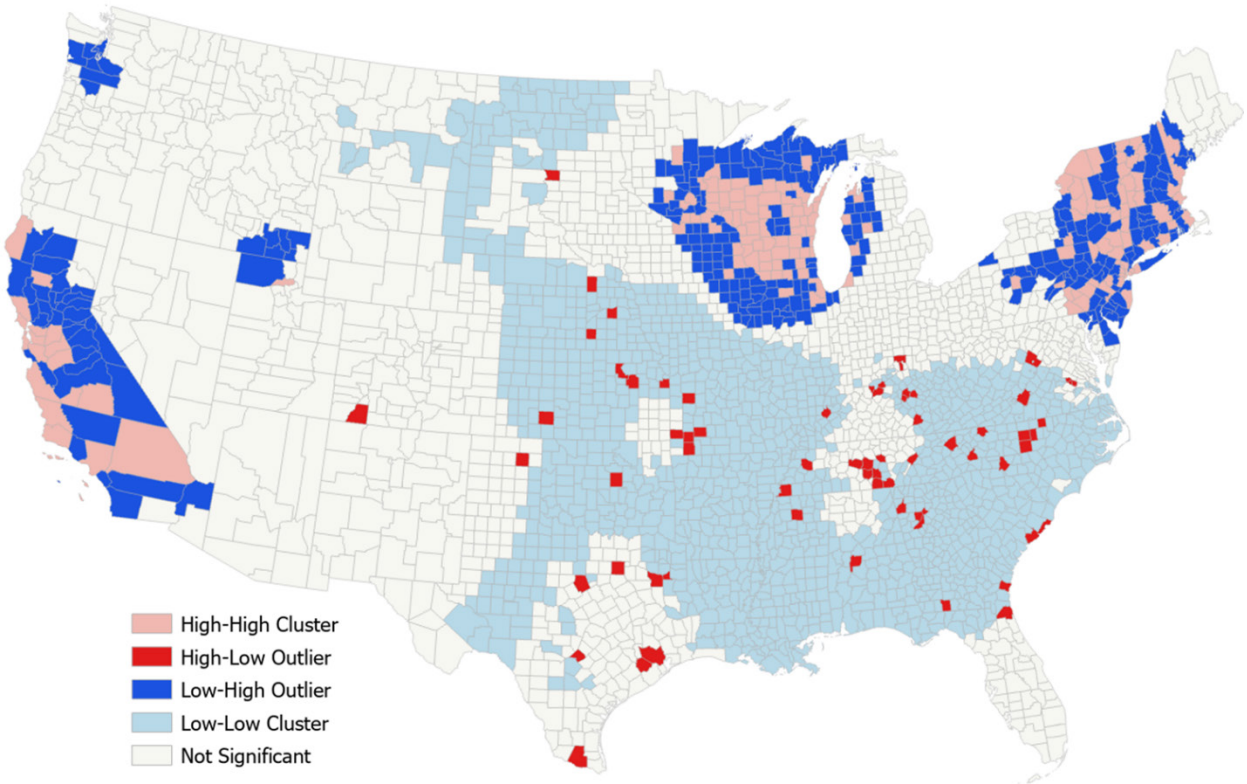
For Wisconsin dairy, processing is dominated by cheese production, and a simple dot-density mapping of the location of cheese processing establishments (Figure 9a) clearly demonstrates the spatial clustering of cheese establishments in and around Wisconsin. The spatial clustering of dairy processing plants, particularly cheese manufacturers, reflects the geographic proximity of dairy farms. By locating near milk producers, these plants reduce transportation costs and ensure a steady supply of milk. Wisconsin's leadership in cheese production is driven by this geographic advantage, positioning the state as a leader in both national and international dairy markets. This strategic positioning helps sustain Wisconsin's competitive edge in dairy processing, particularly in value-added products such as cheese. Looking across the nation, there are three parts of the U.S. with spatial clustering of cheese processors: Wisconsin, the upper Mid-Atlantic and New England, and California (Figure 9b). This matches the spatial cluster analysis above. There are fewer high-low counties (red) that might be linked to urban markets. These spatial patterns make sense when considering transportation costs: Transporting cheese is cheaper than milk. This is sometimes referred to as a "weight-losing process" where the weight of inputs is higher than the weight of outputs. Industries that can be described in this way tend to locate closer to input suppliers, or in this case, dairy farmers.

Figure 9a Number of Cheese Processing Establishments



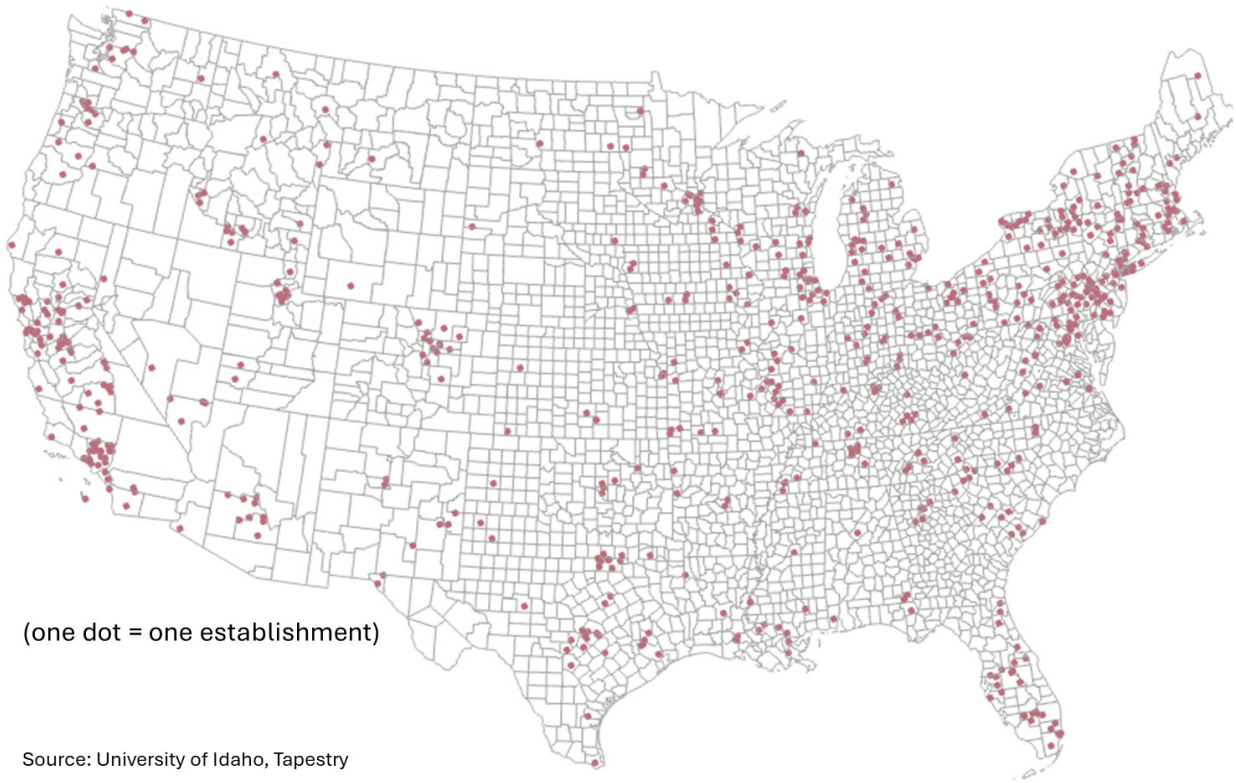
Source: University of Idaho, Tapestry

Figure 9b Number of Cheese Processing Establishments Spatial Clustering



We complete the locational analysis of dairy processing with simple dot-density maps for fluid milk (Figure 10a), creamy butter (Figure 10b), dry, condensed, and evaporated milk (Figure 10c), and ice cream and frozen desserts (Figure 10d). There are logical patterns in the location of each of these different types of dairy processing establishments that help better understand the nature of the industry. Fluid milk establishments face a challenge balancing costs of shipping bulk milk to the facility and then packaged milk to customers. Note, for example, the density of fluid milk establishments in urban markets such as Chicago and the Twin Cities. There are also clusters in the Washington D.C. to Boston corridor, Los Angeles, central California (e.g., San Fransico region), and Denver, all areas associated with higher population concentrations. This pattern in the demand for fluid milk coupled with transportation costs helps explain why there is a dairy farm in nearly every county in the U.S. (Figure 7a). While there are remarkably few standalone butter processing establishments, there is a clear spatial clustering of dry, condensed, and evaporated milk establishments predominately in Wisconsin and a few clusters in California, around the New York City region, and a few others. The role of access to customers (i.e., large urban markets) is clearest in the locational patterns of ice cream and frozen desserts. Here larger urban areas are easily identifiable (e.g., Los Angeles, San Fransico, Houston and Dallas, Chicago, Detroit, Atlanta, and the Washington D.C. to Boston corridor). Perhaps most interesting is the very high concentration of ice cream and frozen desserts in Florida (central and southern). Indeed, the identification of the spatial cluster of dairy processing in Florida (Figure 8c) is largely explained by the high concentration of ice cream and frozen dessert establishments. Given the population densities, the tourist economy, and the climate of Florida, this pattern is easily understood.

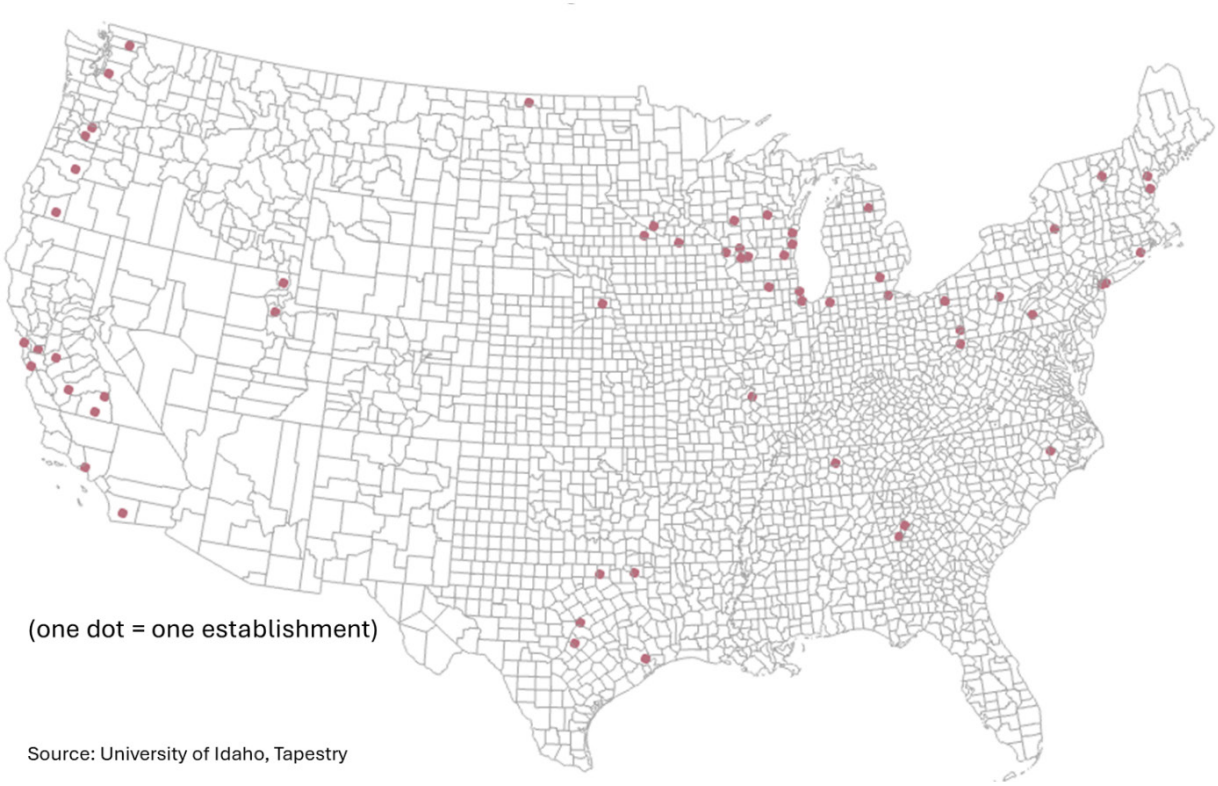
Figure 10a Number of Fluid Milk Establishments



(one dot = one establishment)

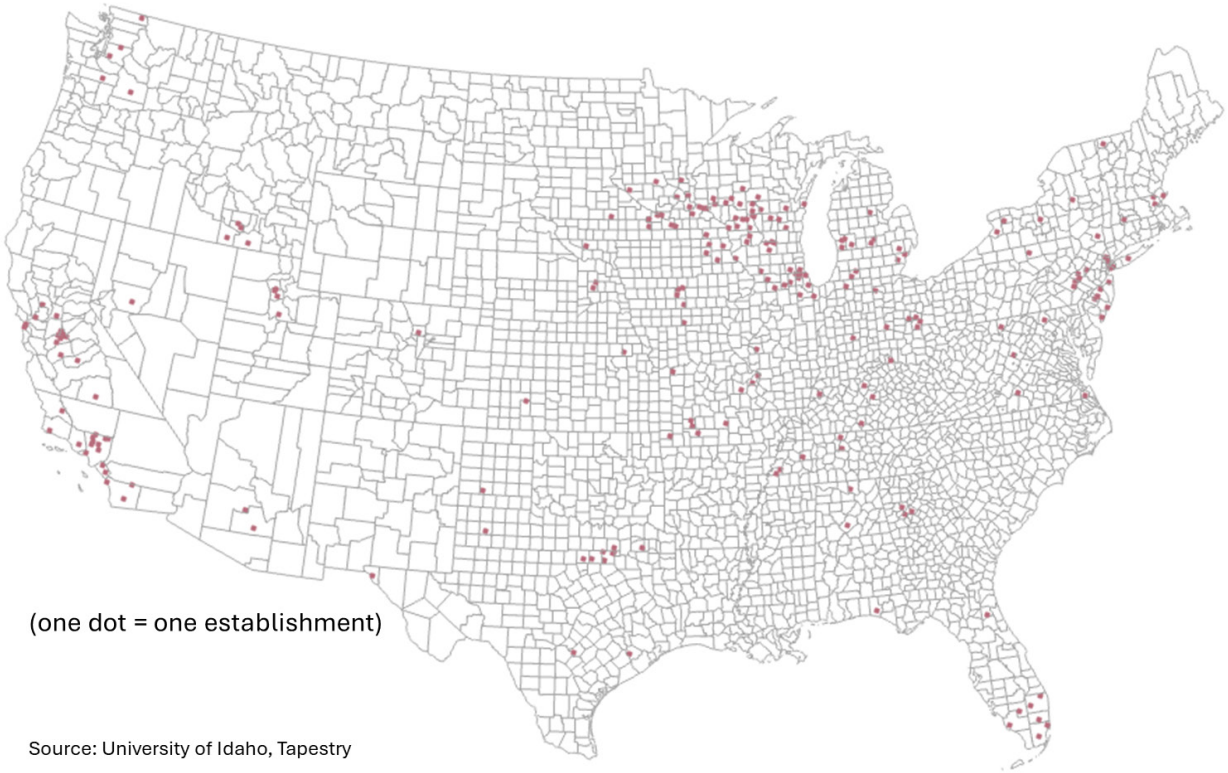
Source: University of Idaho, Tapestry

Figure 10b Number of Creamy Butter Establishments



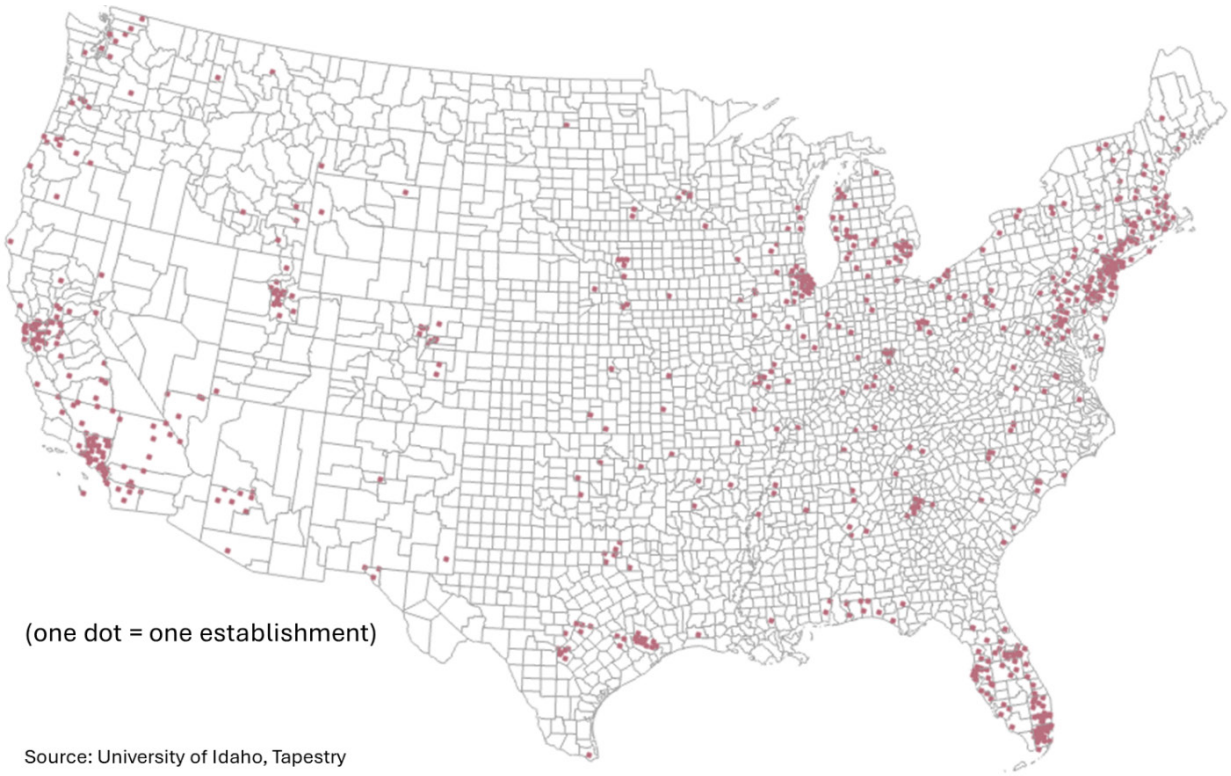
Source: University of Idaho, Tapestry

Figure 10c Number of Dry, Condensed, Evaporated Milk Establishments



Source: University of Idaho, Tapestry

Figure 10d Number of Ice Cream and Frozen Dessert Establishments



Source: University of Idaho, Tapestry

Dairy Cluster Analysis

As outlined in Deller and Hadachek (2024), Wisconsin state agencies charged with fostering economic growth and development have identified the dairy industry as a potential economic cluster. Economic clusters refer to geographic concentrations (e.g., cheese processing Figure 9a) of interconnected businesses, suppliers, and associated institutions in a particular industry. These clusters can foster innovation, increase productivity, and stimulate new business formation. Some alternative terms include "industry hubs" which are areas where businesses in the same industry work together, benefiting from shared resources and knowledge, "business ecosystems" which is a network of companies, research institutions, and government bodies interacting to drive economic growth and development, or "specialized economic zones", which are localized regions with a high concentration of related industries that boost economic performance and competitiveness. There are two key central themes: (1) a geographic concentration of similar types of businesses within a given industry and (2) the willingness of the various businesses and institutions to coordinate efforts, which advances all the industry. These coordinated efforts, however, cannot cross into collusion such as price setting or contract fixing which is illegal.

We follow the methods adopted by Deller and Hadachek (2024), which identified dairy in aggregate, as a strength of the Wisconsin agricultural economy and could be viewed as an economic cluster, to explore dairy in more detail. Here we use employment levels in different components of the Wisconsin dairy industry to compute Location Quotients (LQ) for two periods in time: 2001 and 2022, the most recent year of available data. A LQ is a simple way to measure how concentrated a particular industry, specifically different components of

dairy in Wisconsin compared to a larger region, like the whole country. If the LQ is greater than one (1), it means the industry is more concentrated in Wisconsin than in the larger region (U.S.). This can indicate that the area specializes in that industry. If the LQ is less than one, the industry is less concentrated in the area, suggesting it is less important there compared to the larger region. A simple method to identify potential economic clusters is to look at current values of the LQ, changes in the LQ over time, and the relative size of the industry.

In this approach there are four possible combinations of LQ and changes in the LQ over time. First, LQ is greater than one and the change is positive or the LQ is growing over time. Industries with these characteristics could be considered as potential economic clusters. Second, LQ is greater than one, but the change is negative or the LQ is declining over time. These industries might be considered a threat: The industry has a high concentration but is showing signs of weakness. Third, the LQ is less than one, but growing over time. These types of industries could be considered an opportunity: The industry does not have a particularly high concentration, but that concentration is growing. The final combination is a LQ less than one and declining over time. Industries that fit this combination are generally not considered focuses for economic development.

The relative size of the industry, generally measured as the percent of Wisconsin's total employment within the industry, is more difficult to interpret when identifying economic clusters. For example, Deller and Hadachek (2024) identified fur-bearing animal production (e.g., fur for clothing) as a strength (large and growing LQ), but the level of employment is very modest. While the LQ indicates a growing strength, the industry is perhaps too small to have a meaningful impact on the larger Wisconsin economy. The challenge in identifying viable economic clusters is what is a reasonable threshold level of employment? There is no generally accepted answer to this question.

The analysis of Wisconsin dairy industry is provided in Figure 11 and Table 1. Of the six components (subsectors) of the dairy industry, four are classified as a strength and growing, or potentially economic clusters and include on-farm dairy operations, cheese production, dry, condensed, and evaporated milk production, and fluid milk processing. For butter production, which has a very large LQ, the LQ is declining over the study period, suggesting that this component of dairy processing could be a threat. The final industry classified as part of dairy processing, ice cream, and frozen dessert processing is not necessarily a strength and relative to the U.S. is declining. When we look at the historical trends in employment coupled with the spatial distribution of dairy farms, cheese processing, and dry, condensed and evaporated milk, these results are expected.

Figure 11 Wisconsin Dairy Industry Cluster Analysis

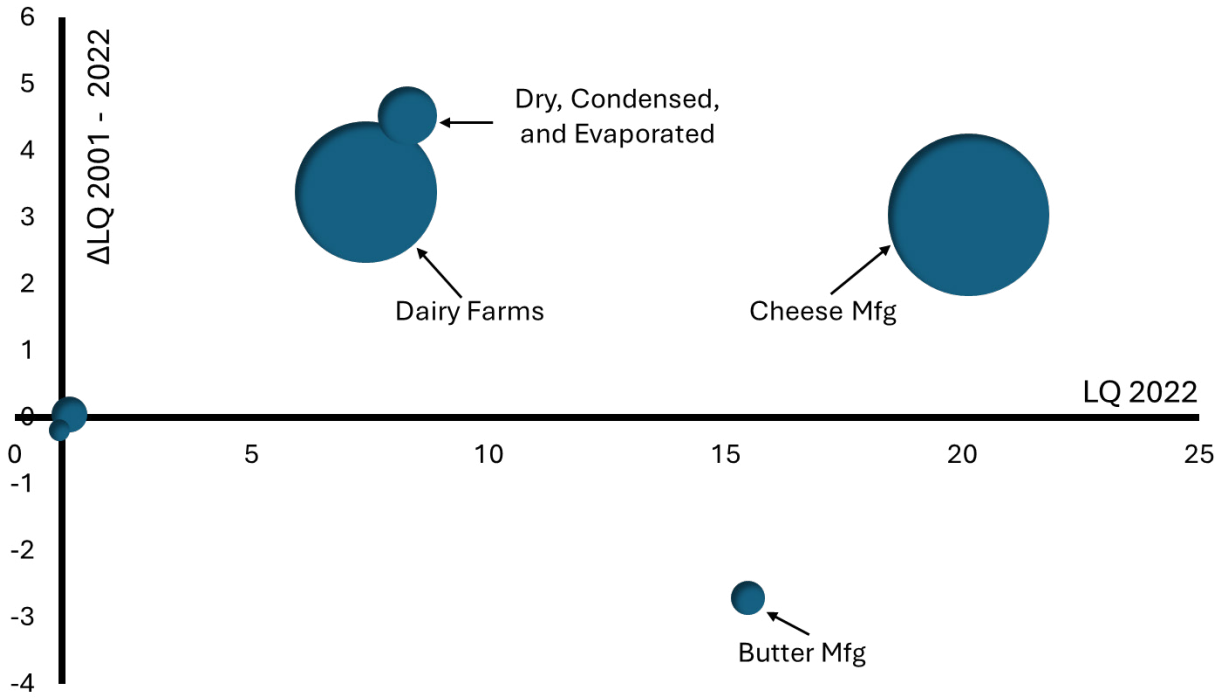


Table 1 Wisconsin Dairy Industry Cluster Analysis

	LQ 2022	Change LQ 2001-2022	Share of State Employment (%)
Potential Cluster			
Cheese	20.133	3.043	0.60%
Dry, Condensed, and Evaporated	8.288	4.531	0.08%
Dairy Cattle and Milk Production	7.415	3.381	0.46%
Fluid Milk	1.159	0.045	0.03%
Potential Threat			
Butter	15.477	-2.709	0.03%
Potential Opportunity			
Weakness-Declining			
Ice Cream and Frozen Desert	0.941	-0.189	0.01%

There are several strategies to enhance economic clusters including:

Foster Collaboration: Encourage partnerships among businesses, universities, and government agencies to drive innovation and share knowledge. Some scholars who have studied effective economic clusters maintain that the key to dynamic clusters is networking, which allows for enhanced flow of information, which in turn drives innovation. Examples include the Dairy Innovation Hub within the College of Agriculture and Life Sciences at the University of Wisconsin-Madison, leadership development efforts such as the programs offered by the Professional Dairy Producers of Wisconsin, or networking and professional development opportunities provided by the Wisconsin Cheese Makers Association, among others. A key element is coordination and cooperation amongst all the public institutions (e.g., UW and DATCP) and business/industry organizations (e.g., Dairy Business Association, Professional Dairy Producers of Wisconsin, Wisconsin Dairy Products Association, and the Wisconsin Cheese Makers Association, among others).

Invest in Infrastructure: Develop transportation, communication, and technology infrastructure to support efficient operations within the cluster. For example, access to broadband internet is becoming necessary for a competitive dairy industry and under the federal Broadband Equity Access and Deployment Program (BEAD) many communities across Wisconsin are partnering to build out the broadband infrastructure. An effective cluster would ensure that dairy representatives are involved in these investment decisions.

Promote Workforce Development: Invest in education and training programs to ensure a skilled workforce tailored to the cluster's needs. For the dairy cluster to ensure dynamic growth and development there must be not only a continuous flow of new workers entering the industry, but also constant professional development opportunities. In addition to the professional development opportunities offered by the various dairy organizations referred to above and educational programs offered through the University of Wisconsin (e.g. the dairy science program at UW-River Falls or the Division of Extension), the dairy industry must be actively engaged with youth development programs such as 4-H and the Wisconsin Association of FFA.

Support Research and Development (R&D): Encourage research and development through funding and collaboration between industries and academic institutions. Individual businesses elect to be proactive members of an industrial cluster because involvement enhances the business's profitability, resilience, and sustainability. Such outcomes often flow from innovations in business management strategies as well as production methods. Active involvement in programs such as the UW-Madison Dairy Innovation Hub help ensure that individual dairy-related businesses see a benefit for engagement in the cluster.

Strengthen Supply Chains: Enhance local supply chains to reduce costs and increase efficiency within the cluster. Often analysis of economic industrial clusters focuses only on the types of businesses that directly define the industry, such as the analysis presented in Table 1 and Figure 11. Consider dairy farm production, input service providers such as veterinary services, feed and nutritional consultants, artificial insemination services, milk testing and quality assurance services, along with continuous supply of quality animal feed are all integral to a viable dynamic cluster. In some parts of the U.S., as an example, that many large animal veterinarians are approaching or beyond retirement age and the flow of new veterinarians is a concern. While not generally thought of as a traditional input into dairy, is access to quality and affordable broadband internet services an input that needs to be addressed? A dynamic economic cluster is constantly monitoring such issues and working towards policies to address any potential problem areas.

Economic Impact of Dairy Industry

This study uses regional input-output models, specifically the IMPLAN system, to assess the economic impact of Wisconsin's dairy industry. The effects of dairy farm activities are categorized into direct, indirect, and induced impacts. Direct effects include jobs and income generated by dairy farms, such as wages and milk sales. Indirect effects stem from business-to-business transactions, like purchasing feed and services, which further stimulate the economy. Induced effects occur when dairy employees spend their wages locally, supporting additional jobs in various sectors. Together, these effects illustrate the dairy industry's significant role in sustaining employment, income, and economic activity, particularly in rural areas.

Economic Contribution Analysis

Consider the contribution of dairy, the dominant agricultural sector in Wisconsin. In 2022, the dairy industry (on-farm and processing) contributed $52.8 billion to total industrial revenues, or 6.5% of the state total, 120,700 jobs (3.3% of the state total employment), $7.9 billion to labor income (3.2% of the state total), and $13.7 billion to total income (3.4% of state total) (Tables 2 and 3). Compared to the contribution of dairy in 2017, this represented a 16.0% increase in total industrial revenues (sales), but a decline in employment (23.2%), labor income (12.5%), and total income (9.0%). Looking more closely at farm activity, dairy farms contributed $15.2 billion to industrial revenues, 48,800 jobs, $2.6 billion to labor income, and $5.2 billion to total income. As expected, dairy processing had a much larger contribution to the Wisconsin economy because of the relatively larger share of employment and the inclusion of dairy farms in the input supply chain of dairy processors. If we remove the feedback effects of dairy processing on dairy farms, the dairy processing sector contributed $37.1 billion to industrial revenues (about 70% of the total contribution of all dairy), 70,200 jobs (58.1% of all dairy contribution), $5.1 billion to labor income (65.2% of all dairy contribution) and $8.3 billion to total income (60.7% of all dairy contribution).

The historical trends and patterns in milk production on farms and dairy processing in the state tend to understate the contribution of the industry to the State's economy, because it fails to account for the indirect and induced effects (see Methodology in Deller and Hadachek, 2024). Dairy is integrated into local economies through the employment income and input purchases the industry generates. Employment income and input purchases from dairy production positively contribute to the regional economies.

Income flowing to workers (labor income) was much higher in food processing than on-farm activities. The typical job in food processing, had an income of $82,070 compared to $35,500 in on-farm activity. Because the stronger "purchasing power" of the typical food processing worker was higher than the typical on-farm worker, the resulting "induced effects" embedded in the multiplier (i.e., the impact of workers spending income in the regional economy) was larger for food processing. This increased purchasing power is felt most strongly in urban areas, where food processing jobs tend to be concentrated. The dairy industry's contribution to Wisconsin's economy is not limited to rural areas but also significantly impacts urban economies. In particular, the dairy processing sector, led by cheese production, supports metropolitan areas such as Green Bay and Appleton through higher-paying jobs. Dairy processing jobs typically offer higher wages compared to on-farm positions, directly benefiting local economies. For urban legislators, this is a clear example of how the dairy industry is not just a rural issue but a driver of employment and economic stability in urban centers.

Table 2 Contribution of Agriculture to the Wisconsin Economy: 2022

	Employment	Labor Income (MM$)	Total Income (MM$)	Industry Revenues (MM$)
Dairy On Farm	48,786	$2,648.65	$5,203.21	$15,228.73
Dairy Processing	118,954	$7,792.03	$13,527.50	$52,291.36
All Dairy	120,708	$7,887.28	$13,714.64	$52,838.87
Dairy On Farm (%)	1.3	1.1	1.3	1.9
Dairy Processing (%)	3.2	3.2	3.4	6.4
All Dairy (%)	3.3	3.2	3.4	6.5

Table 3 Fiscal Impacts on Government

	Local Govt (MM$)	State Govt (MM$)	Federal Govt (MM$)	Total (MM$)
Dairy On Farm	$212.48	$309.85	$640.27	$1,162.61
Dairy Processing	$422.40	$693.02	$1,868.70	$2,984.12
All Dairy	$430.05	$704.17	$1,891.72	$3,025.94

In addition to supporting industrial revenues, employment, and income, the economic activity associated with agriculture also generates tax revenues for all levels of government. For example, workers pay income, sales, and property taxes, and businesses pay a range of taxes as part of their operations. Dairy generated about $3.0 billion in total tax revenues, and a majority came from dairy processing-related activities. Dairy also contributed $704.2 million to state government revenues and $430.0 million to local government revenues.

Multiplier Analysis

While the summary contribution analysis provided above is helpful, we can gain finer insights into the nature of how dairy contributes to the Wisconsin economy by decomposing the multipliers associated with each individual component of the dairy industry (e.g., on-farm and processing). The multipliers are composed of three parts (direct, indirect, induced), the summation of which yields the total multiplier effect:

Direct Effects: These represent the initial level of activity within the dairy industry itself. For example, a dairy farm or processing plant directly employs workers, pays wages and generates income, and generates levels of sales that are easily observable and measurable.

Indirect Effects: These occur when the dairy industry makes business-to-business transactions. For example, a dairy farm purchasing feed, veterinary services, or equipment contributes to additional economic activity within those supporting industries. Those supportive industries must increase outputs to meet the demands created by the operation of the dairy farms (or cheese plants or fluid milk processing facilities). This increase in activity generates jobs, wages and income, and industry sales. In addition, tax revenues are supported by that activity.

Induced Effects: These result from the spending of wages by workers affected by the dairy operation. When a dairy farm worker, for example, spends their income at local businesses, such as grocery stores or restaurants, additional economic activity is created in the local economy. This reflects how labor or work-related income circulates through the economy, generating further economic activity.

By decomposing the total contribution into its components (direct, indirect, and induced) can provide insights into the nature of the industry. The economic multiplier effect of Wisconsin's dairy industry extends far beyond the farms and processing plants. For every dollar spent on dairy production, an additional $0.93 is generated in the local economy. This multiplier effect translates into more business for local suppliers, grocery stores, and schools, particularly in suburban areas. For example, increased spending by dairy employees directly benefits local businesses, which in turn creates additional jobs and supports the broader community. By illustrating these tangible benefits, it becomes clear how the dairy industry contributes to economic vitality throughout Wisconsin. For example, industries where the indirect effect is larger than the induced effects one can infer that these particular industries tend to be more capital intensive relative to labor and/or offer more modest wages to workers. The health care sector tends to have more modest indirect effects and relatively large induced effects reflecting the labor-intensive nature of the industry, relatively higher wages paid in health care, and many of the capital items (e.g., expensive medical equipment) are imported into the region.

Consider the decomposed economic contributions of dairy on-farm activity first (Table 4). As noted above, dairy on-farm activity generates $15.2 billion in total industrial revenues, which is about 1.9% of Wisconsin total. Note that the corresponding multiplier is 1.931 which can be interpreted as for every $100 in dairy on-farm revenues (sales) there is an additional $93 in industrial revenues elsewhere in the Wisconsin economy. Of the total economic contribution to industrial revenues, 51.8% is captured by the direct effect, or dairy farms activity specifically, 36.6% is through the indirect effect, or business-to-business activity, and 11.6% is through the induced, or labor spending activity. This suggests that the contribution of dairy on-farm activity is largely due to the farms themselves (direct effect) and non-labor business-to-business (indirect effect) activities. This could be interpreted as dairy farms as more capital intensive and/or offers more modest pay to workers. Examining the economic multipliers for dairy on-farm across the three other measures of economic activity (employment, labor income, and total income) the largest source of economic impact is in the form of indirect effects. This suggests that the non-labor related operations of dairy farms account for the majority of total economic contributions.

Turning attention to dairy processing, which again is dominated by cheese processing, the nature of the economic contribution follows dairy farm contributions. For industrial revenues, the multiplier is 1.843 which 51.8% of the contribution derived from direct effects, or the dairy processing firms themselves, 35.6% from indirect effects, and only 9.9% from induced or labor income effects. As with dairy farms, looking at the other three measures of economic activity, nearly half of the economic contribution of dairy processing comes from the indirect effects accounting for 52.5% of employment contributions, 49.8% of labor income and 50.9% of total income contributions. Given the nature of dairy processing in Wisconsin, the relatively large share of the contribution attributable to the indirect, or business-to-business, effects can be traced to the purchase of bulk milk from dairy farmers within Wisconsin. This "feedback" on dairy farms explains why the contribution of dairy processing closely mimics the contribution of all dairy.

Table 4 Decomposition of Dairy Economic Multipliers

	Employment	Labor Income (MM$)	Total Income (MM$)	Industry Revenues (MM$)
Dairy On-Farm				
Direct	16,996	$791.95	$1,830.89	$7,884.87
Indirect	21,961	$1,296.53	$2,346.81	$5,578.81
Induced	9,829	$560.16	$1,025.51	$1,765.05
Total	48,786	$2,648.65	$5,203.21	$15,228.73
Multiplier	2.87	3.344	2.842	1.931
Share of State Total (%)	1.30%	1.10%	1.30%	1.90%
Dairy Processing				
Direct	27,563	$2,262.10	$3,622.22	$28,367.75
Indirect	62,456	$3,880.54	$6,885.31	$18,738.75
Induced	28,934	$1,649.39	$3,019.97	$5,184.86
Total	118,954	$7,792.03	$13,527.50	$52,291.36
Multiplier	4.316	3.445	3.735	1.843
Share of State Total (%)	3.20%	3.20%	3.40%	6.40%
All Dairy				
Direct	44,559	$3,054.05	$5,453.11	$36,252.63
Indirect	46,866	$3,163.94	$5,205.17	$11,339.56
Induced	29,283	$1,669.29	$3,056.36	$5,246.68
Total	120,708	$7,887.28	$13,714.64	$52,838.87

Sub-State Analysis

Following the analysis in Deller and Hadachek, (2024) the contribution of dairy was explored within the nine sub-regions of the state as defined by the National Agricultural Statistical Agency. The economic impact of dairy varies across Wisconsin's regions (Tables 5a and 5b; Figures 12a, 12b and 12c). When dairy on-farm and processing are considered together, the region with the largest total economic contribution is the East Central region is the largest contributor, with dairy activities accounting for $13.3 billion in total economic impact, or 8.1% of the region's total economic activity, 24,800 jobs, 3.7% of total regional employment, and $2.8 billion in total income, 3.9% of the regional total. If one considers the spatial distribution of dairy operations discussed in detail above, a relatively larger clustering of dairy businesses is located in the East Central region. Two potential underlying factors at play: appropriate geographical characteristics (farming) and sufficient urban factors such as larger labor markets (processing). One could also consider the historical settlement patterns of Wisconsin playing an important role. The Southwest region, however, is the most dependent on dairy, with 18.1% of total industrial revenues dependent upon dairy. This regional variation reflects the diverse economic landscape of Wisconsin, where dairy plays a critical role in both rural and urban economies.

Table 5a Contribution of Agriculture to the Wisconsin Economy: Substate Regional Analysis

	South East	East Central	North East	North Central	Central	North West	West Central	South West	South Central
Industry Revenues (MM$)									
On-Farm Dairy	$397.66	$2,976.67	$730.20	$1,439.36	$738.22	$713.17	$1,340.39	$1,327.13	$1,672.38
Dairy Processing	$1,321.26	$11,555.31	$997.60	$6,776.60	$1,647.41	$1,391.73	$4,898.39	$4,609.53	$5,587.50
All Dairy	$1,607.88	$13,311.97	$1,493.90	$7,086.97	$2,027.19	$1,696.00	$5,676.56	$4,875.99	$6,264.75
Employment									
On-Farm Dairy	1,168	9,062	2,282	4,544	2,207	2,682	4,329	4,346	5,052
Dairy Processing	2,259	19,433	1,825	12,057	3,068	2,971	8,869	8,510	10,028
All Dairy	3,084	24,833	3,385	13,068	4,084	4,124	11,393	9,414	11,966
Labor Income (MM$)									
On-Farm Dairy	$52.59	$489.26	$111.60	$238.69	$89.84	$99.65	$171.31	$185.58	$243.54
Dairy Processing	$159.19	$1,446.16	$106.60	$783.43	$165.58	$151.59	$606.49	$469.88	$643.69
All Dairy	$196.83	$1,741.49	$184.50	$831.53	$206.78	$196.67	$709.08	$506.74	$744.01
Total Income (MM$)									
On-Farm Dairy	$120.48	$904.39	$213.20	$451.92	$216.40	$211.29	$402.99	$396.47	$533.11
Dairy Processing	$286.35	$2,294.65	$179.80	$1,358.33	$310.85	$266.71	$1,083.54	$868.66	$1,072.23
All Dairy	$372.11	$2,834.27	$326.50	$1,452.10	$420.66	$357.53	$1,318.68	$949.89	$1,296.03

Table 5b Contribution of Agriculture to the Wisconsin Economy as a Share of Region Total: Substate Regional Analysis

	South East	East Central	North East	North Central	Central	North West	West Central	South West	South Central
Industry Revenues (%)									
On-Farm Dairy	0.1	1.8	4.9	3.3	2.2	2.1	2	4.9	1.1
Dairy Processing	0.5	7	6.7	15.5	4.9	4.1	7.4	17.1	3.7
All Dairy	0.6	8.1	10	16.2	6	5	8.6	18.1	4.1
Employment (%)									
On-Farm Dairy	0.1	1.3	3.1	2.4	1.4	1.8	1.3	3.3	0.7
Dairy Processing	0.2	2.9	2.4	6.2	1.9	2	2.7	6.4	1.5
All Dairy	0.2	3.7	4.5	6.8	2.6	2.7	3.4	7.1	1.8
Labor Income (%)									
On-Farm Dairy	0.1	1.1	2.9	2.1	1	1.2	0.9	2.6	0.5
Dairy Processing	0.2	3.3	2.8	7	1.8	1.9	3.1	6.5	1.3
All Dairy	0.2	3.9	4.8	7.5	2.3	2.4	3.6	7	1.5
Total Income (%)									
On-Farm Dairy	0.1	1.2	3.3	2.4	1.4	1.5	1.3	3.2	0.7
Dairy Processing	0.2	3.1	2.8	7.3	2	1.9	3.4	7	1.3
All Dairy	0.3	3.9	5.1	7.8	2.7	2.5	4.1	7.7	1.6

Figure 12a Dairy On Farm Contribution to Industrial Revenues (MM$)

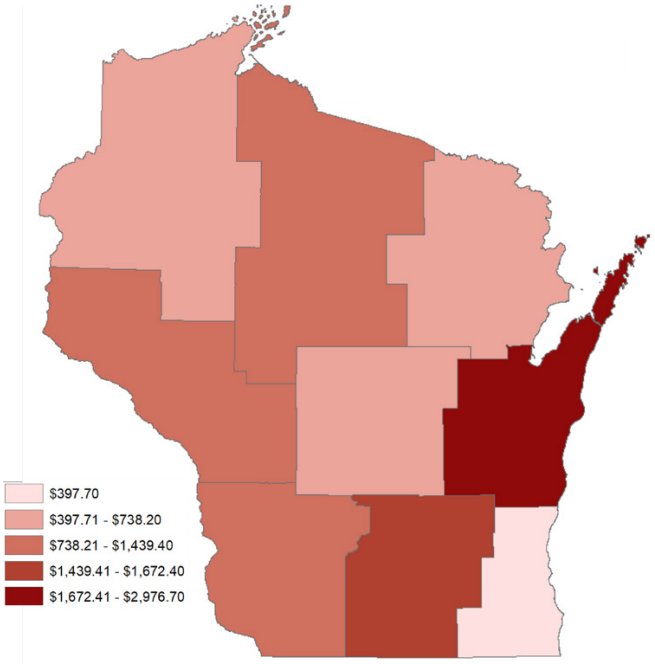


Figure 12b Dairy Processing Contribution to Industrial Revenues (MM$)

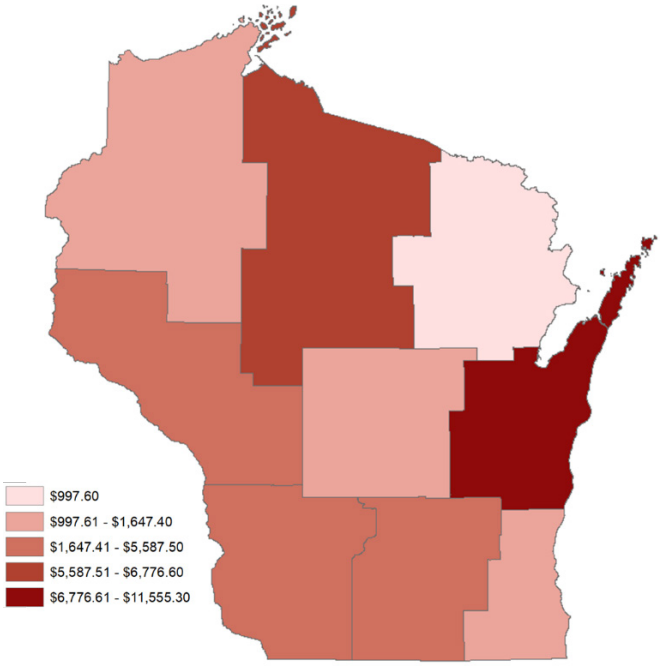
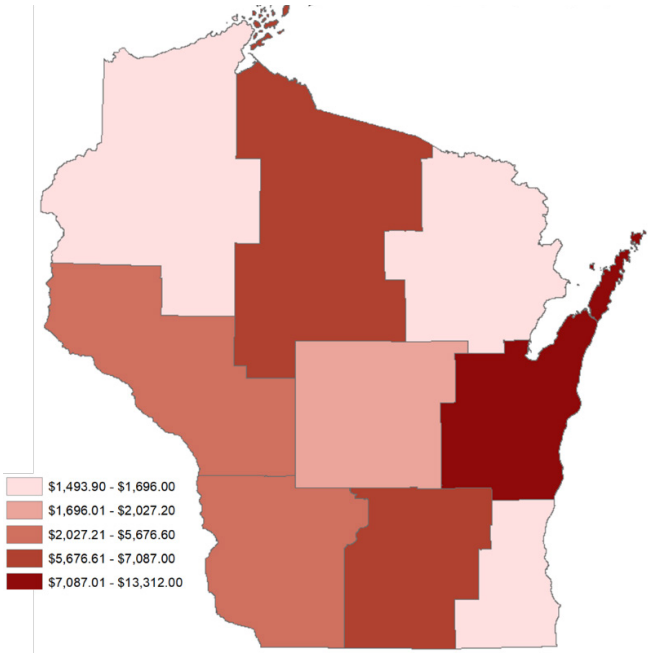


Figure 12c All Dairy Contribution to Industrial Revenues (MM$)



The latter observation concerns the role that dairy plays in both rural and urban economies and should not be overlooked. While dairy farms tend to be located in more rural parts of Wisconsin, the location of many (76.2%) cheese processing establishments are actually located in counties that are classified as metropolitan. Now, one could argue that the way in which counties are classified as metropolitan or not is masking important difference (e.g., Green and Iowa counties are part of the Madison Metropolitan Area and as such plants located in Monroe, Brodhead or Arena, all widely considered as smaller rural communities, are classified as metropolitan). Still, many of the larger cheese processors are located in larger urban settings such as Little Chute, Appleton or Green Bay. Because of the significant footprint dairy processing has in urban Wisconsin, thinking of dairy as a rural-based industry is too narrow. A growing and dynamic dairy industry can impact urban Wisconsin.

Conclusion

Despite the challenges posed by farm consolidation and economic pressures the dairy industry remains a vital component of Wisconsin's economy and is integral to the total U.S. dairy industry. Dairy processing (largely cheese production) continues to expand, displaying economic growth, and is a strong source of employment for the sector. Analysis presented here suggests that the industry can continue to identify symbiotic relationships in the value chain to promote the industry, including fostering information networks, and establishing reliable infrastructure, and expanding in value-added opportunities that consumers demand. As Wisconsin navigates the future, the dairy industry will likely remain a key pillar of the state's economic structure, contributing to both its cultural identity and economic resilience.