The Economic Impacts of Agriculture in Wisconsin Counties

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Steven C. Deller and David Williams

Executive Summary

In Wisconsin, policy makers are exploring ways to unleash the private sector to stimulate the economy with an emphasis on job creation. Historically agriculture has been an important part of the Wisconsin economy, but over the years the relative importance of agriculture in the economy has diminished as the service sector employment, such as recreation and tourism, became more predominant. With the loss of many manufacturing jobs and the recent recession, there is renewed interest in agriculture in terms of employment and as a potential source of new employment opportunities. But is this renewed interest justified? Is the agricultural sector one that can have a larger or stimulative role in the Wisconsin economy? How should local and state policy makers consider an "old" industry that seems to again have relevance?

In an original study by Deller (2004), the contributions of agriculture to the Wisconsin economy were documented and more recently re-examined by Deller and Williams in 2009. In both of these studies agriculture was defined to include on-farm production and food processing. Using 2007 data, Wisconsin agriculture was found to contribute $59.16 billion to total business sales (about 12.5 percent of the Wisconsin total); 353,991 jobs (10 percent of total employment) and $20.2 billion of total income (about nine percent of the Wisconsin total). For the first time, the 2009 study also used "clustering analysis" to examine changes (2001 to 2007) in subsectors of on-farm and food processing to identify strengths, weaknesses, opportunities and threats of the industry (SWOT).

This study updates some of this prior work with the most recent data available. General employment trends in Wisconsin farm and food processing industries are updated. The "clustering analysis" is updated to examine changes from 2001 to 2009. Finally the economic impact or contribution of agriculture in individual Wisconsin counties is examined. All three parts of this study suggest that agriculture will continue to be an important contributor to Wisconsin's economy.

- Trends show recent stability in farm and food processing employment. Advances in technology have allowed farmers and food processors to gain significant cost savings through economies of size. Many of these advances have come in the form of labor-saving technologies. Trends suggest that agriculture is a not a declining industry, but that it is becoming less labor intensive.

- Using "clustering analysis" several subsectors are identified as growing strengths of Wisconsin agriculture including the farm subsectors dairy farming, production of animals for fur, floriculture and the food processing sectors dry, condensed and evaporated dairy, breweries, frozen specialty food processing and fruit and vegetable canning.

- Two broad conclusions are reached from the county level analysis. First, in some, mostly larger, more urban counties agricultural economic impacts (employment, business or industry sales and income) are large, but as a percentage of the entire county economy, not as large as many more rural counties. Second, in many, more rural counties agricultural economic impacts may or may not be large, but as a percentage of the local county economy they are large.

THE ECONOMIC IMPACTS OF AGRICULTURE IN WISCONSIN COUNTIES

Steven C. Deller and David Williams[1]

Introduction

The intent of this study is to provide updated reference material to a series of agricultural economic impact reports first developed in Deller (2004) and revisited by Deller and Williams (2009). In the 2004 study Deller documented the contribution of agriculture to the whole of the Wisconsin economy using 2000 data as well as the economic impact of agriculture on 66 of Wisconsin's 72 counties. These individual impact assessments provided the backbone for a collection of "county agricultural economic impact brochures" that were individually crafted for each of the 66 counties included in the analysis.

UW-Extension, Cooperative Extension County Agriculture Educators used the information to explain and describe the "value and economic impact" of agriculture in the county which they worked. Local farm organizations, agricultural groups and others used the information to "tell the story" of agriculture to elected officials, professionals working in the county in roles impacting agriculture (e.g. county land conservation professionals, economic development professionals, planners, among others) and the general public.

Using 2007 data, Deller and Williams (2009) documented that agriculture contributes $59.16 billion to Wisconsin's total industrial output (about 12.5 percent of the Wisconsin total); 353,991 jobs (10 percent of total employment) and $20.2 billion of total income (about 9 percent of the Wisconsin total). As part of that 2009 update we have undertaken an updating of the individual county-by-county agriculture economic impact assessments. For this latter effort we used the more current 2008 county level data.

In addition to the county-by-county impact analysis, we also take advantage of updated data to revise some of the trend and economic "clustering" analysis provided in the 2009 state level analysis. This updated analysis included general agricultural and food processing employment trends along with changes in the "location quotient" (our simple measure of industry concentration) from 2001 to 2009. Current levels of industry concentration coupled with changes in those concentrations over time will allow us to review agricultural strengths and weaknesses along with the identification of potential threats and opportunities within the various Wisconsin agricultural industries.

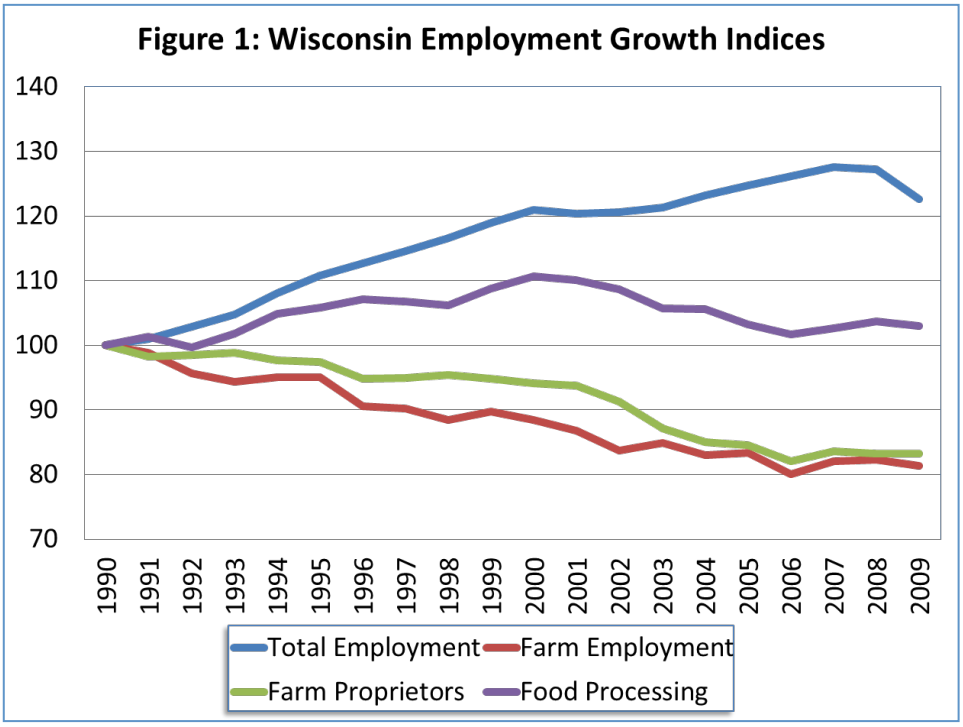
Beyond these simple introductory statements, this study is composed of three additional sections. First we review some of the simple employment and earnings trends where we compare Wisconsin to the nation and the Great Lake states. We then revisit our cluster analysis. In the third section we outline the county-by-county economic impact analysis. We also provide brief reviews of cluster analysis and economic impact methods.

Agricultural Trends

There are numerous ways in which to measure the size of the agricultural economy, including jobs, wages and salaries, and industry or business sales. Given the current economic climate and unemployment rates that are frustratingly high and not reflective of the economic recovery, considerable attention has been focused on the creation of jobs. In addition, because of their very nature, agricultural sales and labor income tend to be highly unstable and sensitive to sometimes wide swings in commodity prices and, in Wisconsin particularly, the price of milk. Therefore, in this simple analysis of agricultural trends we will limit ourselves to employment.

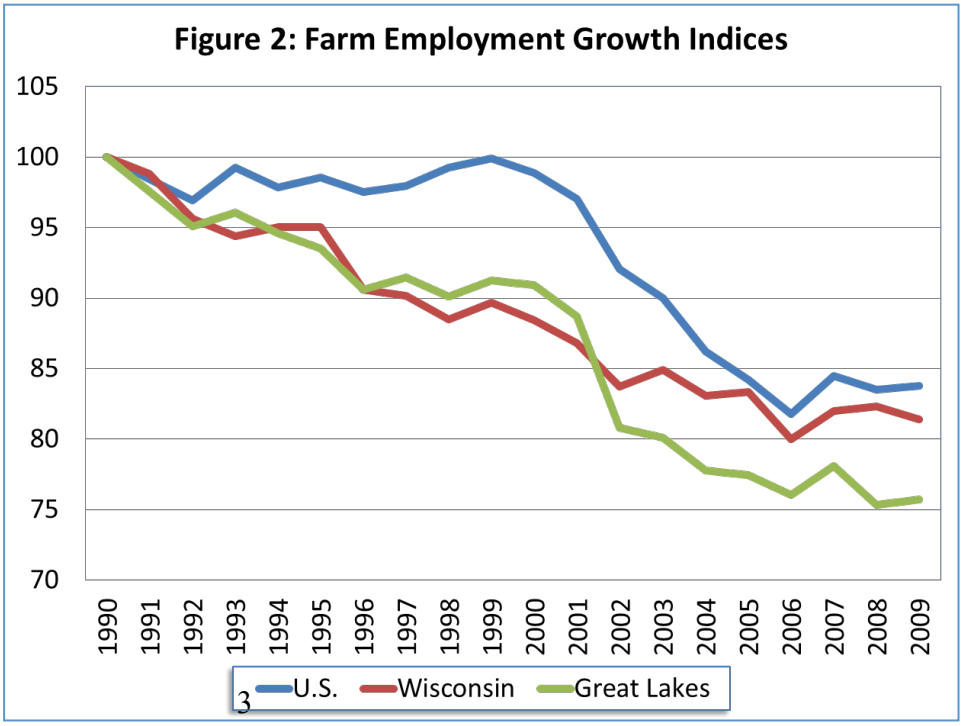
[1] This work has benefited from the helpful comments of Paul Mitchell, Ken Barnett and Bruce Jones. All expressed opinions, interpretations of the analysis and errors are the responsibility of the authors.

In Figure 1 we provide a simple employment growth index for Wisconsin total employment along with food processing employment, farm employment and farm proprietors' employment from 1990 to 2009, the most current year data is available. We employ a growth index because it allows us to directly compare trends across the different industries. Changes in the index from one year to the next can be interpreted as a percent change in the index, allowing us to see if the industry is trending upward or downward and the industry's overall stability. Several trends are evident in Figure 1. Total employment growth in Wisconsin was strong during the 1990s but moderated during the past ten years. The significant drop in employment from the last recession is clearly evident with the 2009 data.



Farm employment and proprietors' employment experienced steady decline from 1990 till the mid-2000s, a decline of almost 20 percent. But since the low point in 2006 there has been relative stability and even some evidence of modest growth. This latter observation speaks to a stabilization of the relative size of farming as measured by employment. It is also of interest to note that there is little evidence of the latest recession with the farm employment data. In general, on-farm employment patterns are independent of the larger macro economy and may provide a modest cushion against larger macroeconomic recessions.

The growth in food processing employment was modestly positive increasing by about ten percent between 1990 and 2000, but there was a decline between 2000 and 2006. Since 2006, employment in food processing appears to have stabilized and is neither growing nor declining. While the decline in farm employment can be attributed to a rising gap between retiring and new farmers entering the industry, the observed pattern in food processing is not as easily explained. There is some evidence of modernization within the industry that saw the introduction of more labor saving technologies. But in the past few years there has been a growth in the number of smaller specialty food processors (e.g., craft cheeses and breweries). These smaller food processors also tend to be more labor-intensive, thus representing a potential source of employment growth.

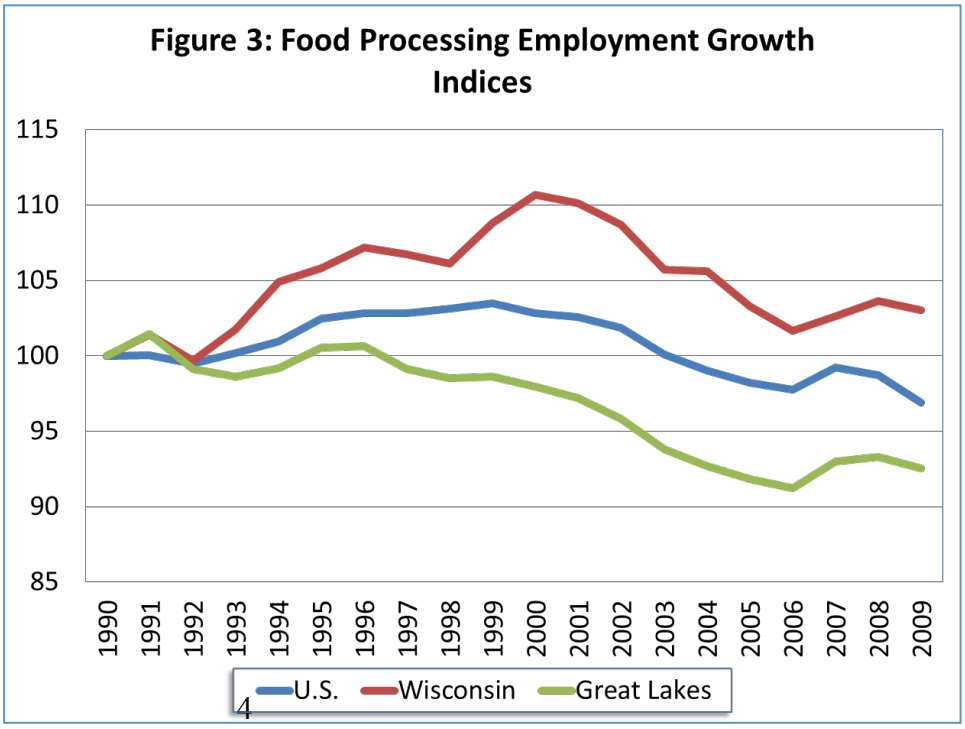


If we compare Wisconsin farm employment to the U.S. and the Great Lakes region, two patterns emerge (Figure 2). First, farm employment has been declining across Wisconsin and the Great Lakes region over the whole period. For the U.S., farm employment was relatively stable throughout the 1990s and declined rapidly in the 2000s. It is not clear why the Great Lakes farm employment declined so significantly between 2001 and 2002. The general reasoning behind the noticeable decline in farm employment centers on significant consolidation of small- and medium-size farm enterprises into larger farms that take advantage of economies of scale. In essence, through consolidation and technology adaptation it takes fewer farm workers to produce the same, and indeed increasing, levels of output.

The recent stability in farm employment beginning in about 2006 appears to apply to not only Wisconsin but also to the U.S. and, to a lesser extent, the Great Lakes region. While these data are too aggregate to explain why farm employment has stabilized, anecdotal evidence suggests that expanding markets for organic and locally produced foods selling primarily into small or niche markets may be playing a role. But to confirm this insight requires additional research.

From a national perspective, the food processing industry has not been a source of employment growth over the past two decades (Figure 3). Indeed, for the Great Lakes region there has been a steady decline in employment in food processing. As noted above, for Wisconsin, food processing had been a source of employment growth from the end of the mild recession of the early 1990s to 2000. But between 2000 and 2006 Wisconsin food processing employment trends followed the Great Lakes trend and actually lost jobs at a faster rate than the U.S. Much of this decline came from the adoption of labor-saving technologies. But for Wisconsin and the Great Lakes, there has been modest employment growth from 2006 to 2008. It is not clear if the dip in 2009 is a reflection of continued structural changes in the food processing industry or the most recent recession. As with the rise in the market for organic and local foods, these data do not allow us to explore the role of small specialty food manufacturing, but again anecdotal evidence suggests that these new and growing markets might be a source of modest employment growth in Wisconsin agriculture.

One of the most widely held perceptions is that agriculture is a shrinking industry. Advances in technology have allowed farmers and food processors to gain significant cost savings through economies of size. Many of these advances have come in the form of labor-saving technologies. Examination of these simple employment trends seems to confirm these perceptions. It is not that agriculture—both on-farm production and food processing—is a declining industry, it is that it is becoming less labor intensive. At the same time, the movement toward people willing to spend more for organics and local foods may have opened business opportunities for smaller scale, more specialized food products. The question remains about the long-term market potential of these new or mostly niche markets and about the quality of jobs in these markets.



We can expand on this simple analysis of broad employment trends by looking within detailed subsectors of the agricultural and food processing industries.

Unfortunately, examining individual growth trends is cumbersome and difficult to draw inferences from. We can move forward by looking at changes in employment using a method commonly referred to as "clustering analysis."

Agricultural Clusters

The notion of "economic clusters" has entered into the economic growth and development policy realm due to the work of Harvard business economist Michael Porter. While regional economists have debated the scholarly contribution of Porter (see, for example, Deller 2009) his work has greatly influenced how states and local governments think about and pursue economic growth and development policies. In an attempt to rethink Wisconsin's economic development policies, the Doyle Administration undertook an analysis of Wisconsin industries to identify which sectors Wisconsin has a "comparative advantage." That initiative identified eight "Established Wisconsin Clusters" (wind energy, biotechnology, dairy, food products and processing, paper and wood products, plastics, printing and tourism) and two "Emerging Wisconsin Clusters" (information technology and medical devices).[2]

There are numerous definitions of clusters (again, see Deller 2009 for a discussion) including several offered by Porter (2000: 254), such as: "A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementaries." While economists debate the merits of individual elements of what comprises a cluster, there are common themes that are generally agreed upon. The most basic is that a firm finds that it is in their own profit-motivated self-interest to locate in close spatial proximity to competitors. Dairy farmers and cheese makers find that it is to their own self-interest (i.e., profits) to be located in the same general geographic areas. By "co-locating" they can build a "critical mass" that improves the profitability of individual firms.

Porter offers a "diamond model" of four characteristics or drives of how regional clusters can develop and promoted (see Woodward and Guimarães 2009):

- Sophisticated local demand for cluster products and services. For example, the demand for specialty cheeses and organic milk can spur the dairy industry to be more innovative and competitive and may encourage the development of industry subsectors such as dairy goats and sheep.

- Local supply inputs from related and supporting industries. For dairy this might include a critical mass of large animal veterinarians, dairy, forage and manure handling equipment dealers, educational opportunities or specialized labor and professional services.

- Favorable factor (resource) conditions. There are adequate supplies of water and terrain that is suitable for forage production for dairy feed and manure spreading, or a local road system that can manage the demands of milk trucks.

- A competitive context for firm rivalry, further driving innovation and productivity. Specialty cheese makers enter spirited competitions to see who makes the best products.

It is important that simply being in close spatial proximity is not sufficient to create competitive and innovative clusters. Firms view each other as not only competitors but also potential collaborators. Firms learn from each other both formally and informally. They are willing to form institutions, such as a regional dairy council or

[2]For more discussion see Forward Wisconsin at http://www.forwardwi.com/category44/Industry-Clusters.

professional cheese-makers organization, to facilitate collaboration. This synergy creates a situation where the sum of the parts is greater than the parts.

The role of public policy can take many forms. For example, the creation of public-private partnerships to facilitate networking amongst the potential members of the cluster; can the public sector help facilitate the creation of the regional dairy council or cheese-maker organization? Can targeted educational programs offered through the technical colleges, the University or the UW-Extension, Cooperative Extension be crafted to meet the needs of the cluster? Are local land-use policies and regulations consistent with the needs of the cluster?[3]

The challenge facing economists and policy analysts is the identification of the relevant clusters. Here there is significant debate within the academic literature (for a detailed discussion, see Goetz, Deller and Harris 2009). Some argue that economists are "not smart enough" to outguess the markets and should simply allow the markets to function almost in a *laissez faire* manner. Others suggest that economists can offer some insights that can help inform policy discussions. Perhaps the simplest tool to help in the first step to identifying potential clusters is to examine industry strengths and weaknesses and changes in those strengths and weaknesses over time. Porter suggested the use of a standard tool of regional economists, the location quotient (LQ).

The location quotient (LQ) compares the relative level of economic specialization of the community, region or state to a national average. The location quotient is simply computed as

$$LQ_{ri} = \frac{Percent\ of\ Employment\ in\ Local\ (r) in\ an\ Industry\ (i)}{Percent\ of\ Employment\ in\ Nation\ in\ an\ Industry\ (i)}$$

and can be viewed as a measure of self-sufficiency. An LQ of 1.0 means that the local economy has the same proportion of economic activity (employment) in industry *i* as the nation. The community or region just meets local consumption through local production. This is the level of economic activity in this industry that we might expect. If the LQ is less than 1.0, the community or region is not producing enough of that good or service and must import to satisfy local consumption or demand. An LQ greater than 1.0 that means that the community has more economic activity than one would expect and might be considered a strength of the local or regional economy.[4] This approach provides a step beyond the simple employment growth indices analysis provided in the first section of this study.

Consider an area that might be considered a "tourist" area such as the Wisconsin Dells or Door County. Here we would find that the LQ for hotels-motels, for example, to be relatively large. Indeed, for 2009 the LQ for hotels and motels for Door County is 4.85, which is an indicator of the importance of the tourism industry to Door County. For Brown County the LQ for paper manufacturing in 2009 is 13.95, which is very large and is again an indicator of how important the paper industry is to the Green Bay economy.

The question that Porter asks is: What is happening to these relative strengths over time? Is the location quotient growing over time, declining or staying the same? Porter notes that there are four possibilities: strength and growing, strength and declining, weakness but growing, weakness and declining. These four possible combinations can be visualized via a simple graphic (Figure 4).

[3]In these types of discussions the local community can enter into an honest discussion if the potential cluster is consistent with their vision of their community.

[4] For a detailed discussion of the limitations of the location quotient see Shaffer, Deller and Marcouiller (2004).

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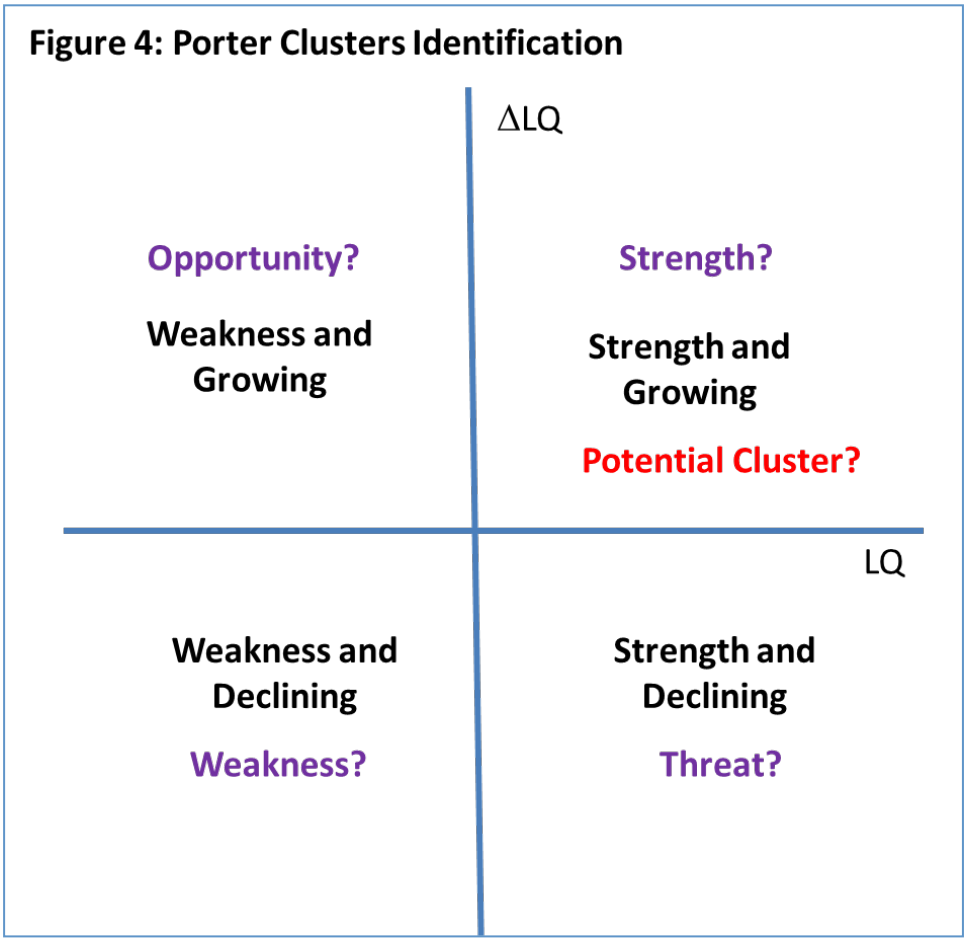
Figure 4: Porter Clusters Identification



One can almost think of using the location quotients to conduct a "SWOT" analysis (Strengths, Weaknesses, Opportunities, and Threats). Here an industry that has a large (i.e., greater than one) location quotient and is increasing over time is considered a "strength" and might form the foundation for a potential cluster. At a minimum these industries should warrant further examination.

An industry that has a large location quotient but is declining over time might be considered a "threat" in the sense that a strong industry is in decline. These industries may be experiencing a natural decline, not experiencing the same growth as the industry at the national level or shifts in technology alters how they influence the regional economy. For example, if we use employment to compute our location quotients and an industry, such as agriculture and food processing, is adopting labor saving technologies at a rate faster than the nation as a whole, the transition to fewer employees may be misinterpreted as a threat. Again, the approach outline in Figure 4 could be considered a filter to refine our thinking about the strength and weaknesses of Wisconsin industries. There may be many reasons explaining any particular pattern.

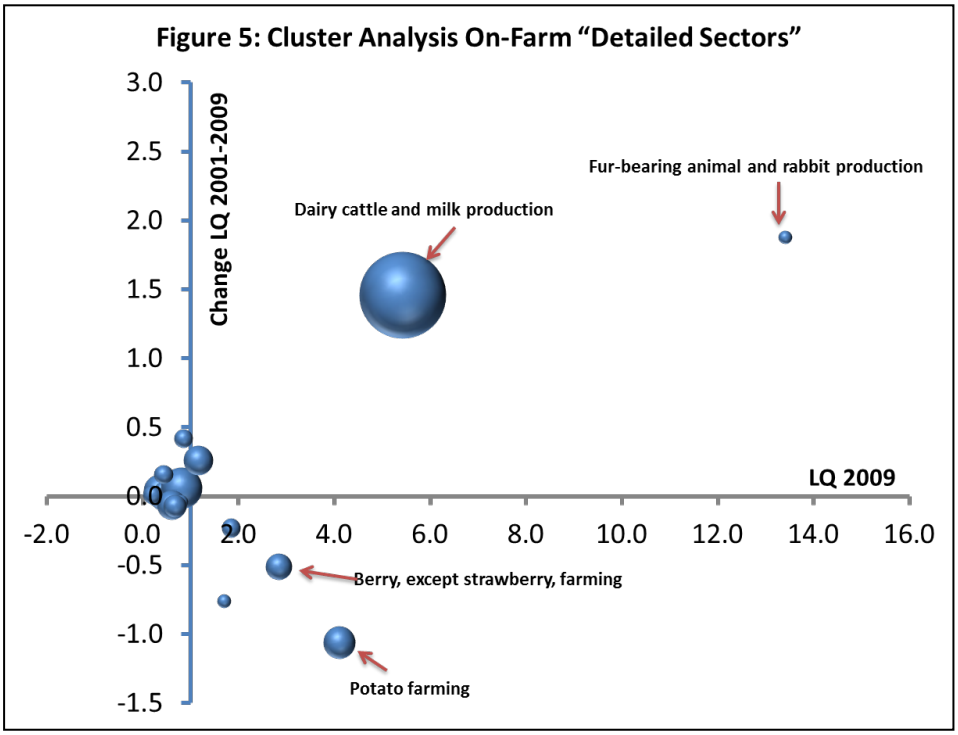
The lower-left-hand quadrant of Figure 4 is where industries that are small and declining will be located and the industries in this category might be considered weaknesses. From a Porter perspective these industries should not be considered further for evaluation. In a purely theoretical economic perspective Wisconsin does not have a comparative advantage in these industries and to pursue the promotion of these industries would be futile.

The upper-left-hand quadrant is composed of industries with small (i.e., less than one) but increasing location quotients. From our perspective, industries that fall into this sector might be considered opportunities for Wisconsin. The question to be asked is why the industry is gaining strength? Is this an industry that has strong growth potential for Wisconsin and can policies be crafted in such a way to enhance the competitiveness of the industry? Is this an industry that is consistent with the vision of the future of Wisconsin?

In the end, the clustering analysis presented here is intended to help think about the Wisconsin agricultural industry in a different light. How do Wisconsin agricultural sectors compare to a national average and how is that changing over time? As mentioned above, several economists have raised concerns over this type of analysis, ranging from being overly simplistic to too sensitive a metric of economic activity such as employment. The location quotient by definition is a very simple measure of economic strength (or weakness) and the decision to compare Wisconsin to a national average somewhat arbitrary. In the end, we believe that the analysis presented here will help us think about Wisconsin agriculture in a slightly different light.

Cluster Analysis of Wisconsin On-Farm Production Our analysis, which is an update of our prior work (Deller and Williams 2009), is composed of two parts. The first, provided in Figure 5 and Table 1, focuses on farm level production sectors. The second part, provided in Figure 6 and Table 2, examines food processing industries. In addition to the level of the location quotient in 2009, the most recent year we have data, and change in the location quotient from 2001 to 2009 we also include the relative size of the industry measured by the percent of Wisconsin's total employment within the industry. This would simply be the numerator of the location quotient formula as outlined above. Some care must be taken here in interpreting the relative size. One must keep in mind that these industry definitions are very detailed and as such can appear to be small in isolation. In terms of the figures, the size of the individual "bubbles" corresponds to the size of the industry: larger "bubbles" represent larger industries independent of their relative strength (i.e., size of the location quotient).

There are five farm-based sectors that fall into the "strength and growing" classification that Porter would suggest warrant further examination as potential industrial clusters. One that stands out as a very strong sector with significant growth is "fur-bearing animal and rabbit production." Wisconsin is a major contributor of raw materials to the clothing industry that uses animal furs. From a simple analysis of the location quotients this is a sector that should be considered as an industry that might be a cluster. If one looks at the level of employment in this sector it is relatively modest. This raises a fundamental question: is this particular industry sufficiently large to have any meaningful impact on the larger economy? In addition, what is the future growth potential for this industry at the national or even international level? Is it possible that from a national perspective the industry is in decline (i.e., the denominator of the LQ formula is getting smaller) but in Wisconsin the industry is remaining stable or declining more slowly than at the national level? It is vital to view the analysis presented in Figure 5 and Table 1 as a means to help refine our thinking about the industry.



Two of the five sectors identified as potential clusters that may warrant further consideration are floricultural production and on-farm dairy operations. The latter is not unexpected and speaks to the importance of Wisconsin's on-farm dairy industry to not only Wisconsin but also its relative position within the U.S. Floriculture, or as it is more commonly referred horticulture, is concerned with the cultivation of flowering and ornamental plants for gardens and is best thought of as nurseries and greenhouses. This does not necessarily include landscaping services. The question that needs to be thought about is which markets does the Wisconsin floriculture industry service? If this industry is just supplying Wisconsin markets, one would expect the location quotient to be equal to, not greater than one. Since the location quotient is greater than one, it might

Table 1: Wisconsin Farm Cluster Analysis

	LQ 2009	Change in LQ 2001 to 2009	Percent of Jobs 2009
Potential Cluster			
Fur-bearing animal and rabbit production	13.41	1.88	0.01%
Dairy cattle and milk production	5.43	1.46	0.44%
Other poultry production	2.45	2.45	0.00%
Floriculture production	1.16	0.26	0.05%
Hunting and trapping	1.13	0.28	0.00%
Strength Declining			
Potato farming	4.11	-1.06	0.06%
Berry, except strawberry, farming	2.85	-0.51	0.04%
Corn farming	1.85	-0.23	0.02%
All other animal production	1.70	-0.76	0.01%
Weakness Growing			
Soil preparation, planting, and cultivating	0.86	0.42	0.02%
Nursery and floriculture production	0.81	0.06	0.10%
All other grain farming	0.68	0.44	0.00%
Finfish farming and fish hatcheries	0.62	0.20	0.00%
Crop harvesting, primarily by machine	0.46	0.46	0.00%
Beef cattle ranching, farming, and feedlots	0.44	0.16	0.02%
Soybean farming	0.41	0.41	0.00%
Other grain farming	0.41	0.25	0.00%
Apple orchards	0.40	0.05	0.01%
Noncitrus fruit and tree nut farming	0.36	0.04	0.06%
Support activities for forestry	0.32	0.07	0.00%
Oilseed and grain combination farming	0.31	0.20	0.00%
Food crops grown under cover	0.23	0.02	0.00%
Other postharvest crop activities	0.21	0.01	0.02%
Mushroom production	0.20	0.03	0.00%
Farm labor contractors and crew leaders	0.01	0.01	0.00%
Weakness Declining			
Chicken egg production	0.81	-0.04	0.01%
Logging	0.68	-0.07	0.03%
Nursery and tree production	0.61	-0.06	0.05%
Finfish fishing	0.49	-0.18	0.00%
Other vegetable and melon farming	0.41	-0.02	0.03%
Other food crops grown under cover	0.28	-0.09	0.00%
Farm management services	0.10	-0.03	0.00%
Turkey production	0.09	-0.06	0.00%

seem reasonable that Wisconsin may be in a position to export floriculture products out of the state, perhaps to the Chicago or Minneapolis market or beyond. One element of the floriculture industry that might warrant further consideration is the cut flower market. The U.S. is a major importer of cut flowers with many of those coming from South America, particularly Columbia. Is this a market that Wisconsin might consider for further exploration?

Farming sectors that are strengths for Wisconsin but appear to be losing some of that strength include potato farming, berry production—which for Wisconsin is cranberries—and corn production. Care must be taken with corn production because much of the corn produced in Wisconsin is sweet corn, but this industry includes all corn, including corn grown for ethanol production and livestock feed. The cranberry industry has been undergoing some restructuring, and care must be taken in drawing too much from the declining location quotient. It is not clear why potato farming appears to be losing some of its strength, but for the central part of Wisconsin this is a major industry. One potential reason was the closure of large potato processing plant in 2008 and the corresponding decline in potato production. While it does not appear that any of these farming sectors are at threat of collapsing, the relative weakening of these sectors could be a cause for concern.

In the "weakness but growing" sector, the one industry that appears to have some potential that may warrant further consideration is nursery and floriculture production. This result complements the observation above about floriculture but the distinction between the two centers on the immediate markets that these businesses are servicing. Nurseries here (weak but growing) tend to service local markets providing materials and services to home gardeners. Other farm sectors that fall into this "weakness but growing" category but may be too small include aquaculture and apple production. While these latter two sectors may have strong geographic concentrations, thus making them potentially important to those narrow geographic areas, they are perhaps too small at the current time to have a significant impact on the whole of Wisconsin's economy.[5]

The observation on aquaculture points to a potential problem with the clustering approach used in this study; do historical patterns adequately suggest future potential? There are numerous examples where historical patterns cannot predict the potential expansion rate of future new markets. While aquaculture might be a "modest" industry in Wisconsin today, it may be a "significant" industry tomorrow. In addition, what defines the difference between what is considered "modest" and "significant"? These are subjective terms and reasonable people can draw different conclusions. Again, the intent of this cluster analysis is to provide additional insights into the Wisconsin agricultural economy.

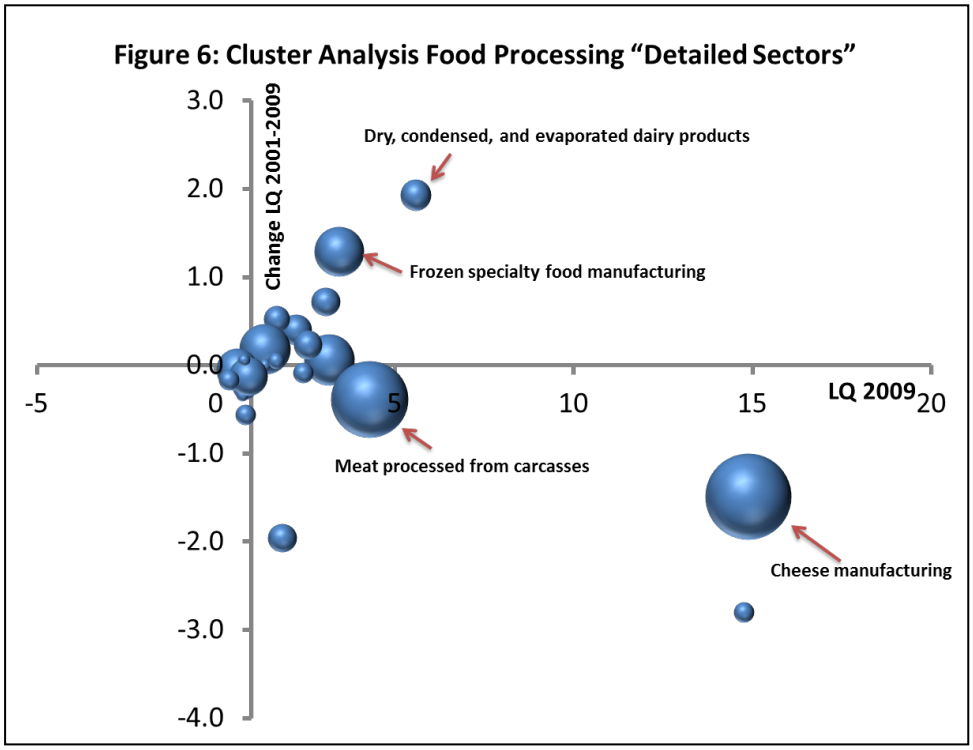
There are a small handful of farm-based industries that fall into the "weakness and declining" sector that employs a fair number of people, including logging and nursery and tree production. The logging result might appear to be surprising given the forest resources within Wisconsin, but the logging industry has changed significantly over time. Most logging that occurs in Wisconsin today is small-scale, with small firms doing selected harvesting on predominately small privately owned wood lots. Large-scale commercial logging is difficult in Wisconsin given land ownership patterns along with the growing importance of tourism and large tracks of public forest land placed in conservation reserves. The nursery and tree production result seems to contradict the prior results on floriculture. Some care must be taken here because of the refined level of industry detail that we are exploring in this analysis. Some firms may classify themselves slightly differently when filing

[5] For the economic contributions of aquaculture see the report prepared by the UW-Extension, Cooperative Extension in partnership with the UW-Stevens Point Northern Aquaculture Demonstration Facility at:
http://www.wisconsinaquaculture.com/Forms/2009_WI_Aqua_Industry_brochure_2.pdf
For an analysis of the contribution of specialty crops to the Wisconsin economy see the work of Paul Mitchell with the Department of Agricultural and Applied Economics, University of Wisconsin-Madison/Extension at:
http://www.aae.wisc.edu/pubs/misc/docs/mitchell.crop.impacts.pdf

their taxes thus causing two firms that are basically competitors being in different industry groupings.[6] Taken in tandem, these results on floriculture and horticulture suggest that a more detailed analysis of the industry as a potential cluster for Wisconsin needs to be undertaken.

Cluster Analysis of Wisconsin Food Processing One piece of vital information that we gained from our study of the agriculture industry (Deller and Williams 2009) is the importance of food processing to employment, income and business sales. In many cases, some food processing industries, such as cheese production, can have a greater impact on the Wisconsin economy than their farm counterparts. To gain additional insights into the strengths and weaknesses of the food processing industry, we again look at the level of the location quotient in 2009 and the change in that location quotient from 2001 to 2009. The results of this analysis are provided in Figures 6 and Table 2.

Unlike on-farm production, there are numerous food processing sectors that fall into the "strength and growing" quadrant of the Porter based analysis. Of the 24 separate food processing industries included in the analysis, ten of them—or about 42%—are potential cluster industries that warrant further examination. For example, it is not necessarily surprising that Wisconsin is a leader in dry, condensed and evaporated dairy products, but we must understand that much of the market for this industry is foreign exports. History has shown us that these types of export markets can be very volatile and care must be taken. Other strong food processing clusters include frozen specialty food manufacturing such as frozen pizzas, and fruit and vegetable canning. Animal food manufacturing, which includes livestock and horse feed, and confectionery manufacturing from purchased chocolate are also strong and growing industries in Wisconsin. But these tend to be known within Wisconsin as relative strengths within the broader agricultural industry. There are others, however, such as spice and extract manufacturing along with the manufacturing of mixes and dough from flour, that could also be deemed to be potential clusters in Wisconsin.



Other food processing industries that have historically been strengths in Wisconsin that appear to be losing some strength include cheese as well as creamery butter manufacturing. In 2009 the location quotients for these two mainstays of the dairy industry are above 14.5, which are extremely large LQs by any measure and suggest that these remain important sectors but the declines over time may be a cause for concern. We hypothesize that the declines in the location quotients is a reflection of growth in employment in these two sectors outside of

[6]When firms file their taxes, either income or unemployment compensation, they are required to classify themselves within a particular industry classification. As these industry classifications become more detailed the potential for what statisticians call "noise in the data" become very real.

Table 2: Wisconsin Food Processing Cluster Analysis

	LQ 2009	Change in LQ 2001 to 2009	Percent of Jobs 2009
Potential Cluster			
Dry, condensed, and evaporated dairy products	5.59	1.93	0.07%
Frozen specialty food manufacturing	3.45	1.29	0.18%
Fruit and vegetable canning	3.17	0.06	0.19%
Spice and extract manufacturing	3.07	0.72	0.06%
All other miscellaneous food manufacturing	2.58	0.23	0.06%
Other animal food manufacturing	2.25	0.40	0.07%
Confectionery mfg. from purchased chocolate	1.71	0.52	0.05%
Mixes and dough made from purchased flour	1.69	0.05	0.02%
Animal, except poultry, slaughtering	1.38	0.18	0.19%
Rendering and meat byproduct processing	1.38	0.00	0.01%
Strength Declining			
Cheese manufacturing	14.88	-1.49	0.55%
Creamery butter manufacturing	14.77	-2.80	0.03%
Meat processed from carcasses	4.30	-0.39	0.44%
Mayonnaise, dressing, and sauce manufacturing	2.45	-0.09	0.03%
Frozen fruit and vegetable manufacturing	1.86	-1.96	0.06%
Dog and cat food manufacturing	1.15	-0.07	0.02%
Weakness Growing			
Bottled water manufacturing	0.79	0.06	0.01%
Ice manufacturing	0.67	0.43	0.00%
Weakness Declining			
Commercial bakeries	0.91	-0.13	0.11%
Perishable prepared food manufacturing	0.83	-0.56	0.03%
Fluid milk manufacturing	0.82	-0.26	0.04%
Ice cream and frozen dessert manufacturing	0.75	-0.34	0.01%
Poultry processing	0.60	-0.05	0.13%
Soft drink manufacturing	0.37	-0.17	0.03%

Wisconsin. In essence, the denominator in the location quotient equation is growing faster than the numerator. This begs the question why. Is there a growing market for cheese that Wisconsin is not capturing? Alternatively, because the location quotient is based on employment levels, is the Wisconsin cheese processing industry becoming less labor intensive? Are cheese processors shifting to labor saving technologies? Given our simple location quotient analysis we really cannot answer these questions; rather our analysis is aimed at helping refine some of the questions that need to be addressed as policy discussions move forward.

Perhaps more important than the weakening of the creamery butter industry is the weakening of the meat processing industry from carcasses due to the relatively larger share of total number of jobs that are in this sector. While the decline in the location quotient might be considered small, the growth in animal slaughtering, other than poultry, coupled with the decline in meat processing raises an interesting question. If our animal slaughtering industry is growing but our meat processing industry is declining, there is *prima facie* evidence of a "disconnect" between the two industries. Are these slaughtered animals being shipped out of Wisconsin for processing? Are we losing a market opportunity?

Also notice the differences between canned fruits and vegetables (which in Wisconsin is primarily vegetables) processing, which is identified as a "strength and growing," and the "strength but weakening" of frozen fruits and vegetables. Indeed, the drop in the location quotient for frozen fruits and vegetables is alarming. Are Wisconsin fruits and vegetables grown for processing simply being shifted from frozen to canned, or is something more fundamental occurring within these two industries? The decline in potato farming identified in the on-farm production section above warrants further analysis.

Other food processing sectors that warrant mentioning include bottled water, which is not necessarily a strength for Wisconsin, but it is demonstrating some growth and might be an industry worth looking at more closely. In addition, given the strength of the dairy industry in Wisconsin, it is somewhat surprising to find that fluid milk processing for direct consumption is a weakness and declining. This speaks to the fact that the bulk of Wisconsin milk production goes into the manufacturing process, in particularly cheese production. We know from the location quotient analysis milk is not moving into ice cream and frozen dessert production in any significant way.

What this cluster analysis has provided us is additional insights into the strengths and weaknesses along with the opportunities and threats (SWOT) of the Wisconsin agricultural industry. We have seen that some sectors are strong and becoming stronger; how can we build on these strengths? We have also seen that some of our strongest sectors, such as cheese processing, is losing some of its strength from a national perspective; are these threats that need to be addressed? There are also a small number of up-and-coming industries, such as some elements of horticulture, that may warrant further consideration.

This analysis has also demonstrated that Wisconsin agriculture is extremely heterogeneous and vertically integrated. This means that we produce a range of on farm agricultural commodities ranging from milk to potatoes to cranberries and ginseng; Wisconsin cannot be described as having a monoculture agricultural base. Vertically integrated indicates that we are capturing significant value added processing to our farm grown products. The most evident of this is Wisconsin produced milk flowing to a Wisconsin cheese processer who in turns sells to a Wisconsin frozen pizza manufacturer. We add value to much of the farm-produced commodities and products. The presence of such a strong food processing industry makes Wisconsin's agricultural sector stand out as an important part of the Wisconsin economy.

Economic Impacts

A Simple Review of Methods As discussed at length in Deller (2004) and Deller and Williams (2009) the power of input-output analysis is the ability to use the tool to track small changes in one part of the economy

throughout the entire economy. For example the expansion of dairy farms or a vegetable canning processor in the local (county) economy introduces new or additional levels of spending in the local economy. This new spending causes a ripple or multiplier effect throughout the economy. Using input-output analysis, we can track and measure this ripple effect.

The impact of an expansion of dairy farms is composed of three parts: the *direct*, *indirect* and *induced*. First, the *direct* or *initial* effect captures the event that caused the initial change in the economy; say a new dairy beginning its operations. The dairy farm contributes directly to the local economy by selling farm products, employing people and paying wages and salaries (generating income). Our new dairy farm has two types of expenditures that can be used to better understand the second two parts of the impact or multiplier. The first are business-to-business transactions, such as the purchase of feed from other farms or feed suppliers, fertilizer, seed and chemicals, veterinary services, trucking services to haul milk and livestock, electric and other utilities, insurance, interest and other financial services, land rent, farm and equipment repairs and maintenance and many others. These business-to-business transactions are captured in the model through the *indirect* effect. For example, a grain farmer uses the proceeds from feed sales to dairy farmers to pay his or her own farm's operating expenses, make investments, or buy new equipment.

The second type of expenditure dairy farms introduce into the local economy is wages and salaries paid to employees as well as to the farmer him- or herself. Spending this income in the local economy is captured by the *induced* effect. Dairy farmers and their employees spend their income at local grocery stores, movie theaters, restaurants and many other retail outlets. The theater owner, for example, could use part of the money spent by dairy farmers to pay theater employees, and the cycle continues.

The combination of the *direct*, *indirect* and *induced* tells us what the impact or contribution of any particular industry has on the whole of the economy. By looking that the *indirect* and *induced* impacts we can gain insights into how the industry of interest is connected or linked into the local economy. For example, industries that tend to be labor intensive and offer high wages tend to have larger *induced* effects on the local economy. Industries that are more capital intensive or offer lower wages tend to have larger *indirect* effects. We can also gain additional insights into the make-up of the local economy by examining the relative size of the multiplier effects. Smaller economies tend to have smaller multiplier or ripple effects than larger economies. This is because the "leakages" out of the local economy occurs faster in smaller economies, hence capturing less or smaller multiplier effects. Larger economies have greater opportunities to keep those dollars within the local economy for a longer period of time, hence capturing more of the multiplier effect. Some smaller more rural communities that have pursued tourism development have used multiplier analysis to better understand that simply bringing more tourists to the community is not sufficient, there must be someplace for those tourists to spend their money.

For this study, the input-output modeling system IMPLAN (IMpact analysis for PLANning) is used. The IMPLAN system was originally developed by the U.S. Forest Service in the 1980s in response to a federal mandate requiring the Forest Service to assess the economic impact of alternative uses of forested lands under the control of the Forest Service. Today, the IMPLAN system is maintained by the Minnesota IMPLAN Group in Stillwater, Minnesota. In addition to the modeling system software, which allows users to build input-output models and the next generation of social account matrices (SAMS), IMPLAN also provides detailed databases that include county level information. These databases cover 440 individual industries including 19 on-farm sectors and 33 agricultural processing industries. The data is drawn from the Bureau of Economic Analysis' Regional Economic Information System (BEA-REIS), County Business Patterns, and the Economic Censuses including the Census of Agriculture.

Economic Impact Results For this study, summary information of the economic impacts of agriculture (on farm and food processing) at the county level is presented for all 72 of Wisconsin's counties in Table 3. Metrics

are provided for employment (jobs), industrial (business sales) and income and for simplicity we report out only the total economic impacts (i.e. the direct, indirect and induced effects combined).

One challenge of considering the economic impacts of agriculture at the county level is context. What is an important or significant contribution of some sector of a local (county) economy to the entire local (county) economy? As we saw with the cluster analysis above there is somewhat of an arbitrary judgment call that must be made when interpreting these results. For example, we commonly dismissed some agricultural sectors from further consideration, such as ice making, because the size of the industry is too small. But what or who defines what is "too small"? The fur production industry has a huge location quotient and is growing, but is the absolute size of the industry too small to warrant further consideration from a state-wide policy perspective?

One way of considering the relevance of a given economic impact is to consider that impact as a share or percentage of the total economy. For each of the three metrics (employment, business or industry sales and income) the percentage of that metric as a share of the total metric for the county is presented. Summary maps for the combined on-farm and food processing impacts are provided for each of the three metrics in absolute and percentage levels. Accompanying each map are details for the 10 largest counties is also provided.

A detailed discussion of each of the six reported set of results (six maps) would be lengthy and tedious. Rather we will outline three broad observations that we have drawn from the analysis.

1. If we consider the counties with the largest impacts in absolute number of jobs, income and business sales generated they tend to be dominated by mostly larger, more urban counties. These are counties with larger populations, city centers with larger food processing firms including Brown (Green Bay), Dane (Madison) and Milwaukee counties. While at first thought this result may seem counterintuitive, but upon deep reflection these results are as expected. First, many of the larger food processing facilities need to be able to draw on a larger labor pool, which can be more readily found in more urban areas. Second, these are total economic impacts of the whole of the agricultural industry and as discussed above, more urban counties will tend to have larger multiplier effects than smaller more rural counties. In essence, larger more urban economies are better able to capture more of those inter-industry linkages (i.e., indirect) as well as labor spending (i.e., induced). There are, however, a number of more rural counties that are within the "top ten" in terms of total economic impact including Barron, Dodge and Clark counties.

2. If we look at the relative contribution of agriculture on each counties' economy measured in terms of percent of total (e.g., total jobs generated by agriculture as a percent of the county's total employment) a different picture is painted. For many more rural counties agriculture's economic impacts may be more modest in term of total jobs, income or business sales, but as a percentage of the local county economy agriculture becomes much larger. In general, these counties are not heavily populated, do not have large city centers and are more distant from population centers and interstate transportation infrastructure. Counties where agriculture accounts for a larger share of total economic activity include Lafayette, Clark, Richland, Vernon, Buffalo, Marquette, Taylor, Pepin, Oconto, Green and Trempealeau.

3. In addition to generating employment, income and business sales, agriculture also helps generate state and local government revenues. Consistent with the first general observation the counties with the largest absolute value of state and local government revenue generated tend to be more urban: Milwaukee, Brown, Dane, Jefferson, Outagamie, Marathon, Fond du Lac, La Crosse, Dodge and Sheboygan

Table 3: Contribution of Agriculture to Wisconsin Counties (2008)

County	Jobs	%	Business Sales (M$)	%	Income (M$)	%	State& Local Govt Revenues (M$)
Adams	1,194	14.2	196	22.4	72	16.5	6.6
Ashland	531	4.7	43	3.2	15	2.4	2.0
Barron	8,231	28.6	1,376	38.6	367	25.9	28.6
Bayfield	536	9.2	98	17.5	32	11.4	4.5
Brown	21,037	11.6	5,711	20.0	1,558	11.8	138.8
Buffalo	3,045	36.1	528	48.7	141	28.2	13.2
Burnett	848	12.4	158	20.3	32	9.4	3.0
Calument	4,093	19.2	1,173	37.3	253	23.2	23.8
Chippewa	4,387	13.9	622	14.3	170	10.3	18.9
Clark	7,697	45.5	1,547	63.1	404	47.2	36.2
Columbia	4,527	15.6	1,004	24.5	261	14.6	24.1
Crawford	1,488	14.2	161	13.2	48	9.0	4.2
Dane	16,766	4.4	3,451	6.6	1,206	4.2	117.2
Dodge	9,608	20.0	2,317	32.4	559	19.7	47.4
Door	2,098	11.1	288	13.9	90	9.3	9.0
Douglas	686	3.5	105	3.4	36	2.8	3.1
Dunn	3,881	18.3	688	27.1	193	16.3	16.8
Eau Claire	4,481	6.4	1,097	13.0	275	6.8	23.1
Florence	214	15.2	48	28.3	7	11.6	2.1
Fond du Lac	8,691	14.7	2,306	21.6	576	14.4	52.1
Forest	193	4.1	7	1.7	3	1.4	0.2
Grant	6,456	24.5	985	32.4	312	21.8	29.5
Green	5,911	27.8	1,387	41.1	328	26.0	39.6
Green Lake	1,463	15.0	320	26.5	88	16.3	7.4
Iowa	2,765	17.8	332	15.0	108	8.7	9.6
Iron	72	2.7	7	2.7	3	2.3	0.2
Jackson	2,543	22.1	321	25.0	105	16.9	9.1
Jefferson	8,732	18.1	2,141	27.0	564	18.3	62.7
Juneau	1,577	14.0	246	17.5	70	11.6	5.9
Kenosha	2,507	3.6	811	9.0	180	4.0	13.2
Kewaunee	2,618	25.0	488	27.6	148	17.9	13.1
La Crosse	4,062	5.1	1,366	13.6	257	5.3	48.6
Lafayette	3,561	54.2	841	85.3	215	62.6	19.9
Langlade	1,926	15.6	267	15.7	79	10.8	6.5
Lincoln	1,309	8.4	142	6.2	39	4.3	3.2
Manitowoc	4,871	11.1	1,436	18.3	276	8.8	20.4

Table 3 (cont): Contribution of Agriculture to Wisconsin Counties (2008)

County	Jobs	%	Business Sales (M$)	%	Income (M$)	%	State& Local Govt Revenues (M$)
Marathon	13,266	14.9	2,411	17.6	630	11.0	57.9
Marinette	1,146	4.7	128	3.7	47	3.5	4.5
Marquette	1,935	34.9	357	52.0	107	39.2	8.7
Milwaukee	14,228	2.2	6,032	6.4	1,390	2.9	220.9
Monroe	4,281	17.3	858	26.4	205	14.5	16.5
Oconto	3,997	30.2	788	44.6	181	27.7	15.9
Oneida	627	2.5	71	2.6	27	1.9	2.3
Outagamie	11,592	9.3	2,797	13.8	705	7.8	58.0
Ozaukee	1,614	3.1	544	6.3	100	2.6	5.6
Pepin	1,035	31.7	166	44.8	50	29.9	4.9
Pierce	2,378	16.6	287	18.9	98	12.8	8.7
Polk	3,692	18.4	725	26.8	177	16.3	18.8
Portage	5,551	12.9	1,105	17.7	339	12.1	32.2
Price	547	6.6	34	2.6	12	2.6	1.0
Racine	3,205	3.5	702	4.1	206	2.6	17.9
Richland	3,699	41.0	774	48.6	158	32.9	13.6
Rock	6,265	7.6	1,448	9.2	445	7.5	36.5
Rusk	1,157	15.8	111	14.1	39	11.4	3.2
St. Croix	3,605	9.3	533	11.1	158	7.2	15.4
Sauk	4,731	9.9	676	11.2	219	7.7	20.4
Sawyer	500	5.1	51	5.5	20	4.0	1.7
Shawano	4,266	22.5	487	24.0	175	18.9	15.6
Sheboygan	8,137	10.8	3,152	23.7	597	11.6	46.5
Taylor	3,744	33.1	615	43.5	192	32.9	16.9
Trempealeau	4,778	28.3	786	33.3	207	20.8	17.1
Vernon	5,371	37.0	576	38.9	186	26.1	18.7
Vilas	289	2.8	30	3.2	11	2.2	1.0
Walworth	3,780	7.1	600	9.0	209	6.8	17.7
Washburn	1,081	16.1	248	28.4	45	12.4	3.6
Washington	3,505	5.3	746	8.0	218	4.9	21.0
Waukesha	3,231	1.1	980	2.1	207	0.9	14.3
Waupaca	4,427	17.2	872	23.7	209	14.2	20.1
Waushara	1,547	18.9	230	22.9	81	18.4	7.0
Winnebago	2,625	2.5	529	2.9	145	1.9	11.2
Wood	4,616	9.1	1,017	12.3	253	6.6	21.9

Several other general observations can be noted:

- In 35 Wisconsin counties agriculture impacts 3,561 or more jobs
- In 34 Wisconsin counties agriculture supports more than 14.2 percent (a seventh) of all the jobs in the county.
- In 35 Wisconsin counties agriculture stimulates more than $615M in industry sales
- In 34 Wisconsin counties the share of total industry sales stimulated by agriculture exceeds 18.4 percent
- In 35 Wisconsin counties agriculture contributes more than $177.5M in total income
- Is 35 Wisconsin counties the share of total county income contributed by agriculture exceeds 11.6%
- In 16 Wisconsin counties agriculture generates more than $25.1M in state and local government revenue (not including taxes paid for K-12 education).

We should note that in the analysis just reviewed we define agriculture as the aggregate of on farm and food processing. We do not consider what some might consider being part of agricultural value added processing. For example, we do not consider ethanol production nor do we consider clothing production such as using Wisconsin produced leather that is used in leather goods. We exclude these types of industries to remain consistent with prior studies of Wisconsin's agricultural industries.

Conclusions

In this modest study we have updated three sets of analysis. First, we have revisited basic trends in agricultural employment from 1990 to 2009. While we found that agriculture as a source of employment growth is limited, the downward trend in employment appears to have stabilized with some evidence of modest growth. Second, we updated a "Porter style" cluster analysis of numerous on farm and food processing sectors. We identified several sectors that are "strong and strengthening" and may serve as potential clusters for future development. Examples include certain elements of horticulture and frozen specialty foods such as frozen pizzas. We also found that dairy, while extremely important to Wisconsin's economy, is losing some of its strength when compared to the nation. We hypothesize that the dairy industry is growing outside of Wisconsin but is stable inside Wisconsin.

The more important contribution of this analysis is the county-by-county economic impact analysis. We find that agriculture, which includes both on farm as well as food processing, is important in nearly every county in Wisconsin except for perhaps the very northern counties. Some of the most urban counties in Wisconsin, including Brown, Dane and Milwaukee, have some of the largest absolute agricultural impacts in terms of jobs, income and business sales. But in terms of relative contributions, specifically agriculture's contribution as a share of the total county's economy, some of the most rural counties are most dependent upon agriculture including Lafayette, Taylor and Trempealeau. The analysis presented here can be described at best as descriptive. Agricultural markets ebb and flow over time, as is the case with dry, condensed and evaporated dairy products and export markets. Next steps involve a more detailed analysis of some of the sectors that could serve as the foundation for promotion as a future potential cluster.

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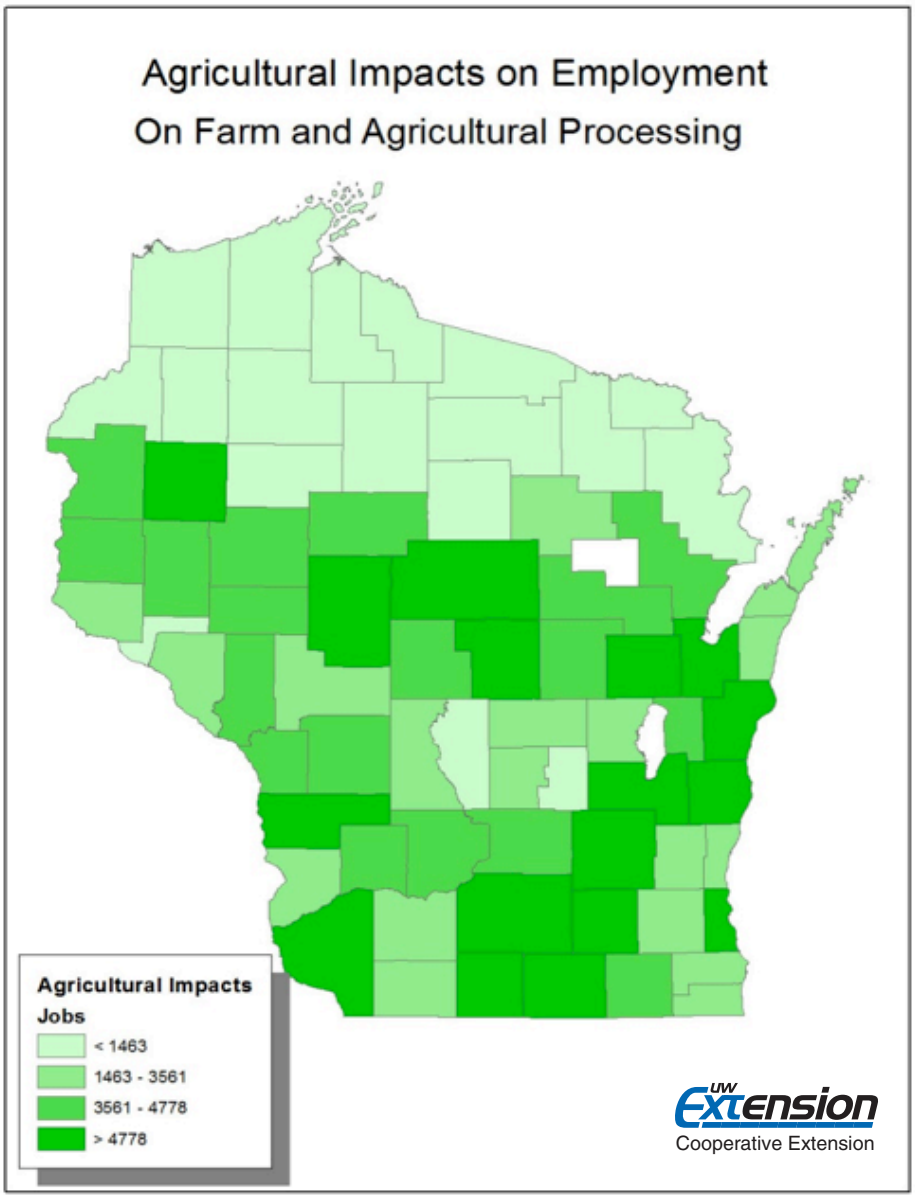
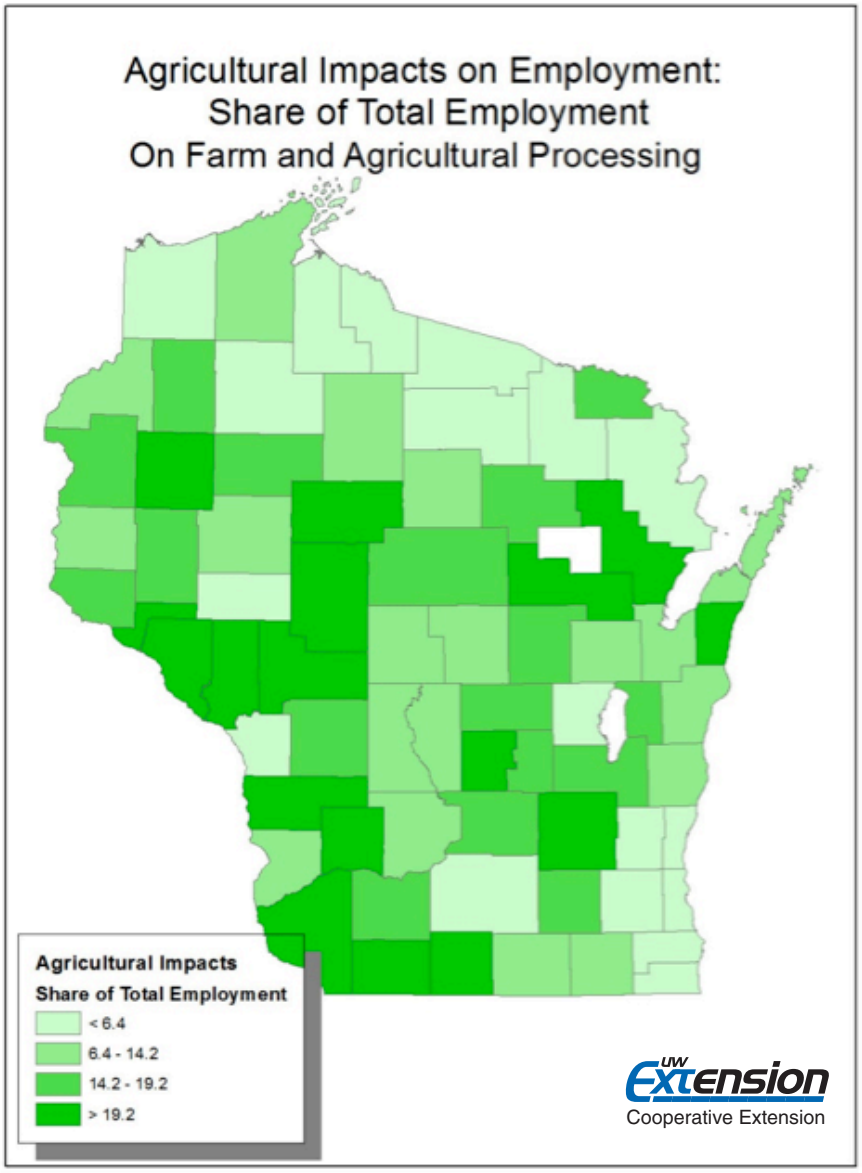


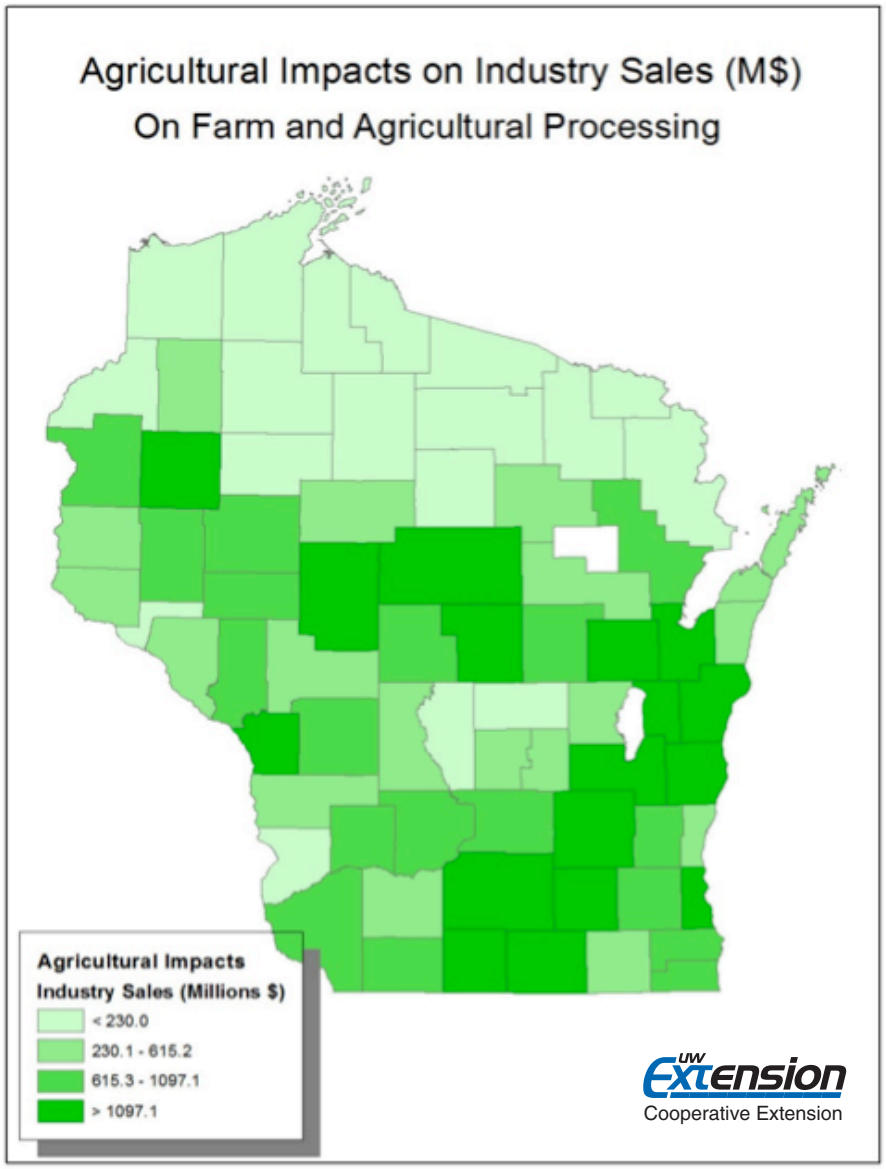
Top 10 Counties 2008

	County	Jobs	Percent of all Jobs
1.	Brown	21,037	11.6
2.	Dane	16,766	4.4
3.	Milwaukee	14,228	2.2
4.	Marathon	13,266	14.9
5.	Outagamie	11,592	9.3
6.	Dodge	9,608	20.0
7.	Jefferson	8,732	18.1
8.	Fond du Lac	8,691	14.7
9.	Barron	8,231	28.6
10.	Sheboygan	8,137	10.8



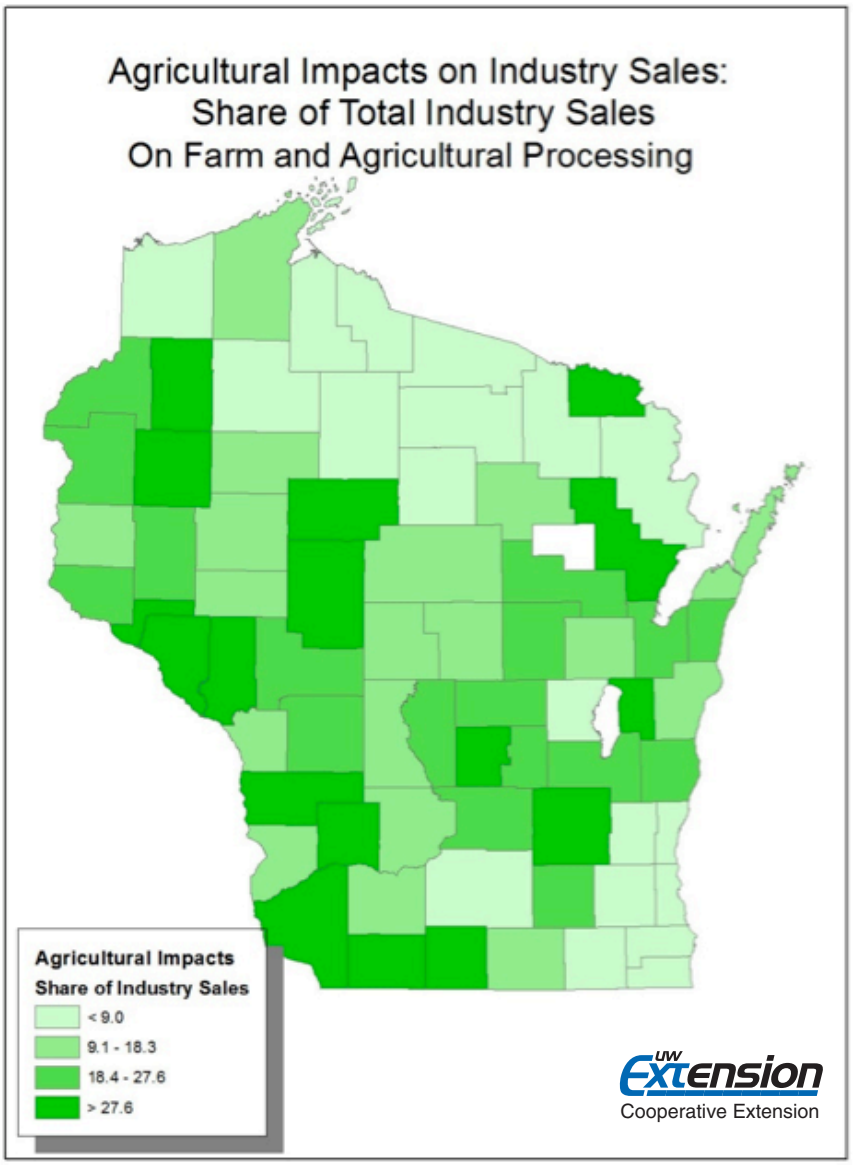
Top 10 Counties 2008

	County	Jobs	Percent of all Jobs
1.	Lafayette	3,561	54.2
2.	Clark	7,697	45.5
3.	Richland	3,699	41.0
4.	Vernon	5,371	37.0
5.	Buffalo	3,045	36.1
6.	Marquette	1,935	34.9
7.	Taylor	3,744	33.1
8.	Pepin	1,035	31.7
9.	Oconto	3,997	30.1
10.	Trempealeau	4,778	28.3



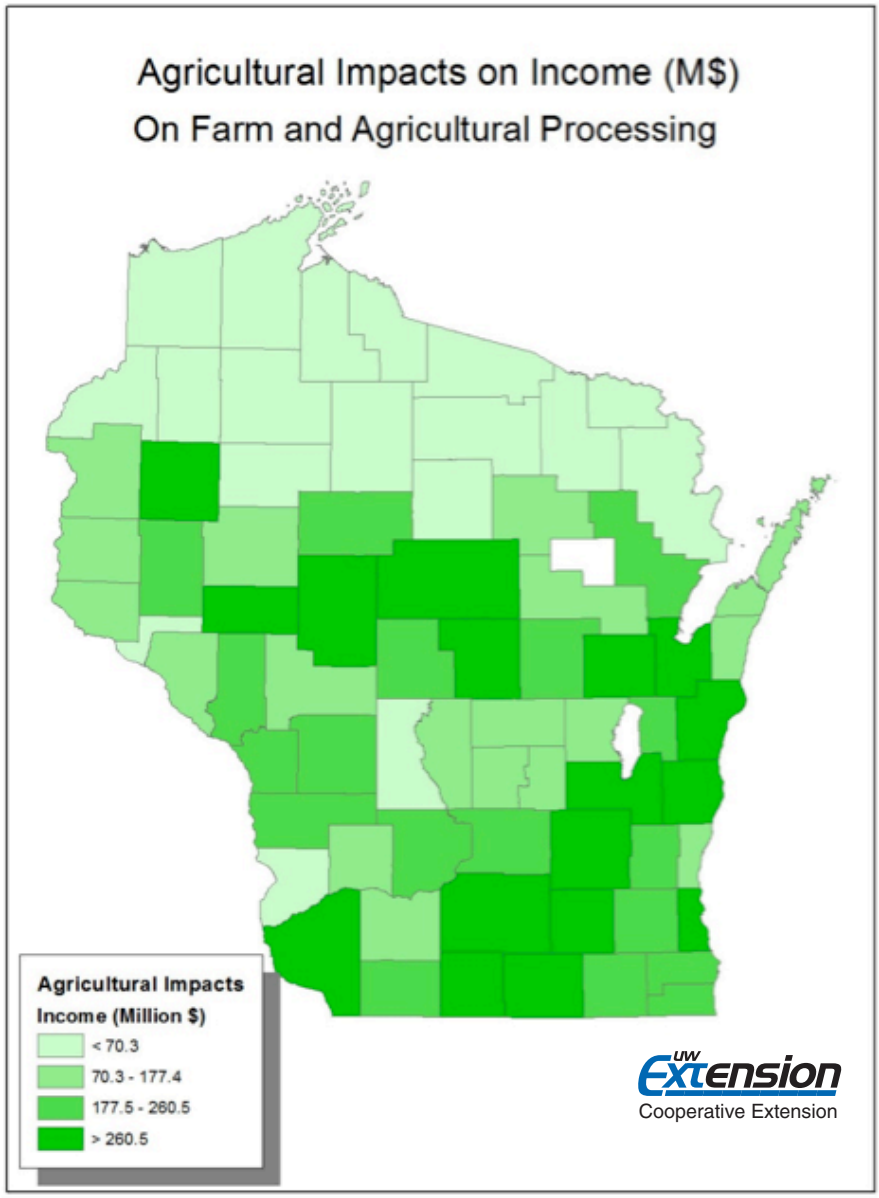
Top 10 Counties 2008

	County	Industrial Sales (M$)	Share of Total Industry Sales (%)
1.	Milwaukee	6,031.79	6.4
2.	Brown	5,711.49	20.4
3.	Dane	3,450.50	6.6
4.	Sheboygan	3,151.69	23.7
5.	Outagamie	2,797.48	13.8
6.	Marathon	2,411.10	17.6
7.	Dodge	2,317.14	32.4
8.	Fond do Lac	2,305.81	21.6
9.	Jefferson	2,141.12	27.0
10.	Clark	1,546.52	63.1



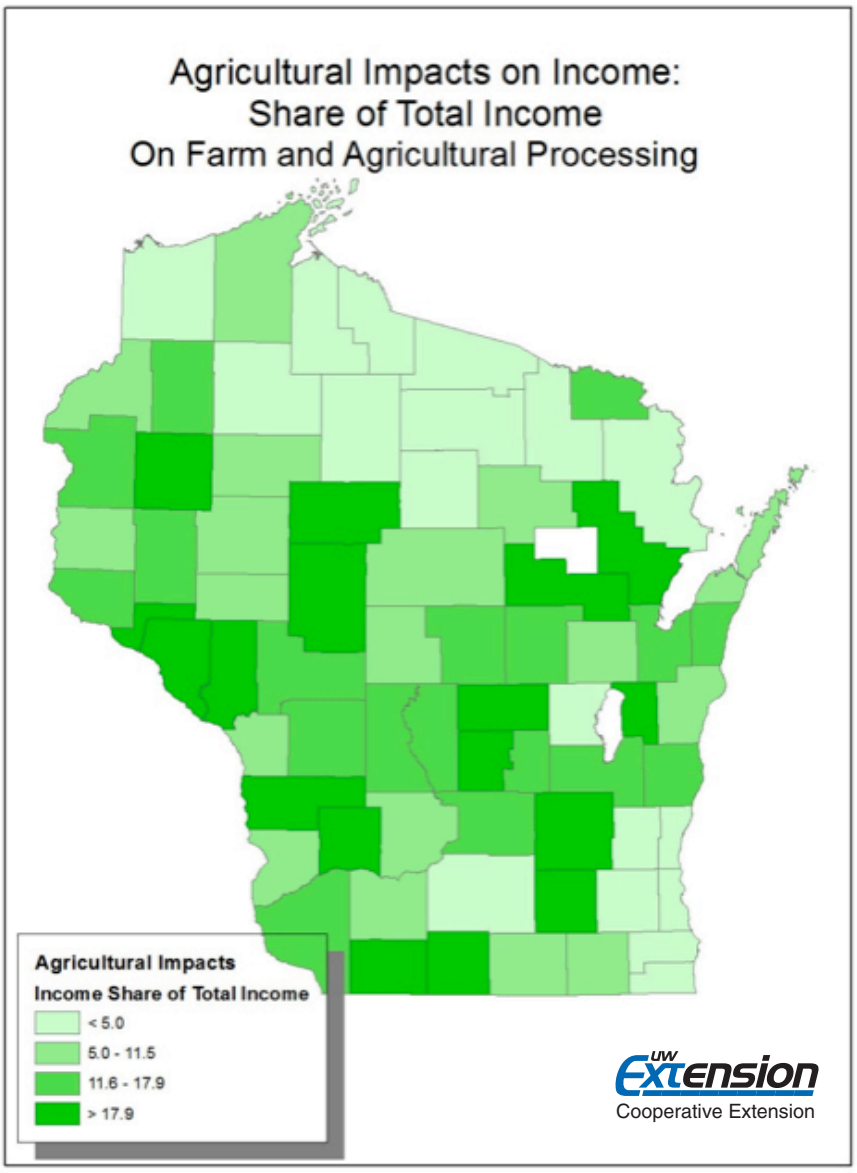
Top 10 Counties 2008

	County	Industrial Sales ($M)	Share of Total Industrial Sales (%)
1.	Lafayette	840.61	85.3
2.	Clark	1,546.52	63.1
3.	Marquette	356.68	52.0
4.	Buffalo	527.64	48.7
5.	Richland	774.29	48.6
6.	Pepin	165.64	44.8
7.	Oconto	788.21	44.6
8.	Taylor	615.22	43.5
9.	Green	1,386.66	41.1
10.	Vernon	575.81	38.9



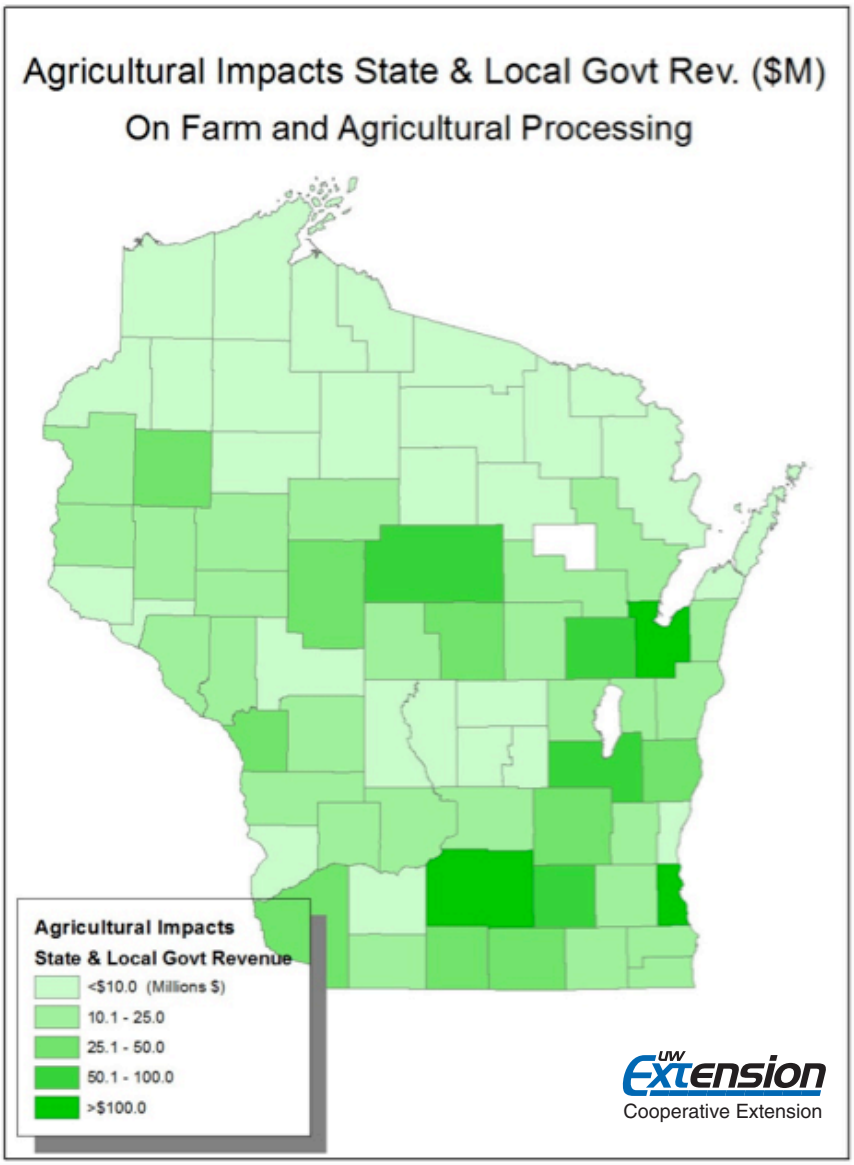
Top 10 Counties 2008

	County	Income (M$)	Share of Total Income (%)
1.	Brown	1,557.50	11.8
2.	Milwaukee	1,389.83	2.9
3.	Dane	1,205.66	4.2
4.	Outagamie	704.55	7.8
5.	Marathon	629.60	11.0
6.	Sheboygan	596.77	11.6
7.	Fond du Lac	576.44	14.4
8.	Jefferson	563.87	18.3
9.	Dodge	558.72	19.7
10.	Rock	444.58	7.5



Top 10 Counties 2008

	County	Income ($M)	Share of Total Income (%)
1.	Lafayette	214.61	62.6
2.	Clark	403.52	47.2
3.	Marquette	107.49	39.2
4.	Taylor	192.44	32.9
5.	Richland	158.24	32.9
6.	Pepin	50.37	29.9
7.	Buffalo	140.85	28.2
8.	Oconto	181.36	27.7
9.	Vernon	185.99	26.1
10.	Green	328.18	26.0



Top 10 Counties 2008

	County	State and Local Government Revenue ($M)
1.	Milwaukee	220.91
2.	Brown	138.75
3.	Dane	117.15
4.	Jefferson	62.71
5.	Outagamie	58.04
6.	Marathon	57.89
7.	Fond du Lac	52.08
8.	La Crosse	48.57
9.	Dodge	47.38
10.	Sheboygan	46.51