Study to Support Growth and Competitiveness of the Pennsylvania Dairy Industry

Phase I Report

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Executive Summary

This study was begun early in 2017 after discussions with leadership of the Pennsylvania Department of Agriculture and the Center for Dairy Excellence. The objectives for Phase I are primarily diagnostic, focusing on a review of aggregated secondary data regarding farm and processing sector performance. A key purpose of this document is to provide input for subsequent discussions by industry stakeholders.

- Milk production in Pennsylvania has grown little in the past decade, with slower growth in milk per cow than in comparison states with similar agronomic resources (NY, MI, WI). The southeastern and central regions of the state have seen growth in milk production since 2007. Larger milk per cow is associated with use of a nutritionist, systematic breeding and location in the southeastern part of the state. Farm size is not associated with milk per cow, and older milking facilities were associated with lower milk per cow;
- A survey of nearly 1000 dairy producers by the Center for Dairy Excellence indicated that 14% expect to exit the industry in the next five years, with a 18% overall reduction in cow numbers based on current intentions. Surveyed producers placed less emphasis on increasing herd size or milk per cow than on obtaining higher and more stable prices to improve future business performance;
- Available published data on dairy processing in Pennsylvania are limited and do not allow a comprehensive assessment of state-level processing performance. NDM and butter plants processed volumes above the overall US average in 2015, but volumes per plant are small compared to the overall US average for other products.
- Available NASS data suggest that total Pennsylvania cheese production has been roughly constant since 2000, whereas Wisconsin cheese production has grown by 50%. Ice cream production has decreased in Pennsylvania, and although sour cream and yogurt have increased in recent years, the volumes remain small.
- There has been a marked increase in recent years in Pennsylvania milk pooled in Class IV under the Northeast Federal Milk Marketing Order, whereas the amount of milk pooled in other classes has been roughly constant since 2006. Volumes of milk utilized in dry milk products are highly volatile and have increased notably since 2014.

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- Despite a 15% decline in overall Class I sales in the Northeast Federal Milk Marketing Order since 2006, the amount of Pennsylvania farm milk in Class I uses has remained roughly constant during the past 11 years;
- Economic development entities in Pennsylvania have benefitted a relatively small number of dairy-related entities in the state (primarily in dairy processing), but likely could be used to a greater extent.
- A study[2] sponsored by the International Dairy Foods Association (IDFA) indicated large economic impacts of post-farm dairy processing in Pennsylvania during 2014, including nearly $9 billion in direct economic activity and 45,000 jobs.
- An initial review of the data on Pennsylvania farm milk used in fluid processing and economic logic[3] suggests that the regulated milk pricing structure under the Pennsylvania Milk Marketing Board is not a major causal factor in the decline of fluid milk sales in the region more generally and the volume of fluid milk processed in the state. Moreover, the Pennsylvania Class I premium is considered a reference point for privately negotiated Class I premiums in other states. This probably means is that even if a Pennsylvania farm is selling to a NJ fluid plant, the farm is getting a premium that has benefited from the regulated pricing structure in Pennsylvania.

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[2] The IDFA study was released online in July 2017 and is separate from a similar assessment of economic impacts that will be undertaken as one component of the *Study to Support Growth and Competitiveness of the Pennsylvania Dairy Industry*. The findings of the IDFA-sponsored study are reported because they provide additional evidence of the economic importance of the Pennsylvania dairy industry.

[3] A subsequent component of study will examine the impacts of the PMMB in greater detail.

Background and Phase I Study Objectives

This study was begun early in 2017 after discussions with leadership of the Pennsylvania Department of Agriculture and the Center for Dairy Excellence. The objectives for Phase I are primarily diagnostic, and are designed to provide input for subsequent discussions by industry stakeholders. The Phase I objectives include:

1) Comparative performance of Pennsylvania dairy farm productivity and profitability;
2) Comparative performance of Pennyslvania dairy processing capacity, performance and future plans;
3) Availability assessment of data relevant to the analysis of current status of the dairy industry and development or modifications of programs or policies;
4) Comparative summary of organizations and institutions to support dairy sector development;
5) Summary of programs and policies in Pennsylvania that affect future growth and competitiveness;
6) What economic development efforts in Pennsylvania other states support growth of agribusiness and dairy?;
7) Initial discussion of issues related to the Pennsylvania Milk Marketing Board.

This interim report summarizes the findings to date for each of these project components.

Farm-level Performance

Sector-Level Performance Assessment

Although this component of the project seeks insights about how to enhance the productivity and profitability of Pennsylvania's dairy farms through comparisons of farm-level data, a review of more aggregated data provides relevant context. A key observation is that total milk production in Pennsylvania as reported by the National Agricultural Statistics Service (NASS) has grown little in the past 16 years (Figure 1), which contrasts with the much more rapid rates of growth in production in comparison states (WI, NY and MI). Michigan's milk production has nearly doubled during 2000 to 2016, and although Wisconsin lost production during the first few years of the 2000s, it has grown considerably since its low point in 2004. Growth in New York has increased since the low-margin year of 2009. One factor affecting state-level milk production is productivity. Milk per cow in Pennsylvania (also reported by NASS) has increased at less than 1% per year, a rate much slower than those of comparison states (Figure 2). These comparisons suggest that growth in milk production and productivity per cow are occurring in other states with similar agronomic resources, which underscores the need to understand why the pattern of growth is markedly different in Pennsylvania. These are key questions to be addressed by this study: what underlies the pattern of growth in Pennsylvania and what might be done to accelerate profitable growth at the farm level?

Although overall growth in milk production has been slow in Pennsylvania, production has increased in some counties and decreased in others (Figures 3 and 4). This analysis compares data from the 2007 Census of Agriculture and our estimates of county-level milk production in 2016[4] to assess changes in a volume and as a percentage. In general, counties with larger milk production in 2007 showed more growth—that is, there has been a further geographic concentration of milk production. The largest production increases occurred in Lancaster, Berks, Franklin and Blair counties (Figure 3). Milk production declines were concentrated in the northeast and southwest corners of the state, with the exception of York county. The percentage growth was larger for some counties with lower production levels, including Potter, Clinton, Jefferson and Columbia. As for state-level milk production, these patterns provide a basis for further analysis about why production is growing in some counties and declining in others.

[4] County-level milk production was estimated from county-level milk receipts, where reported, from various statistical bulletins from federal milk marketing orders receiving milk from Pennsylvania (Federal Orders 1, 33, 5, 7 and 6). Milk production estimates are also made from county-level Agricultural Census reports of dairy cow numbers conducted by the National Agricultural Statics Service for 2012. The sum of the county estimates of milk volume and components exactly sum to the state totals for the months used in the USDSS spatial model and the years reported.

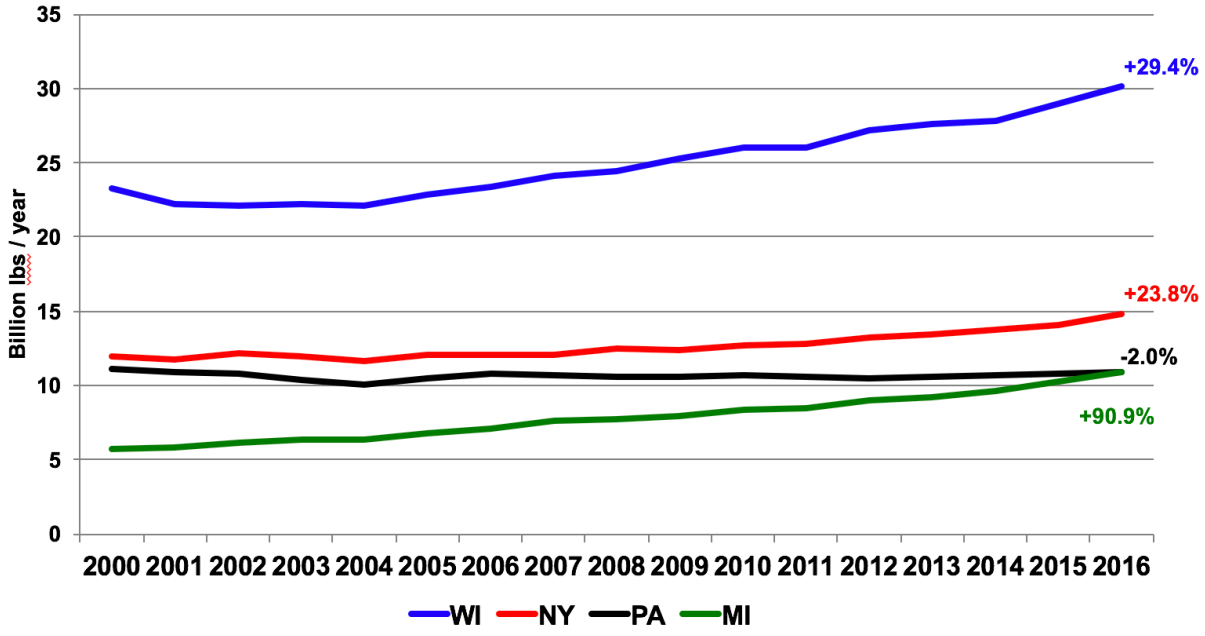


Figure 1. Total Annual Milk Production for Selected States, 2000 to 2016

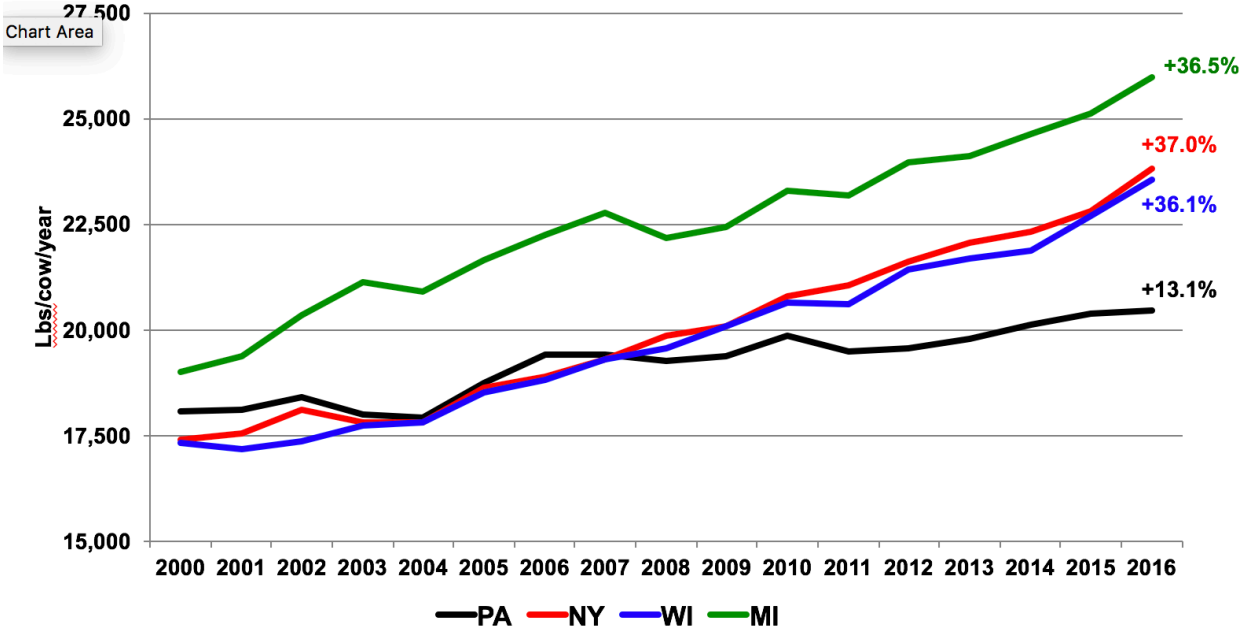


Figure 2. Total Annual Average Milk Per Cow for Selected States, 2000 to 2016

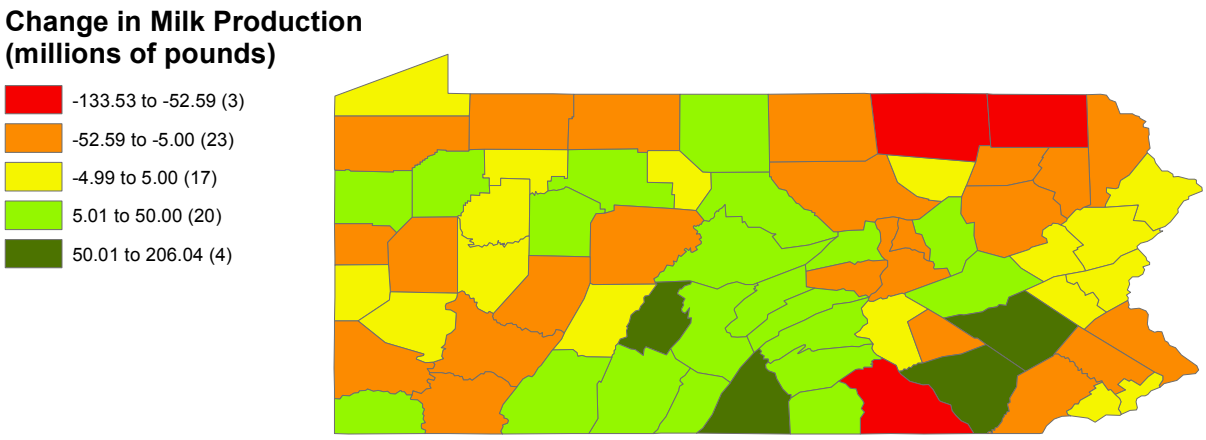
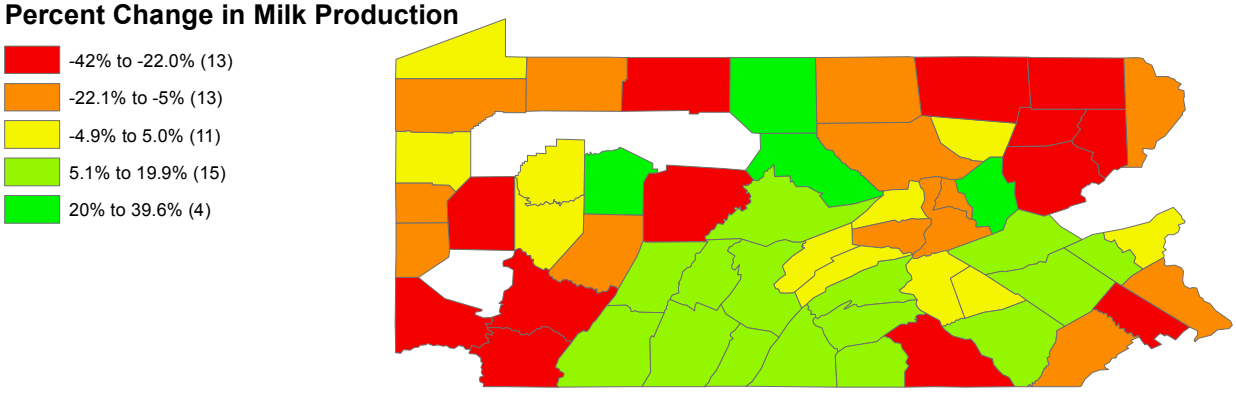


Figure 3. Estimated Change in Milk Production, Pennsylvania Counties, 2007 to 2016



Note: Counties not shown had milk production values that were not reported in the 2007 Census of Agriculture.

Figure 4. Estimated Percentage Change in Milk Production, Pennsylvania Counties, 2007 to 2016

Center for Dairy Excellence 2017 Producer Survey Analysis

Data from farm-level surveys can also provide some insights about the state- and county-level patterns described above. The Center for Dairy Excellence has undertaken statewide producer surveys in 2008, 2012 and 2017. We analyzed data from the 2017 survey to provide additional perspective on milk production and productivity patterns. In 2017, 992 dairy farms (roughly 14% of Pennsylvania's approximately 7,000 dairy farms) responded to the survey[5]. Responses were received from most counties in the state, and response rates were roughly proportional to the number of dairy farms and(or) milk production by county (Figure 5). About 11% of the farms surveyed indicated that they were no longer milking cows, which is suggestive of a rate of exit of farms during the five years between surveys. Of the survey respondents who are still milking cows (N=879), the average farm size was 102 cows, with a range from 6 to 1900. Seventy-five percent of respondents had fewer the 100 cows, and 50% of respondents had < 70 cows.

Although the CDE survey provides information on a broader set of characteristics and expectations for the state's dairy producers, we focused on a few key outcomes that relate to the potential for future growth and competitiveness. One such factor is whether farms expect to be in business five years from the time of the survey (that is, in 2022). Overall, about 14% of the surveyed farms expect to exit during the next five years (a rate roughly comparable to the exit rate suggested by the 11% of farms who exited between 2012 and 2017). However, the expected rates of exit vary by farm size, with higher rates expected for smaller farm sizes (Figure 6). About 20% of farms with 50 cows or less expect to exit by 2022, but none of the farms with more than 250 cows plan to exit. These expectations can also be examined based on expected reductions in cow numbers by 2022. On average, the survey farms expect to reduce cow numbers by 18%, which includes a number of "100% reduction" responses by farms that expect to exit. As for farm exits, smaller farms expect larger reductions in cow numbers, and the largest farms expect to grow (Figure 7). Together, these results do not suggest strong growth in milk production during the next five years, although it is important to note that these are <u>expectations</u>, not yet <u>realities</u>. The overall effect of future exits on milk production and appropriate processing capacity in the state depends on the decisions of producers who do not exit and the broader market context. The components of the current study do not include a projection of the numbers, or sizes of Pennsylvania farms and milk production under alternative market conditions or proposed changes, although perhaps a future study of this nature would be useful.

[5] A response rate of 14% to a broad-based survey of this nature would be considered fairly good from the perspective of most social science research. This survey appears to reflect somewhat smaller farms and less productive farms on average, but does not appear to have a degree of bias that renders the results either suspect or unhelpful.

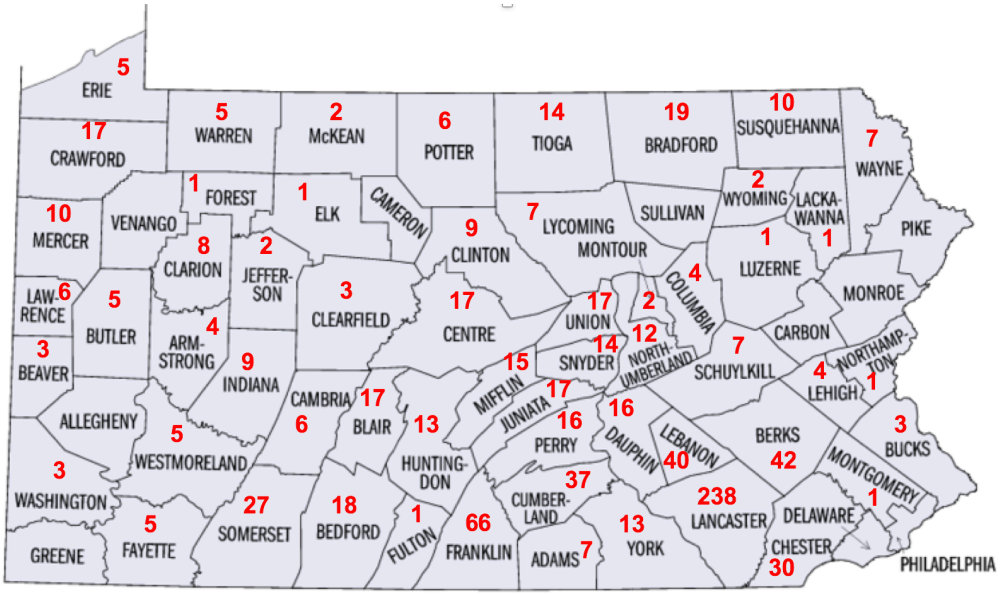


Figure 5. Number of Respondents by County to Center for Dairy Excellence 2017 Producer Survey

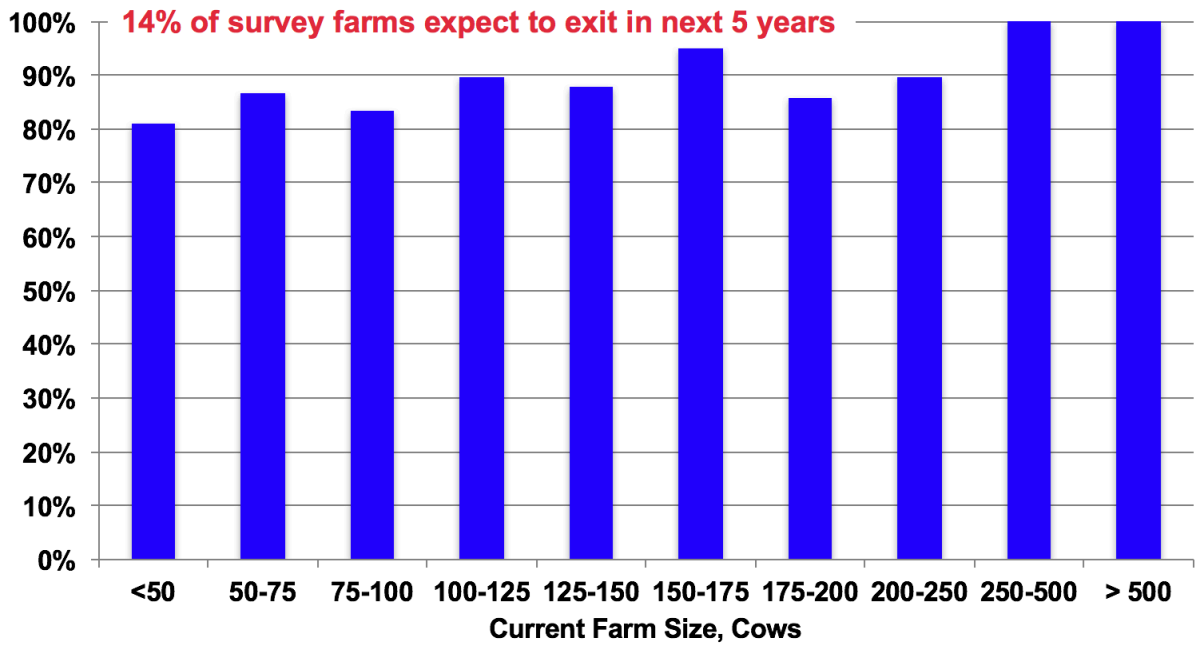


Figure 6. Proportion of Surveyed Farms Expecting to be in Dairying Five Years from Now, by Farm Size Category

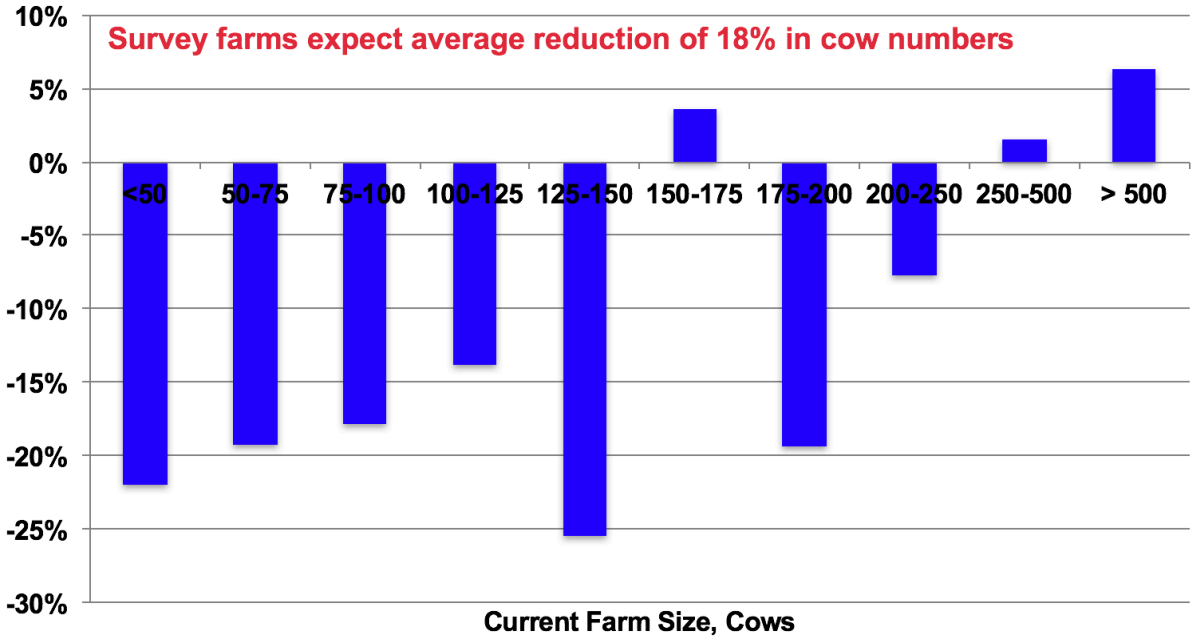


Figure 7. Expected Percentage Reduction in Cow Numbers Five Years from Now on Surveyed Farms, by Farm Size Category

The expected change in cow numbers by survey respondents can also be examined by county (Figure 8), although caution should be exercised based on the small number of respondents in some counties. Respondents from counties with larger milk production in 2016 generally indicated neutral to positive expected percentage changes in cow numbers, and counties with less milk production negative expected changes[6].

The factors reported by survey respondents as important to the improvement of farm business performance during the next three to five years also provide insights about the potential for growth and improvement competitiveness. The survey asked respondents to rank as "Not Important", "Somewhat Important" or "Very Important" eight factors relating to milk prices, cost structures, productivity and farm size. To summarize these results, we assigned values of 0, 1 and 2 to these categories, respectively, and took the average of the responses. Maximizing the price received for milk and stabilizing milk prices were the highest ranked factors (Figure 9), followed by decreasing costs of production overall and specifically those for feed. Improvements in milk components and udder health were ranked next most important. As highlighted in the figure, survey respondents ranked increasing milk per cow and farm size as the lowest priority (particularly the latter), which suggests that surveyed farms do not view productivity gains or farm size as critical for future business performance.

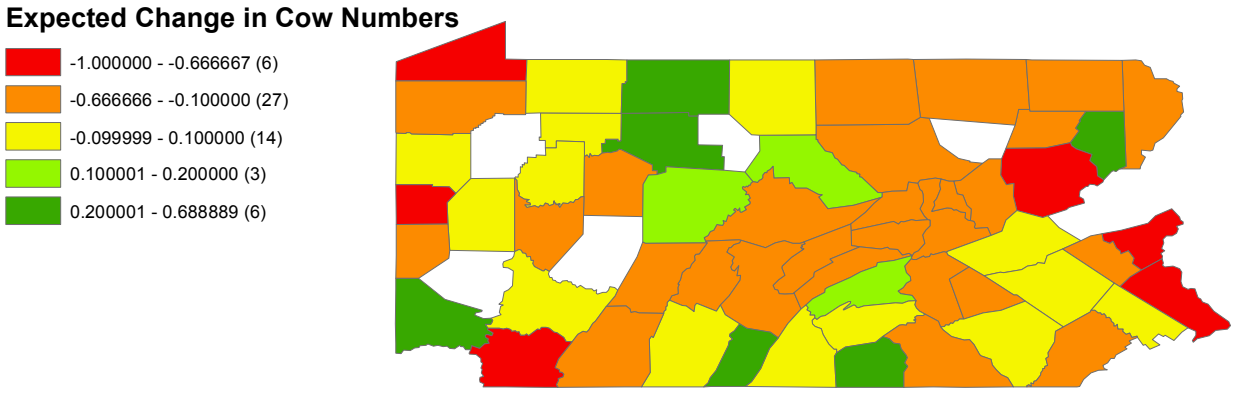
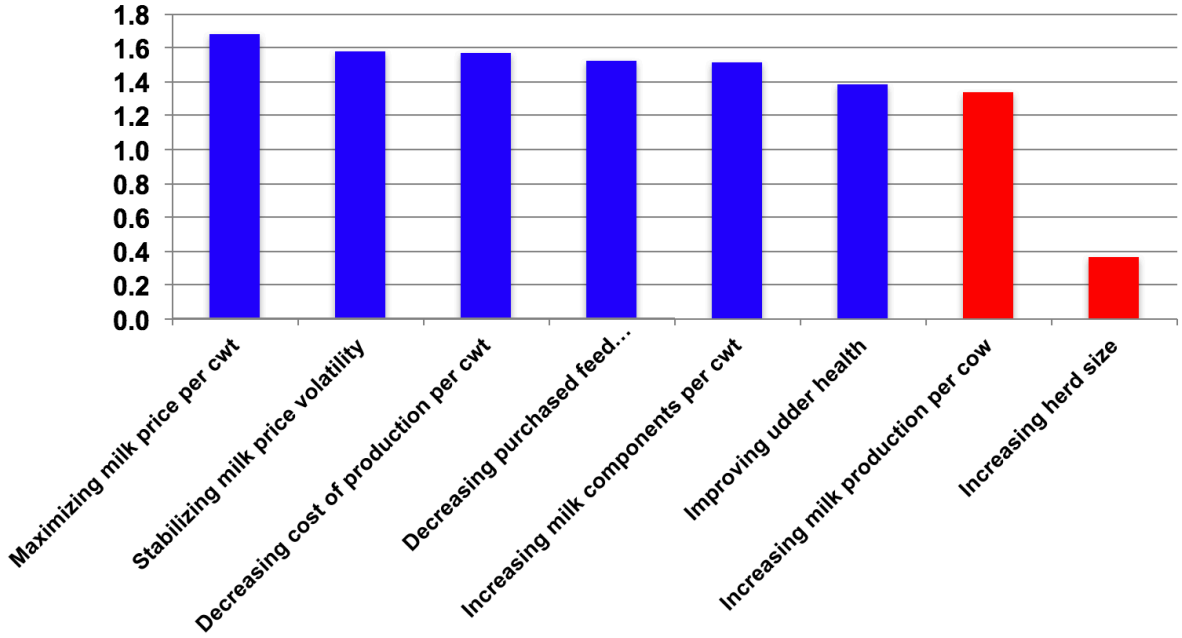


Figure 8. Expected Proportional Change in Cow Numbers Five Years from Now, Pennsylvania Counties

[6] The counties of McKean, Elk, Lackawanna, and Washington indicate growth but all have very small numbers of survey responses (3 or less).



Note: Values are the average of 0 = Not Important, 1 = Somewhat important and 2 = Very important.

Figure 9. Reported Importance of Factors to Improving the Business Performance During the Next Three to Five Years

Given that growth in milk per cow has been slower in Pennsylvania than in other states with similar agronomic resources, an analysis of factors associated with milk per cow reported by survey respondents is relevant. Respondents reported 2016 milk production, and we eliminated 74 farms for which either daily or annual milk production values appeared to be inaccurate. There is a great deal of variation in annual milk per cow reported by survey respondents, particularly for the smaller farm sizes (Figure 10). We then used regression analysis to determine statistical associations[7] between selected factors from the survey and reported daily or annual milk per cow. The CDE survey reports on the use of number of management practices, and when facilities for housing or milking were last upgraded on the farm. We used these variables, along farm size and whether the farm was located in a county in southeastern Pennsylvania to assess their impacts on daily or annual reported milk per cow. Farm size (based on cow numbers), use of a nutritionist, use of a systematic breeding program and use of AI for 75% of all breedings were all associated with an increase in both daily and annual milk per cow (Tables 1 and 2). The strongest of these effects was for management practices, particularly the use of a nutritionist. Farms located in southeastern Pennsylvania had higher milk per cow, despite a climate that is probably somewhat less conducive to productivity. The impact of farm size, although statistically significant, was small—for each 100 cows a farm owned, daily milk production was higher by only 2 pounds, and each cow owned was associated with an increase in annual milk production of 6 pounds. The number of years elapsed since a farm upgraded milking facilities was associated with a negative impact on milk per cow, but was not statistically significant for annual milk per cow.

[7] A statistical association indicates that there is a statistical relationship between the variables, but it is important to note that this is not the same as causality. That is, it does not suggest that changing a variable like the use of a nutritionist will automatically result in an effect on milk per cow.

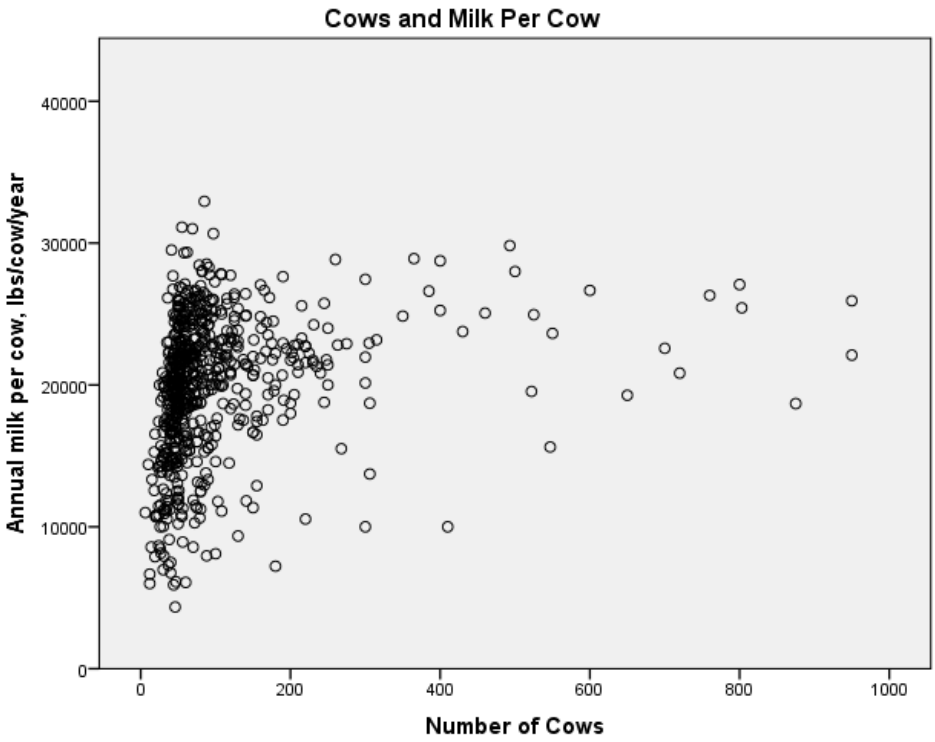


Figure 10. Scatter Plot of Reported Annual Milk Per Cow by Number of Cows on Surveyed Farms

Table 1. Regression Analysis of Factors Associated with Reported Daily Milk Per Cow

Variable	Coefficient	Std. Error	t-Statistic	P value
(Constant)	42.94	1.85	23.24	0.00
Number of Cows	0.02	0.00	5.35	0.00
Used Nutritionist?	14.70	1.68	8.77	0.00
Years since upgraded milking facilities	-0.11	0.04	-2.91	0.00
Used Systematic Breeding Plan?	4.26	1.07	3.98	0.00
Used AI for 75% of Breedings?	7.81	1.50	5.21	0.00
Farm in Southeastern PA Region?	3.42	0.96	3.56	0.00

N=692 CDE survey respondents, R^2 = 0.33, regression F-value = 56.3, regression p<0.000

Table 2. Regression Analysis of Factors Associated with Reported Annual Milk Per Cow

Variable	Coefficient	Std. Error	t-Statistic	P value
(Constant)	11,383	653	17.42	0.00
Number of Cows	6	1	4.00	0.00
Used Nutritionist?	4,419	587	7.53	0.00
Years since upgraded milking facilities	-21	14	-1.53	0.13
Used Systematic Breeding Plan?	1,383	375	3.69	0.00
Used AI for 75% of Breedings?	3,063	542	5.65	0.00
Farm in Southeastern PA Region?	1,483	340	4.36	0.00

N=598 survey respondents, $R^2 = 0.31$, regression F-value = 46.2, regression $p<0.000$

Although this analysis omits many other factors that might reasonably be associated with milk per cow, together, the basic pattern of a high degree of farm-level variation in the data and the statistical associations suggest that improvements are technically possible—but would require additional assessment for individual farm settings.

Processing Sector Performance

For growth and competitiveness of Pennsylvania's dairy farms to be enhanced, the processing sector must provide transformation and marketing of farm milk at a reasonable cost. Particularly in light of the discussions in recent years about the (in)adequacy of processing capacity in the state, we examined available data to assess trends in Pennsylvania's dairy processing sector. Our original intent was to rely heavily on NASS data on dairy production, but we quickly realized that these data were sufficiently incomplete to make a broad range of comparisons difficult. As an example, consider the available data for NDM production (Figure 11). National-level data are available continuously under NASS data-reporting guidelines, which specify that NASS must receive "at least (1) 3 good responses to our survey and (2) no producer controls 60% of more of the total production within the state" (personal communication from Adam Pike, Agricultural Statistician at the Northeastern Regional Field Office of NASS). Data on NDM production in Pennsylvania are available only for selected years, with a gap from January 2006 to December 2013. Similarly, data on cheese production are available only for selected states and time periods (Table 3, rendering comparisons to other states difficult.

However, we can assess selected trends with NASS data, and have complemented this with data from the Northeast Federal Milk Marketing Order on reported volumes processed in Pennsylvania dairy processing plants. Based on NASS data, production of butter and all cheese varieties in Pennsylvania has not increased to any great extent since 2000 (Figure 12), and the average value of production is essential constant during the past five years (albeit with sometimes significant seasonal variation). The limited growth of cheese production in Pennsylvania contrasts with the very rapid growth of cheese production in Wisconsin during this same time period (Figure 13). Total cheese production increased about 50% in Wisconsin during the 16 years beginning in 2000, and growth in production is more rapid in recent years.

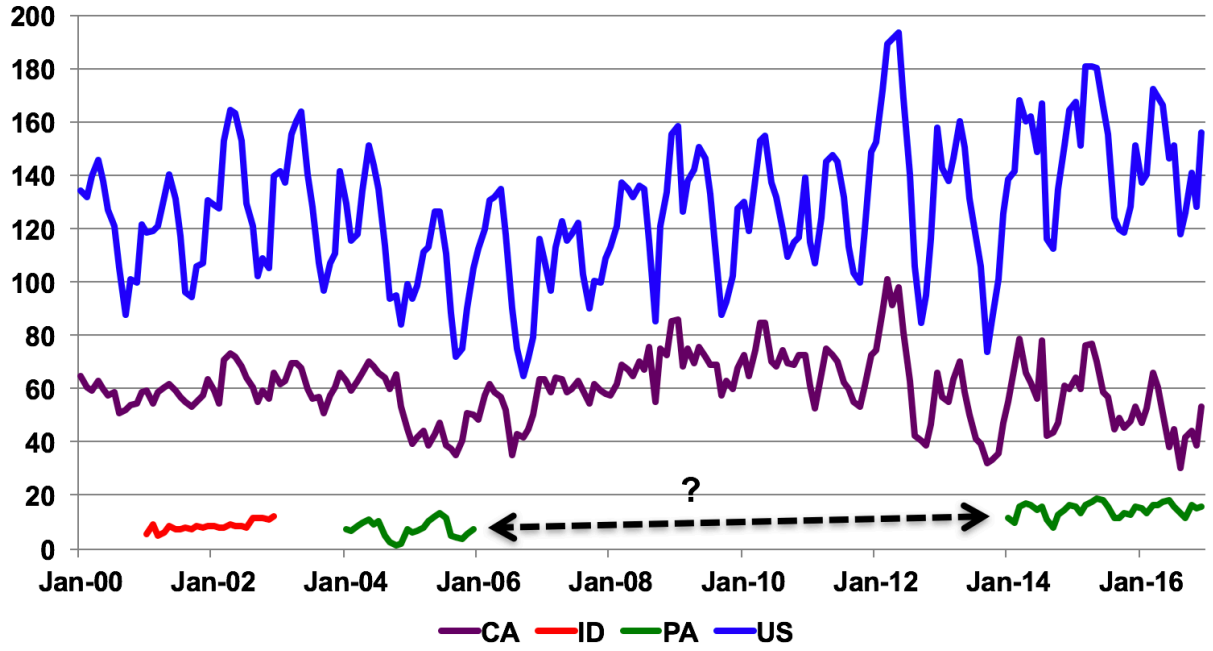


Figure 11. NDM Production Data Reported by National Agricultural Statistics Service, Selected States, 2000-2016

Table 3. Summary of NASS Data Availability for Selected Cheese Products for Pennsylvania and Comparison States

	US	PA	NY	WI
Cheese, All Other Types, Production	2000-date	1993-1994	2000-2008	2000-2001, 2004-2008
Cheese, American Types, Cheddar - Production	2000-date	1992	2000-2004	2000-date
Cheese, American Types, Production	2000-date	2014-2016	2000-2004, 2014-2016	2000-date
Cheese, American Types, Other (Colby, Monterey and Jack) - Production	2000-date	Not listed	2000-2009	2000-2015
Cheese, Blue and Gorgonzola, Production	2010-date	Not listed	Not listed	1990-1995
Cheese, Brick and Muenster, Production	2000-date	Not listed	Not listed	2000-2004
Cheese, Cream and Neufchatel, Production	2000-date	1996-1997	1994-1997	Not listed
Cheese, Feta, Production	2010-date	Not listed	Not listed	Not listed
Cheese, Gouda, Production	2010-date	Not listed	Not listed	Not listed
Cheese, Hispanic, Production	2000-date	Not listed	Not listed	2000-2015

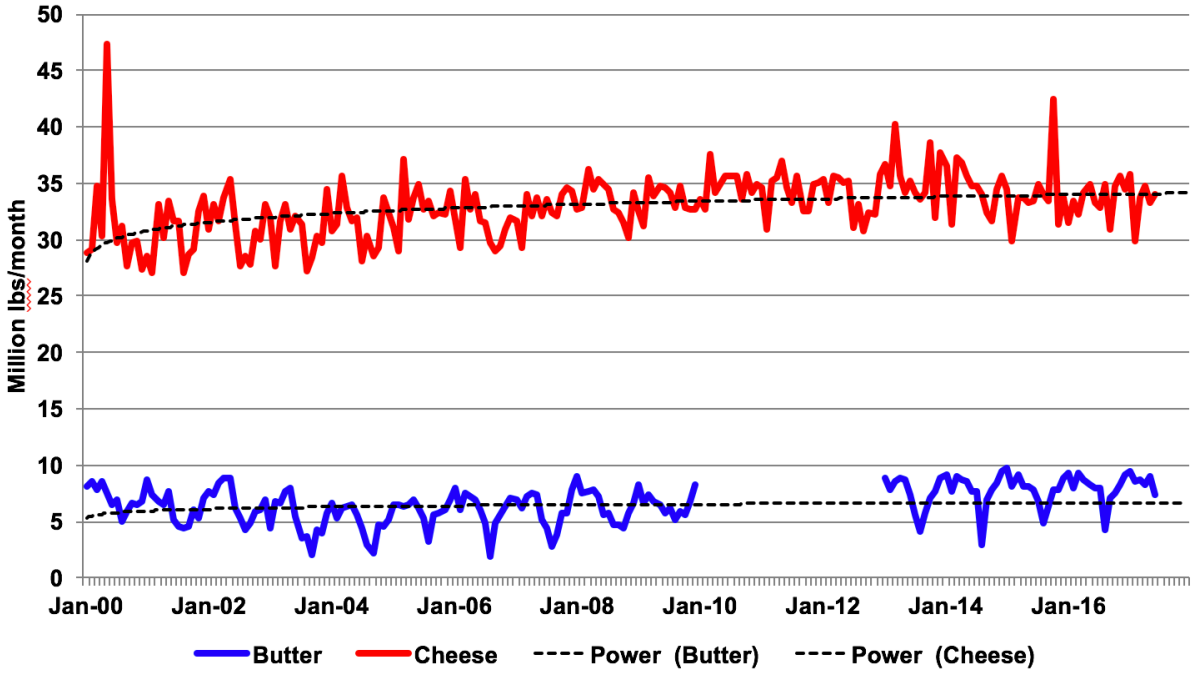


Figure 12. Pennsylvania Butter and Total Cheese Production Reported by NASS, 2000-2016

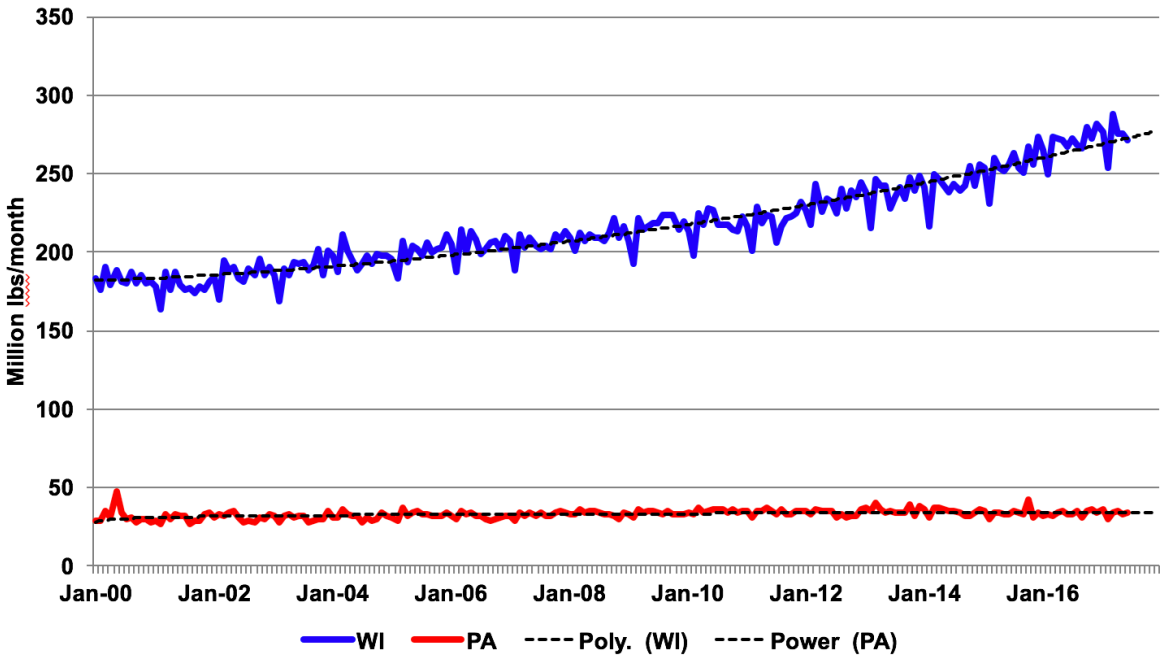


Figure 13. Total Cheese Production Reported by NASS, Pennsylvania and Wisconsin, 2000-2016

NASS data are also available of limited time periods to assess production of American Cheese, Sour cream and yogurt, although the American cheese data are now quite dated (more than 10 years old). Both sour cream and yogurt production have grown since 2014 (Figure 14), but the amounts of product are relatively small compared to other uses. Ice cream production in Pennsylvania has shown a declining trend since 2000, although is relatively stable since 2013 for regular hard ice cream (Figure 15).

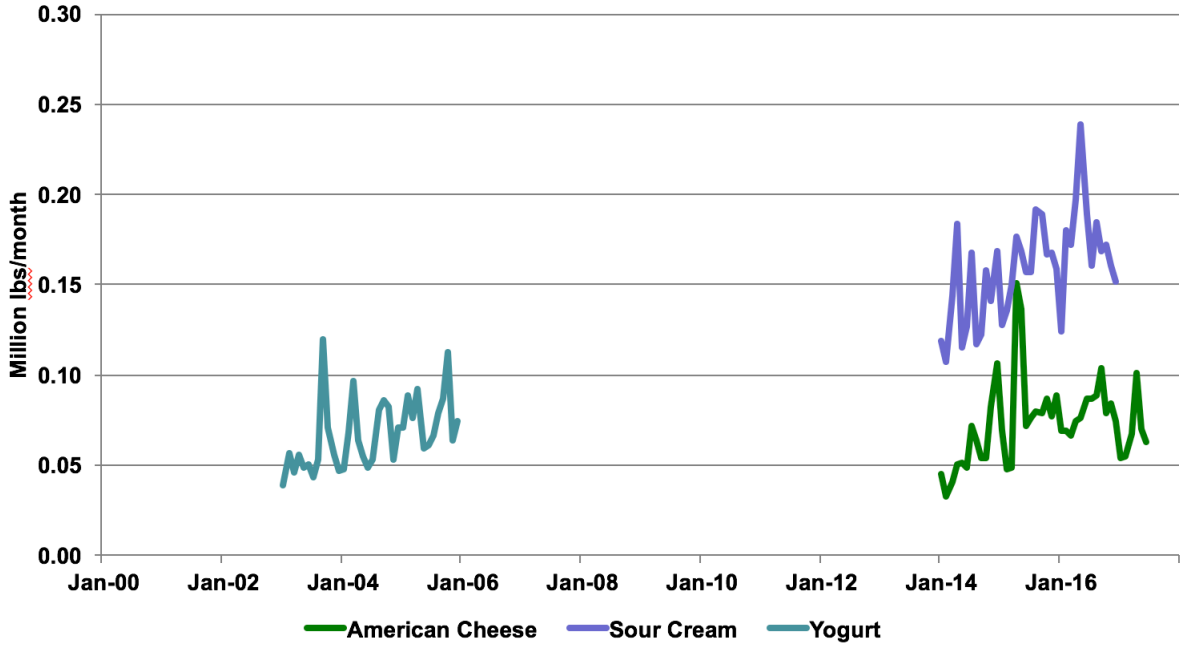


Figure 14. Pennsylvania American Cheese, Sour Cream and Yogurt Production Reported by NASS, 2000-2016

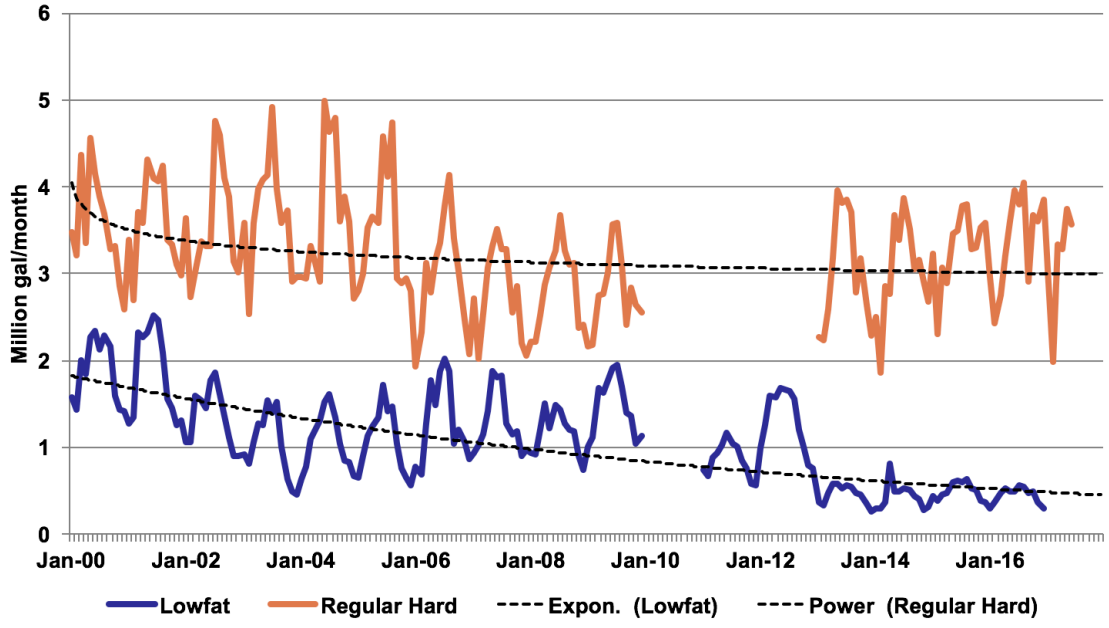


Figure 15. Pennsylvania Lowfat and Regular Hard Ice Cream Production Reported by NASS, 2000-2016

NASS data can also be used to provide a rough assessment of plant processing volumes by product compared to national average processing volumes. Average processing volumes often are related to unit processing costs, due to significant economies of scale in most dairy processing facilities. Based on 2015 data, Pennsylvania plants processed larger-than-average volumes of NDM (perhaps reflecting the balancing issues in the state in recent years), and about-average per plant volumes of butter and ice cream mix. Most other products for which data are available had much-smaller-than-average processing volumes per plant, which may be suggestive of higher per-unit processing costs[8].

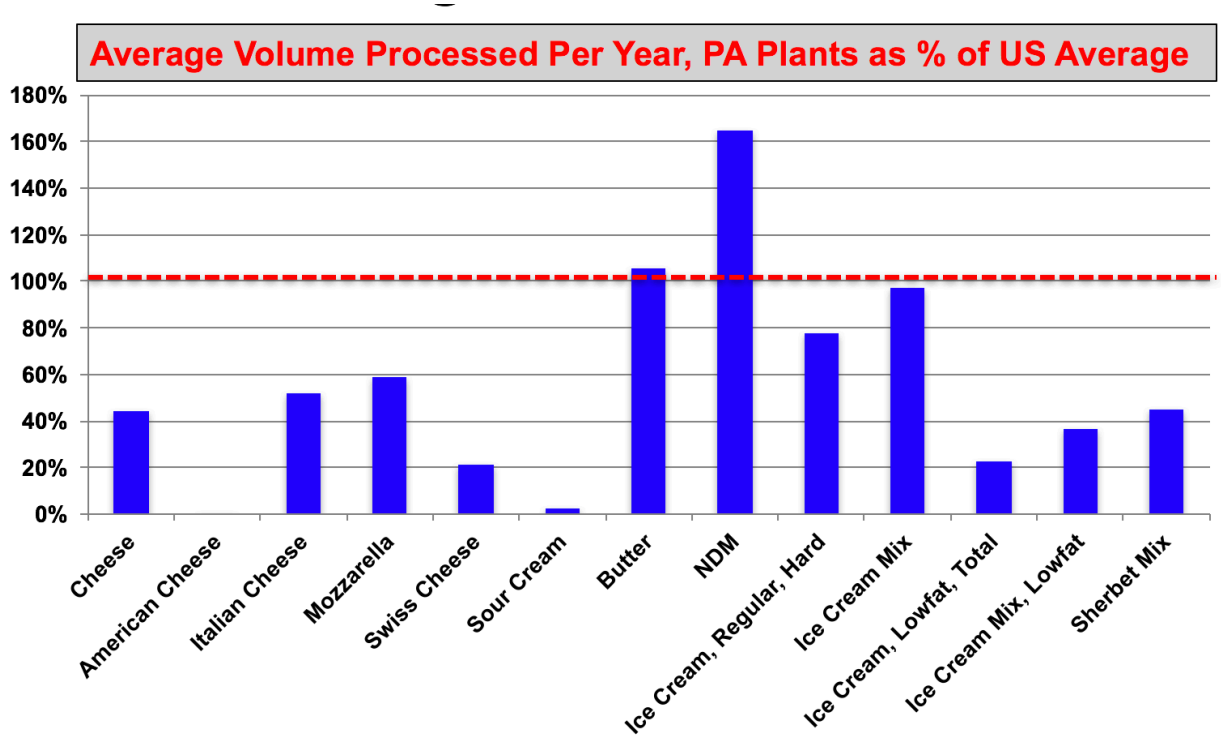


Figure 16. Volumes Processed Per Plant Per Year in Pennsylvania as a Percentage of Average US Plant Volumes, Selected Products, Based on 2015 NASS Data

NASS data can be useful—and would be more so if more years were available—but they do not report milk used for all product categories. In particular, processing volumes for fluid milk are not available, so we cannot assess the per-plant volumes for that product category in Pennsylvania relative to other states or the national average. As a complement to NASS data,

[8] There is insufficient information available to determine causal factors about why average processing volumes are lower. As noted in our discussion of the location of fluid milk processing in the PMMB study component, many factors affect the evolution of the dairy supply chain over time and we do not have sufficient data to assess them all. It is important to note that we are not implying that there is something somehow incorrect about decisions made in the Pennsylvania processing sector because there were smaller than average processing volumes for some products in 2015. We are only pointing out that relative to national averages, those volumes are smaller, and note that these tend to be associated with higher per-unit processing costs. We view this as a useful starting point for discussions about the extent to which this is an issue and what (if anything) could or should be done to address it.

we obtained information from the Northeast Federal Milk Marketing Order[9] about milk used in Pennsylvania processing facilities pooled under the order from 2006 to 2017. These data can be assessed by individual product uses of milk, but the reporting of milk by pricing class provides relevant insights. The average amount of milk pooled per month on the Northeast Order has remained roughly constant since 2006 for fluid milk products (Class I[10]) and cheese (Class III). The data suggest modest increases in Class II volumes pooled. Of particular note, though, is the great deal of seasonal fluctuation in Class IV use and the higher volumes processed since 2014.

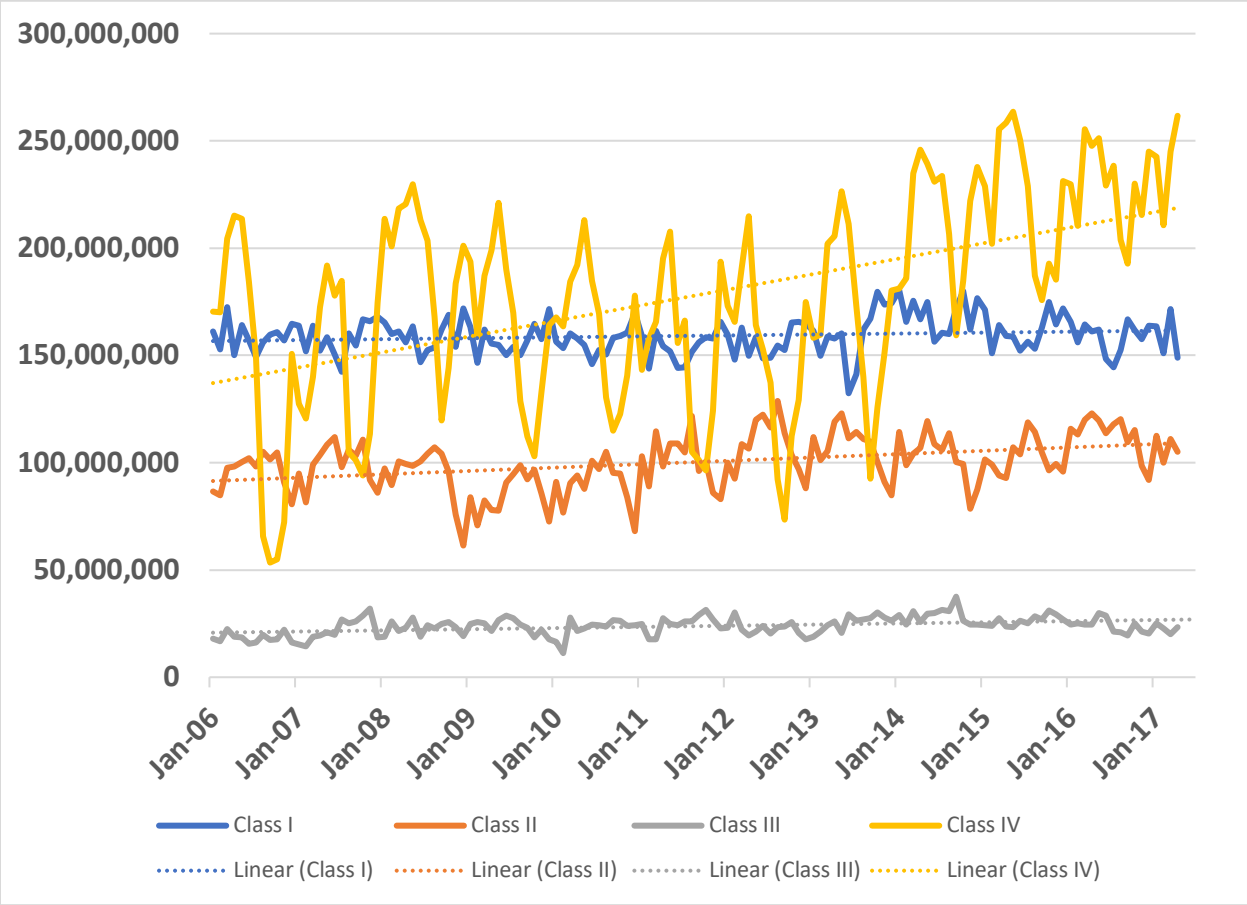


Figure 17. Utilization of Farm Milk at Processing Facilities in Pennsylvania Reported by the Northeast Federal Milk Marketing Order, by Class, 2006-2017 (lbs/month)

The pattern of fluctuations in Class IV utilization—especially the high and less variable levels since mid-2015—suggests the degree of stress on the state's butter/powder processing facilities in recent years. Further disaggregation of the data suggests that most of the issue arises with "dry milk products" (Figure 18).

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[9] We greatly appreciate the cooperation of Erik Rasmussen, Market Administrator of the Northeast Order, as well as Peter Fredericks and Brian Riordan to facilitate our access to these data.

[10] Roughly constant average amounts of Class I milk may suggest that minimum pricing regulation under the PMMB is not having a substantive detrimental effect on Class I processing in the state, and notably contrasts with the general decline in class I milk pooled in the Northeast order overall.

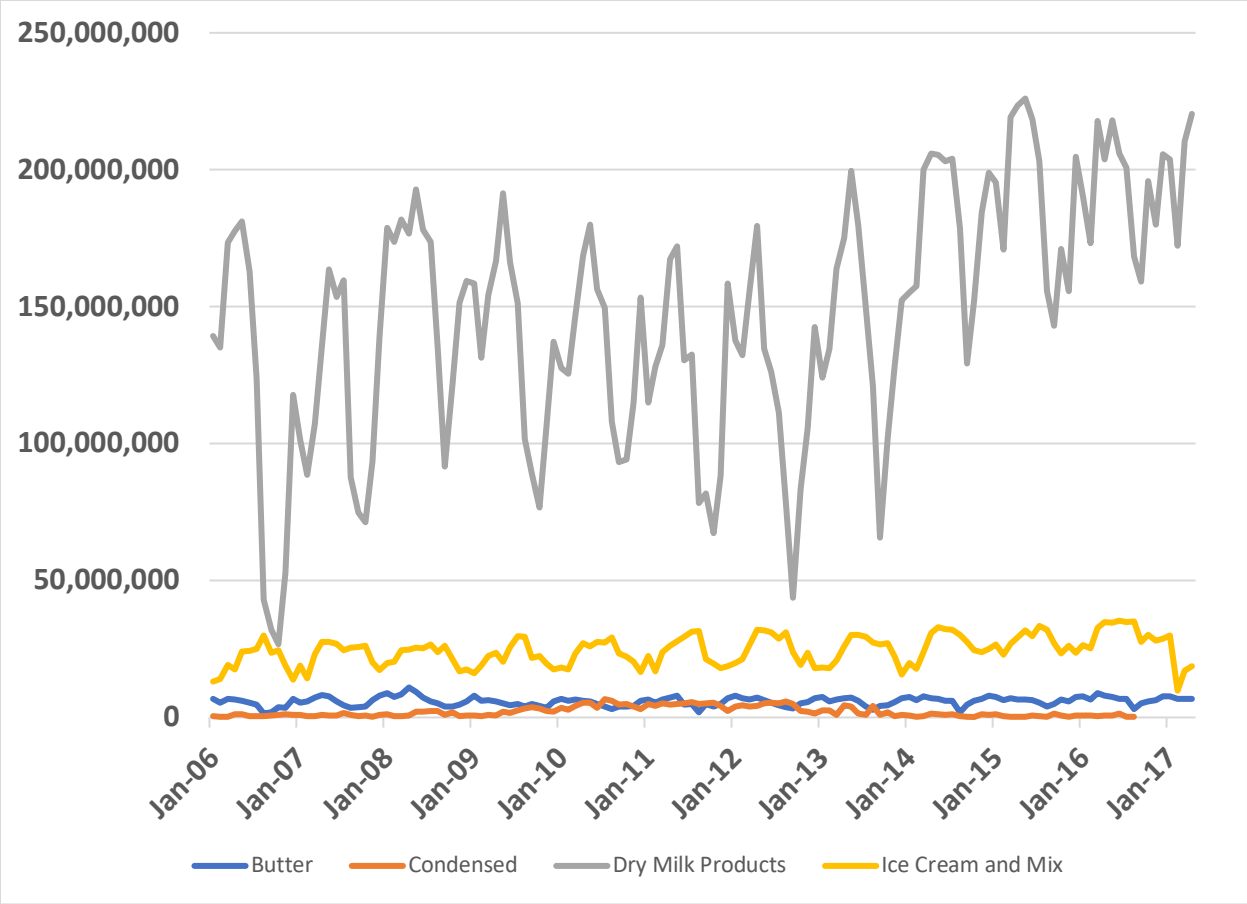


Figure 18. Utilization of Pennsylvania Farm Milk in the Northeast Federal Milk Marketing Order, Selected Products, 2006-2017 (lbs/month)

Data Assessment

Although our assessment of data needs perceived by industry stakeholders in the state is not yet completed, it is clear that additional data on farm-level performance and processing volumes and capacity would be of considerable use in assessing the current status of the industry and proposed programs or policies to support growth and competitiveness. The utility of obtaining a wider range of farm-level performance data was specifically discussed by stakeholders at the informational meeting at Ag Progress Days on 8/16/17, and will be facilitated by the further development of the FarmBench data collaboration effort that is ongoing. Pennsylvania entities will be extended an invitation to participate in the FarmBench project in the near future. It is our hope that the processor survey will provide relevant insights about current capacity issues and future plans, and may serve as a basis for its repetition at appropriate time intervals in the future.

Institutional Assessment

Our assessment of institutional arrangements perceived by industry stakeholders in the state is not yet completed, pending input from industry stakeholders at upcoming listening sessions. However, it has been noted in previous discussions that in other states (notably, Wisconsin),

there is greater financial support and a closer working integration between state entities that support farm-level performance (e.g., the Center for Dairy Profitability), processing innovation (the Center for Dairy Research) and state-level policy development.

Current Programs and Policies

Our assessment of the perceptions of current programs and policies by industry stakeholders in the state is not yet completed, pending input from industry stakeholders at upcoming listening sessions.

Economic Development Assessment

Although our analysis of the role of economic development organizations in the state—and comparisons to other states—is not yet completed, initial discussions have been undertaken with relevant economic development entities. More specifically, we interviewed key stakeholders involved in dairy-related economic development, including Jodi Gauker, Agriculture Program Consultant, Chester County Economic Development Council (CCEDC) and Suzanne Milshaw International Marketing Program Manager, Food Export—Northeast. These interviews suggest that economic development assistance has benefitted a relatively small number of dairy related entities in the state (primarily in smaller-scale dairy processing), but likely could be used to a greater extent. It is important to note that this resource has also been available to support farm-level projects, and we received a comment on an earlier draft version of this document indicating that "Lancaster and Berks County have done substantial development assistance for dairy farmers and other farmers."

Economic Contribution of the Dairy Industry

Although our study of the economic impacts of the dairy industry in the state is ongoing, a complementary study of impacts by state in 2014 was released by the International Dairy Foods Association and is available at http://idfa.guerrillaeconomics.net.

This study uses a similar analytical approach (input-output modeling, implemented through IMPLAN) to that our study and that of the Temple University researchers will use. The 2014 is based on a year with record-high milk prices, and thus it likely to indicate larger impacts than would be observed in an average price year. The reported impacts include:

- $8.9 billion in direct post-farm economic activity;
- $4.0 billion in direct activity on farms ("agriculture" in the "supplier impacts" category)
- $1.75 billion in wages in directly related post-farm industries;
- More than 45,000 jobs in directly related post-farm industries;
- Total economic activity in the state of $28.3 billion, or 1.2% of state GDP;
- An additional 92,600 jobs indirectly supported by the dairy industry.

Of the direct impacts estimated, the largest post-farm component is for milk and yogurt processing, which accounts for more than half of the total value (Table 4).

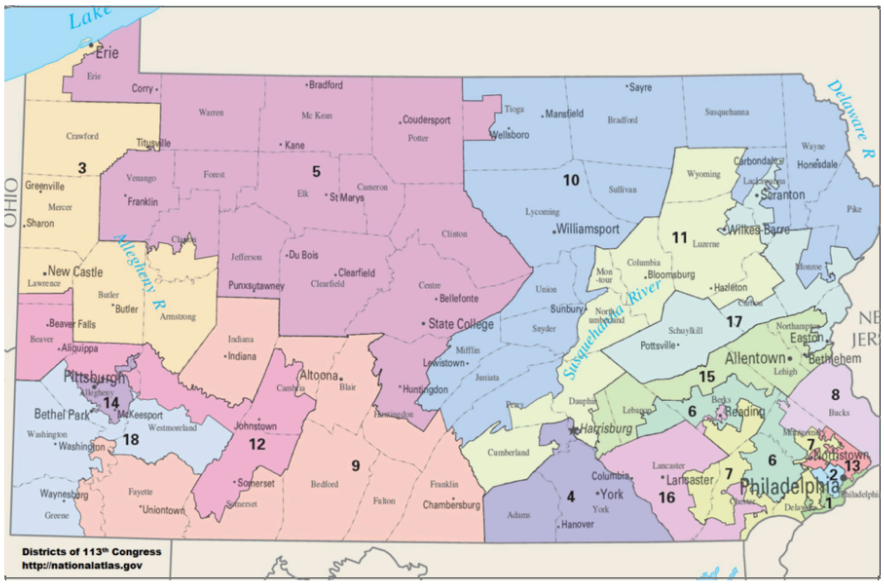
Table 4. Estimated Post-Farm Economic Impacts of the Dairy Industry in Pennsylvania, by Product or Marketing Activity, 2014

	Jobs	Wages	Economic Impact
Direct Impacts			
Dairy Products	7,477	$507,553,900	$6,177,967,500
Cheese	505	$39,477,300	$514,802,300
Ice Cream	526	$39,683,400	$215,597,000
Milk & Yogurt	6,026	$401,083,600	$4,754,496,500
Other Products	420	$27,309,600	$693,071,700
Wholesaling	3,237	$307,901,000	$828,025,900
Retailing	34,315	$935,834,500	$1,891,975,000
Total Direct Impacts	**45,029**	**$1,751,289,400**	**$8,897,968,400**

Source: Table generate for Pennsylvania at http://idfa.guerrillaeconomics.net. Note that "Milk" in the "Milk & Yogurt" category refers to "*Fluid* milk" processing.

The estimated effects differ by region of the state, as delineated below by Congressional District (Figure 19)[11]. These estimates reflect to some extent that only economic impacts within the state are accounted for, and do not include farm-related activity. This may explain why Congressional District 3 has the largest impact, despite much larger milk production in the southeastern part of the state.

[11] It is not entirely clear from the information provided by the previous study why results for some Districts were omitted, but it is likely because their impacts were smaller. Other analysts have noted that the district-level disaggregations tend not to be that accurate, and we reported them here with some reluctance. The multiplier analysis we developed for one component of the current study will seek to avoid this issue by using a different set of regional areas within the state as the basis for analysis. Note that although there is a conceptual link with the analysis of economic incentives for additional processing capacity in Pennsylvania, there is no direct quantitative link to multiplier impacts between the estimates here and those reported in our other study components.



District	Jobs	Wages	Economic Impact
PA Total	45,029	$1,751,289,400	$8,897,968,400
3	2,987	$136,024,100	$1,084,785,500
4	2,703	$111,641,000	$524,175,500
5	2,199	$72,026,000	$285,253,900
9	2,079	$72,137,600	$31,438,800
10	2,279	$90,030,600	$345,327,000
11	2,906	$121,675,300	$780,216,700
12	2,879	$116,571,400	$488,761,200
15	2,738	$114,201,000	$617,944,400
16	3,188	$145,054,500	$945,939,400
17	2,128	$82,370,600	$340,445,500
18	2,305	$77,287,500	$262,894,100

Source: Table generated by http://idfa.guerrillaeconomics.net

Figure 19. Summary of Estimated Direct (Post-Farm) Impacts of the Dairy Industry in Pennsylvania, by Congressional District, 2014

Initial Discussion of the Impacts of the Pennsylvania Milk Marketing Board

Although a more formal and quantitative analysis of PMMB impacts is forthcoming, it is possible to undertake a more conceptual analysis of certain issues discussed with regard to the PMMB. One set of questions descriptive, such as where does PA milk go, where does milk and dairy products sold in PA stores come from, etc. Another set of questions relates to the PMMB pricing system and how it traces through the supply chain. This gets into the issue of “stranded premiums” that are mentioned as an issue.

First, as noted above, the available evidence suggests that over the period 2006 to 2017, the average amount of fluid milk processed in Pennsylvania and pooled on the Northeast order) has remained roughly constant (Figure 17). This is the case despite marked declines in overall Class I sales and percentage utilization in the order. This suggests that the regulated milk pricing structure in Pennsylvania is not a major causal factor in the decline of fluid milk sales in the region more generally and or that processing volumes have been markedly affected (at least during the time period for which data are available).

The spatial economic model that is being used for analysis of the potential impacts of additional processing capacity in Pennsylvania is driven by the goal of minimizing costs along the entire supply chain, given milk produced here and dairy products consumer there. That is a bit of oversimplification, but the fact is that the industry pays attention to transportation and marketing costs. The reason why there are so many bottling plants around major cities is because supply chain costs favor processing liquid milk is small packages close to where people buy it. Manufactured products, in particular cheese, have a supply chain economics that favors putting plants closer to where the farm milk comes from. This economic logic is not much affected by our current pricing schemes, either federal or state. Butter/powder plants are more like cheese plants than fluid plants but with one important caveat. A lot of the cream that goes into a Class IV plant comes from the overflow from Class I plants. Because of this, we often see butter/powder plants in the Northeast being located closer to fluid plants than is true in the West or Central states.

Discussions of the PMMB sometimes refer to “stranded premiums” as an issue. It is not entirely clear what is meant by “stranded premium” but our current interpretation is as follows. It is widely understood that PMMB (or any state entity) can only regulate economic activity within the state. Thus, only milk that is produced on a PA farm, processed in a PA plant, and sold in a PA store can be regulated. Pennsylvania can regulate prices in a PA grocery store no matter where the milk comes from, either in terms of the processing plant or the farm. Thus, the minimum retail price applies to all milk sold in that store but only the PA bottler is obliged to pay the PA premium that undergirds that PA retail minimum. Then, that PA bottler is only obliged to pay the state premium to PA farmers. Hence the difference between the gross value of the premium at the retail level and the gross value of the premium paid out to PA farmers is identified as “stranded”: retailers collected the money in the form of the minimum price but not all of that up charge finds its way back to PA farms. This certainly can be perceived as a lost opportunity for PA dairy farmers, but is difficult to avoid given the constitutional limitations on state’s authority to regulate economic activity.

However, this probably is not quite as bad as it sounds to a lot of PA farmers. It is also fairly widely understood that the PA Class I premium is a reference point for privately negotiated Class I premiums in other states. Cooperatives, including the GNEMMA group, have said that having the PA premium makes it easier for them to establish price points in neighboring states. This likely has diminished with the current glut but nevertheless this probably means is that even if a PA farmer is selling to a NJ fluid plant, he is getting a premium that has benefited from the regulated pricing structure in PA.

It is also true that the PA retailer is obliged to pay the PA bottler the minimum wholesale price so that minimum retail price doesn’t provide any extra profits for the retailer. By the same token, if the delivered price from NJ plant is paying more or less the same premium as a competitive (instead of regulated) price, then there isn’t any extra money left in the retailers’ pockets. It is

our conjecture that whether the NJ plant pays out premiums to its suppliers or not, they are clever enough to realize that the PA regulated wholesale price is their competitor. These plants likely sell for something that is close to that price and no lower than necessary to ensure the sale. Again, this would imply that there isn't a large sum of money left at the PA retailer.

Lastly, one of the considerations is that Class I premiums get paid by bottlers on Class I milk but farmers get this blended out across all milk (including II, III and IV sales). If a bottling plant has an independent supply, its Class I premium will go to all the milk it buys from that direct ship milk. Chances are that plant is a very high percentage Class I (maybe a little Class II); so that independent suppliers will see a high percentage of the Class I premium per cwt on their blend. On the other hand, a coop, say LOL or DFA, that gets all the PA premium and some competitive Class I premiums on non-PA milk will pool that premium across all their milk production. Chances are their coop Class I sales are more like 20 or 30 percent of total member milk; hence that Class I premium per cwt gets seriously diluted. This has nothing to do with being "stranded". This is about pooling and how big the pool is. BTW, if PA had market-wide pooling instead of handler pools, the per cwt payment could be distributed more equally to all PA producers. It wouldn't change the total amount of money paid out but it would change how it is distributed. Needless to say, that would be delightful for some PA farmers and a disaster for those independent shippers. It would also be a situation where all the PA premium was pooled across the state but competitive premiums were not. In effect, coop members would essentially be double dipping on Class I premiums.

Appendix 1: Response to Initial Questions

Participants at industry meetings early in 2017 were asked to provide questions for consideration by the study. A summary of these questions and the initial responses is provided below.

1) **What is the trend on packaged fluid milk coming into Pennsylvania from outside its borders?**

   We may be able to address this if data from PMMB are available under Task 2.7. We can consider what our national spatial economic model (the USDSS) would say is "optimal" to be sourced-processed-and distributed in PA for comparison with actual.

2) **How much does the price of milk affect purchasing decisions of consumers in the median to low income brackets?**

3) **Is the over-order premium helping or hurting growth of milk sales in Pennsylvania?**

   We should be able to address Questions 2 and 3 at least in part if data from PMMB are available and can be combined with estimates from previous studies on the price responsiveness of fluid milk sales, and also conceptually as a part of the review of the impacts of PMMB (Task 2.7). We believe that Jug Capps et al. at Texas A&M have done some fairly recent studies of income and own price elasticities relevant for this. We can look at demographic population profiles across PA including metropolitan areas to make some assessments. Questions 2 and 3 require data from PMMB on the magnitude of the premiums AND PA milk sales and processing. Of course, USDA provides data on PA milk production but we assume that "milk sales" here refers to Class I sales.

4) **Is the over-order premium helping or hurting new processing development in Pennsylvania?**

   We should be able to address this at least in part if data from PMMB are available and are combined with assessment of the profitability of processing within and outside of PMMB regulation, and also conceptually as a part of the review of the impacts of PMMB (Tasks 1.3, 2.4 and 2.7).

5) **Where does the money from the over-order premium go and who spends it? How is it distributed?**

   We believe that this question is best answered by the PMMB and dairy cooperatives, as it is largely procedural and descriptive, not analytical. As a result, we have no particular comparative advantage in addressing it.

6) **What are consumer habits in Pennsylvania compared to the purchasing habits of consumers in other states? What controls their purchasing habits?**

To some extent, the implied question here may be addressed in our assessment of questions 2 and 3 above. We consider a broader assessment of dairy consumer behavior to be outside the scope of our study, and note that CDE and others have funded previous work in this area (such as studies conducted by Dr. Stanton of St. Joseph's University).

7) **What is the value of the over-order premium to producers? To cooperatives? To processors?**

We interpret this 'value' to be a cash value (i.e., how much $) not a broader value judgment question. We can provide at least an indirect answer to this question through Task 2.7. The counterfactual is really important here. The premium be in the absence of the PMMB would almost certainly not be 0. We will also assess in Task 2.7 the broader implications of PMMB regulation.

8) **What is the value of the balancing of the marketplace provided by cooperatives in Pennsylvania?**

This question is not included in the current scope of the study and to us does not seem to directly address the objective of strategic vision development for PA. We may be able to provide at least a partial assessment of the overall balancing issue given that PA is supplying milk and product to NYC and the Southeast, they are certainly forced into a balancing role. By our calculations, they are the largest net surplus milk state in the northeast and middle Atlantic region, so balancing is a given. As a component of Tasks 1.3 and 2.4 we may be able to analyze with the USDSS whether NDM and butter comprise the best product mix for balancing. Directly addressing this question in detail would require a modification of the current project scope.

9) **What is the effect of the state pricing regulations on purchasing habits? Funding habits of processing infrastructure?**

This is similar to questions 2, 3 and 4 above.

10) **Are there other states where the dairy industry is regulated, and how do they compare?**

11) **Are there other states where the dairy industry went from a regulated environment to an unregulated environment? What happened?**

For questions 10 and 11, our assessment is that although other states have milk price regulation, there is nothing similar enough to what is done by the PMMB that we should study them to assess the effects of PMMB. Comparisons to regulation under other geographic areas will always suffer from the differences in specifics of the regulation and the market context (time frame). We propose an alternative approach under Task 2.7 to develop an analysis for PA that provides a quantitative counterfactual (that is, what would happen in PA in the absence of PMMB regulation?).

12) **Is there a guarantee on the share of the premium that cooperatives get?**

We believe that this question is best answered by the PMMB and dairy cooperatives, as it is largely procedural and descriptive, not analytical. As a result, we have no particular comparative advantage in addressing it.

13) Why is Pennsylvania's cost of production higher than in other parts of the country? What can be done at the producer level and at the industry level to lower cost of production?

We propose to examine costs of production and other farm-level performance indicators under Task 1.2, and compare the PA indicators to other states. We have made a request to the Pennsylvania Farm Bureau to collaborate with them in the analysis of these issues using their farm-level data. The PFB data would allow us to look at farm costs compared to similar farm business models in three other states and we have some data about the proportion of farms in various size categories from 2012 and previous years. Task 2.4 will provides recommended actions to address farm-level productivity and profitability.

14) What are the dairy processing needs in the state? What is here and what is needed? What is the product mix that's needed?

This will be addressed to some extent with Tasks 1.3 and 2.4, including a survey of the state's processors.

15) What do exports look like coming out of the state? Are there opportunities in exports for Pennsylvania?
16) How can the Port of Philadelphia be used as an asset for dairy?

We will examine components of questions 15 and 16, specifically, the potential for "exports" from PA as a part of our analyses (Tasks 2.2, 2.3, 2.4 and 2.5), and can use the USDSS to assess both the potential for increased exports and the milk price impacts of increased exports through the port of Philadelphia.

17) What impact is the PMMB minimum pricing having on producer receipts and the competitiveness of Pennsylvania's milk sales?

This is a variant of previous questions related to the impacts of the PMMB, and would be addressed at least in part by Task 2.7.

18) What are the trends in the volume of packaged milk coming from out of state into the state of Pennsylvania for sale? (BACKGROUND: We do know that the PMMB has approved a growing number of out-of-state milk dealer licenses. This is relevant in showing impact of current PMMB minimum retail milk price (magnet) and the fate of the over-order premium which is a portion of that minimum price.)

Also a variant of previous questions, addressed at least in part by Task 2.7.

19) What impact is the PMMB minimum pricing and over-order premium having on sales of milk to consumers? The PA retail milk price exceeds national average by $1/gallon and there are no studies to quantify price impact on sales among middle and lower income families. Anecdotal evidence indicates that mothers and families make choices based on 25 cent per gallon differences in price (example, choosing 2% instead of whole based on small differences in price)

As noted in previous responses, this can be part of Task 2.7 assuming data can be available. We believe, however, that comparisons to the national average probably are not the most appropriate here—the spatial value of farm milk used in fluid varies throughout the US, with the highest values in the southeast and northeast.

20) What are the trends in the volume of milk coming into Pennsylvania from out of state by tankerload? As in question 1, it is important to know what impact our state pricing system is having on the profile of milk origin it attracts into our state even as we are looking for markets outside of our state in this modern day of milk movement and as the cooperatives and processors and USDA increasingly move toward nationalizing the price paid to farmers. Dairy market experts Calvin Covington and Mary Ledman have both confirmed that milk used to move north to south and it is now moving south to north and considerable east-west / west-east load transfers. How does PMMB fit with today's growing centralized control of milk marketing and movement?

This can be part of Task 2.7 assuming data can be made available. We also will be exploring the impact of processing capacity in the state on these milk movements, which seem driven more by lack of processing capacity in certain southeast regions at certain times of year. We can make a comparison of what USDSS believes is possible to produce, process and distribute within the state in an optimal solution and compare it to volumes that PMMB actually regulates. We could also look at forcing PMMB to make all fluid milk PMMB regulated product and see how the optimal solution compare to the cost of the constrained one.

21) What specific benefit does the PMMB minimum pricing and over-order premium bring considering that Pennsylvania is losing ground while other states without such a program are growing, and in light of the fact that our 287 independent Pennsylvania dairy farms -- supplying Class I fluid bottlers that have either gone out of business or been purchased by DFA or contracted by DMS -- will be kicked to the curb by DFA on April 1. Meanwhile, we have milk entering Pennsylvania from Michigan and New York via the major national cooperatives. Pennsylvania has remained flat in its production, while Michigan and New York continue to show 4 to 8% year over year growth in production.

This is generally part of assessment of PMMB for Task 2.7.

22) Can we examine the flow of the $30 million paid by consumers annually in over-order premiums that are built into PA's minimum retail and wholesale milk prices

to evaluate its overall margin benefits to PA dairy farms and the competitiveness of PA's dairy industry?

We can examine the general impacts of PMMB on farm milk and fluid milk prices under Task 2.7, but the distributional impacts may be difficult to assess given a lack of data on which producers actually receive payment.

23) Where does the half-cent per hundredweight go that milk haulers pay on all milk transported in the state of Pennsylvania? (estimated to total $550,000 annually and ultimately paid by dairy farmers since dairy farmers pay for milk transportation.

This is not part of current study. If it appears to be a major component necessary to address other study objectives, we will consider it.

24) Why is a royalty paid by Dean Foods (ostensibly for a name) get built into the processing cost recovery for all bottlers within the state's minimum retail and wholesale price dating back to at least 2007 and perhaps as far back as 2002? This amounts to nearly 6 cents per gallon in the retail price and the board will vote in April whether to keep this in the processor cost recovery portion of the PMMB minimum retail/wholesale price but it is not a cost of bottling. Meanwhile dairy farmers are selling milk below their actual costs of production.

We consider this outside of the scope of the current study.

25) In the words of a dairy farmer: "As farmers, we want to understand where the value is added under the state's milk marketing law, what is gained by the law at the farm level, at the margin level, which is what we live and operate. Why -- with this state premium and minimum pricing -- have our margins dropped relative to national margins?"

This is generally part of assessment of PMMB for Task 2.7. We can consider the impacts of PMMB on margins, although a direct comparison to other states may not be the most appropriate (for reasons mentioned in response to questions 10 and 11 above).

26) An attorney for the milk processors at a recent meeting cited 2006 figures showing that PMMB had a stabilizing effect on Class I utilization and sales and resulted in PA having the tightest spread between the farm price and the retail price of milk. HOWEVER, That was more than a decade ago and much has changed. What is the spread IN CURRENT YEARS between the realized MAILBOX milk price received by PA farmers and the retail minimum price PA consumers are forced to pay?

If our initial assessment under Tasks 1.1 and 2.7 suggest that the stability of margins is an important potential impact of regulation under the PMMB, we will attempt to further assess this, assuming sufficient data are available.

Appendix 2: Processing Survey Questionnaire

The nationwide survey of processors was implemented beginning early in September 2017, and we expect that it will take some weeks to complete and begin analysis. The questions asked processors included the following:

Zip Code in which plant is located:

Management role of person completing survey:

- Plant manager
- Plant administrative staff (accountant?)
- Other, specify

Contact Information:

- Phone
- Email

Products produced in this plant in the last 12 months (*select all that apply*)

- Fluid milk products
- Yogurt products
- Ice cream products
- Cottage cheese
- Cream cheese
- Cheddar/American Cheese
- Mozzarella Cheese
- Other Cheese
- Dry whey
- Lactose
- Whey protein concentrate and/or isolate
- Nonfat dry milk and/or skim milk powder
- Whole milk powder
- Milk protein concentrate
- Casein or caseinates
- Evaporated or condensed milk products (canned or bulk)

What is the typical volume of milk processed on an average processing day at your plant?

- Less than 500,000 lbs
- 500,000-2,000,000 lbs
- 2,000,000-5,000,000 lbs
- More than 5,000,000 lbs

What is the maximum volume of milk your plant could process, relative to the average daily volume?

0-10% more than average daily volume
10-25% more than average daily volume
25-50% more than average daily volume
50-75% more than average daily volume
75-100% more than average daily volume
>100% more than average daily volume

Which statement best describes how frequently your plant operated at close to this maximum capacity during the last 12 months?

Less than 5 processing days during the last 12 months
5 – 10 processing days during the last 12 months
10 - 30 processing days during the last 12 months
More than 30 processing days during the last 12 months

What statement best describes changes in your *maximum* plant capacity during the past 3 years?

Capacity has increased by more than 25%
Capacity has increased by less than 25%
Capacity has not really changed
Capacity has decreased by less than 25%
Capacity has decreased by more than 25%
Don't know

What statement best describes planned changes in your maximum plant capacity during the next 3 years?

Capacity will be increased by more than 25%
Capacity will be increased by less than 25%
Capacity will not really change
Capacity will be decreased by less than 25%
Capacity will be decreased by more than 25%
Don't know

Which of the following statements about the potential to expand capacity describe the situation at your plant (*select all that apply*)

Milk receiving facilities would be a major constraint to expanding plant capacity
Milk storage facilities would be a major constraint to expanding plant capacity
Milk pasteurization equipment would be a major constraint to expanding plant capacity
Processing equipment would be a major constraint to expanding plant capacity
Finished product storage facilities would be a major constraint to expanding plant capacity
Labor availability would be a major constraint to expanding plant capacity
Marketing products produced in the plant would be a major constraint to expanding plant capacity
It would be relatively easy to add additional shifts with current plant facilities and equipment
Milk supply in region would be a major constraint to expanding plant capacity
Other: *please explain*

Which of the following statements describes the current status of products produced in this plant with regard to exports to countries outside the US?

Products are not currently exported and no plans to export
Products are not currently exported but exports are planned in the next 12 months
Products are not currently exported and are not currently planned, but could be of interest
Products are currently exported and we may expand the volume
Products are currently exported and we will probably remain at this volume
Products are currently exported but we will probably reduce volume or discontinue altogether