



## 2011 Milk Component Analysis

### Methodology

This study analyzes the component levels of milk marketed by producers associated with the Mideast marketing area, Federal Order 33, for 2011. The milk components analyzed in this study include butterfat, protein, other solids and somatic cell count (SCC). These components were selected because the Mideast marketing area uses multiple component pricing (MCP) as the basis for establishing the value of milk pooled on the order. Under MCP, producer milk is priced on the cumulative value of butterfat, protein and other solids pounds (lbs) with an adjustment for the somatic cell count.

Producer payrolls were analyzed to determine how component levels and milk values varied relative to production region, delivery volume and season. Econometric models were also used to estimate the trend and seasonal patterns observed in the milk components from 2006 to 2011.

### Data

For 2011 there were 7,709 producers associated with the Mideast marketing area that were included in this analysis. Milk was pooled on the order from 17 states. The geographical area captured by the data population includes Iowa, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Michigan, Minnesota, North Carolina, New Mexico, New York, Ohio, Pennsylvania, Texas, Virginia, Wisconsin, and West Virginia. Of those states, Indiana, Kentucky, Michigan, Ohio, Pennsylvania and West Virginia are located or partially located within the Mideast marketing area.

For the purpose of calculating representative weighted averages, milk from producers with depooled milk, and who pooled milk on multiple orders were included in this analysis provided they also pooled milk on FMMO 33 during 2011. As a result, there is a difference in the number of producers, milk volume and component tests in this study and the number of producers, milk volume and component tests as pooled on FMMO 33 during 2011.

### 2011 Summary

The producers included in this study marketed approximately 19.1 billion lbs of milk in 2011, and the average monthly delivery volume per producer was 229,253 lbs.

**Table 1. Milk Component Statistics FMMO 33, Mideast Marketing Area 2011 - 2010**

|                               | 2011  | 2010  |
|-------------------------------|-------|-------|
| <b>Weighted Average</b>       |       |       |
| Butterfat Test                | 3.70  | 3.65  |
| Protein Test                  | 3.07  | 3.05  |
| Other Solids Test             | 5.72  | 5.71  |
| Somatic Cell Count (000)      | 214   | 223   |
| Milk Component Value (\$/cwt) | 19.11 | 14.90 |
| <b>Simple Average</b>         |       |       |
| Butterfat Test                | 3.85  | 3.82  |
| Protein Test                  | 3.12  | 3.11  |
| Other Solids Test             | 5.66  | 5.65  |
| Somatic Cell Count (000)      | 278   | 286   |
| Milk Component Value (\$/cwt) | 19.52 | 15.30 |

For 2011 the weighted average butterfat test was 3.70 percent (%), an increase of 0.05 from 2010. The mean butterfat test for 2011 was 3.85 %. The range of butterfat tests within one standard deviation of the mean was 3.47 to 4.23 %.

For 2011 the weighted average protein test was 3.07 %, an increase of 0.02 comparable to 2010 protein levels. The mean protein test for 2011 was 3.12 %. The range of protein tests within one standard deviation of the mean was 2.90 to 3.34 %.

For 2011 the weighted average other solids test was 5.72 %. The mean other solids test for 2011 was 5.66 %. The range of other solids tests within one standard deviation of the mean was 5.56 to 5.76 %.

For 2011 the weighted average SCC was 214, a decrease of 4.0 % from 2010. The mean SCC for 2011 was 278. The range of SCC within one standard deviation of the mean was 127 to 428.

For 2011 the weighted average milk component value for producers included in this analysis was \$19.11 per cwt, an increase of 28.3 % from 2010. The mean milk component value for 2011 was \$19.52 per cwt. The range of milk component values within one standard deviation of the mean was \$17.27 to \$21.77 per cwt. When considering the milk component value ranges it is important to note that for 2011 Class III milk prices ranged from a low of \$13.48 per cwt in January to a high of \$21.67 in August. The milk component value does not include premiums or authorized deductions other than FMMO SCC adjustments.

### Component Analysis by Month

Dairy cows, when exposed to high temperature coupled with high humidity or radiant energy (sunlight) traditionally respond with reduced milk yield and lower butterfat and protein tests.

The weighted average butterfat test ranged from a high of 3.83% in January to a low of 3.54 % in July.

The weighted average protein test ranged from a low of 2.93 % in July to a high of 3.19 % in November and December.

Other solids tests remained steady throughout the year, ranging from a high of 5.74 % in May to a low of 5.69 % in August.

As seen in figure 1 the variations in somatic cell counts were opposite that of butterfat and protein. Weighted average SCCs ranged from a low of 195 in April and December to a high of 260 in August.

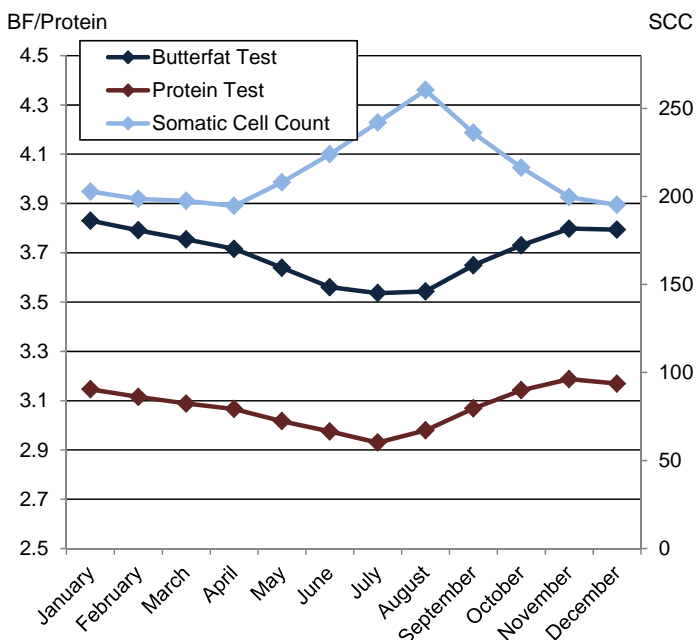
A convenient aspect of computing the milk value using milk components is that a comparison can be drawn between the component milk value and the announced class III price. In this study that difference is referred to as the component price difference (CPD). Positive (negative)

values are a result of component tests that are greater (less) than the standard component tests used to calculate the Class III price.<sup>1/</sup>

The milk component value ranged from a low of \$14.53 per cwt in January to a high of \$21.82 per cwt in August. Meanwhile the CPD ranged from a low of -\$0.03 in July (when BF and Protein were at their lowest) to a high of \$1.36 per cwt in November.

As demonstrated there is a strong seasonal pattern in the component levels. Figure 2 shows the component levels over the past six years and the seasonal patterns repeat annually. In order to measure the impact of seasonality the component levels were detrended by their 12-month moving average and the monthly means were calculated.

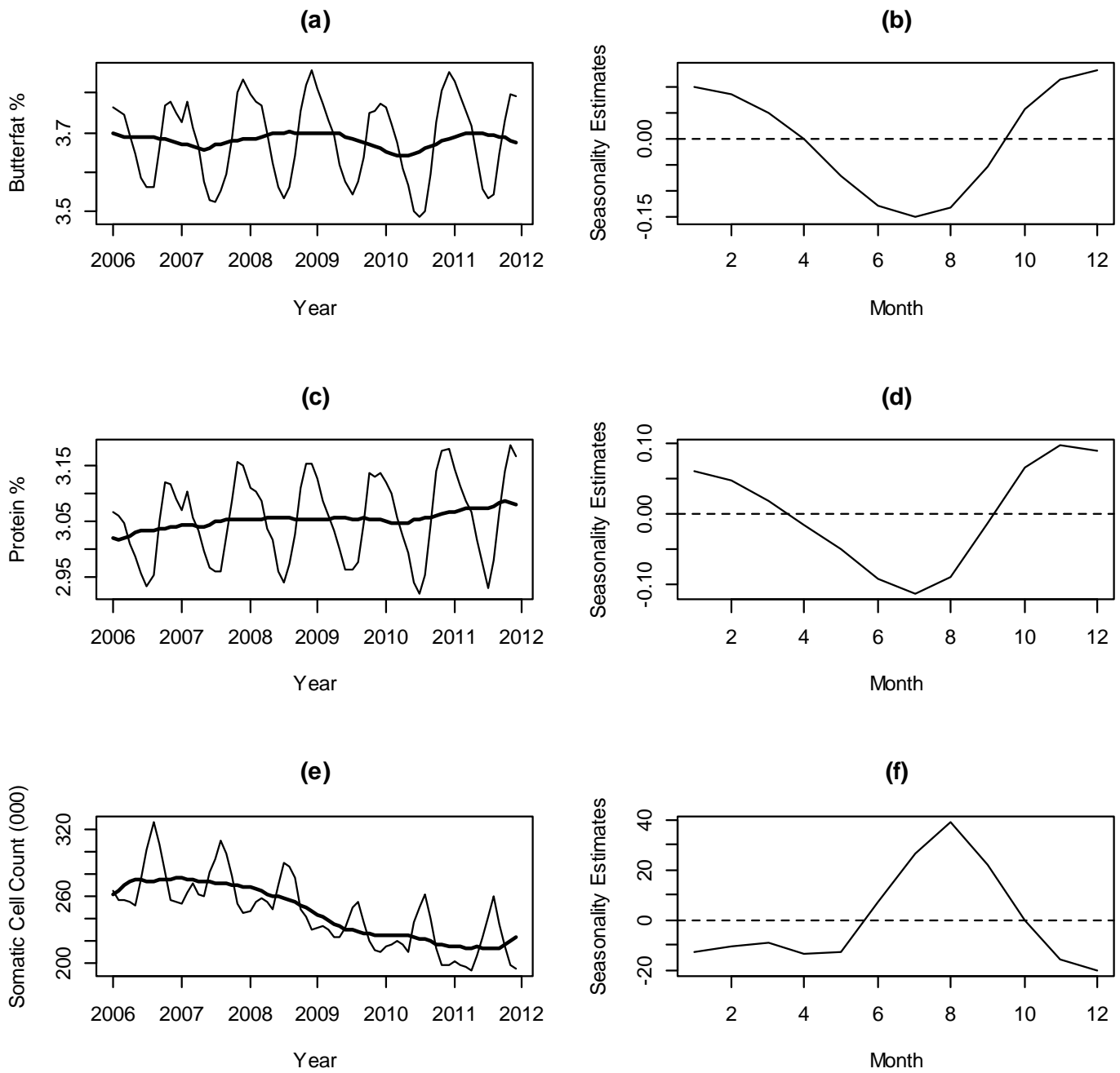
**Figure 1. Weighted Average Component Tests by Month, Mideast Marketing Area 2011**



**Table 2. Weighted Average Component Tests by Month, Mideast Marketing Area 2011**

| Month                   | Butterfat Test | Protein Test | Other-Solids Test | Somatic Cell Count | Milk Component Value | Component Price Difference |
|-------------------------|----------------|--------------|-------------------|--------------------|----------------------|----------------------------|
|                         | %              | %            | %                 | (000)              | \$/cwt               | \$/cwt                     |
| January                 | 3.83           | 3.15         | 5.71              | 203                | 14.53                | 1.05                       |
| February                | 3.79           | 3.12         | 5.72              | 199                | 18.13                | 1.13                       |
| March                   | 3.75           | 3.09         | 5.72              | 198                | 20.46                | 1.06                       |
| April                   | 3.72           | 3.07         | 5.73              | 195                | 17.67                | 0.80                       |
| May                     | 3.64           | 3.02         | 5.74              | 208                | 17.02                | 0.50                       |
| June                    | 3.56           | 2.97         | 5.73              | 224                | 19.34                | 0.23                       |
| July                    | 3.54           | 2.93         | 5.71              | 242                | 21.36                | -0.03                      |
| August                  | 3.54           | 2.98         | 5.69              | 260                | 21.82                | 0.15                       |
| September               | 3.65           | 3.07         | 5.70              | 236                | 19.74                | 0.67                       |
| October                 | 3.73           | 3.14         | 5.70              | 216                | 19.05                | 1.02                       |
| November                | 3.80           | 3.19         | 5.70              | 200                | 20.43                | 1.36                       |
| December                | 3.79           | 3.17         | 5.72              | 195                | 20.02                | 1.25                       |
| <b>Weighted Average</b> | <b>3.70</b>    | <b>3.07</b>  | <b>5.72</b>       | <b>214</b>         | <b>19.11</b>         | <b>0.76</b>                |

<sup>1/</sup> Class III milk price is calculated using the formula: 2.99(Protein price) + 5.69(Other solids price) + 3.5(Butterfat price).



**Figure 2. Estimates of the Seasonality, 2006-2011.** The plots on the left represent the observed component levels with the 12-month moving average in bold. The plots on the right represent the seasonality estimates. (a) Butterfat %, (b) Butterfat Seasonality, (c) Protein %, (d) Protein Seasonality, (e) Somatic Cell Count (000), (f) Somatic Cell Count Seasonality.

As seen above in plot (b) butterfat %, (d) protein %, and (f) SCC there are strong seasonal patterns that repeat annually. The butterfat and protein %'s are lower in the summer months, while the SCC peaks in the summer. Also, of note is the negative trend in the SCC over the past 6 years. The plots on the right are the observed components

for the six year period. In plot (c) and (e) are the annual trends observed in the protein % and the SCC, respectively. The protein % has a positive slope while there is a negative trend in the SCC over the past 6 years. In (a) we do not see a positive or negative slope for the butterfat %.

### Component Analysis by State 2/

Of the states included in this analysis, total 2011 delivery lbs ranged from a low of 825 thousand lbs for North Carolina producers, to a high of 8.1 billion lbs for Michigan producers. Milk from Michigan producers accounted for approximately 42.2 % of the milk included in this analysis.

The weighted average butterfat test for producers pooling on the Mideast order ranged from a low of 3.48 % in Georgia to a high of 3.92 % in West Virginia. For states located within the Mideast marketing area the weighted average butterfat test was the lowest in Michigan at 3.65 %.

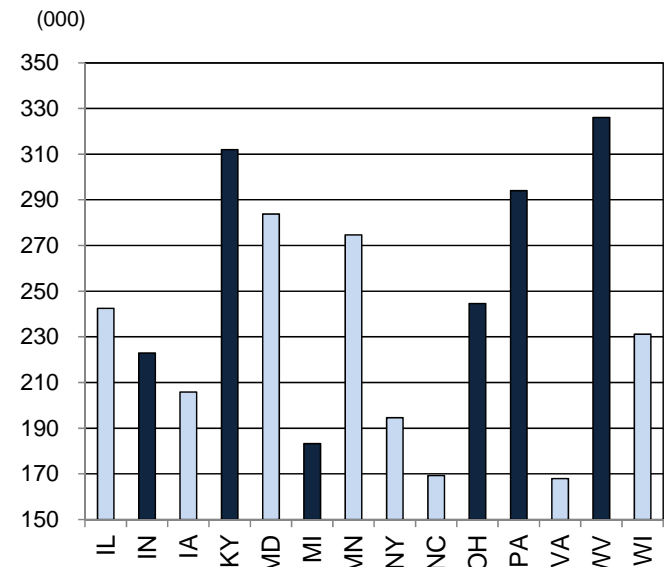
The weighted average protein test for producers pooling on the Mideast order ranged from a low of 2.96 % in Iowa to a high of 3.20 % in West Virginia. For states located within the Mideast marketing area the weighted average protein tests was the lowest in Michigan at 3.06 %.

The weighted average other solids test for producers pooling on the Mideast order ranged from a low of 5.65 % in West Virginia and Kentucky to a high of 5.83 % in Iowa. For states located within the Mideast marketing area the weighted average other solids tests was the highest in Michigan at 5.72 %.

The weighted average SCC for producers pooling on the Mideast order ranged from a low of 168 in Virginia to a high of 326 in West Virginia. For states located within the Mideast marketing area the weighted average SCC ranged was the lowest in Michigan at 183.

The weighted average milk component value for producers pooling on the Mideast order ranged from a low of \$18.14 per cwt in Virginia to a high of \$19.78 per cwt in West Virginia. For states located within the Mideast marketing area the weighted average milk component value was the lowest in Indiana at \$19.01 per cwt. The value of the milk in this section is based on when the milk was pooled. During some months more or less milk may be pooled on the order from a particular state resulting in higher or lower milk value approximations.

**Figure 3. Weighted Average Somatic Cell Count, Mideast Marketing Area 2011 3/**



**Table 3. Weighted Average Component Tests by State, Mideast Marketing Area 2011 3/**

| State                   | Butterfat Test | Protein Test | Other-Solids Test | Somatic Cell Count | Milk Component Value | Component Price Difference |
|-------------------------|----------------|--------------|-------------------|--------------------|----------------------|----------------------------|
|                         | %              | %            | %                 | (000)              | \$/cwt               | \$/cwt                     |
| Illinois                | 3.71           | 3.06         | 5.74              | 242                | 18.99                | 0.73                       |
| Indiana                 | 3.70           | 3.08         | 5.70              | 223                | 19.01                | 0.77                       |
| Iowa                    | 3.54           | 2.96         | 5.83              | 206                | 18.43                | 0.13                       |
| Kentucky                | 3.79           | 3.11         | 5.65              | 312                | 19.41                | 0.95                       |
| Maryland                | 3.90           | 3.14         | 5.68              | 284                | 19.66                | 1.31                       |
| Michigan                | 3.65           | 3.06         | 5.72              | 183                | 19.02                | 0.67                       |
| Minnesota               | 3.91           | 3.14         | 5.74              | 275                | 19.38                | 1.33                       |
| New York                | 3.69           | 3.06         | 5.73              | 195                | 19.11                | 0.74                       |
| North Carolina          | 3.48           | 3.03         | 5.76              | 169                | 19.06                | 0.29                       |
| Ohio                    | 3.74           | 3.10         | 5.70              | 245                | 19.26                | 0.90                       |
| Pennsylvania            | 3.79           | 3.09         | 5.68              | 294                | 19.30                | 0.95                       |
| Virginia                | 3.58           | 3.02         | 5.66              | 168                | 18.14                | 0.40                       |
| West Virginia           | 3.92           | 3.20         | 5.65              | 326                | 19.78                | 1.47                       |
| Wisconsin               | 3.68           | 3.08         | 5.77              | 231                | 19.15                | 0.76                       |
| <b>Weighted Average</b> | <b>3.70</b>    | <b>3.07</b>  | <b>5.72</b>       | <b>214</b>         | <b>19.11</b>         | <b>0.76</b>                |

2/ Information from states with fewer than 3 producers is restricted and not included in this analysis.

3/ Shaded states denotes states located within the Mideast marketing area.

### Component Analysis by Delivery Volume

In order to examine the impact producer size has on the component levels of herd milk, producers associated with the Mideast market were categorized by their average delivery volume. Producers with similar delivery volumes were grouped together. The delivery volume categories are identified in table 4 below. For future component analyses categorizing producers based on delivery volume ranges will replace percentile group categorization. This change will allow producers to identify which delivery volume category their farm operation is in.

The weighted average butterfat test ranged from a high of 3.97 % for producers delivering less than 30,000 lbs to a low of 3.60 % for producers delivering more than one million lbs.

The weighted average protein test ranged from a high of 3.15 % for producers delivering less than 30,000 lbs to a low of 3.04 % for producers delivering between one million and two million lbs.

The weighted average other solids test ranged from a low of 5.60 % for producers delivering less than 30,000 lbs to a high of 5.74 % for producers delivering more than one million lbs.

The weighted average SCC ranged from a high of 328 for producers delivering less than 30,000 lbs to a low of 181 for producers delivering more than two million lbs.

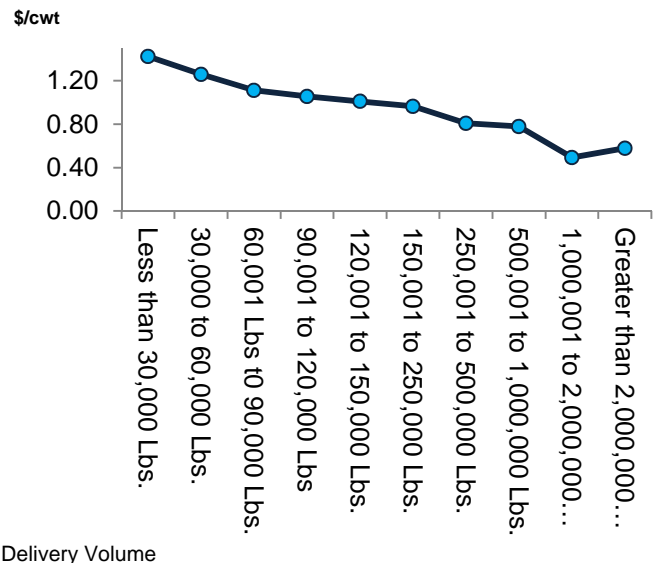
The data suggests that component levels of butterfat, protein and SCC are negatively correlated with producer delivery volume, while other solids tests are positively correlated with delivery volume.

The weighted average milk component value ranged from a high of \$19.78 per cwt for producers delivering less than 30,000 lbs of milk to a low of \$18.82 per cwt for producers delivering between one million and two million lbs.

The weighted average CPD ranged from a high of \$1.42 per cwt for producers delivering less than 30,000 lbs of milk to a low of \$0.49 per cwt for producers delivering between one million and two million lbs. Figure 4 shows the weighted average CPD by delivery volume.

Delivery statistics varied considerably among the size ranges. The largest group accounted for more than 6 billion lbs of milk, representing approximately 31 percent of the milk that was included in this analysis. The smallest percentile group accounted for 257 million lbs of milk, representing little more than one percent of the milk that was included in this analysis.

**Figure 4. Component Price Differential by Producer Delivery Volume, Mideast Marketing Area 2011**

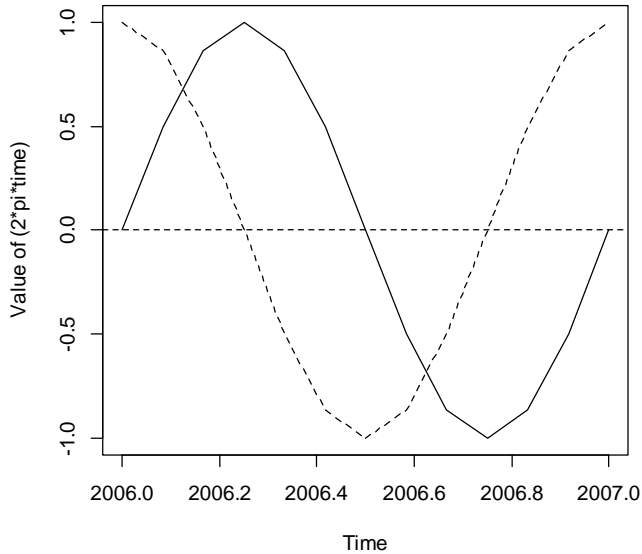


**Table 4. Weighted Average Component Tests by Delivery Volume, Mideast Marketing Area 2011**

| Delivery Volume             | Butterfat Test | Protein Test | Other-Solids Test | Somatic Cell Count | Milk Component Value | Component Price Difference |
|-----------------------------|----------------|--------------|-------------------|--------------------|----------------------|----------------------------|
|                             | %              | %            | %                 | (000)              | \$/cwt               | \$/cwt                     |
| Less than 30,000 Lbs.       | 3.97           | 3.15         | 5.60              | 328                | 19.78                | 1.42                       |
| 30,000 to 60,000 Lbs.       | 3.91           | 3.13         | 5.64              | 302                | 19.60                | 1.26                       |
| 60,001 Lbs to 90,000 Lbs.   | 3.85           | 3.11         | 5.67              | 291                | 19.45                | 1.11                       |
| 90,001 to 120,000 Lbs.      | 3.83           | 3.10         | 5.68              | 277                | 19.39                | 1.06                       |
| 120,001 to 150,000 Lbs.     | 3.80           | 3.11         | 5.69              | 269                | 19.36                | 1.01                       |
| 150,001 to 250,000 Lbs.     | 3.78           | 3.10         | 5.70              | 248                | 19.32                | 0.96                       |
| 250,001 to 500,000 Lbs.     | 3.72           | 3.07         | 5.71              | 219                | 19.16                | 0.81                       |
| 500,001 to 1,000,000 Lbs.   | 3.70           | 3.07         | 5.73              | 184                | 19.14                | 0.78                       |
| 1,000,001 to 2,000,000 Lbs. | 3.60           | 3.04         | 5.74              | 189                | 18.82                | 0.49                       |
| Greater than 2,000,000 Lbs. | 3.60           | 3.06         | 5.74              | 181                | 18.91                | 0.58                       |
| <b>Weighted Average</b>     | <b>3.70</b>    | <b>3.07</b>  | <b>5.72</b>       | <b>214</b>         | <b>19.11</b>         | <b>0.76</b>                |

## Regression Analysis

OLS regression analysis was used to estimate the trend and seasonal patterns in the milk components from 2006 to 2011. OLS estimations were performed for butterfat, protein and SCC. The independent variables used in each model included: time (in years) to capture the trend, and  $\sin(2\pi \cdot \text{time})$  and  $\cos(2\pi \cdot \text{time})$  waves to capture seasonality.



**Figure 5. Sine and Cosine Values Used as OLS Independent Variables.** Solid Line: Sine Wave, Dotted Line: Cosine Wave. The sine and cosine values repeat annually.

## Model Results

OLS regression results are presented in Table 5. Model results indicate a strong seasonal component for butterfat, protein and SCC. The trend component for butterfat was negligible, a positive trend was observed for protein and a negative trend was observed for SCC.

To determine the significance of the estimate coefficients the residuals were checked for serial correlation. In all three models the residuals were correlated over time. Since serial correlation does not bias the coefficients their values are asymptotically efficient. However, the standard errors and t-statistics (which are indicators of significance) are biased.

An effort was not made to re-estimate the standard errors. For the purposes of this analysis the estimated slope coefficients appropriately demonstrate the movement of the components over time and season.

Figure 6 on the following page shows the observed component levels for the six-year period analyzed and the fitted values from the OLS models.

**Table 5. OLS Regression Results**

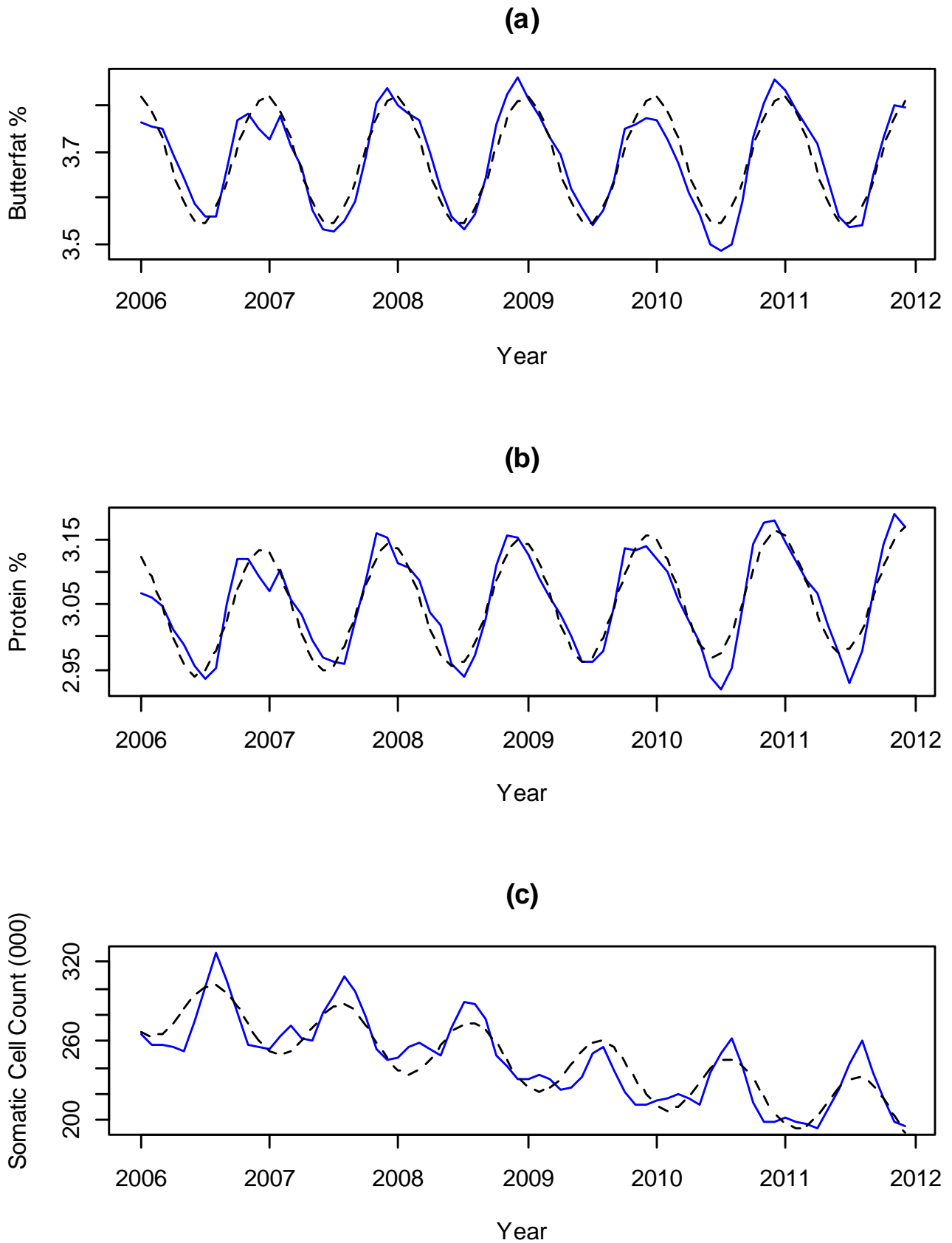
| Dependent Variable | Butterfat           | Protein            | SCC              |
|--------------------|---------------------|--------------------|------------------|
| Intercept          | 3.68<br>(0.01)      | 3.02<br>(0.00)     | 301.06<br>(3.82) |
| Time               | -1.23E-04<br>(0.00) | 6.95E-03<br>(0.00) | -13.92<br>(0.89) |
| Sine Term          | -0.02<br>(0.01)     | -0.04<br>(0.00)    | -9.78<br>(2.17)  |
| Cosine Term        | 0.13<br>(0.01)      | 0.09<br>(0.01)     | -20.88<br>(2.15) |
| R-Squared          | 0.875               | 0.871              | 0.825            |

1/ Approximated standard errors in parenthesis; \*p < 0.01; (N=72)

As seen in the plot of SCC and in table 5 the estimate trend is negative. This indicates that year-over-year SCC for producers associated with the Mideast marketing area are declining. This trend is of particular importance when considering the current policy landscape that is increasing emphasizing the need for producers to reduce the somatic cell count in milk.

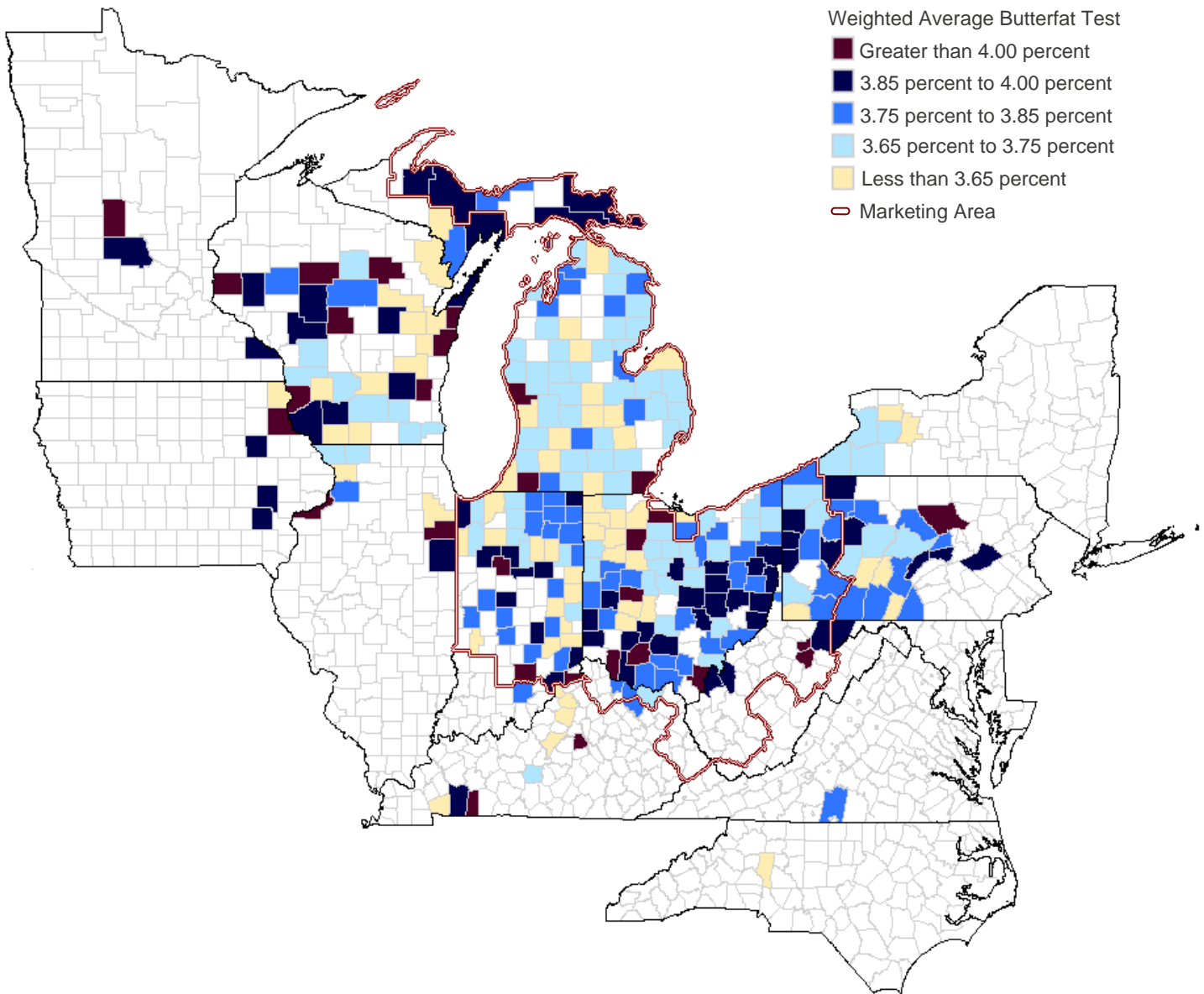
## Conclusion

The data included in this analysis indicates that component levels vary significantly with respect to delivery volume, production region and season. Additional causes of component variation not captured in this analysis likely include herd demographics, lactation stage, climate conditions, farm management, or mechanical issues such as sampling problems, agitation problems or tank temperature.



**Figure 6. Plot of OLS Results.** The solid line represents the observed component levels and the dashed line represents the OLS fitted values. **(a)** Butterfat %, **(b)** Protein %, **(c)** Somatic Cell Count (000)

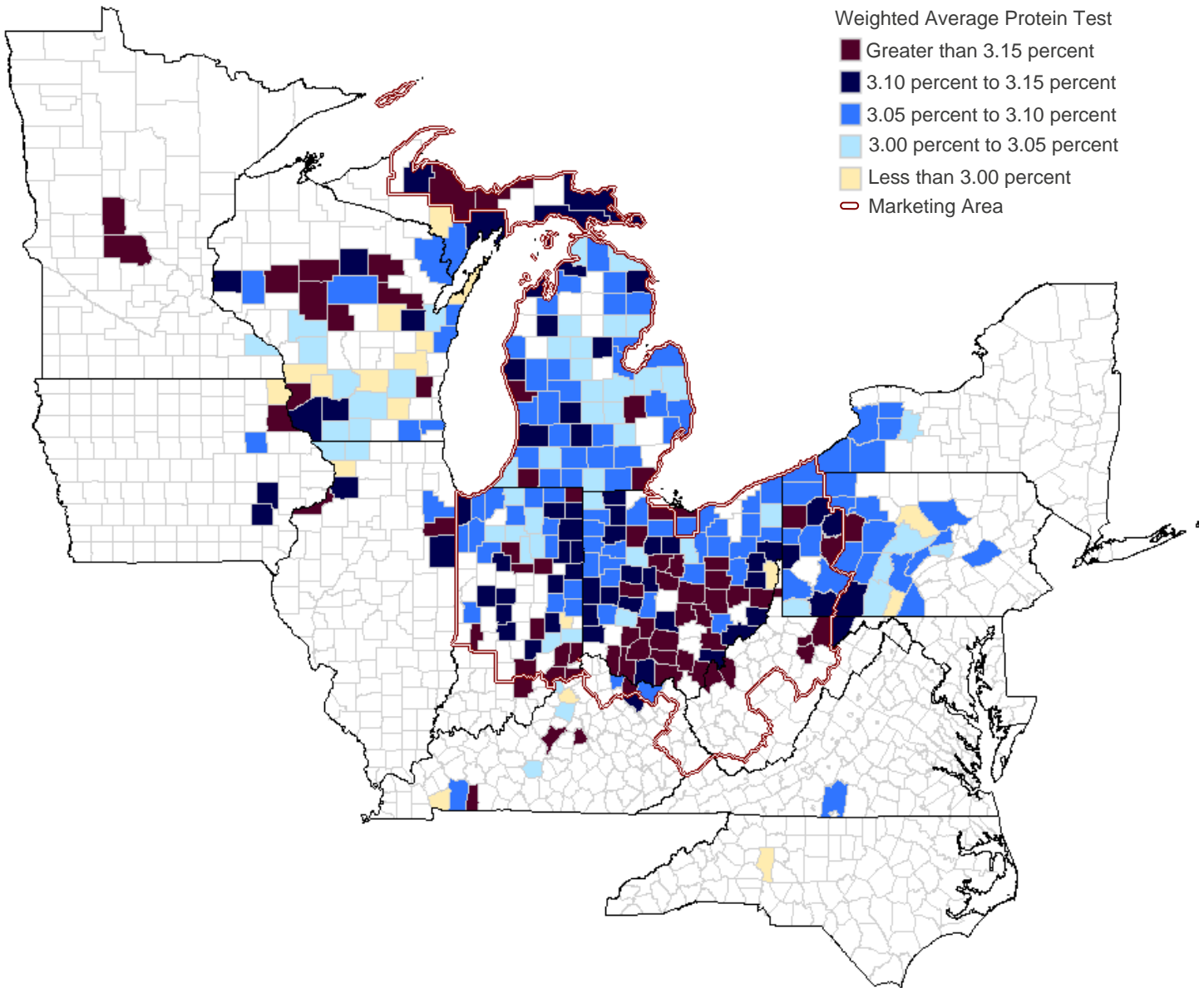
Figure 7. Weighted Average Butterfat Test by State and County, Mideast Marketing Area 2011 4/



4/ Excludes restricted data.

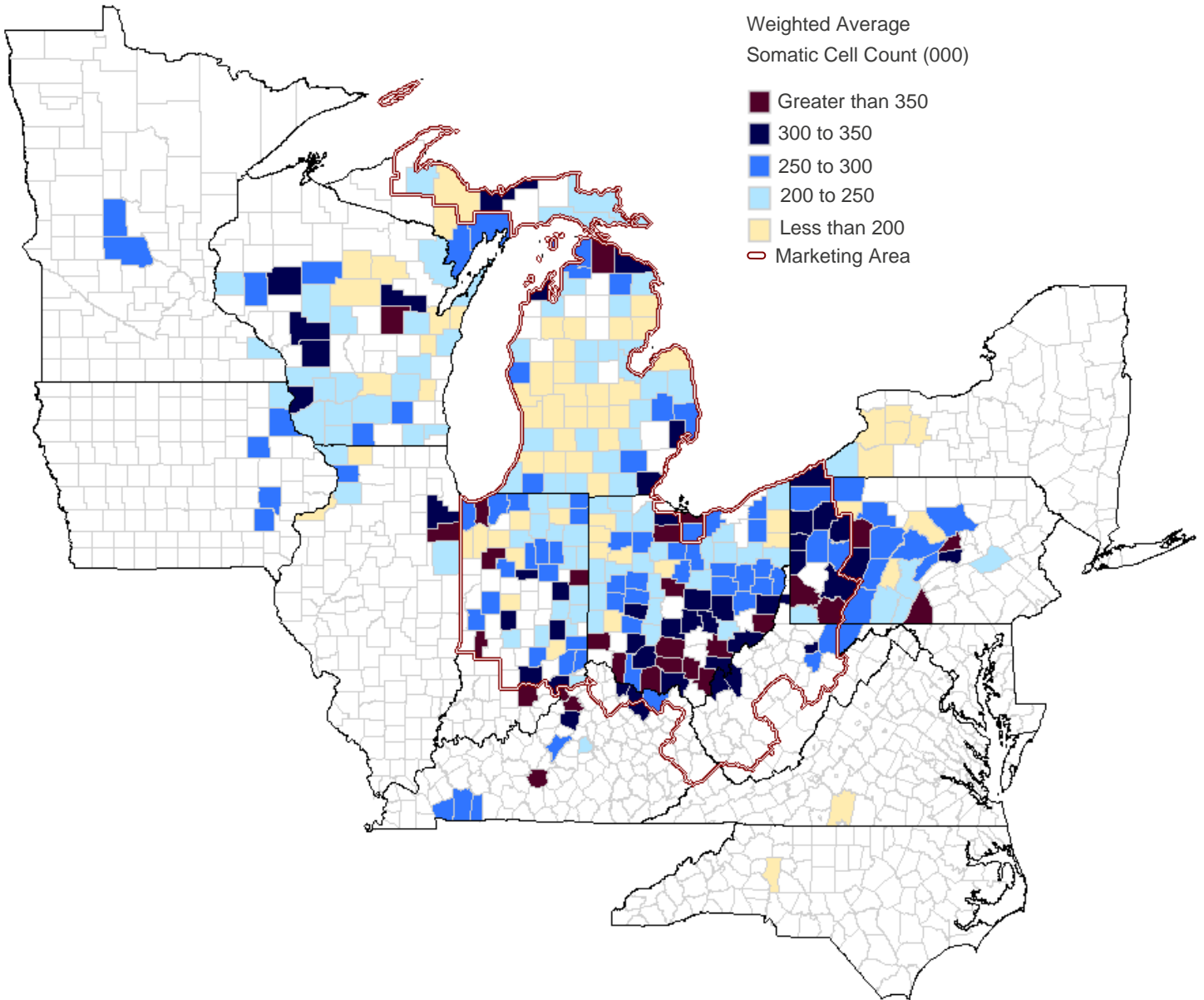


Figure 8. Weighted Average Protein Test by State and County, Mideast Marketing Area 4/



4/ Excludes restricted data.

Figure 9. Weighted Average Somatic Cell Count Test by State and County, Mideast Marketing Area 2011 4/



4/ Excludes restricted data.