UPPER MIDWEST MARKETING AREA

ANALYSIS OF COMPONENT LEVELS AND SOMATIC CELL COUNT IN INDIVIDUAL HERD MILK AT THE FARM LEVEL
2016

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Corey Freije[1]

I. INTRODUCTION

This study analyzes the component levels and values comprising milk production for Federal Order 30 for 2016. The payroll data for producers who were associated with the Upper Midwest Marketing Order were examined. On average, 12,684 dairy producers were associated with the market every month.

The payroll data presented for this study are for those dairy farmers residing in any county in the states comprising Federal Order 30. The exception to this is Michigan whose included area is held to the Upper Peninsula. The data are aggregated to the farm level which is consistent with other staff papers done by this office.

II. DATA AND METHODOLOGY

The data used in this analysis are from monthly payroll records submitted to the Upper Midwest Order. Since handlers generally submit their entire payrolls, the data include not only producer milk pooled on the Upper Midwest, but also may include, in some cases, producer milk pooled on other orders and milk historically associated with the order but not pooled in some months because of price relationships between classes and other Federal marketing orders. The result is a difference between the number of producers and milk production reported in this study and the number of producers and milk production reported as pooled on the Upper Midwest Order. Also, there are a number of instances in which there are multiple cases representing producer milk from one farm. These are situations where more than one producer received a share of the milk check, or there is more than one bulk tank on the farm. For individual producers, total monthly milk marketed, component pounds and somatic cell count (scc) from payrolls submitted to the Market

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Administrator's office are aggregated to the farm level for this analysis. All producer milk was included in the analysis that follows unless otherwise noted in the text, figures or tables.

Other solids, for purposes of Federal milk order pricing, are defined as solids-not-fat (snf) minus protein. Therefore, other solids consist primarily of lactose and ash. Ash traditionally has been considered a constant in snf, while lactose does vary somewhat in the snf.

Many factors such as weather, feed quality and feeding practices, breed of cattle, etc., may impact component levels and relationships among components in milk. No attempt was made to estimate the specific effects of such factors on milk composition. However, average component levels were examined for seasonal or within-year variation. In addition, component levels were examined for the seven primary states that are at least partially within the milk procurement area of the Upper Midwest Order. Since the procurement area stretches from south of Chicago to northwestern North Dakota, state level component and scc statistics provide a means of reflecting variation in milk composition across a large geographic area. For 2016, average component levels by size of producer marketings were also examined.

This paper also looks at somatic cell count data for the period 2004 to 2016. The analysis seeks to identify and quantify a possible trend in decreasing somatic cell counts. The trend component must also be separated from the cyclical component endemic to somatic cell counts.

The cumulative value of butterfat, protein and other solids, adjusted for scc, on an annual per cwt. basis was examined to observe how milk values varied under differing constraints. Monthly Federal order component prices that apply to the Upper Midwest Order were used to calculate milk values for this study.

III. SEASONAL VARIATION IN MILK COMPONENT LEVELS AND SOMATIC CELL COUNT

While widespread use of artificial insemination, freestall barns and total mix rations have reduced production swings, seasonality is still present. Seasonal production 'spring flush' and the winter drop in production also lead to seasonal movements in component tests. As Table 1 indicates, butterfat, protein and snf tests have their lowest levels in June or July and

peak in November. Somatic cell counts peak in the warm summer months and reach a low point in November. Other solids tests show little variation but usually peak in the spring or summer months.

Seasonal changes in component levels for 2016 appeared to be relatively normal. Beginning in January, butterfat and protein tests tapered off during the summer to low points in June and July, then rose to peak levels at some time in the winter. Other solids tests increased slightly in the spring and then declined slightly and leveled off for the remainder of the year. The seasonality of changes and magnitude of variation in component levels during the year were generally similar to the observed results from previous studies. Seasonal variation in the monthly average scc appeared to be typical, with higher levels in the summer and lower levels in the fall and winter. Monthly weighted average component levels and scc for 2016 are summarized in Table 1 and miscellaneous annual statistics, in addition to weighted averages, are summarized in Table 2.

Table 1

Weighted Average Levels of Selected Components and Somatic Cell Count in Milk by Month

2016

Month	Butterfat Test	Protein Test	Other Solids Test	Solids-Not-Fat Test	Somatic Cell Count
	- % -	- % -	- % -	- % -	- 1,000 -
January	3.92	3.18	5.73	8.85	201
February	3.89	3.15	5.73	8.77	201
March	3.85	3.12	5.75	8.95	202
April	3.83	3.11	5.74	8.88	199
May	3.78	3.08	5.76	8.90	198
June	3.71	3.03	5.77	8.77	213
July	3.69	2.99	5.78	8.79	230
August	3.69	3.01	5.75	8.86	242
September	3.78	3.09	5.77	8.84	231
October	3.88	3.17	5.72	8.93	213
November	3.92	3.20	5.72	8.89	200
December	3.97	3.23	5.72	8.86	202
Minimum	3.69	2.99	5.72	8.77	198
Maximum	3.97	3.23	5.78	8.95	242
Annual Average	3.83	3.11	5.74	8.86	211

During the year, butterfat levels dropped from 3.92% in January to 3.69% in July and August, then rose to 3.97% by December. Protein and snf showed similar seasonal patterns during the year by bottoming out in the summer and peaking by year-end. The standard deviation for butterfat, protein and snf was 0.33, 0.17 and 0.18 percentage points, respectively. Other solids demonstrated the narrowest range of variation with no apparent seasonal pattern. Other solids levels ranged from a high of 5.78% in the summer months and a low of 5.72% in October, November and December. The seasonal high scc of 242,000 was reached in August following a low of 198,000 in May, a change of 44,000 during the year.

For the year, the simple average protein levels were equal to or higher than the weighted average. The higher simple averages relative to the weighted averages for butterfat indicates that smaller producers (in terms of monthly milk deliveries) tend to have higher levels of butterfat than their larger counterparts. Conversely, the simple averages for other solids and snf were lower than the weighted averages for the respective components indicating that larger producers tended to have higher levels of these components than smaller producers. For the year 2016, the simple average scc (257,000) was higher than the weighted average (211,000) indicating that larger producers tended to have, on average, lower scc than their smaller counterparts. Moreover, the median scc level (192,000) was also lower than the simple average scc, indicating that the distribution of scc levels for the market was skewed toward higher scc levels.

Table 2

Component Levels and Somatic Cell Count of Milk:
Weighted Average, Simple Average, Weighted Standard Deviation,
Weighted Median, Minimum and Maximum

2016

Component	Weighted Average	Simple Average	Weighted Standard Deviation	Weighted Median	Minimum	Maximum
	- % -	- % -	- % -	- % -	- % -	- % -
Butterfat	3.83	3.88	0.33	3.78	1.54	6.56
Protein	3.11	3.11	0.17	3.09	0.99	7.45
Other Solids	5.74	5.69	0.08	5.75	2.27	9.37
SNF	8.86	8.79	0.18	8.85	3.26	13.59
SCC (1,000's)	211	257	98	192	20	1,888

As Table 2 shows, the weighted averages for butterfat and somatic cell counts lie below the simple average. Historically, this relationship was also true for protein tests. In the past, this relationship has indicated that production, other solids, and solids-not-fat tests were directly related while butterfat, protein, and somatic cell counts were inversely related to production levels. The period of time 2012 to 2016 has seen higher protein levels and overall higher component levels in the largest production group as seen in Tables 5a and 5b. The more numerous smaller dairies have tests more likely equal to the simple average and the fewer larger dairies more likely equal the weighted average. A more detailed breakdown of that skewness is presented in Tables 3a and 3b. The data for Tables 3a and 3b are from producers for which we have data for all 12 months.

The overall distributions for butterfat, protein and solids-not-fat tests are all approximately normal with other solids and somatic cell counts being skewed. Somatic cell counts are skewed right with a large number of observations at lower levels and fewer large values, meaning that 80% of the farms have a higher somatic cell count than the weighted average somatic cell count. The lower somatic cell count of the larger producers drags down the weighted average.

The range of component levels observed in the data was fairly wide. Individual monthly average butterfat levels in the data were as low as 1.54% and as high as 6.56%; protein levels ranged from 0.99% to 7.45%; other solids levels ranged from 2.27% to 9.37%; solids-not-fat levels ranged from 3.26% to 13.59%; and scc ranged from 20,000 to 1,888,000.

However, during the year, the component test levels and scc levels in most producer milk were within one standard deviation of the weighted average.[2] The ranges of component levels within one standard deviation of the weighted average were: 3.50% to 4.16% for butterfat; 2.94% to 3.29% for protein; 5.67% to 5.82% for other solids; 8.68% to 9.03% for solids-not-fat; and 113,000 to 309,000 for scc. Approximately three-quarters of the observed component levels and scc in the 2016 data were within these ranges.

The differences in the weighted and simple averages and the medians of the component tests warrant a closer look at the relationship between farm size, based on monthly average milk marketed, and milk component levels. Producers with marketings for each month of

[2] By definition, for a *normal distribution*, approximately 68 percent of observations are within one standard deviation of the weighted average.

2016 were divided into ten percentiles, ten groups with the same number of producers, based on average monthly production. The monthly average production and component tests are shown in Table 3a. The range of average monthly production and total production by group are also shown in Table 3b.

Table 3a

Weighted Average Component Tests by Monthly Average Producer Milk Production
Producers with Production in Each Month of 2016

Percentile	Number of Producers	Butterfat Test - % -	Protein Test - % -	Other Solids Test - % -	Solids-Not-Fat Test - % -	Somatic Cell Count - 1,000 -
1	1,171	3.97	3.13	5.59	8.72	314
2	1,171	3.92	3.11	5.64	8.75	305
3	1,172	3.90	3.10	5.66	8.76	286
4	1,171	3.88	3.10	5.68	8.79	274
5	1,171	3.86	3.09	5.70	8.79	253
6	1,172	3.86	3.10	5.71	8.81	244
7	1,171	3.84	3.10	5.72	8.81	234
8	1,172	3.84	3.10	5.73	8.83	216
9	1,171	3.81	3.09	5.74	8.83	204
10	1,171	3.81	3.12	5.76	8.89	193
Total or Average	11,713	3.83	3.11	5.74	8.86	209

Table 3b

Monthly Average Producer Milk by Producer Size
Producers with Production in Each Month of 2016

Percentile	Monthly Average Pounds	Minimum Monthly Average Pounds	Maximum Monthly Average Pounds	Total Pounds	Percent of Total Pounds	Cumulative Percent of Total
1	23,411	1,141	34,585	328,974,615	0.76%	0.76%
2	43,352	34,586	51,871	609,188,394	1.40%	2.16%
3	60,856	51,874	69,740	855,882,124	1.97%	4.12%
4	78,989	69,755	88,623	1,109,959,992	2.55%	6.67%
5	98,917	88,625	110,541	1,389,985,108	3.19%	9.86%
6	123,985	110,546	139,800	1,743,730,527	4.01%	13.87%
7	161,126	139,809	186,961	2,264,138,493	5.20%	19.07%
8	232,615	186,968	291,714	3,271,491,168	7.52%	26.59%
9	411,711	291,799	604,018	5,785,360,755	13.29%	39.88%
10	1,862,290	605,065	23,608,140	26,168,893,592	60.12%	100.00%
Total or Average	309,682			43,527,604,768		

A more detailed look at the relationship between producer size and component levels shows that larger producers tend to have lower butterfat tests and scc than do smaller producers. Producers averaging 23,411 pounds per month had an average butterfat test of 3.97% while producers averaging 1,862,290 pounds averaged a 3.81% butterfat test. The butterfat test declined steadily from a weighted average of 3.97% for the smallest group to a weighted average of 3.81% for both groups 9 and 10. The scc declined steadily from an average of 314,000 for producers averaging 23,411 pounds per month to an average of 193,000 for producers averaging 1,862,290 pounds per month, a difference in the scc of 121,000.

Protein tests also declined from the smaller producers to the larger producers but to a smaller extent than for butterfat, falling from 3.13% for producer's averaging 23,411 pounds per month to 3.09% percent for producers averaging 411,711 pounds of milk marketed per month and rising to 3.12% for producers averaging 1,862,290 pounds.

Other solids and solids-not-fat tests steadily increased as average monthly production increased. Other solids tests increased from 5.59% to 5.76%, while solids-not-fat tests increased steadily from 8.72% to 8.89%, as monthly average production increased from 23,411 pounds to 1,862,290 pounds.

The data from this group of producers also offer some interesting insight into the structure of the market. For instance, the smallest ten percent of producers supply less than one percent of the milk while the largest ten percent of producers supply more than 60 percent of the milk in the market. More than 80 percent of the producers have a monthly production below the monthly average market production of 309,682 pounds.

IV. VARIATIONS IN MILK COMPONENT LEVELS AND SOMATIC CELL COUNTS WITHIN THE MARKETING AREA

Milk component levels and scc were examined for the seven states that have counties within the Upper Midwest Marketing Area (see Table 4). Differences in average component levels and scc between the states were observed. One-way analysis of variance was used to determine that the weighted averages of the states were not equal. In addition, several post hoc paired tests were conducted to determine if any of the individual states' weighted averages were equal. These tests indicated that even though the observed differences between some of the states were relatively small, the differences between the weighted averages were significant.

Of the states that are wholly or partially located in the Upper Midwest Marketing Area, South Dakota had the highest weighted average butterfat test and the highest weighted average protein test. North Dakota had the highest weighted average other solids test, while South Dakota had the highest weighted average solids-not-fat test. Of the states that are included in the Upper Midwest Marketing Area, Michigan U.P. had the lowest weighted average scc and Minnesota and South Dakota tied for the highest.

Table 4

Weighted Average Components Levels and Somatic Cell Count in Milk by State
2016

State	Butterfat Test	Protein Test	Other Solids Test	Solids-Not-Fat Test	Somatic Cell Count
	- % -	- % -	- % -	- % -	- 1,000 -
Illinois	3.81	3.11	5.73	8.84	220
Iowa	3.86	3.14	5.75	8.90	216
Michigan U.P.	3.77	3.09	5.75	8.84	197
Minnesota	3.89	3.14	5.75	8.89	223
North Dakota	3.80	3.11	5.76	8.87	217
South Dakota	4.10	3.25	5.74	8.98	223
Wisconsin	3.78	3.09	5.74	8.83	205
Market	3.83	3.11	5.74	8.86	211
Minimum	3.77	3.09	5.73	8.83	197
Maximum	4.10	3.25	5.76	8.98	223

Tables 5a and 5b use a scale of production employed by the Upper Midwest Milk Order to illustrate differences present over production ranges from less than 50,000 pounds to over 5,000,000 pounds. Table 5a shows that butterfat and protein tests and somatic cell counts tend to decline as scale increases, though none of the trends are monotonic. The largest scale of production, 5,000,000 pounds, has a substantial increase in butterfat and protein tests and a drop in somatic cell counts over the next smaller size range. Table 5b indicates the average monthly production for the largest range is twice the second largest size range's average monthly delivery. Table 5b also shows the largest size category produces 16.01% of the total production.

Table 5a

Weighted Average Component Tests by Monthly Average Producer Milk Production
All Producers 2016

Size Categories (Pounds)	Monthly Average Pounds	Butterfat Test	Protein Test	Other Solids Test	Solids-Not-Fat Test	Somatic Cell Count
		- % -	- % -	- % -	- % -	- 1,000 -
Up to 49,999	29,814	3.96	3.13	5.61	8.75	311
50,000 to 99,999	73,930	3.89	3.10	5.68	8.78	276
100,000 to 249,999	153,889	3.85	3.10	5.72	8.81	233
250,000 to 399,999	312,328	3.83	3.10	5.74	8.84	209
400,000 to 599,999	487,437	3.79	3.08	5.74	8.82	204
600,000 to 999,999	771,536	3.78	3.09	5.76	8.84	197
1,000,000 to 1,499,999	1,211,292	3.77	3.09	5.76	8.85	192
1,500,000 to 2,499,999	1,910,395	3.77	3.10	5.77	8.87	190
2,500,000 to 4,999,999	3,365,960	3.81	3.13	5.76	8.89	204
5,000,000 or more	7,926,343	3.90	3.17	5.76	8.93	195
Average	300,503	3.83	3.11	5.74	8.86	211

Table 5b

Monthly Average Producer Milk by Producer Size
All Producers 2016

Size Categories (Pounds)	Number of Observations	Minimum Monthly Average Pounds	Maximum Monthly Average Pounds	Percent of Total Pounds	Cumulative Percent of Total
Up to 49,999	32,978	31	49,999	2.15%	2.15%
50,000 to 99,999	39,558	50,001	99,999	6.39%	8.54%
100,000 to 249,999	45,975	100,000	249,998	15.47%	24.01%
250,000 to 399,999	12,039	250,005	399,996	8.22%	32.23%
400,000 to 599,999	6,866	400,017	599,995	7.32%	39.55%
600,000 to 999,999	5,751	600,027	999,922	9.70%	49.25%
1,000,000 to 1,499,999	3,407	1,000,000	1,499,900	9.02%	58.27%
1,500,000 to 2,499,999	2,822	1,500,008	2,499,726	11.79%	70.06%
2,500,000 to 4,999,999	1,893	2,500,405	4,997,650	13.93%	83.99%
5,000,000 or more	924	5,000,638	25,898,220	16.01%	100.00%
Total	152,213				

V. COMPONENT VALUES UNDER THE UPPER MIDWEST ORDER

Multiple component pricing on the Upper Midwest Order allows for component levels to be viewed in terms of the value of producer milk given its composition. Milk values, for the purpose of this study, were calculated on an annual basis using monthly Federal order component prices applied to producer milk associated with the Upper Midwest Order during

2016. These values reflect the aggregated value of butterfat, protein and other solids only. These values do not include monthly producer price differentials for the Upper Midwest Order or premiums and/or deductions that handlers pooling milk under the order may apply to producer pay prices.

In Table 6 for 2016, the cumulative value of butterfat, protein, other solids and an adjustment for scc averaged $15.98 per cwt. for the market. The value of each component comprised by the $15.98 per cwt. price was $8.83 for butterfat, $6.52 for protein, and $0.52 for other solids. The scc adjustment for the year amounted to about $0.11 per cwt.

Categorized by size range of delivery in Table 7, average values of producer milk ranged from a low of $15.82 per cwt. for monthly producer milk deliveries of at least 1,000,000 and less than 1,500,000 pounds to a high of $16.30 per cwt. for monthly producer milk deliveries of 5,000,000 or more. In general, the average value of producer milk, per cwt., declines as monthly deliveries increase. Specifically, the average value per cwt. dropped from $16.27 for the smallest producers to $15.82 for those producing between 1,000,000 and 1,499,999 pounds a month, then rose for the larger producers. Historically, this relationship between value per cwt. and production has been inversely related with the producers in the 5 million pound or more range having increased value over the next largest category since 2010. These results correspond well to comparisons between simple and weighted average component levels in Part III of this paper.

Component Value

Table 8 contains the component prices announced by the Federal orders for 2016. Table 7 indicates the overall component value for each size category using Table 8 prices and Upper Midwest producer data. Given the distribution of larger component test values at smaller sized farms, it's not surprising that the value per cwt. is larger for all but the largest categories. Table 6 shows the breakdown by component on a cwt. basis for overall milk value. Butterfat and protein contribute the vast majority of the milk's value with other solids and somatic cell counts contributing just 3.95%.

Table 6

Breakdown of Component Values of Producer Milk Deliveries

2016

	Component				
	Butterfat	Protein	Other Solids	Somatic Cell Count	Total Value
Value ($/cwt.)*	$8.83	$6.52	$0.52	$0.11	$15.98
Percentage	55.24%	40.81%	3.26%	0.69%	100.00%

*Sum may not add due to rounding.

Table 7

Aggregated Component Values by Size Range of Monthly Producer Milk Deliveries

2016

Size Categories (Pounds)	Aggregated Component Values*	Producer Milk (Pounds)	Weighted Average Value (Cwt.)
Up to 49,999	$159,954,140.73	983,220,981	$16.27
50,000 to 99,999	$468,737,922.30	2,924,511,241	$16.03
100,000 to 249,999	$1,128,111,902.93	7,075,061,896	$15.94
250,000 to 399,999	$598,921,097.40	3,760,111,598	$15.93
400,000 to 599,999	$529,818,086.09	3,346,739,250	$15.83
600,000 to 999,999	$702,802,805.03	4,437,101,949	$15.84
1,000,000 to 1,499,999	$653,012,066.00	4,126,870,841	$15.82
1,500,000 to 2,499,999	$855,799,697.90	5,391,135,726	$15.87
2,500,000 to 4,999,999	$1,018,460,554.64	6,371,762,943	$15.98
5,000,000 or more	$1,194,089,301.33	7,323,941,346	$16.30
Total	$7,309,707,574.35	45,740,457,771	$15.98

* Total value of pounds of butterfat, protein, and other solids, adjusted for scc.

Table 8

Monthly Component Prices and Somatic Cell Adjustment Rates for the Upper Midwest Order Producers

2016

Month	Butterfat Price	Protein Price	Other Solids Price	Somatic Cell Adjustment Rate
	($/Pound)			($/cwt. Per 1,000 SCC)
January	$2.3062	$1.8169	$0.0371	$0.00076
February	$2.3778	$1.7389	$0.0492	$0.00076
March	$2.2028	$1.9206	$0.0501	$0.00076
April	$2.2376	$1.8450	$0.0489	$0.00075
May	$2.2846	$1.4935	$0.0529	$0.00071
June	$2.4109	$1.4807	$0.0628	$0.00072
July	$2.5964	$1.9112	$0.0774	$0.00082
August	$2.4873	$2.5738	$0.0881	$0.00091
September	$2.3082	$2.5675	$0.1096	$0.00088
October	$2.0493	$2.2975	$0.1351	$0.00079
November	$2.1044	$2.8085	$0.1750	$0.00088
December	$2.3354	$2.6922	$0.2063	$0.00090
Simple Average	$2.3084	$2.0955	$0.0910	$0.00080

VI. TRENDS IN SOMATIC CELL COUNTS UNDER THE UPPER MIDWEST ORDER

Recently, the European Union shifted to a lower somatic cell count maximum for milk used to produce dairy products in the rest of the world, exported to their market. This shift has spurred an effort in the US to move the maximum somatic cell count from 750,000 cells per milliliter to 400,000 cells per milliliter for Grade A milk. The effects of such a move and the question over if there would be an impact at all have been part of the decision making process. The possibility of the tighter restrictions not having a substantial effect rests on the assumption that changes in the dairy industry have led to lower and lower somatic cell counts. The following data in Table 9 shows that the weighted average somatic cell counts on the Upper Midwest Federal Order have fallen over time. In addition, Table 9 indicates that the weighted standard deviation of somatic cell counts in herd data have also fallen over time. This trend means, in general, the average has fallen and the distribution has tightened up around that average in the period from 2004 to 2016.

Chart 1 indicates that in addition to a downward sloped trend line, the effect of the trend is greater than the normal seasonal shifts in monthly somatic cell count. The herd milk from producers in recent years has a seasonal high somatic cell count, usually in mid or late summer; that high point no longer rises to the winter lows of earlier years. The seasonal highs for 2012 and on are below the seasonal low for the year 2004. A trend line fitted to the data shows a downward slope of -.6622 times the average, so after a hundred observations or months the average cell count falls by 66.22 1,000s of cells per milliliter from January 2004 to December 2016.

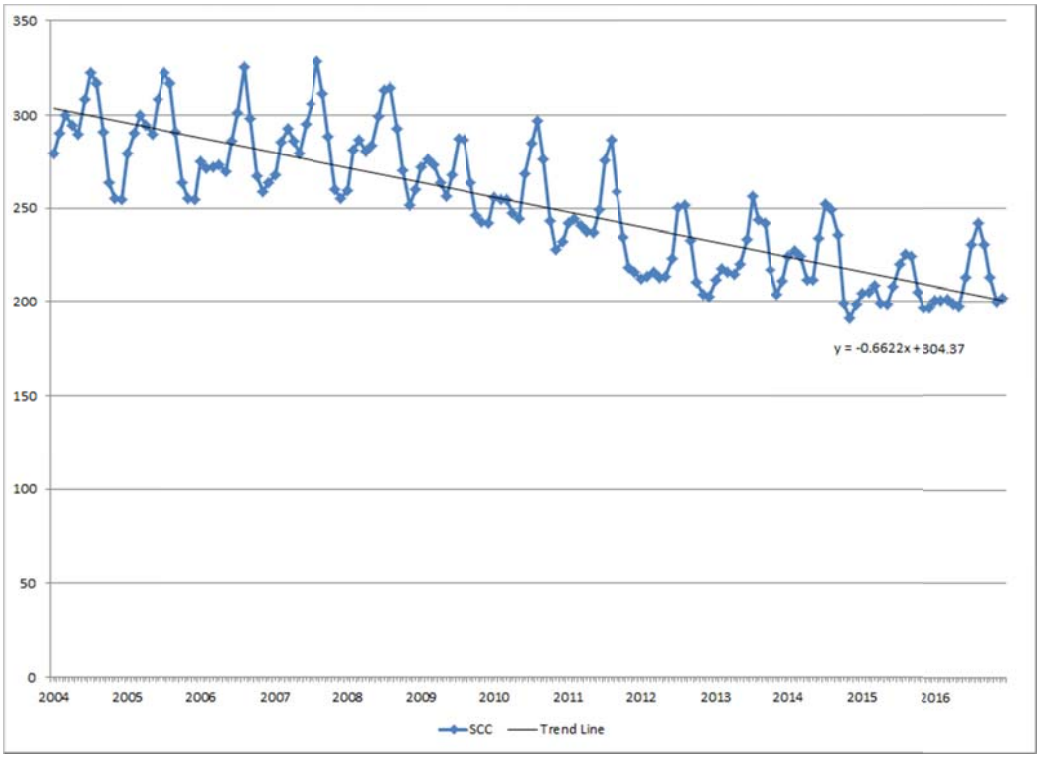
Table 9

Weighted Average Somatic Cell Count in Milk
2004 - 2016

Year	Weighted Average Somatic Cell Count	Weighted Average Standard Deviation
	-1,000-	-1,000-
2004	289	140
2005	285	147
2006	280	133
2007	288	137
2008	283	137
2009	265	130
2010	257	123
2011	245	115
2012	220	98
2013	224	100
2014	222	104
2015	208	94
2016	211	98

Chart 1

Weighted Average Somatic Cell Count by Month, 2004 to 2016



VII. SUMMARY

The producer payroll data for Federal Order 30 is characterized by seasonality, roughly normal distributions, and a pronounced skewness in number of producers by size. Seasonally, somatic cell counts increase in the summer months as the other tests are decreasing. The somatic cell counts are also distributed with a skewness to higher values and a median value lower than the weighted average somatic cell count. The producer data has a large number of farms producing a relatively small proportion of total milk. The component tests for these small farms have been historically higher including somatic cell counts. As a consequence of this skewness, the cwt. component value of the milk is also higher for smaller farms. Statewide average component values reflect the makeup of the producer distribution. A recent break from historical trends is that the largest categories of dairies have higher tests and milk value.

Smaller producers, based on average monthly milk marketed, had higher butterfat tests, protein tests and scc than larger producers, while larger producers had higher other solids and snf tests than smaller producers.

The smallest producers marketed less than three percent of the milk while the largest producers, those over 1,500,000 pounds, marketed more than a third of all the milk. The monthly average pounds of milk marketed were 300,503 pounds, however, over 80 percent of the producers had marketings below the market average.

Somatic cell counts under the Upper Midwest Marketing Order have shown a sustained and substantial downward trend over the period 2004 to 2016. This trend has coincided with a tightening of the distribution of somatic cell counts about the mean.

Under multiple component pricing, the annual weighted average value of butterfat, protein, and other solids, adjusted for scc, was $15.98 per cwt. for the market. Butterfat and protein contribute most of the milk's value with other solids and scc contributing 3.95% of the total value.