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Dairy Programs

MIDEAST MARKETING AREA
Federal Order 33

ANALYSIS OF COMPONENT LEVELS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL FOR PRODUCERS ASSOCIATED WITH THE MIDEAST ORDER

2007

Staff Paper
08-01

Prepared by:
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March 2008

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MIDEAST MARKETING AREA
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Staff Paper
08-01

Analysis of Component Levels in Individual Herd Milk at the Farm Level for Producers Associated With the Mideast Order 2007

John Newton

This staff paper details market statistics for the component levels of producer milk associated with the Mideast Marketing Area, Federal Order 33, for 2007. For 2007, the weighted average butterfat test was 3.66 percent, the weighted average protein test was 3.05 percent, the weighted average other solids test was 5.71 percent, and the weighted average SCC level was 273. Additionally, weighted average milk value, driven by higher protein prices, was $18.48 per cwt for 2007.

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ANALYSIS OF COMPONENT LEVELS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL FOR PRODUCERS ASSOCIATED WITH THE MIDEAST ORDER

2007

John Newton[1]

1. INTRODUCTION

This study analyzes the component levels of milk marketed by producers associated with the Mideast Marketing Area, Federal Order 33, for 2007. The milk components included in this study include butterfat, protein, other solids, and somatic cell count (SCC). These components are selected because the Mideast Marketing Area uses multiple component pricing[2] (MCP) as the basis for establishing the value of milk pooled on the order.

The component levels of producer milk were analyzed to determine weighted average butterfat, protein[3], other solids, and SCC levels with an emphasis on regional and seasonal variation patterns. Additionally, component levels were analyzed to determine whether significant differences existed among the means using month as the independent variable. An effort was also made to identify a statistical relationship among the components in herd level milk. Furthermore, milk included in this study was priced using component prices for 2007 to determine the financial variations within herd level milk due to season, producer size, and state.

For 2007 there were a total of 9,168 producers who were associated with the Mideast Marketing Area. The geographical region encompassed in this population includes Ohio, Michigan, Indiana, West Virginia, Pennsylvania, Kentucky, Kansas, Iowa, Illinois, Maryland, Minnesota, New York, Virginia, and Wisconsin.

2. BACKGROUND

Research into the component tests of producer milk at the herd level for producers associated with the Mideast Marketing Area has never been published. This study has historically been performed by Upper Midwest staff for producers associated with

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[1] Assisting Mr. Newton were Ron Gjurkovitsch, William Pollock and Sharon Uther of the Mideast Market Administrator's office.
[2] Under MCP, producer milk is priced on the cumulative value of butterfat, protein and other solids pounds with adjustments for SCC levels.
[3] Protein tests for 2007 reflect the change from crude protein to true protein testing methods that occurred in January 2000. The difference between crude and true protein levels in milk is non-protein nitrogen (NPN).

Federal Order 30, and Pacific Northwest staff for producers associated with Federal Order 124. Staff papers conducted by Federal Order 30 and the Pacific Northwest indicate that component tests vary noticeably by state, producer size, and season. Staff papers from Federal Order 30 and the Pacific Northwest also published multiple estimators indicating that statistical relationships existed between component tests at the herd level. The estimators generated in specific where: protein test as a function of the butterfat test; solids-non-fat test as a function of the protein test; and solids-non-fat test as a function of the butterfat test.

This research project will reproduce some of the research found in the Federal Order 30 and the Pacific Northwest staff papers; however, the estimators and statistics reported will represent the milk associated with Federal Order 33. This paper will use Ordinary Least Squared (OLS) analysis to test the butterfat test as a function of the protein test, and the other solids test as a function of both butterfat and protein tests. Additionally, butterfat tests will be tested using multiple dummy variables for the month and producer size. Considering that solids-not-fat is a combination of the other solids test and the protein test this analysis will not attempt to quantify the statistical relationship between solids-non-fat and protein or butterfat.

Examinations into the component levels reported by the Mideast Marketing Area indicate that component tests follow a reliable pattern. Other Solids tests remain steady year round while butterfat and protein tests tend to be the lowest in the spring and summer months. Table 2.1 details the component tests of producer milk on Federal Order 33 for 2005 and 2006.

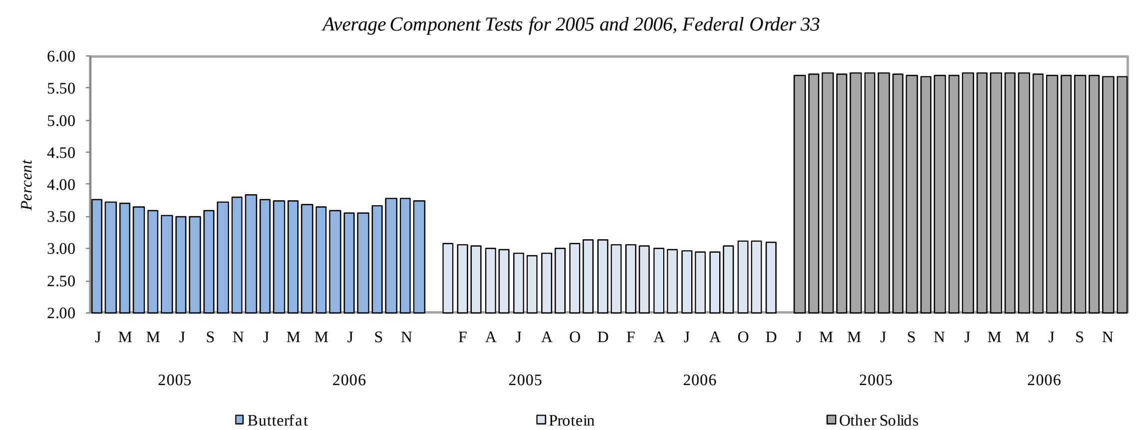


FIGURE 2.1-Average component tests for milk pooled on Federal Order 33, 2005-2006

3. DATA AND METHODOLOGY

The data population utilized in this analysis consists of all producer milk pooled on the Mideast Order. The data was collected from producer payrolls submitted by handlers and cooperatives to the market administrator's office. As handlers generally submit their entire payrolls, the data not only includes producer milk pooled on Federal Order 33, but also milk pooled on other orders and milk associated with the market but not pooled due to price fluctuations and/or price relationships among federal orders. As a result, there is a significant difference in the milk production[4] in this study and the milk production as pooled on the Mideast Federal order. The producer payrolls submitted to this office also included producers who were not associated with Federal Order 33. Producers who appeared on the payrolls submitted to this office but who did not pool milk on Federal Order 33 were *not* included in this analysis. It is possible for a producer to be associated with other markets and/or non-pool during a month; therefore, monthly totals by farm base ID number were aggregated to properly determine the weighted average of the herd component levels.

As noted by Freije (2006), many factors such as weather, feed quality, feeding practices, breed of cattle, and the stage of lactation impact the component levels in herd milk. No attempt was made to quantify the effect of weather or stage of lactation on milk composition. However, in the early stages of this research project an attempt was made to quantify the effect of feed costs on herd component levels. The Economic Research Service (ERS) publishes monthly cost of production estimates for each state. Survey data from ERS is based on indexed 2005 costs; as a result detailed survey results were unavailable. The cost data was limited in that it did not detail cost of production statistics at the county level. The lack of county level data prevents the impact of changing feed costs on component output from being quantified because it presupposes that producers are homogeneous and costs are alike throughout an entire state, when in fact costs vary significantly throughout a state. As a result, no further attempt was made to quantify the effects of the feed costs on milk composition.

In order to test whether the mean component levels are significantly different due to seasonal changes a one-way analysis of variance test will be performed for butterfat and protein. The variables will be analyzed using month as the independent factor.

In order to calculate the weighted averages for component tests and milk value, the observed test or milk value was weighted using the production pounds. For each analysis the component test was multiplied by the production volume. The sum product was then divided by the sum of total production to determine the weighted average component

[4] For this analysis milk production represents the aggregate delivery total.

price or milk value. Example 3.1 details the function used to calculate the weighted average component test or milk value:

$$\bar{x} = \frac{p_1 x_1 + p_2 x_2 + ... + p_n x_n}{p_1 + p_2 + ... + p_n}$$

Where, x represents the observed component test or milk value for herd n:

$$[x_1, x_2, ..., x_n]$$

And, production, p, is observed for herd n:

$$[p_1, p_2, ..., p_n]$$

EXAMPLE 3.1-Weighted average function

Calculating the weighted average allows herds with little or no production volume to contribute less to the weighted mean than herds with a high production volume. Where the simple mean would weigh all herd component tests or milk values equally, the weighted average weighs each herd accordingly, providing a better understanding of the actual component test and value of milk associated with the Mideast Marketing Area.

Since producers in the Mideast Marketing Area are paid on MCP, an effort will be made to detail milk price variations as a function of state, season and producer size. It is anticipated that milk value will vary dramatically as producer size and location changes. No attempt will be made in this analysis to incorporate the impact of SCC on milk value, nor will the producer price differential be considered. The component prices for each month were multiplied by the component tests to calculate the milk value at the herd level for producers included in this study. The milk values reported in this study do not represent actual prices paid to producers.

The data population was analyzed using multiple variations of OLS regression analysis. OLS was used to measure component relationships at the herd level, and to calculate the impact of seasonality and producer size on component tests.

4. DESCRIPTIVE STATISTICS FOR 2007

For 2007 the weighted average butterfat test was 3.66 percent, down 0.81 percent from the previous year. The simple average butterfat test for 2007 was 3.79 percent. This statistic implies that for 2007 smaller producers (based on monthly deliveries) had a tendency to have higher butterfat tests than larger producers. For 2007 the range of butterfat tests within two standard deviations of the mean[5] was 3.09 percent to 4.49 percent. Of the milk included in this analysis 25 percent had a butterfat test of 3.8

[5] For a normal distribution, 95 percent of all observations are within two standard deviations of the mean.

percent or greater. Figure 4.1 details the total milk pooled by component test ranges for butterfat and protein for 2007.

For 2007 the weighted average protein test was 3.05 percent, up 0.66 percent from the previous year. The simple average protein test for 2007 was 3.09 percent. This statistic implies that for 2007 smaller producers had a tendency to have higher protein tests than larger producers. For 2007 the range of protein tests within two standard deviations of the mean was 2.69 percent to 3.49 percent. Of the milk included in this analysis, 59 percent had a protein test equal to or greater than 2.9 percent but less than 3.1 percent. Table 4.1 details component tests statistics for 2007. Data from 2006 is included for comparative purposes.

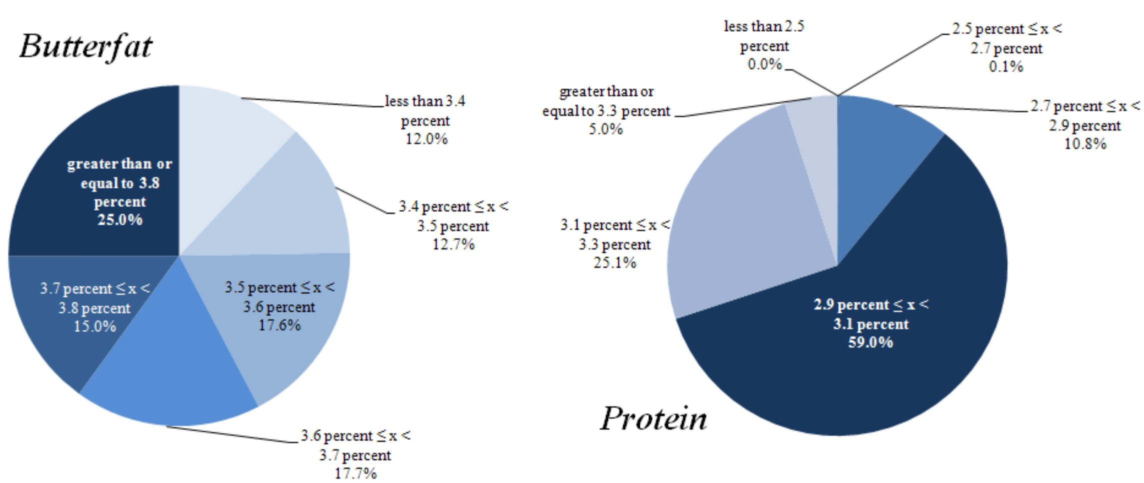


FIGURE 4.1-Milk pooled by component test range for butterfat and protein for 2007

For 2007 the weighted average other solids test was 5.71 percent, consistent with the previous year's results. The simple average other solids test for 2007 was 5.66 percent. This statistic implies that for 2007 large producers had a tendency to have higher other solids tests than smaller producers. For 2007 the range of other solids tests within two standard deviations of the mean was 5.43 percent to 5.89 percent.

STATISTICAL DATA FOR PRODUCERS ON THE MIDEAST ORDER FOR 2006 AND 2007

	2006 Weighted Average	**2007 Weighted Average**	Mean	Standard Deviation	Lower Bound	Upper Bound
					95 % Confidence Interval	
Butterfat *percent*	3.69	**3.66**	3.79	0.35	3.09	4.49
Protein *percent*	3.03	**3.05**	3.09	0.20	2.69	3.49
Other Solids *percent*	5.71	**5.71**	5.66	0.12	5.43	5.89
SCC *(1,000)*	274	**273**	320	163	0	647
Milk Value *$/cwt*	12.17	**18.48**	18.89	2.72	13.44	24.34

TABLE 4.1-Component test statistics for 2006 and 2007

For 2007 the weighted average SCC was 273, down 0.36 percent from 2006. The simple average SCC for 2007 was 320. Both averages are less than the 350 SCC limit on milk, meaning that on average, for 2007, the SCC value for milk was positive[6]. For 2007 the range of SCC within two standard deviations of the mean was 0 to 647. The lower bound confidence interval at 95 percent for somatic cell count is negative; since SCC cannot be negative the lower bound SCC has been replaced by zero.

Additionally, for 2007 the weighted average milk value was $18.48 per cwt, up 52 percent from the previous year. The simple average milk value for 2007 was $18.89 per cwt. This statistic implies that for 2007 smaller producers generally receive more for their milk than larger producers. For 2007 the range of milk prices within two standard deviations of the mean was $13.44 per cwt to $24.34 per cwt. This milk value range is related more to the increase in protein prices during 2007 than to changing component levels.

5. MEAN COMPARISON

For this section, the component tests were evaluated to test if the means were significantly different. The components were analyzed using month as the independent factor. The results of a one-way ANOVA analysis are useful in two ways:

- It allows for comparisons to be made within the independent variable categories.
- The descriptive statistics such as variability, standard error, overall mean, and the confidence interval for the mean at 95 percent can be analyzed to formulate general suppositions regarding the data population.

[6] SCC adjustment rate is equal to 0.0005 times the weighted average protein price, rounded to the 5th decimal place, multiplied by 350 less the SCC count (in thousands) of the milk.

The descriptive statistics generated from the one-way analysis indicated that the mean component levels of this data population adhered to historical trends for the Mideast Marketing Area.

When analyzing component levels using month as the independent variable, using Bonferroni post hoc analysis, a majority of the observed mean differences for month were significant at the 0.05 level. The computed F-values were greater than the critical F-values; therefore the null hypotheses that there are no significant differences between the means could be rejected. The significant differences in the means indicate that component levels do vary considerably by month. Table 5.1 displays the pairwise multiple comparisons for the means of butterfat and protein.

PAIRWISE MULTIPLE COMPARISON

Dependent Variable: Butterfat Test

Mean Difference

Month	January	February	March	April	May	June	July	August	September	October	November	December
January		(0.053)	0.018	0.081	0.223	0.286	0.302	0.279	0.204	0.082	(0.080)	(0.126)
February	0.053		0.071	0.134	0.276	0.338	0.355	0.332	0.256	0.134	(0.027)	(0.073)
March	(0.018)	(0.071)		0.063	0.205	0.267	0.284	0.261	0.186	0.064	(0.098)	(0.144)
April	(0.081)	(0.134)	(0.063)		0.142	0.205	0.221	0.198	0.123	0.001	(0.161)	(0.206)
May	(0.223)	(0.276)	(0.205)	(0.142)		0.063	0.079	0.056	(0.019)	(0.141)	(0.303)	(0.348)
June	(0.286)	(0.338)	(0.267)	(0.205)	(0.063)		0.017	(0.006)	(0.082)	(0.204)	(0.366)	(0.411)
July	(0.302)	(0.355)	(0.284)	(0.221)	(0.079)	(0.017)		(0.023)	(0.099)	(0.221)	(0.382)	(0.428)
August	(0.279)	(0.332)	(0.261)	(0.198)	(0.056)	0.006	0.023		(0.076)	(0.198)	(0.359)	(0.405)
September	(0.204)	(0.256)	(0.186)	(0.123)	0.019	0.082	0.099	0.076		(0.122)	(0.284)	(0.329)
October	(0.082)	(0.134)	(0.064)	(0.001)	0.141	0.204	0.221	0.198	0.122		(0.162)	(0.207)
November	0.080	0.027	0.098	0.161	0.303	0.366	0.382	0.359	0.284	0.162		(0.045)
December	0.126	0.073	0.144	0.206	0.348	0.411	0.428	0.405	0.329	0.207	0.045	

PAIRWISE MULTIPLE COMPARISON

Dependent Variable: Protein Test

Mean Difference

Month	January	February	March	April	May	June	July	August	September	October	November	December
January		(0.025)	0.030	0.057	0.078	0.129	0.152	0.155	0.059	(0.021)	(0.104)	(0.086)
February	0.025		0.055	0.083	0.103	0.154	0.177	0.180	0.084	0.004	(0.079)	(0.061)
March	(0.030)	(0.055)		0.028	0.049	0.099	0.123	0.126	0.030	(0.051)	(0.134)	(0.116)
April	(0.057)	(0.083)	(0.028)		0.021	0.071	0.095	0.098	0.002	(0.079)	(0.162)	(0.144)
May	(0.078)	(0.103)	(0.049)	(0.021)		0.051	0.074	0.077	(0.019)	(0.100)	(0.183)	(0.165)
June	(0.129)	(0.154)	(0.099)	(0.071)	(0.051)		0.023	0.026	(0.070)	(0.150)	(0.233)	(0.215)
July	(0.152)	(0.177)	(0.123)	(0.095)	(0.074)	(0.023)		0.003	(0.093)	(0.173)	(0.257)	(0.239)
August	(0.155)	(0.180)	(0.126)	(0.098)	(0.077)	(0.026)	(0.003)		(0.096)	(0.177)	(0.260)	(0.242)
September	(0.059)	(0.084)	(0.030)	(0.002)	0.019	0.070	0.093	0.096		(0.081)	(0.164)	(0.146)
October	0.021	(0.004)	0.051	0.079	0.100	0.150	0.173	0.177	0.081		(0.083)	(0.065)
November	0.104	0.079	0.134	0.162	0.183	0.233	0.257	0.260	0.164	0.083		0.018
December	0.086	0.061	0.116	0.144	0.165	0.215	0.239	0.242	0.146	0.065	(0.018)	

TABLE 5.1-Multiple comparisons using Bonferroni post hoc analysis

Bonferroni post hoc analyses traditionally increase the probability of committing a Type I error: the error of rejecting the null hypothesis that is actually true. In this case, the error of the first kind would reject the hypothesis that there is no significant difference between the means; when in reality there *is **no significant difference***. To account for this, Tukey's honest significant difference post hoc analysis was run to compute a new critical value. Using Tukey's HSD, the means were not significant at the 0.05 level.

The difference in results between Tukey's HSD and Bonferroni post hoc analyses suggests that component variations exists but are not significantly different using month as the independent factor. It is likely that in addition to month other factors cause component variations. The following sections will use variants of region and producer size (in terms of monthly deliveries) to measure their impact on component levels.

6. SEASONAL VARIATION IN MILK COMPONENT LEVELS

Dairy cows, when exposed to high temperature coupled with high humidity or radiant energy (sunlight) often respond with reduced milk yield and lower butterfat and protein tests, West (2002). Appropriately, beginning in February, butterfat and protein tests decreased steadily in the spring and bottomed out in the summer before hitting their highest points in the winter months. Meanwhile, other solids tests remained steady throughout the year. The observed variations in SCC were opposite that of butterfat and protein, where higher SCCs were observed in the summer months.

The observed changes in component tests followed the normal patterns detailed in section two of this staff paper. The findings were also supported by the findings of Freije and Werner (2006); both researchers concluded that component tests of herd level milk were impacted by seasonality changes.

Since milk value is dependent on component prices and the component percentages, the impact of seasonality on milk value can be measured by subtracting the announced Class III price from the monthly weighted average milk value. The announced Class III milk price formula using the standard component levels[7] is equal to:

- 2.99(Protein price) + 5.69(Other solids price) + 3.5(Butterfat price).

The difference in milk value will be a result of component levels that are higher or lower than the standard component levels. Therefore, when component levels change due to seasonality, the variation in milk value will change accordingly. Figure 6.1 details the difference in value between the Class III announced price and the monthly weighted average milk price.

[7] As defined by Dairy Programs.

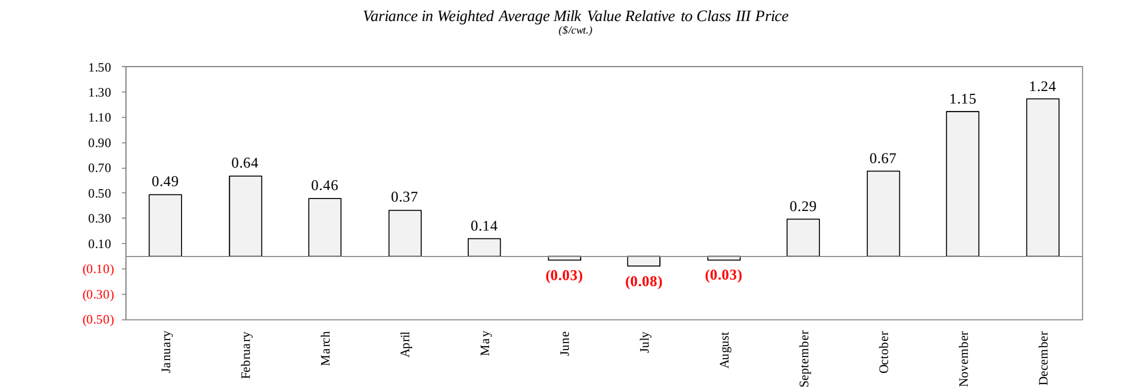


FIGURE 6.1-Variance in monthly weighted average milk value relative to Class III price

As anticipated the milk value moves in association with the butterfat and protein test levels. Beginning in February the weighted average milk price variance decreases gradually, finally reaching a low point in July. Thereafter, the observed variance between milk value and the announced Class III price continues to widen gradually up to December 2007. By analyzing the weighted average variance instead of the weighted average milk value, the impact of price changes on milk value is canceled, leaving only price variations due to seasonality.

Figure 6.2 details the seasonality patterns for butterfat, protein, other solids, and SCC.

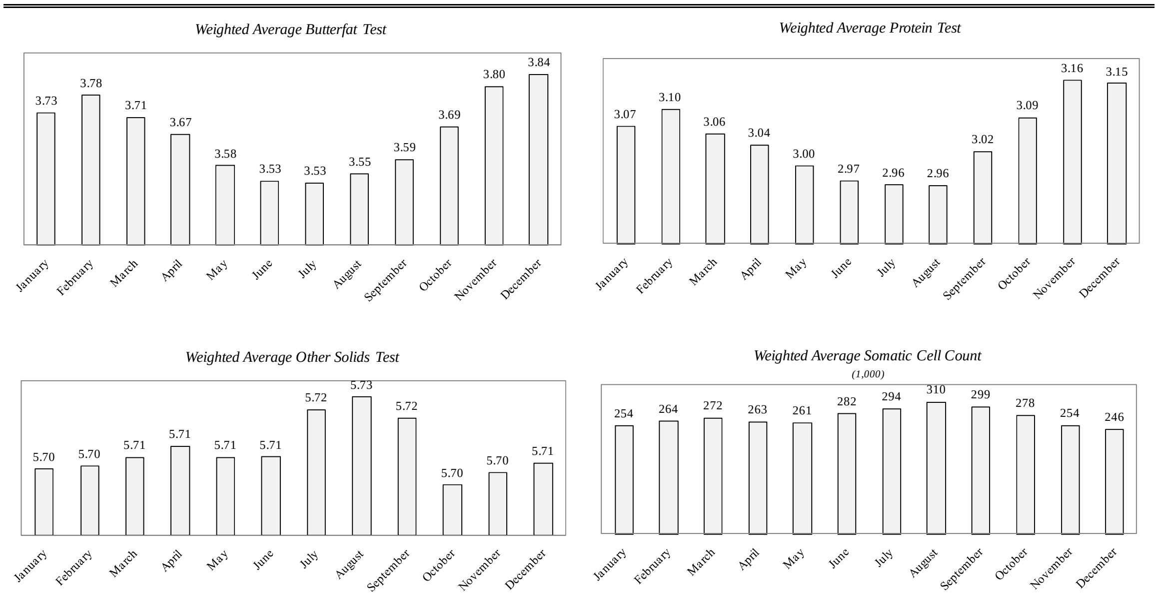


FIGURE 6.2-Weighted average component levels by month for 2007

It appears, as observed in figure 6.2, that other solids levels increase as butterfat and protein levels decrease. Although the relationship is not one to one, it is important to note that lactose (a key component of other solids) maintains osmotic pressure across the mammary membrane in the cow. As butterfat and protein percentages decrease, lactose must increase to maintain the osmotic pressure in the mammary membrane (MacNish, 2008).

Weighted average butterfat tests reached a minimum in June and July of 2007 at 3.53 percent. The maximum weighted average butterfat test occurred in December at 3.84 percent. The minimum simple average butterfat tests was 3.59 percent in July, and the maximum simple average butterfat test was 4.02 percent in December. December had the widest range of observed butterfat tests, where the range of butterfat tests within two standard deviations of the mean was 3.27 percent to 4.77 percent. Table 6.1 includes component statistics by month for 2007.

DESCRIPTIVE STATISTICS BY MONTH FOR 2007, FEDERAL ORDER 33
SELECTED COMPONENTS, SOMATIC CELL COUNT, AND MILK VALUE

	Butterfat			*Protein*			*Other Solids*		
	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation
		percent			*percent*			*percent*	
2007									
January	3.73	3.89	0.36	3.07	3.13	0.20	5.70	5.65	0.12
February	3.78	3.94	0.35	3.10	3.15	0.20	5.70	5.66	0.13
March	3.71	3.87	0.32	3.06	3.10	0.18	5.71	5.66	0.12
April	3.67	3.81	0.31	3.04	3.07	0.17	5.71	5.67	0.11
May	3.58	3.67	0.30	3.00	3.05	0.17	5.71	5.67	0.11
June	3.53	3.61	0.28	2.97	3.00	0.16	5.71	5.67	0.11
July	3.53	3.59	0.27	2.96	2.98	0.15	5.72	5.67	0.11
August	3.55	3.61	0.27	2.96	2.97	0.15	5.73	5.67	0.12
September	3.59	3.69	0.30	3.02	3.07	0.17	5.72	5.66	0.12
October	3.69	3.81	0.32	3.09	3.15	0.18	5.70	5.64	0.11
November	3.80	3.97	0.36	3.16	3.23	0.21	5.70	5.65	0.12
December	3.84	4.02	0.38	3.15	3.21	0.21	5.71	5.66	0.12
AVERAGE	**3.66**	**3.79**	**0.32**	**3.05**	**3.09**	**0.18**	**5.71**	**5.66**	**0.12**

	Solids-Non-Fat			*Somatic Cell Count*			*Milk Value*		
	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation
		percent			*(1,000)*			*$/cwt*	
2007									
January	8.77	8.78	0.32	254	305	163	14.05	14.38	0.88
February	8.81	8.81	0.33	264	316	177	14.82	15.14	0.87
March	8.76	8.76	0.30	272	330	185	15.55	15.85	0.82
April	8.75	8.74	0.28	263	314	165	16.46	16.73	0.82
May	8.70	8.72	0.28	261	303	149	17.74	18.02	0.88
June	8.68	8.66	0.26	282	326	156	20.14	20.35	0.95
July	8.68	8.64	0.27	294	344	164	21.30	21.44	0.98
August	8.68	8.64	0.27	310	362	173	19.80	19.93	0.94
September	8.74	8.73	0.28	299	345	163	20.36	20.68	1.08
October	8.79	8.79	0.30	278	317	151	19.37	19.79	1.13
November	8.86	8.88	0.33	254	289	141	20.37	20.91	1.35
December	8.86	8.87	0.33	246	289	149	21.84	22.38	1.47
AVERAGE	8.76	8.75	0.30	**273**	**320**	**161**	**18.48**	**18.80**	**1.01**

TABLE 6.1-Component level and price descriptive statistics by month for 2007

Weighted average protein tests reached a minimum in July and August of 2007 at 2.96 percent. The maximum weighted average protein test occurred in November at 3.16 percent. The minimum simple average protein tests was 2.97 percent in August, and the maximum simple average protein test was 3.23 percent in November. November and December had the widest range of observed protein tests, where the range of protein tests within two standard deviations of the mean were 2.81 percent to 3.66 percent, and 2.79 percent to 3.64 percent respectively.

Weighted average other solids tests never fell below 5.70 percent throughout the year. The maximum weighted average other solids test occurred in August at 5.73 percent. The minimum simple average other solids tests was 5.64 percent for October. Several times throughout the year, the simple average other solids test reached a maximum of 5.67 percent. February had the widest range of observed other solids tests, where the range of other solids tests within two standard deviations of the mean was 5.39 percent to 5.92 percent.

Weighted average SCC was the lowest in December at 246. The maximum weighted average SCC occurred in August at 310. The minimum simple average SCC was lowest at the end of the year at 289 for November and December. The maximum simple average SCC was 362 in August.

The overwhelming theme perceived when comparing the weighted average and the simple average is that component levels are significantly different as producer size (in terms of monthly deliveries) changes. In order to capture this effect, the following section will analyze the impact of producer size on component levels.

7. VARIATIONS IN MILK COMPONENT LEVELS BY PRODUCER SIZE

In order to examine the impact producer size has on the component levels of herd milk, producers associated with the market were divided into 10 groups with the same number of producers, based on average monthly deliveries. In total there were 9,168 producers associated with the market included in this study Percentile one represents producers with the smallest average monthly delivery volume, and ten represents producers with the highest average monthly delivery volume. In order to put the percentile groups into perspective, percentile group ten supplied over 57 percent of the milk included in this analysis. Meanwhile, percentile group one supplied only 0.6 percent of the milk included in this analysis. Figure 7.1 details the total milk supplied as a percentage for each percentile group and the average monthly deliveries by percentile group.

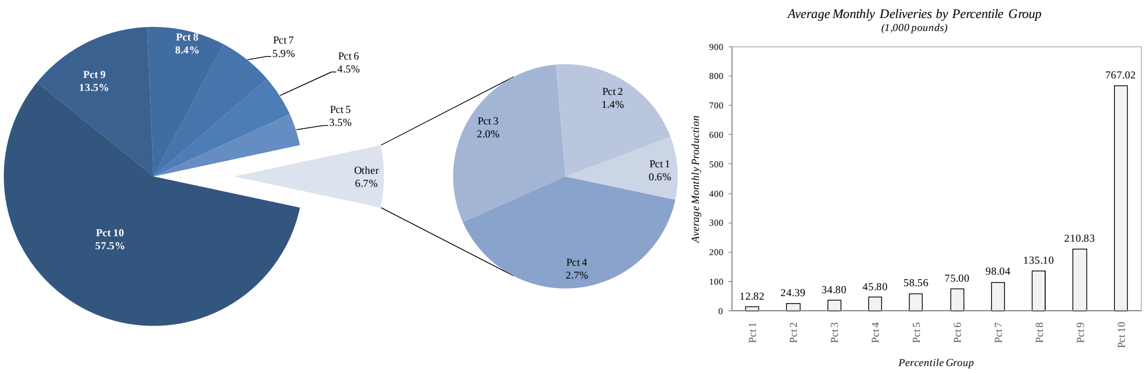


FIGURE 7.1-Average monthly deliveries and market share by percentile group

Beginning with percentile group one, the increase in average monthly deliveries grows at an average incremental rate of 43 percent from percentile group one to percentile group nine. However, from percentile group nine to percentile group ten, the percentage change in average monthly deliveries is greater than 260 percent.

As anticipated in the previous section, component levels of butterfat, protein, other solids, and SCC are influenced by producer size. As producer size increases the SCC, butterfat, and protein levels decrease. On the other hand, as producer size increases, other solids levels increase. Table 7.1 includes component statistics by percentile group for 2007.

Observable in table 7.1, the absolute value variations in component levels between the smallest and largest percentile groups are: 0.33 percent for butterfat, 0.12 percent for protein, 0.16 percent for other solids, 126 for SCC, and $1.07 per cwt in milk value. Similar variations in component levels as a result of producer size were also observed in staff papers published by Federal Order 30 and 124.

The variations in component levels by producer size could be caused by multiple factors at the herd level including but not limited to: herd type or mixed herds, different types of feed used at each level, feed substitution due to changes in feed costs, and feed allotments per cow. Additionally, it is possible that the goal of larger producers may be weighted more towards production quantity rather than maximizing component levels.

Additionally, another interesting detail related to component levels by producer size is that the standard deviations for all categories are downward sloping from percentile group one to percentile group ten. This statistic implies that there is less variation in component levels as producer size increases. For example, in percentile group one the butterfat range within two standard deviations of the mean is 3.05 percent to 4.87 percent. However, the butterfat range within two standard deviations of the mean for percentile group ten is 3.12 percent to 4.41 percent.

DESCRIPTIVE STATISTICS BY PERCENTILE GROUP FOR 2007, FEDERAL ORDER 33
SELECTED COMPONENTS, SOMATIC CELL COUNT, AND MILK VALUE

	Butterfat			*Protein*			*Other Solids*		
	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation
		percent			*percent*			*percent*	
Percentile									
Pct 1	3.93	3.96	0.46	3.14	3.17	0.28	5.57	5.55	0.19
Pct 2	3.88	3.90	0.41	3.13	3.14	0.24	5.61	5.61	0.12
Pct 3	3.85	3.86	0.39	3.12	3.12	0.23	5.64	5.63	0.11
Pct 4	3.81	3.82	0.35	3.10	3.10	0.20	5.64	5.64	0.11
Pct 5	3.80	3.80	0.34	3.09	3.10	0.19	5.66	5.66	0.09
Pct 6	3.78	3.78	0.32	3.08	3.08	0.18	5.67	5.67	0.10
Pct 7	3.76	3.77	0.30	3.08	3.08	0.17	5.68	5.68	0.10
Pct 8	3.74	3.74	0.31	3.07	3.08	0.17	5.69	5.69	0.08
Pct 9	3.71	3.71	0.29	3.06	3.06	0.16	5.71	5.70	0.08
Pct 10	3.60	3.63	0.26	3.02	3.03	0.13	5.73	5.72	0.06

	Solids-Non-Fat			*Somatic Cell Count*			*Milk Value*		
	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation
		percent			*(1,000)*			*$/cwt*	
Percentile									
Pct 1	8.71	8.72	0.47	375	383	227	19.36	19.48	3.01
Pct 2	8.74	8.75	0.37	371	373	200	19.14	19.23	2.83
Pct 3	8.75	8.75	0.33	335	336	173	19.01	19.08	2.81
Pct 4	8.74	8.75	0.31	338	340	165	18.91	18.95	2.73
Pct 5	8.75	8.75	0.29	344	346	164	18.86	18.92	2.69
Pct 6	8.75	8.75	0.28	320	323	152	18.79	18.84	2.65
Pct 7	8.76	8.76	0.27	307	309	142	18.74	18.80	2.63
Pct 8	8.77	8.77	0.25	301	303	130	18.70	18.78	2.64
Pct 9	8.76	8.76	0.23	272	274	125	18.57	18.66	2.62
Pct 10	8.76	8.76	0.20	249	254	104	18.29	18.44	2.59

TABLE 7.1-Component level and price descriptive statistics by percentile group for 2007

8. VARIATIONS IN COMPONENT LEVELS BY PRODUCTION REGION

For this section, milk components, SCC, and milk value were analyzed by the production region. The geographical region encompassed in this population includes: Ohio, Michigan, Indiana, West Virginia, Pennsylvania, Kentucky, Kansas, Iowa, Illinois, Maryland, Minnesota, New York, Virginia, and Wisconsin. Of those states, Ohio, Michigan, Indiana, West Virginia, Pennsylvania, and Kentucky are states located (partially) within the Mideast Marketing Area.

Average monthly delivery statistics can be deceiving, especially when comparing production from states outside the marketing area to states within the marketing area. For example, average deliveries from Illinois appear to be on par with average deliveries from Michigan. However, Illinois represents only 0.7 percent of the milk included in this analysis, compared to 37.76 percent for Michigan. Altogether the six states comprising the Mideast Marketing Area supplied over 80 percent of the milk included in this analysis. Figure 8.1 details the percent of milk and average monthly deliveries by state included in this analysis. Yellow denotes states associated with the Mideast Marketing Area.

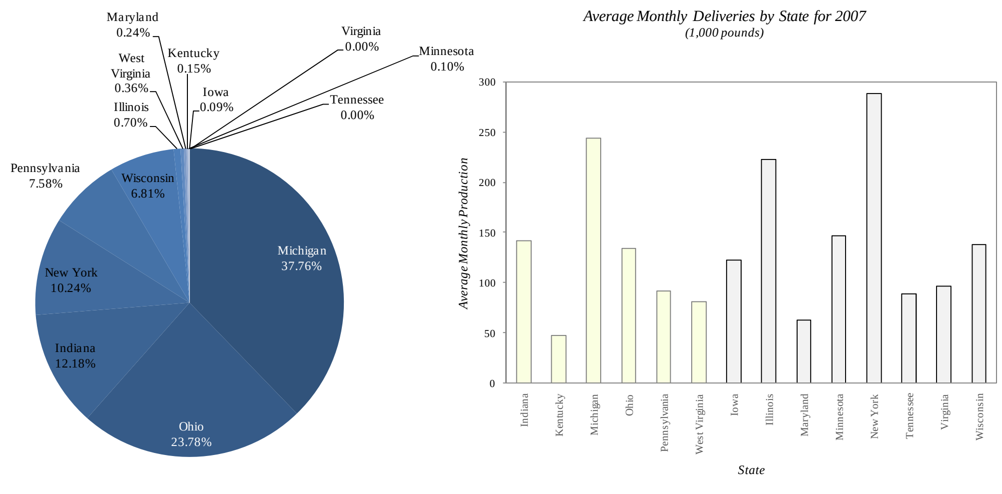


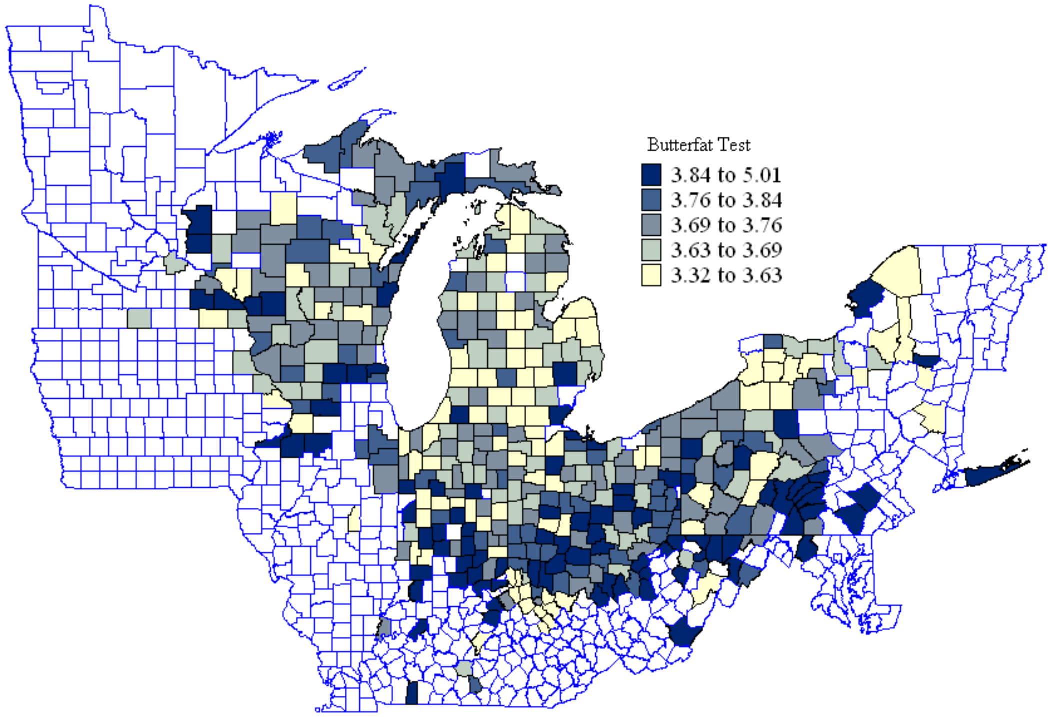
FIGURE 8.1-Average monthly deliveries and market share by state

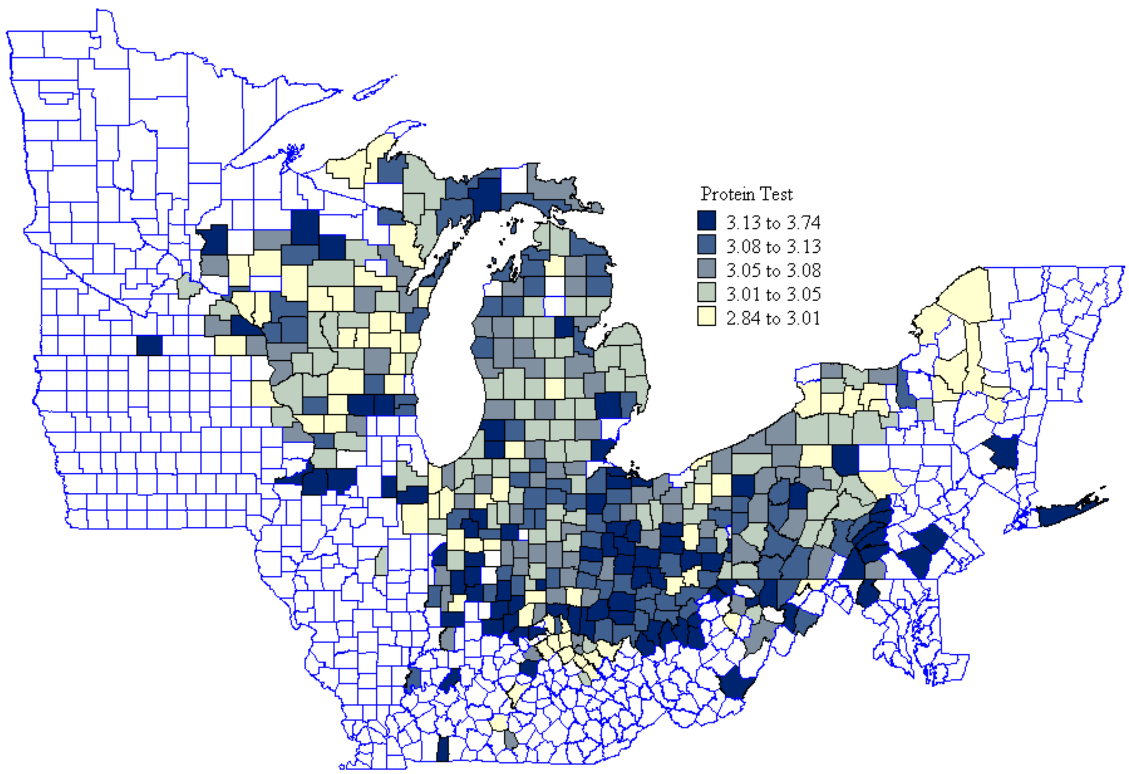
Of the states included in this analysis, West Virginia had the highest weighted average butterfat test of 3.89 percent; whereas, Tennessee had the lowest weighted average butterfat test at 3.33 percent. Of the states located within the Mideast Marketing Area Michigan had the lowest weighted average butterfat test at 3.61 percent.

The weighted average protein test ranged from a high of 3.20 percent in Tennessee to a low of 3.01 percent in Illinois. Of the states included in the Mideast Marketing Area West Virginia had the highest weighted average protein test at 3.19 percent, while Kentucky had the lowest at 3.02 percent. Map 8.1 details weighted average butterfat and protein test ranges by county for 2007. Tennessee and Virginia were excluded.

The weighted average other solids test ranged from a high of 5.76 percent for Illinois to a low of 5.59 percent in Virginia. Of the states included in the Mideast Marketing Area Michigan had the highest weighted average other solids test at 5.72 percent, while Kentucky had the lowest at 5.60 percent.

Weighted average somatic cell count ranged from a high of 442 in Tennessee to a low of 200 in Virginia. Of the states included in the Mideast Marketing Area Kentucky had the highest weighted average SCC at 409, while Michigan had the lowest at 255.





Map 8.1-Weighted average butterfat and protein tests by county for 2007

Weighted average milk value ranged from a low of $17.99 per cwt in New York to a high of $20.92 per cwt in Virginia. Of the states within the Mideast Marketing Area Kentucky had the highest weighted average milk value at $19.51 per cwt, while Michigan had the lowest at $18.38 per cwt.

Table 8.1 details the weighted average, simple average, and the standard deviation of components by state for 2007.

DESCRIPTIVE STATISTICS BY STATE FOR 2007, FEDERAL ORDER 33
SELECTED COMPONENTS, SOMATIC CELL COUNT, AND MILK VALUE

	Butterfat			*Protein*			*Other Solids*		
	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation
		percent			*percent*			*percent*	
State									
Iowa	3.64	3.65	0.24	3.03	3.03	0.19	5.74	5.75	0.07
Illinois	3.62	3.74	0.27	3.01	3.06	0.19	5.76	5.68	0.09
Indiana	**3.70**	**3.78**	**0.34**	**3.03**	**3.09**	**0.20**	**5.70**	**5.65**	**0.10**
Kentucky	**3.63**	**3.65**	**0.38**	**3.02**	**3.03**	**0.23**	**5.60**	**5.55**	**0.13**
Maryland	3.86	3.93	0.38	3.12	3.14	0.20	5.68	5.66	0.10
Michigan	**3.61**	**3.73**	**0.32**	**3.04**	**3.08**	**0.18**	**5.72**	**5.68**	**0.11**
Minnesota	3.66	3.69	0.29	3.06	3.07	0.14	5.72	5.70	0.09
New York	3.61	3.72	0.28	3.02	3.04	0.15	5.74	5.69	0.11
Ohio	**3.72**	**3.84**	**0.39**	**3.07**	**3.12**	**0.22**	**5.69**	**5.64**	**0.11**
Pennsylvania	**3.76**	**3.83**	**0.36**	**3.08**	**3.10**	**0.19**	**5.68**	**5.64**	**0.13**
Tennessee	3.33	3.42	0.34	3.20	3.19	0.07	5.62	5.62	0.06
Virginia	3.88	4.01	0.49	3.10	3.23	0.36	5.59	5.55	0.17
Wisconsin	3.71	3.78	0.26	3.02	3.05	0.17	5.75	5.70	0.12
West Virginia	**3.89**	**3.96**	**0.39**	**3.19**	**3.20**	**0.23**	**5.67**	**5.60**	**0.16**

	Solids-Non-Fat			*Somatic Cell Count*			*Milk Value*		
	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation	Weighted Average	Mean	Standard Deviation
		percent			*(1,000)*			*$/cwt*	
State									
Iowa	8.77	8.78	0.25	267	285	121	20.08	20.16	1.17
Illinois	8.78	8.73	0.29	233	351	163	18.47	19.57	2.06
Indiana	**8.73**	**8.74**	**0.30**	**289**	**319**	**156**	**18.53**	**18.88**	**2.69**
Kentucky	**8.62**	**8.58**	**0.37**	**409**	**429**	**186**	**19.51**	**20.13**	**2.22**
Maryland	8.80	8.80	0.31	319	346	183	18.72	18.89	2.87
Michigan	**8.76**	**8.76**	**0.29**	**255**	**305**	**157**	**18.38**	**18.79**	**2.65**
Minnesota	8.78	8.77	0.23	356	407	175	20.24	20.45	1.10
New York	8.75	8.73	0.27	236	283	146	17.99	18.20	2.72
Ohio	**8.76**	**8.76**	**0.34**	**290**	**320**	**159**	**18.63**	**19.04**	**2.83**
Pennsylvania	**8.76**	**8.74**	**0.32**	**334**	**363**	**182**	**18.64**	**18.80**	**2.77**
Tennessee	8.82	8.82	0.14	442	422	92	20.54	20.64	0.71
Virginia	8.69	8.78	0.53	200	223	68	20.92	21.00	2.55
Wisconsin	8.77	8.75	0.28	265	312	166	18.87	19.12	2.49
West Virginia	**8.86**	**8.80**	**0.39**	**355**	**363**	**176**	**19.32**	**19.38**	**2.95**

TABLE 8.1-Component level and price descriptive statistics by state for 2007

When analyzing component statistics by state, it is important to understand that the statistics only represent producers associated with the Mideast Marketing Area. Producer counts and delivery volume vary significantly by state. For example, very few producers were included in this analysis from Illinois. Since a limited amount of data was available from Illinois (and other states), it is unreasonable to expect the component statistics to be representative of all producers in the state(s). In order to put this into perspective consider that the National Agricultural Statistics Service reported 869 million pounds produced in Pennsylvania for November, 2007 against only 106 million pounds pooled on Federal Order 33. The milk pooled on Federal Order 33 represents only 12 percent of all milk produced in Pennsylvania for November 2007.

Additionally, component statistics at the state level are dependent on the producer makeup for each specific state. For example, since Michigan producers generally are larger in size than Ohio producers, Ohio should have higher weighted average butterfat and protein tests than Michigan. Section 9 of this analysis will visit component variations within each state.

As illustrated in the previous sections, component levels vary significantly by season, producer size and state. The following section will attempt to measure multiple factors simultaneously. For example, how do component levels vary by month within each percentile group, how do component levels vary by producer size from state to state, or how do component levels vary by month from state to state?

9. COMPONENT LEVEL VARIATIONS BY SUBGROUP

For this section, the data was divided into multiple distinct subsets. Each subset was analyzed to determine weighted average component tests for butterfat and protein within a homogeneous group. For example, butterfat and protein tests were analyzed by month and percentile group to determine how seasonality affects small producers in comparison with large producers. Alternatively, in order to see how homogeneously sized producers vary butterfat and protein tests were analyzed by percentile group, within each state. Finally, butterfat and protein tests were analyzed by state and month to see how seasonality affects each state separately.

When butterfat and protein tests were analyzed by month and percentile group, it was discovered that for all months of 2007 percentile groups one through nine had weighted average butterfat tests greater than the monthly weighted averages. In all months percentile group ten had weighted average butterfat tests below the monthly weighted average. The weighted average butterfat test ranged from a low in June and July for percentile group ten at 3.49 percent, to a high of 4.24 percent for percentile group one in December. Table 9.1 details weighted average butterfat and protein tests as a function of percentile group and month.

In all months except August and October, percentile groups one through nine had weighted average protein tests greater than the monthly weighted average tests. The weighted average protein test ranged from a high of 3.32 percent for percentile group one in November, to a low of 2.95 percent for percentile group nine in August, and percentile group ten in June and July.

WEIGHTED AVERAGE COMPONENT LEVELS BY MONTH AND PERCENTILE GROUP
FOR PRODUCERS ASSOCIATED WITH THE MIDEAST MARKETING AREA

	Weighted Average	January	February	March	April	May	June	July	August	September	October	November	December
							Component: Butterfat						
Weighted Average		***3.73***	***3.78***	***3.71***	***3.67***	***3.58***	***3.53***	***3.53***	***3.55***	***3.59***	***3.69***	***3.80***	***3.84***
Percentile													
Pct 1	***3.93***	4.06	4.13	4.00	3.96	3.79	3.70	3.68	3.74	3.83	3.99	4.18	**4.24**
Pct 2	***3.88***	4.02	4.08	4.00	3.93	3.75	3.66	3.62	3.67	3.76	3.91	4.10	4.15
Pct 3	***3.85***	3.96	4.03	3.97	3.91	3.73	3.64	3.62	3.65	3.74	3.88	4.05	4.10
Pct 4	***3.81***	3.92	3.98	3.93	3.87	3.69	3.61	3.59	3.62	3.70	3.84	4.00	4.04
Pct 5	***3.80***	3.90	3.96	3.90	3.83	3.67	3.60	3.60	3.61	3.69	3.82	3.98	4.02
Pct 6	***3.78***	3.87	3.93	3.87	3.81	3.67	3.60	3.59	3.59	3.67	3.79	3.94	3.98
Pct 7	***3.76***	3.85	3.91	3.84	3.78	3.65	3.59	3.58	3.60	3.67	3.78	3.92	3.96
Pct 8	***3.74***	3.82	3.87	3.81	3.75	3.64	3.57	3.56	3.58	3.66	3.77	3.90	3.94
Pct 9	***3.71***	3.78	3.83	3.76	3.71	3.61	3.56	3.55	3.57	3.64	3.74	3.86	3.90
Pct 10	***3.60***	3.64	3.69	3.63	3.58	3.52	**3.49**	**3.49**	3.52	3.54	3.61	3.71	3.74

	Weighted Average	January	February	March	April	May	June	July	August	September	October	November	December
							Component: Protein						
Weighted Average		***3.07***	***3.10***	***3.06***	***3.04***	***3.00***	***2.97***	***2.96***	***2.96***	***3.02***	***3.09***	***3.16***	***3.15***
Percentile													
Pct 1	***3.14***	3.18	3.19	3.11	3.10	3.15	3.05	2.99	3.01	3.14	3.24	**3.32**	3.28
Pct 2	***3.13***	3.17	3.19	3.13	3.10	3.12	3.03	2.98	3.00	3.11	3.21	3.29	3.25
Pct 3	***3.12***	3.14	3.16	3.11	3.08	3.09	3.02	2.98	2.99	3.11	3.20	3.27	3.24
Pct 4	***3.10***	3.13	3.15	3.10	3.07	3.07	3.00	2.98	2.97	3.08	3.17	3.25	3.22
Pct 5	***3.09***	3.12	3.15	3.09	3.07	3.06	3.00	2.98	2.97	3.07	3.16	3.24	3.21
Pct 6	***3.08***	3.12	3.14	3.10	3.07	3.04	2.99	2.98	2.96	3.05	3.13	3.21	3.19
Pct 7	***3.08***	3.11	3.14	3.09	3.06	3.03	2.98	2.97	2.96	3.04	3.12	3.20	3.19
Pct 8	***3.07***	3.11	3.14	3.09	3.06	3.02	2.98	2.97	2.96	3.05	3.12	3.20	3.19
Pct 9	***3.06***	3.09	3.13	3.07	3.05	3.00	2.97	2.96	2.95	3.03	3.09	3.17	3.17
Pct 10	***3.02***	3.04	3.08	3.03	3.02	2.97	**2.95**	**2.95**	2.96	3.00	3.06	3.12	3.12

TABLE 9.1-Weighted average component levels by percentile group and month

For both butterfat and protein, the seasonal variation decreases as producer size increases. For example, the seasonal range in weighted average butterfat tests for percentile group one is 3.68 percent to 4.24 percent, or 0.56 percentage points. On the other hand, the seasonal range in weighted average butterfat tests for percentile groups ten is 3.49 percent to 3.74 percent, or 0.25 percentage points. Similar variations were observed for the protein tests as a function of producer size and season. For percentile group one the seasonal range in protein tests was 2.99 percent to 3.32 percent, or 0.32 percentage points. For percentile group ten the seasonal range in protein tests was 2.95 percent to 3.12 percent, or 0.17 percentage points.

While analyzing percentile groups by state several patterns began to emerge. The most noticeable pattern was the difference between Michigan and Ohio butterfat tests among similarly sized producers. For each percentile group, Michigan producers had a lower weighted average butterfat test than their Ohio counterparts. Michigan producers had a weighted average butterfat test less than the weighted average for each percentile group. Conversely, Ohio producers had a weighted average butterfat test greater than the weighted average for each percentile group. For the other four states associated with the Mideast Marketing Area, the results were less conclusive. At times, Indiana, Kentucky, and Pennsylvania producers had weighted average butterfat tests lower than the percentile weighted average; while West Virginia generally had weighted average butterfat tests greater than the percentile weighted average. Table 9.2 details weighted average butterfat and protein levels by state and percentile group.

WEIGHTED AVERAGE COMPONENT TEST BY STATE AND PERCENTILE GROUP
FOR STATES ASSOCIATED WITH THE MIDEAST MARKETING AREA

	Weighted Average	Indiana	Kentucky	Michigan	Ohio	Pennsylvania	West Virginia
				Component: Butterfat			
Weighted Average		***3.70***	***3.63***	***3.61***	***3.72***	***3.76***	***3.89***
Percentile							
Pct 1	***3.93***	3.93	3.66	3.88	3.98	3.98	3.91
Pct 2	***3.88***	3.82	3.75	3.84	3.94	3.89	4.05
Pct 3	***3.85***	3.80	3.46	3.81	3.92	3.96	4.13
Pct 4	***3.81***	3.79	3.58	3.78	3.86	3.81	3.87
Pct 5	***3.80***	3.78	3.53	3.78	3.84	3.79	3.97
Pct 6	***3.78***	3.76	3.65	3.74	3.80	3.77	3.82
Pct 7	***3.76***	3.72	3.60	3.73	3.78	3.80	R
Pct 8	***3.74***	3.77	3.56	3.70	3.77	3.72	3.90
Pct 9	***3.71***	3.74	R	3.66	3.73	3.76	3.91
Pct 10	***3.60***	3.64		3.56	3.63	3.65	3.76

	Weighted Average	Indiana	Kentucky	Michigan	Ohio	Pennsylvania	West Virginia
				Component: Protein			
Weighted Average		***3.03***	***3.02***	***3.04***	***3.07***	***3.08***	***3.19***
Percentile							
Pct 1	***3.14***	3.15	3.03	3.12	3.18	3.13	3.16
Pct 2	***3.13***	3.12	3.07	3.13	3.17	3.09	3.25
Pct 3	***3.12***	3.09	2.95	3.12	3.16	3.14	3.32
Pct 4	***3.10***	3.09	2.96	3.10	3.12	3.08	3.11
Pct 5	***3.09***	3.10	2.88	3.10	3.12	3.08	3.16
Pct 6	***3.08***	3.07	3.08	3.09	3.09	3.09	3.15
Pct 7	***3.08***	3.04	3.04	3.08	3.08	3.10	R
Pct 8	***3.07***	3.08	3.06	3.09	3.09	3.06	3.18
Pct 9	***3.06***	3.04	R	3.05	3.07	3.09	3.25
Pct 10	***3.02***	3.01		3.02	3.05	3.05	3.14

	Indiana	Kentucky	Michigan	Ohio	Pennsylvania	West Virginia
			Number of Producers			
Percentile						
Pct 1	108	44	203	234	149	13
Pct 2	147	28	172	256	167	8
Pct 3	194	13	164	225	150	7
Pct 4	129	12	174	264	170	6
Pct 5	137	9	140	252	185	9
Pct 6	114	7	182	275	148	7
Pct 7	106	3	197	291	135	R
Pct 8	110	5	227	275	125	9
Pct 9	111	R	283	254	110	3
Pct 10	80		394	205	51	4

R: Restricted

TABLE 9.2-Weighted average component levels by percentile group and state

The variation in protein tests between states among equally sized producers indicates that producers in Kentucky have below average protein levels as opposed to their counterparts in Indiana, Michigan, Ohio, Pennsylvania, and West Virginia. Also important in regards to Kentucky is the absence of producers in the largest percentile group.

The disparity in component levels between states among equally sized producers (as seen in Ohio v. Michigan) could be the result of multiple factors including: state level dairy educational programs, different operational techniques, different feeding techniques or feed types, and herd mix. Additionally, since each percentile group represents ten percent of the total population, size variations within each percentile group could cause differences in component levels. For example, where do the 44 Kentucky producers in percentile group one rank relative to all other producers in percentile group one? One thing is for certain, component levels do vary by region among homogenously sized producers.

When analyzing the seasonal variation of component levels within each state the most noticeable trend was discovered when analyzing butterfat tests in Michigan. In all months the weighted average Michigan butterfat test was lower than the monthly weighted average. Aside from Michigan, only Kentucky had weighted averages less than the monthly weighted average – this occurred in June and July exclusively. Indiana, Ohio, Pennsylvania and West Virginia all had weighted average butterfat tests greater than the monthly weighted average. Table 9.3 analyzes the seasonal changes of butterfat and protein among the six states included in the Mideast Marketing Area.

WEIGHTED AVERAGE COMPONENT TEST BY STATE AND MONTH
FOR STATES ASSOCIATED WITH THE MIDEAST MARKETING AREA

	Weighted Average	Indiana	Kentucky	Michigan	Ohio	Pennsylvania	West Virginia
				Component: Butterfat			
Weighted Average		***3.70***	***3.63***	***3.61***	***3.72***	***3.76***	***3.89***
Month							
January	***3.73***	3.78	3.78	3.66	3.80	3.84	3.99
February	***3.78***	3.83	3.83	3.71	3.86	3.89	4.04
March	***3.71***	3.76	3.72	3.65	3.77	3.83	3.95
April	***3.67***	3.72	3.70	3.61	3.71	3.78	3.85
May	***3.58***	3.61	3.60	3.53	3.60	3.65	3.71
June	***3.53***	3.56	3.50	3.49	3.56	3.60	3.69
July	***3.53***	3.56	3.49	3.48	3.57	3.60	3.69
August	***3.55***	3.61	3.60	3.50	3.60	3.61	3.70
September	***3.59***	3.60	3.68	3.54	3.65	3.65	3.79
October	***3.69***	3.71	3.85	3.62	3.74	3.77	3.99
November	***3.80***	3.84	3.99	3.74	3.86	3.92	4.16
December	***3.84***	3.87	3.99	3.77	3.90	3.94	4.20

	Weighted Average	Indiana	Kentucky	Michigan	Ohio	Pennsylvania	West Virginia
				Component: Protein			
Weighted Average		***3.03***	***3.02***	***3.04***	***3.07***	***3.08***	***3.19***
Month							
January	***3.07***	3.06	3.12	3.06	3.10	3.10	3.19
February	***3.10***	3.10	3.13	3.10	3.14	3.14	3.24
March	***3.06***	3.03	3.09	3.05	3.08	3.09	3.18
April	***3.04***	3.02	3.06	3.03	3.06	3.06	3.16
May	***3.00***	2.97	3.03	2.98	3.03	3.04	3.13
June	***2.97***	2.96	2.94	2.95	3.00	3.00	3.08
July	***2.96***	2.96	2.95	2.95	2.99	2.98	3.06
August	***2.96***	2.95	2.98	2.96	2.98	2.98	3.05
September	***3.02***	2.99	3.08	3.03	3.05	3.05	3.17
October	***3.09***	3.10	3.20	3.08	3.12	3.13	3.28
November	***3.16***	3.17	3.28	3.14	3.19	3.19	3.36
December	***3.15***	3.15	3.17	3.15	3.18	3.18	3.35

TABLE 9.3-Weighted average component levels by state and month

Weighted average protein tests by state and month were considerably more erratic. Indiana and Michigan generally had weighted average protein tests lower than the monthly weighted averages. For all months of 2007 except for June and July, Kentucky had a weighted average protein test greater than the monthly weighted average. Meanwhile, Ohio, Pennsylvania, and West Virginia all had weighted average protein tests greater than the monthly weighted averages.

The conclusion reached based on the aforementioned results, is that component levels vary significantly at the herd level. Generalizations based on a homogenous category such as state of production or month of production provide some insight into component variations. However, when the data is broken down into subcategories it is obvious that component variations are significantly dependent on factors beyond the scope of this paper. The following section will attempt to quantify the relationship between components at the herd level; however, no attempt will be made to test for variables not captured within the data population.

10. Statistical Relationship Among Milk Components

For this section OLS regression analysis was used to determine if there was a linear relationship among milk components. The estimated regressions were based on historical estimators generated by both Werner and Freije. The formulas by both Werner and Freije were single-independent-variable regression models similar to example 10.1.

$$Component\,(\mathrm{Y})_i = \beta_0 + \beta_1 Component\,(\mathrm{X})_i + \in_i$$

Where:

$Component\;(\mathrm{Y})_i$ = Dependent test for producer/month *i*

$Component\;(\mathrm{X})_i$ = Independent test for producer/month *i*

Example 10.1-Single-independent-variable regression model

The three independent-variable models tested in this analysis were:

1. Butterfat test as a function of the protein test
2. Other solids test as a function of the butterfat test
3. Other solids test as a function of the protein test

For model one the expected coefficient β_1 should be greater than zero. The one-sided hypothesis test for model one resembles example 10.2.

$$H_0 : \beta_1 \le 0$$
$$H_A : \beta_1 > 0$$

Example 10.2-Hypothesis test for model one

For models two and three the expected coefficient β_1 should be less than zero. The one-sided hypothesis test for models two and three resembles example 10.3.

$$H_0 : \beta_1 > 0$$
$$H_A : \beta_1 \leq 0$$

EXAMPLE 10.3-Hypothesis test for models two and three

In all three models the appropriately calculated t-value is greater in absolute value than the critical t-value; therefore, the null hypotheses are rejected.

EXAMPLES 10.4 through 10.6 display the regression equations for models one through three, respectively.

$$(BF)_i = -0.257 + 1.308(P)_i$$

EXAMPLE 10.4-Butterfat test as a function of the protein test

Example 10.4 was generated to determine how butterfat tests were impacted by protein tests. In example 10.4, the estimated coefficients identify a constant of (0.257) percentage points with an increase in percentage points of 1.308 per a one percent increase in the protein test, holding all else constant. The adjusted R squared for the model was 0.552, which indicates that the regression equation does not perfectly fit the data population - as seen in Figure 10.1. The estimator and actual butterfat tests are displayed in figure 10.1.

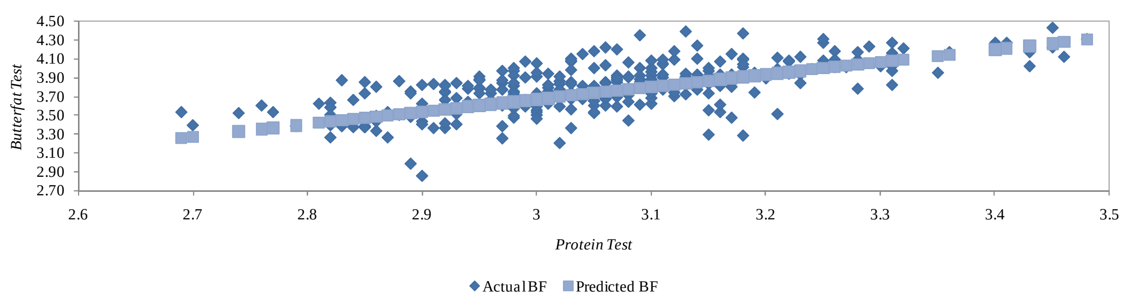


FIGURE 10.1-Butterfat test as a function of the protein test

$$(OS)_i = 5.781 - 0.032(BF)_i$$

EXAMPLE 10.5-Other solids test as a function of the butterfat test

Example 10.5 was generated to determine how other solids tests were impacted by butterfat tests. In example 10.5, the estimated coefficients identify a constant of 5.781 percentage points with a decrease in percentage points of 0.032 per a one percent increase in the butterfat test, holding all else constant. The adjusted R squared for the model was 0.009 which indicates that the regression equation does not fit the data population.

$$(OS)_i = 5.688 - 0.009(P)_i$$

EXAMPLE 10.6-Other solids test as a function of the protein test

Example 10.6 was generated to determine how other solids tests were impacted by protein tests. In example 10.6, the estimated coefficients identify a constant of 5.688 percentage points with a decrease in percentage points of 0.009 per a one percent increase in the protein test, holding all else constant. The adjusted R squared for the model was zero (0.000) which indicates that the regression equation does not fit the data population.

Out of the three models generated, example 10.4 was the most precise estimator. In order to capture the effect of month and producer size on the butterfat test, another set of regression estimators were generated with dummy variables for producer size and month. Dummy variables are defined as a variable that takes on the value of zero or one depending on a qualitative attribute such as month. Examples 10.7 and 10.8 display the models used for this portion.

$$(BF)_i = \beta_0 + \beta_1(P)_i + \beta_2(February)_i .... + \beta_{12}(December)_i + \in_i$$

EXAMPLE 10.7-Butterfat test as a function of protein test and month

$$(BF)_i = \beta_0 + \beta_1(P)_i + \beta_2(Pct1)_i .... + \beta_{10}(Pct9)_i + \in_i$$

EXAMPLE 10.8 Butterfat test as a function of protein test and producer size

Typically, the use of dummy variables increases the fit of the model. However, in this type of model either the constant term has to be removed, or one of the dummy variables has to be excluded. For each analysis, a dummy variable was removed. Removing a dummy variable creates a baseline, where the coefficient for each dummy is in respect to the baseline – or the initial stage. The dummy variables removed were January and percentile group 10. Tables 10.1 and 10.2 display the calculated coefficients and the t-statistics for both models.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.032	.012		2.642	.008
	PROTEIN	1.234	.004	.701	324.115	.000
	FEB	.021	.003	.016	6.106	.000
	MAR	.018	.003	.014	5.336	.000
	APR	-.009	.003	-.007	-2.644	.008
	MAY	-.125	.003	-.099	-36.519	.000
	JUN	-.126	.003	-.102	-36.924	.000
	JUL	-.114	.004	-.087	-32.264	.000
	AUG	-.087	.003	-.072	-25.711	.000
	SEP	-.129	.003	-.102	-37.822	.000
	OCT	-.107	.003	-.086	-31.700	.000
	NOV	-.048	.003	-.039	-14.179	.000
	DEC	.020	.003	.016	5.748	.000

TABLE 10.1-Butterfat test as a function of protein test and month

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	-.226	.011		-20.795	.000
	PCT1	.167	.003	.128	52.534	.000
	PCT2	.134	.003	.112	44.547	.000
	PCT3	.122	.003	.103	40.932	.000
	PCT4	.105	.003	.088	35.197	.000
	PCT5	.097	.003	.082	32.626	.000
	PCT6	.090	.003	.077	30.696	.000
	PCT7	.084	.003	.072	28.467	.000
	PCT8	.062	.003	.053	21.129	.000
	PCT9	.055	.003	.048	19.096	.000
	PROTEIN	1.270	.004	.721	359.752	.000

TABLE 10.2-Butterfat test as a function of protein test and percentile group

Incorporating the dummy variables for month and percentile group did increase the fit of each model to 0.580 and 0.569, respectively. The coefficient signs for all of the dummy variables are consistent with the values expected.

There appears to be a measurable relationship between butterfat and protein tests at the herd level. However, as stated in previous sections, component tests are significantly dependent on factors such as feed, stage of lactation, and herd type – none of which were quantified in this analysis.

11. CONCLUSION

The results of this study determined the weighted average component levels for butterfat, protein, other solids, solids-non-fat, and SCC for 2007. In addition, the weighted average milk value at the herd level was also calculated for 2007. Component variations due to season, region and producer size were also incorporated into this analysis. Finally, the statistical relationships among components in herd level milk were quantified for the Mideast Marketing Area.

For 2007 the weighted average butterfat test was 3.66 percent, down 0.03 percentage points from 2006 levels. The weighted average protein test was 3.05 percent, up 0.02 percentage points from the previous year. The weighted average other solids test remained unchanged from the previous year at 5.71 percent. Weighted average SCC levels were 273 for 2007, compared to 274 for 2006. Weighted average milk value, driven by higher protein prices, was $18.48 per cwt for 2007, a 52 percent increase from 2006.

During 2007 butterfat and protein tests were lowest in the spring and summer and highest in the fall and winter. Other solids tests and SCC were highest in the spring and summer and lowest in the fall and winter.

As producer size (based on average monthly deliveries) increased the SCC, butterfat and protein tests dropped, while other solids tests increased.

Using the 2007 data population the following estimators were derived:

$$(BF)_i = -0.257 + 1.308(P)_i$$

$$(OS)_i = 5.781 - 0.032(BF)_i$$

$$(OS)_i = 5.688 - 0.009(P)_i$$

For 2007 the range of component levels within two standard deviations of the mean was: 3.09 percent to 4.49 percent for butterfat; 2.69 percent to 3.49 percent for protein; 5.43 percent to 5.89 percent for other solids; 0 to 647 for SCC; and $13.44 per cwt to $24.34 per cwt in milk value.

The conclusion reached is that component levels vary significantly at the herd level. Although trends in component levels were observed, it is evident that component levels are dependent more on microeconomics factors at the herd level. Factors include but are not limited to: how resources are allocated and herd type or herd mix.

12. FUTURE STUDIES

This component level analysis should be updated by Federal Order 33 staff on an annual basis. The regressions and weighted averages will change in value; however, the overall trends observed in this study are unlikely to change much without significant changes in the industry.

Areas of interest for future research in this component analysis, or separate analyses, would include:

1. Expanding the study to include all marketing areas and California to determine national trends in component levels.
2. Analyze component levels as a function of resource allocation.
3. Analyze component levels by herd composition.

For questions or more information concerning this analysis, please direct questions to: John Newton, Marketing Specialist, Federal Order 33.

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APPENDIX

SELECTED COMPONENTS, SOMATIC CELL COUNT, AND MILK VALUE DESCRIPTIVE STATISTICS BY MONTH FOR 2007, FEDERAL ORDER 33

	Butterfat					*Protein*					*Other Solids*				
	Weighted Average	Mean	Standard Deviation	95 % Confidence Interval: Lower Bound	95 % Confidence Interval: Upper Bound	Weighted Average	Mean	Standard Deviation	95 % Confidence Interval: Lower Bound	95 % Confidence Interval: Upper Bound	Weighted Average	Mean	Standard Deviation	95 % Confidence Interval: Lower Bound	95 % Confidence Interval: Upper Bound
			percent					*percent*					*percent*		
2007															
January	3.73	3.89	0.36	3.18	4.61	3.07	3.13	0.20	2.73	3.52	5.70	5.65	0.12	5.41	5.89
February	3.78	3.94	0.35	3.24	4.65	3.10	3.15	0.20	2.76	3.54	5.70	5.66	0.13	5.39	5.92
March	3.71	3.87	0.32	3.23	4.52	3.06	3.10	0.18	2.73	3.46	5.71	5.66	0.12	5.42	5.90
April	3.67	3.81	0.31	3.19	4.44	3.04	3.07	0.17	2.73	3.42	5.71	5.67	0.11	5.46	5.88
May	3.58	3.67	0.30	3.07	4.27	3.00	3.05	0.17	2.71	3.39	5.71	5.67	0.11	5.46	5.88
June	3.53	3.61	0.28	3.05	4.16	2.97	3.00	0.16	2.69	3.31	5.71	5.67	0.11	5.45	5.88
July	3.53	3.59	0.27	3.06	4.12	2.96	2.98	0.15	2.67	3.28	5.72	5.67	0.11	5.44	5.89
August	3.55	3.61	0.27	3.07	4.15	2.96	2.97	0.15	2.66	3.28	5.73	5.67	0.12	5.44	5.90
September	3.59	3.69	0.30	3.09	4.28	3.02	3.07	0.17	2.73	3.40	5.72	5.66	0.12	5.43	5.89
October	3.69	3.81	0.32	3.17	4.44	3.09	3.15	0.18	2.78	3.52	5.70	5.64	0.11	5.41	5.87
November	3.80	3.97	0.36	3.24	4.70	3.16	3.23	0.21	2.81	3.66	5.70	5.65	0.12	5.42	5.88
December	3.84	4.02	0.38	3.27	4.77	3.15	3.21	0.21	2.79	3.64	5.71	5.66	0.12	5.42	5.89
AVERAGE	**3.66**	**3.79**	**0.32**	**3.16**	**4.42**	**3.05**	**3.09**	**0.18**	**2.73**	**3.45**	**5.71**	**5.66**	**0.12**	**5.43**	**5.89**

	Solids-Non-Fat					*Somatic Cell Count*					*Milk Value*				
	Weighted Average	Mean	Standard Deviation	95 % Confidence Interval: Lower Bound	95 % Confidence Interval: Upper Bound	Weighted Average	Mean	Standard Deviation	95 % Confidence Interval: Lower Bound	95 % Confidence Interval: Upper Bound	Weighted Average	Mean	Standard Deviation	95 % Confidence Interval: Lower Bound	95 % Confidence Interval: Upper Bound
			percent					*(1,000)*					*$/cwt*		
2007															
January	8.77	8.78	0.32	8.14	9.42	254	305	163	(21)	631	14.05	14.38	0.88	12.63	16.14
February	8.81	8.81	0.33	8.15	9.46	264	316	177	(39)	671	14.82	15.14	0.87	13.41	16.87
March	8.76	8.76	0.30	8.16	9.36	272	330	185	(40)	701	15.55	15.85	0.82	14.21	17.48
April	8.75	8.74	0.28	8.18	9.30	263	314	165	(16)	644	16.46	16.73	0.82	15.10	18.36
May	8.70	8.72	0.28	8.17	9.27	261	303	149	5	600	17.74	18.02	0.88	16.26	19.78
June	8.68	8.66	0.26	8.14	9.19	282	326	156	14	638	20.14	20.35	0.95	18.46	22.24
July	8.68	8.64	0.27	8.11	9.17	294	344	164	15	673	21.30	21.44	0.98	19.48	23.40
August	8.68	8.64	0.27	8.10	9.18	310	362	173	16	708	19.80	19.93	0.94	18.05	21.80
September	8.74	8.73	0.28	8.16	9.29	299	345	163	18	671	20.36	20.68	1.08	18.52	22.85
October	8.79	8.79	0.30	8.19	9.39	278	317	151	15	620	19.37	19.79	1.13	17.53	22.04
November	8.86	8.88	0.33	8.22	9.54	254	289	141	7	572	20.37	20.91	1.35	18.21	23.60
December	8.86	8.87	0.33	8.20	9.54	246	289	149	(10)	588	21.84	22.38	1.47	19.45	25.31
AVERAGE	8.76	8.75	0.30	8.16	9.34	**273**	**320**	**161**	**(3)**	**643**	**18.48**	**18.80**	**1.01**	**16.77**	**20.82**

SELECTED COMPONENT STATISTICS BY MONTH FOR 2007

SELECTED COMPONENTS, SOMATIC CELL COUNT, AND MILK VALUE DESCRIPTIVE STATISTICS BY STATE FOR 2007, FEDERAL ORDER 33

State	*Butterfat* Weighted Average	*Butterfat* Mean	*Butterfat* Standard Deviation	*Butterfat* 95 % Confidence Interval Lower Bound	*Butterfat* 95 % Confidence Interval Upper Bound	*Protein* Weighted Average	*Protein* Mean	*Protein* Standard Deviation	*Protein* 95 % Confidence Interval Lower Bound	*Protein* 95 % Confidence Interval Upper Bound	*Other Solids* Weighted Average	*Other Solids* Mean	*Other Solids* Standard Deviation	*Other Solids* 95 % Confidence Interval Lower Bound	*Other Solids* 95 % Confidence Interval Upper Bound
			percent					*percent*					*percent*		
State															
Iowa	3.64	3.65	0.24	3.17	4.13	3.03	3.03	0.19	2.66	3.41	5.74	5.75	0.07	5.62	5.88
Illinois	3.62	3.74	0.27	3.20	4.28	3.01	3.06	0.19	2.67	3.44	5.76	5.68	0.09	5.49	5.86
Indiana	**3.70**	**3.78**	**0.34**	**3.09**	**4.47**	**3.03**	**3.09**	**0.20**	**2.69**	**3.48**	**5.70**	**5.65**	**0.10**	**5.44**	**5.86**
Kentucky	**3.63**	**3.65**	**0.38**	**2.89**	**4.42**	**3.02**	**3.03**	**0.23**	**2.56**	**3.50**	**5.60**	**5.55**	**0.13**	**5.29**	**5.82**
Maryland	3.86	3.93	0.38	3.18	4.69	3.12	3.14	0.20	2.73	3.55	5.68	5.66	0.10	5.46	5.86
Michigan	**3.61**	**3.73**	**0.32**	**3.08**	**4.38**	**3.04**	**3.08**	**0.18**	**2.72**	**3.45**	**5.72**	**5.68**	**0.11**	**5.45**	**5.90**
Minnesota	3.66	3.69	0.29	3.12	4.27	3.06	3.07	0.14	2.78	3.36	5.72	5.70	0.09	5.53	5.87
New York	3.61	3.72	0.28	3.15	4.29	3.02	3.04	0.15	2.74	3.35	5.74	5.69	0.11	5.46	5.91
Ohio	**3.72**	**3.84**	**0.39**	**3.05**	**4.62**	**3.07**	**3.12**	**0.22**	**2.67**	**3.57**	**5.69**	**5.64**	**0.11**	**5.42**	**5.87**
Pennsylvania	**3.76**	**3.83**	**0.36**	**3.12**	**4.54**	**3.08**	**3.10**	**0.19**	**2.71**	**3.48**	**5.68**	**5.64**	**0.13**	**5.38**	**5.89**
Tennessee	3.33	3.42	0.34	2.75	4.09	3.20	3.19	0.07	3.04	3.34	5.62	5.62	0.06	5.50	5.75
Virginia	3.88	4.01	0.49	3.04	4.99	3.10	3.23	0.36	2.51	3.96	5.59	5.55	0.17	5.21	5.89
Wisconsin	3.71	3.78	0.26	3.25	4.30	3.02	3.05	0.17	2.71	3.38	5.75	5.70	0.12	5.47	5.93
West Virginia	**3.89**	**3.96**	**0.39**	**3.17**	**4.75**	**3.19**	**3.20**	**0.23**	**2.75**	**3.65**	**5.67**	**5.60**	**0.16**	**5.27**	**5.93**

State	*Solids-Non-Fat* Weighted Average	*Solids-Non-Fat* Mean	*Solids-Non-Fat* Standard Deviation	*Solids-Non-Fat* 95 % Confidence Interval Lower Bound	*Solids-Non-Fat* 95 % Confidence Interval Upper Bound	*Somatic Cell Count* Weighted Average	*Somatic Cell Count* Mean	*Somatic Cell Count* Standard Deviation	*Somatic Cell Count* 95 % Confidence Interval Lower Bound	*Somatic Cell Count* 95 % Confidence Interval Upper Bound	*Milk Value* Weighted Average	*Milk Value* Mean	*Milk Value* Standard Deviation	*Milk Value* 95 % Confidence Interval Lower Bound	*Milk Value* 95 % Confidence Interval Upper Bound
			percent					*(1,000)*					*$/cwt*		
Iowa	8.77	8.78	0.25	8.28	9.29	267	285	121	44	526	20.08	20.16	1.17	17.81	22.50
Illinois	8.78	8.73	0.29	8.16	9.30	233	351	163	26	677	18.47	19.57	2.06	15.44	23.70
Indiana	**8.73**	**8.74**	**0.30**	**8.13**	**9.35**	**289**	**319**	**156**	**6**	**631**	**18.53**	**18.88**	**2.69**	**13.51**	**24.25**
Kentucky	**8.62**	**8.58**	**0.37**	**7.85**	**9.31**	**409**	**429**	**186**	**56**	**802**	**19.51**	**20.13**	**2.22**	**15.69**	**24.58**
Maryland	8.80	8.80	0.31	8.19	9.41	319	346	183	(19)	712	18.72	18.89	2.87	13.16	24.63
Michigan	**8.76**	**8.76**	**0.29**	**8.17**	**9.35**	**255**	**305**	**157**	**(9)**	**619**	**18.38**	**18.79**	**2.65**	**13.49**	**24.09**
Minnesota	8.78	8.77	0.23	8.31	9.23	356	407	175	58	757	20.24	20.45	1.10	18.24	22.65
New York	8.75	8.73	0.27	8.20	9.26	236	283	146	(8)	574	17.99	18.20	2.72	12.76	23.63
Ohio	**8.76**	**8.76**	**0.34**	**8.09**	**9.44**	**290**	**320**	**159**	**3**	**638**	**18.63**	**19.04**	**2.83**	**13.38**	**24.70**
Pennsylvania	**8.76**	**8.74**	**0.32**	**8.10**	**9.38**	**334**	**363**	**182**	**(1)**	**727**	**18.64**	**18.80**	**2.77**	**13.27**	**24.34**
Tennessee	8.82	8.82	0.14	8.54	9.09	442	422	92	238	605	20.54	20.64	0.71	19.22	22.07
Virginia	8.69	8.78	0.53	7.72	9.85	200	223	68	87	359	20.92	21.00	2.55	15.89	26.11
Wisconsin	8.77	8.75	0.28	8.18	9.32	265	312	166	(20)	643	18.87	19.12	2.49	14.14	24.10
West Virginia	**8.86**	**8.80**	**0.39**	**8.02**	**9.58**	**355**	**363**	**176**	**11**	**715**	**19.32**	**19.38**	**2.95**	**13.48**	**25.28**

SELECTED COMPONENTS, SOMATIC CELL COUNT, AND MILK VALUE DESCRIPTIVE STATISTICS BY PERCENTILE GROUP FOR 2007, FEDERAL ORDER 33

	Butterfat					*Protein*					*Other Solids*				
				95 % Confidence Interval					95 % Confidence Interval					95 % Confidence Interval	
	Weighted Average	Mean	Standard Deviation	Lower Bound	Upper Bound	Weighted Average	Mean	Standard Deviation	Lower Bound	Upper Bound	Weighted Average	Mean	Standard Deviation	Lower Bound	Upper Bound
			percent					*percent*					*percent*		
Pct 1	3.93	3.96	0.46	3.05	4.87	3.14	3.17	0.28	2.60	3.73	5.57	5.55	0.19	5.17	5.93
Pct 2	3.88	3.90	0.41	3.08	4.71	3.13	3.14	0.24	2.65	3.63	5.61	5.61	0.12	5.36	5.86
Pct 3	3.85	3.86	0.39	3.09	4.63	3.12	3.12	0.23	2.67	3.58	5.64	5.63	0.11	5.42	5.85
Pct 4	3.81	3.82	0.35	3.13	4.52	3.10	3.10	0.20	2.70	3.51	5.64	5.64	0.11	5.42	5.86
Pct 5	3.80	3.80	0.34	3.12	4.49	3.09	3.10	0.19	2.71	3.48	5.66	5.66	0.09	5.47	5.84
Pct 6	3.78	3.78	0.32	3.15	4.41	3.08	3.08	0.18	2.72	3.44	5.67	5.67	0.10	5.46	5.87
Pct 7	3.76	3.77	0.30	3.17	4.36	3.08	3.08	0.17	2.74	3.42	5.68	5.68	0.10	5.49	5.87
Pct 8	3.74	3.74	0.31	3.13	4.35	3.07	3.08	0.17	2.74	3.41	5.69	5.69	0.08	5.53	5.85
Pct 9	3.71	3.71	0.29	3.14	4.29	3.06	3.06	0.16	2.75	3.37	5.71	5.70	0.08	5.55	5.86
Pct 10	3.60	3.63	0.26	3.12	4.14	3.02	3.03	0.13	2.76	3.30	5.73	5.72	0.06	5.60	5.85

	Solids-Non-Fat					*Somatic Cell Count*					*Milk Value*				
				95 % Confidence Interval					95 % Confidence Interval					95 % Confidence Interval	
	Weighted Average	Mean	Standard Deviation	Lower Bound	Upper Bound	Weighted Average	Mean	Standard Deviation	Lower Bound	Upper Bound	Weighted Average	Mean	Standard Deviation	Lower Bound	Upper Bound
			percent					*(1,000)*					*$/cwt*		
Pct 1	8.71	8.72	0.47	7.77	9.66	375	383	227	(72)	837	19.36	19.48	3.01	13.45	25.50
Pct 2	8.74	8.75	0.37	8.01	9.49	371	373	200	(26)	772	19.14	19.23	2.83	13.56	24.89
Pct 3	8.75	8.75	0.33	8.09	9.42	335	336	173	(10)	681	19.01	19.08	2.81	13.46	24.69
Pct 4	8.74	8.75	0.31	8.12	9.37	338	340	165	9	671	18.91	18.95	2.73	13.50	24.41
Pct 5	8.75	8.75	0.29	8.18	9.32	344	346	164	18	674	18.86	18.92	2.69	13.54	24.31
Pct 6	8.75	8.75	0.28	8.19	9.31	320	323	152	18	627	18.79	18.84	2.65	13.55	24.14
Pct 7	8.76	8.76	0.27	8.23	9.29	307	309	142	25	592	18.74	18.80	2.63	13.53	24.06
Pct 8	8.77	8.77	0.25	8.27	9.27	301	303	130	44	563	18.70	18.78	2.64	13.50	24.06
Pct 9	8.76	8.76	0.23	8.30	9.23	272	274	125	23	524	18.57	18.66	2.62	13.42	23.89
Pct 10	8.76	8.76	0.20	8.36	9.15	249	254	104	46	463	18.29	18.44	2.59	13.26	23.62

SELECTED COMPONENT STATISTICS BY PERCENTILE GROUP FOR 2007

SPSS OUTPUT

BUTTERFAT TEST AS A FUNCTION OF PROTEIN TEST

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	PROTEIN[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: BF

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.743[a]	.552	.552	.23452

a. Predictors: (Constant), PROTEIN

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7411.554	1	7411.554	134755.6	.000[a]
	Residual	6023.705	109522	.055		
	Total	13435.258	109523			

a. Predictors: (Constant), PROTEIN

b. Dependent Variable: BF

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.257	.011		-23.250	.000
	PROTEIN	1.308	.004	.743	367.091	.000

a. Dependent Variable: BF

BUTTERFAT TEST AS A FUNCTION OF PROTEIN TEST AND DUMMY VARIABLES FOR MONTH

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	DEC, JUL, FEB, APR, MAR, SEP, PROTEIN, MAY, OCT, JUN, NOV, AUG[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: BF

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.761[a]	.580	.580	.22708

a. Predictors: (Constant), DEC, JUL, FEB, APR, MAR, SEP, PROTEIN, MAY, OCT, JUN, NOV, AUG

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7788.401	12	649.033	12586.879	.000[a]
	Residual	5646.857	109511	.052		
	Total	13435.258	109523			

a. Predictors: (Constant), DEC, JUL, FEB, APR, MAR, SEP, PROTEIN, MAY, OCT, JUN, NOV, AUG

b. Dependent Variable: BF

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.032	.012		2.642	.008
	PROTEIN	1.234	.004	.701	324.115	.000
	FEB	.021	.003	.016	6.106	.000
	MAR	.018	.003	.014	5.336	.000
	APR	-.009	.003	-.007	-2.644	.008
	MAY	-.125	.003	-.099	-36.519	.000
	JUN	-.126	.003	-.102	-36.924	.000
	JUL	-.114	.004	-.087	-32.264	.000
	AUG	-.087	.003	-.072	-25.711	.000
	SEP	-.129	.003	-.102	-37.822	.000
	OCT	-.107	.003	-.086	-31.700	.000
	NOV	-.048	.003	-.039	-14.179	.000
	DEC	.020	.003	.016	5.748	.000

a. Dependent Variable: BF

BUTTERFAT AS A FUNCTION OF PROTEIN AND PCT DUMMY

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	PROTEIN, PCT5, PCT4, PCT6, PCT7, PCT1, PCT3, PCT2, PCT8, PCT9[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: BF

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.754[a]	.569	.569	.23066

a. Predictors: (Constant), PROTEIN, PCT5, PCT4, PCT6, PCT7, PCT1, PCT3, PCT2, PCT8, PCT9

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7798.685	10	779.868	14657.933	.000[a]
	Residual	5908.736	111057	.053		
	Total	13707.421	111067			

a. Predictors: (Constant), PROTEIN, PCT5, PCT4, PCT6, PCT7, PCT1, PCT3, PCT2, PCT8, PCT9

b. Dependent Variable: BF

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.226	.011		-20.795	.000
	PCT1	.167	.003	.128	52.534	.000
	PCT2	.134	.003	.112	44.547	.000
	PCT3	.122	.003	.103	40.932	.000
	PCT4	.105	.003	.088	35.197	.000
	PCT5	.097	.003	.082	32.626	.000
	PCT6	.090	.003	.077	30.696	.000
	PCT7	.084	.003	.072	28.467	.000
	PCT8	.062	.003	.053	21.129	.000
	PCT9	.055	.003	.048	19.096	.000
	PROTEIN	1.270	.004	.721	359.752	.000

a. Dependent Variable: BF

Other Solids Test as a function of Butterfat test

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	BF[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: OS

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.096[a]	.009	.009	.11499

a. Predictors: (Constant), BF

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.574	1	13.574	1026.486	.000[a]
	Residual	1448.247	109522	.013		
	Total	1461.821	109523			

a. Predictors: (Constant), BF

b. Dependent Variable: OS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.781	.004		1532.717	.000
	BF	-.032	.001	-.096	-32.039	.000

a. Dependent Variable: OS

OTHER SOLIDS TEST AS A FUNCTION OF PROTEIN TEST

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	PROTEIN[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: OS

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.016[a]	.000	.000	.11552

a. Predictors: (Constant), PROTEIN

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.355	1	.355	26.582	.000[a]
	Residual	1461.466	109522	.013		
	Total	1461.821	109523			

a. Predictors: (Constant), PROTEIN

b. Dependent Variable: OS

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	5.688	.005		1046.653	.000
	PROTEIN	-.009	.002	-.016	-5.156	.000

a. Dependent Variable: OS

BUTTERFAT AS A FUNCTION OF FEED COST AND DELTA FEED COST

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	DFC, FEEDCOST[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: BF

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.062[a]	.004	.004	.34957

a. Predictors: (Constant), DFC, FEEDCOST

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.918	2	25.959	212.433	.000[a]
	Residual	13383.340	109521	.122		
	Total	13435.258	109523			

a. Predictors: (Constant), DFC, FEEDCOST

b. Dependent Variable: BF

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3.539	.012		294.500	.000
	FEEDCOST	.030	.001	.120	20.192	.000
	DFC	-.033	.002	-.091	-15.281	.000

a. Dependent Variable: BF

MILK VALUE AS A FUNCTION OF PRODUCER SIZE

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	PCT9, PCT1, PCT2, PCT3, PCT4, PCT5, PCT6, PCT7, PCT8[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: MV

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.100[a]	.010	.010	2.71108

a. Predictors: (Constant), PCT9, PCT1, PCT2, PCT3, PCT4, PCT5, PCT6, PCT7, PCT8

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8300.388	9	922.265	125.479	.000[a]
	Residual	816273.9	111058	7.350		
	Total	824574.3	111067			

a. Predictors: (Constant), PCT9, PCT1, PCT2, PCT3, PCT4, PCT5, PCT6, PCT7, PCT8

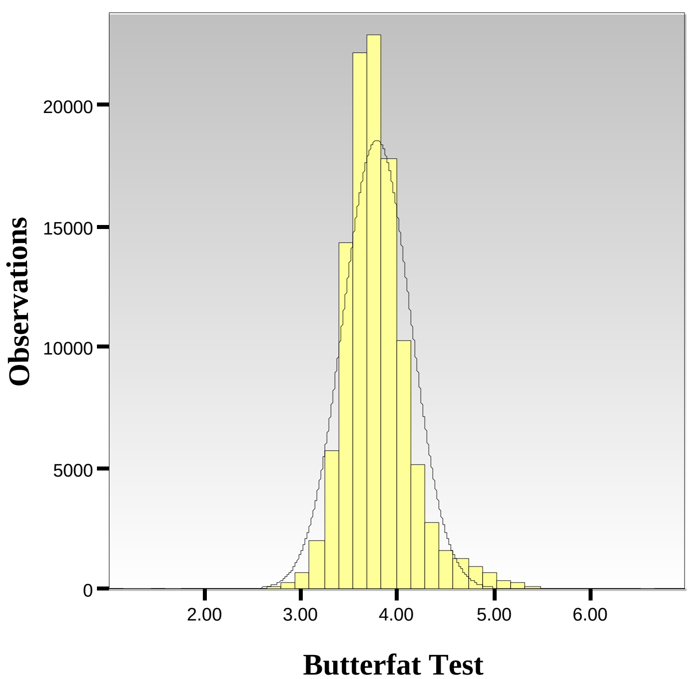
b. Dependent Variable: MV

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	18.438	.023		799.715	.000
	PCT1	1.034	.037	.102	27.940	.000
	PCT2	.782	.035	.084	22.241	.000
	PCT3	.633	.035	.069	18.178	.000
	PCT4	.510	.035	.055	14.642	.000
	PCT5	.480	.035	.052	13.836	.000
	PCT6	.401	.035	.044	11.616	.000
	PCT7	.353	.034	.039	10.253	.000
	PCT8	.335	.034	.037	9.790	.000
	PCT9	.212	.034	.024	6.251	.000

a. Dependent Variable: MV

FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE BUTTERFAT LEVELS, 2007



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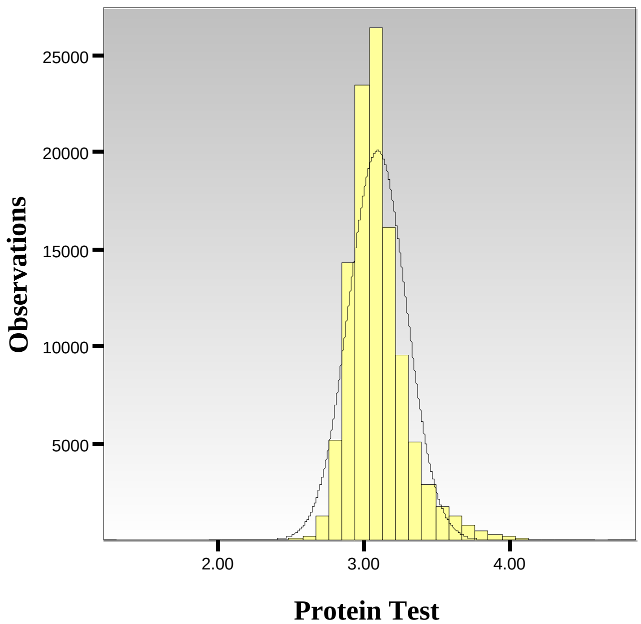

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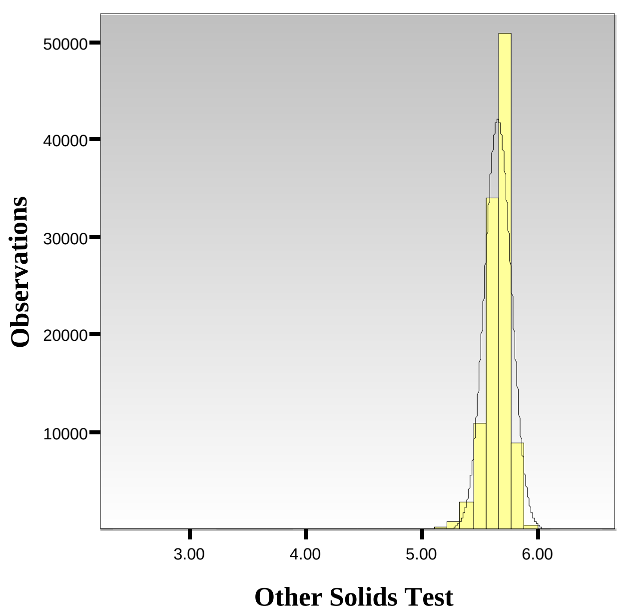

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