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ANALYSIS OF COMPONENT LEVELS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL

PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS

2009

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Lori Espe

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Abstract

Component levels in producer milk pooled on the Pacific Northwest (FO 124) and Arizona (FO 131) Federal Milk Marketing Orders were analyzed for 2009 to determine average levels, regional and seasonal variation, and, when possible, the statistical relationship between components. Handlers regulated under the Pacific Northwest Order report butterfat, protein, and other solids. Handlers regulated under the Arizona Order report butterfat only. Producer milk pooled was also valued using Federal order minimum producer prices for the respective orders. For 2009, a monthly average total of 721 producers were pooled on the Pacific Northwest and Arizona Orders. During 2009, these producers delivered 11.4 billion pounds to the two markets. The milk shed of the two Federal orders includes Arizona, California, Texas, Idaho, Oregon, and Washington.

Major findings of this study include:

1. The 2009 average component levels for the Pacific Northwest Order were 3.71% butterfat, 3.11% true protein, and 5.69% other solids. The 2009 average butterfat level for the Arizona Order was 3.49%.
2. In both orders, butterfat levels decrease during the summer months and increase in the late fall and winter. In the Pacific Northwest Order, protein showed the same seasonality as butterfat.
3. Although the volume of producer milk, number of producers, and average milk production per producer varies greatly between geographic regions, there are relatively small differences in aggregate component levels between these geographic regions within the milk sheds of the two orders.
4. The Pacific Northwest Order's linear regression in 2009 for protein is PRO% = 1.486 + 0.431 * BF%, with an R-squared of 0.66.
5. The Pacific Northwest Order's regressions for estimating other solids using butterfat have a very poor correlation, having an R-squared of less than 0.12. The monthly regressions show a negative relationship; other solids levels appear to be independent of butterfat levels.

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ANALYSIS OF COMPONENT LEVELS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL

PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS

2009

Lori Espe[1]

I. INTRODUCTION

This study examines milk component levels in milk pooled on the Pacific Northwest (FO 124) and Arizona (FO 131) Milk Marketing Orders during 2009. The milk components for the Pacific Northwest Order include butterfat, protein, and other solids and butterfat only for the Arizona Order. Protein and other solids were not included in any analyses concerning the Arizona Order because they were not used as a basis for pricing milk in 2009, and handlers were not obligated under the order to report information on protein and other solids levels.

Component levels in producer milk pooled on the Pacific Northwest and Arizona Orders were analyzed to determine average component levels, regional and seasonal variation, and the statistical relationship between components. Producer milk pooled on each order in 2009 was valued using Federal order minimum producer prices for the respective orders.

For 2009, a monthly average total of 721 producers were pooled on the Pacific Northwest and Arizona Orders. During 2009, these producers delivered 11.4 billion pounds to the two markets.

True protein was used as a basis for pricing milk under the Pacific Northwest Order. Unlike crude protein, true protein does not include non-protein nitrogen. In general, crude protein test levels are about 0.19 percentage points higher than true protein test levels. In a like manner, other solids levels associated with true protein levels are about 0.19 percentage points higher than those associated with crude protein test levels.

During 2009, the Pacific Northwest Order milk shed was comprised of producers located in Washington, Oregon, California, and Idaho. The Arizona Order milk shed was comprised of producers located in Arizona, California, and Texas. The milk shed of the two orders includes various geographic and climatic regions. These regions range from very dry climates (Arizona, Texas, Central Washington, Southern Idaho, and Eastern Oregon) to very wet climates (western and coastal regions of Oregon and Washington). Geographically, the Cascade Mountain Range, Pacific Ocean, and Columbia River provide general geographic and climate demarcations that may impact how dairy operations are managed.

[1] Lori Espe is an Agricultural Economist with the Market Administrator's Office, Bothell, Washington. Assisting Ms. Espe were John Mykrantz and Dan Nguyen of the Pacific Northwest (FO 124) and Arizona (FO 131) Orders' staff.

II. DATA AND METHODOLOGY

The data included in this study comprises all producer milk pooled on the Pacific Northwest and Arizona Orders. The data was collected from producer payrolls submitted by handlers to the market administrator's office. Components available for the Pacific Northwest Order were butterfat, protein, and other solids (other solids is nonfat solids less protein). Protein and other solids were not included for the Arizona Order because they were not used as a basis for pricing milk in 2009, and handlers were not obligated under the order to report information on protein and other solids levels.

Eligible producer milk and producers which were **not** pooled were **not** included in this analysis. Eligible producer milk is Grade A milk production that qualifies to be but is not pooled on the respective order. The exclusion of milk not pooled was due to the unavailability of the information, and it almost always represented less than three handlers and was, therefore, restricted.

The Pacific Northwest and Arizona Orders were divided into seven regions. (See Map A-2.) The small number of producers in Northern California pooled on the Pacific Northwest Order made it necessary to combine them with another region (Western Oregon, Region 5). Region 5 has a similar climate and was geographically adjacent to the two California counties. The Arizona, Southern California, and Texas producers were also combined for reasons of confidentiality. Other than the identified exceptions, order and/or state lines were considered as primary boundaries. The regions within states were defined based on climate conditions and geography. The regions are as follows: Western Washington (Region 1); Central Washington (Region 2); Eastern Washington (Region 3); Northern Idaho (Region 4); Western Oregon and Northern California (Region 5); Central/Eastern Oregon and Southern Idaho (Region 6); and Arizona, Southern California, and Texas (Region 7).

In Oregon and Washington, the west side of the Cascade Mountain Range has more precipitation and is characterized by a milder climate than the eastern side of the states.[2] The region east of the Cascade Mountain Range has a drier climate with warmer summers and colder winters. In Eastern Washington, the precipitation rate begins to increase slightly. Idaho was split into Northern and Southern Idaho. Northern Idaho is wetter and more mountainous compared to Southern Idaho. Arizona is very dry year round with much less precipitation and has many days with average temperatures much higher than the other regions studied.

Ordinary Least Squares regression analysis was used to determine relationships between components.

[2] Climate information based on Western Regional Climate Center precipitation maps.

III. SEASONAL VARIATION IN MILK COMPONENT LEVELS

In 2009, producers associated with the Pacific Northwest Order delivered 7.38 billion pounds. For 2009, producer milk tested, on average, 3.71% butterfat, 3.11% protein, and 5.69% other solids.

In the Pacific Northwest Order, producer milk butterfat percentages decrease in the spring and increase in the fall and winter. Table 1 shows the monthly and annual average component levels for the Pacific Northwest Order. Milk production per cow typically is less, and animals are fed more stored feed in the fall and winter. In the spring, during the flush of milk production, the feeding of more fresh grass increases the total pounds produced but decreases the percentage of butterfat and protein content of milk. The spring flush is additionally impacted by the biological cycle of cows and the increase in temperature in the spring. Butterfat levels in the Pacific Northwest Order in 2009 were the highest in December at 3.85% and lowest in June and August at 3.59%.

The seasonal cycle of protein levels is similar to butterfat but with a lesser degree of variation. Protein levels in 2009 were highest in November at 3.24% and lowest in August at 3.01%. Other solids levels were much more consistent throughout the year when compared to the seasonal changes in butterfat and protein levels. Other solids levels reached a peak of 5.72% in December, a low of 5.67% in February, and showed very little seasonality.

Table 1
Monthly Component Levels
Pacific Northwest Order
2009

Month	Butterfat	Protein	Other Solids
	- percent -	- percent -	- percent -
January	3.77	3.16	5.68
February	3.74	3.13	5.67
March *	3.75	3.11	5.70
April *	3.67	3.06	5.68
May	3.65	3.08	5.70
June	3.59	3.03	5.70
July	3.60	3.02	5.71
August *	3.59	3.01	5.69
September *	3.66	3.09	5.69
October	3.78	3.22	5.69
November	3.84	3.24	5.70
December *	3.85	3.21	5.72
Weighted Average	3.71	3.11	5.69

* Eligible milk not pooled.

Table 2 Monthly Component Levels Arizona Order 2009	
Month	Butterfat - percent -
January	3.60
February	3.53
March	3.45
April	3.43
May	3.41
June	3.42
July	3.43
August	3.39
September	3.45
October	3.54
November	3.58
December	3.63
Weighted Average	3.49

In 2009, producers associated with the Arizona Order delivered 4.04 billion pounds. For 2009, producer milk tested, on average, 3.49% butterfat. Butterfat levels in the Arizona Order follow a similar seasonal pattern as the Pacific Northwest Order. The butterfat levels decrease in the spring and rise again in the fall. (See Table 2 above.) Butterfat levels in the Arizona Order in 2009 were highest in December at 3.63% and lowest in August at 3.39%.

For 2009, the monthly and annual weighted average butterfat and protein levels were less than the mean averages for both components. (See Tables 3 and 4 and Appendix Tables A-1 and A-2.) This difference in relative levels of the weighted average and the mean would indicate that individual producers who deliver smaller amounts of milk (on a monthly basis) have higher levels of these components in their milk than their larger counterparts. Conversely, on the Pacific Northwest Order, the other solids weighted average is higher than the mean, indicating that producers who deliver larger amounts of milk have higher levels of other solids in their milk than their smaller counterparts.

During 2009, for the Pacific Northwest Order, producers' individual monthly average butterfat tests ranged from 2.62% to 5.83%; protein tests ranged from 2.63% to 4.09%, and other solids levels ranged from 4.96% to 5.87%. (See Table 3.) Most monthly average component tests are within one standard deviation of the mean.[3] Based on the definition of a standard deviation, most producers had butterfat tests ranging from 3.46% to 4.28%. Similarly, most protein tests ranged from 2.94% to 3.38%, and most other solids tests ranged from 5.58% to 5.76%. (See Appendix Table A-1 for monthly component statistics.)

[3] By definition, for a *normal distribution*, approximately 68% of observations are within one standard deviation of the mean.

In 2009, Arizona Order producers' butterfat tests ranged from 2.59% to 5.60%. (See Table 4.) Based on the definition of a standard deviation, most producers had butterfat tests ranging from 3.21% to 3.87%. (See Appendix Table A-2 for monthly component statistics.)

Table 3
Component Levels: Weighted Average, Mean, Median, Standard Deviation, Minimum, and Maximum
Pacific Northwest Order
2009

	Butterfat	Protein	Other Solids
	%	%	%
Weighted Average	3.71	3.11	5.69
Mean	3.87	3.16	5.67
Median	3.78	3.11	5.68
Standard Deviation	0.41	0.22	0.09
Minimum	2.62	2.63	4.96
Maximum	5.83	4.09	5.87

Table 4
Component Levels: Weighted Average, Mean, Median, Standard Deviation, Minimum, and Maximum
Arizona Order
2009

	Butterfat
	%
Weighted Average	3.49
Mean	3.54
Median	3.48
Standard Deviation	0.33
Minimum	2.59
Maximum	5.60

IV. REGIONAL VARIATION IN MILK COMPONENT LEVELS

Differences in climate, breeds of cattle, common management practices, feeds, and other characteristics of dairy operations can reveal varying milk component levels on a geographic basis. The data was divided into seven regions based on the geographic location of the dairy farms. The seven regions are primarily based on a combination of relatively homogeneous climates and state and Federal order borders.

Regions 1 through 6 are associated with the Pacific Northwest region and are defined in Appendix Map A-2. Region 7 represents the Arizona Order. Table 5, below, provides 2009 milk production, average number of producers, and component tests for each region. In 2009, the

region with the most milk associated with the Pacific Northwest Order was Region 2 followed by Regions 1, 5, 6, 3 and 4. With the exception of Regions 4 and 5, component levels for each region appear to vary only slightly.

Table 5
Various Statistics by Region For 2009

Region 1 (Western Washington)		**Region 2 (Central Washington)**	
Milk Production	2,076,162,537	Milk Production	2,655,688,596
Average Number of Producers	274	Average Number of Producers	97
Average Pounds Per Producer	7,577,236	Average Pounds Per Producer	27,378,233
Butterfat Test	3.68%	Butterfat Test	3.65%
Protein Test	3.08%	Protein Test	3.09%
Other Solids Test	5.69%	Other Solids Test	5.69%
Region 3 (Eastern Washington)		**Region 4 (Northern Idaho)**	
Milk Production	488,696,405	Milk Production	9,243,047
Average Number of Producers	35	Average Number of Producers	6
Average Pounds Per Producer	13,962,754	Average Pounds Per Producer	1,540,508
Butterfat Test	3.68%	Butterfat Test	3.79%
Protein Test	3.12%	Protein Test	3.17%
Other Solids Test	5.68%	Other Solids Test	5.66%
Region 5 (Western Oregon, Northern California)		**Region 6 (Central/Eastern Oregon, Southern Idaho)**	
Milk Production	1,223,497,044	Milk Production	931,258,900
Average Number of Producers	187	Average Number of Producers	24
Average Pounds Per Producer	6,542,765	Average Pounds Per Producer	38,802,454
Butterfat Test	3.87%	Butterfat Test	3.72%
Protein Test	3.19%	Protein Test	3.17%
Other Solids Test	5.72%	Other Solids Test	5.69%
Region 7 (Arizona/Southern California/Texas)			
Milk Production	4,042,326,590		
Average Number of Producers	97		
Average Pounds Per Producer	41,673,470		
Butterfat Test	3.49%		
Protein Test	n/a		
Other Solids Test	n/a		

n/a = not applicable

In general, comparing all the regions, Region 7 had the most milk pooled in 2009, with 4.04 billion pounds, while Region 1 had the most producers (274 producers on average). Average milk production per producer was the highest in Region 7 with an average of 41.67 million pounds per producer for the year. The highest butterfat levels in 2009 were in Region 5 with annual tests of 3.87%, while Region 7 had the lowest annual butterfat test of 3.49%. Protein levels in Region 5 (3.19%) and other solids levels in Region 5 (5.72%) were the highest for each of those components.

Producer milk, number of producers, and average milk production per producer varied greatly between regions. Some comparatively small differences in component levels were also evident. In 2009, butterfat levels in Regions 4 and 5 were noticeably higher than the other regions, while Region 7 was much lower than the other regions. Protein levels in Region 5 were 0.11% higher than Region 1. Other solids levels by region varied only 0.06% between the high and low for the year 2009; ranging from 5.66% in Region 4 to 5.72% in Region 5.

On the Pacific Northwest Order, changes in producer numbers and milk marketed between November 2008 and November 2009 followed the national trend of increased milk production by fewer producers. The Arizona Order's producer numbers and milk marketed were lower in November 2009 when compared to previous year levels. Table 6, below, provides a brief comparison of producer numbers and milk marketed for November 2008 and 2009. On a regional basis, the historical shift of movement of milk production in Washington State from Western Washington (Region 1) to Central Washington (Region 2) continued. Region 1's production dropped by 11.3 million pounds, while production in Region 2 increased by 12.9 million pounds. Production in Eastern Washington (Region 3) increased milk production by 2.5 million pounds between November of 2008 and 2009, without a change in the number of producers. The number of producers in Northern Idaho (Region 4) decreased by two, and production dropped to 579,335 pounds for November 2009. Region 5, Western Oregon, faces many of the same environmental issues and urban encroachment problems as Region 1, Western Washington; although less severe, the producer numbers and milk marketed were lower in November 2009 for Region 5. The area covering Central/Eastern Oregon and Southern Idaho (Region 6) showed the greatest increase on the Pacific Northwest Order, with a 13.5 million pound increase from November 2008 to 2009. Producer milk in Arizona, Southern California, and Texas, grouped as Region 7, decreased by 17.3 million pounds in 2009 and had a decrease of seven producers, representing decreases of 5.1 percent and 6.9 percent, respectively.

Table 6
Producer Milk and Producers by Region for November 2009 and 2008

	Producer Milk			Producers		
	November 2009	November 2008	Change	November 2009	November 2008	Change
Region 1	161,589,486	172,863,936	-11,274,450	265	286	-21
Region 2	232,154,310	219,260,931	12,893,379	102	100	2
Region 3	46,390,944	43,895,376	2,495,568	36	36	0
Region 4	579,335	963,514	-384,179	6	8	-2
Region 5	105,183,260	106,333,470	-1,150,210	204	216	-12
Region 6	85,131,213	71,618,892	13,512,321	24	21	3
Region 7	318,774,111	336,032,616	-17,258,505	95	102	-7
Total	949,802,659	950,968,735	-1,166,076	732	769	-37

V. STATISTICAL RELATIONSHIP AMONG MILK COMPONENTS

Regression analysis was used to analyze the linear relationship between milk component levels. The analysis revealed that the only significant relationship between components was between butterfat (BF) and protein (PRO). Regressions of nonfat solids and protein and nonfat solids and butterfat were found to be insignificant and not included in this study. This latter finding was expected and is due to: (1) the nonfat solids level is, by definition, protein plus other solids; and (2) other solids levels appear random and show little seasonal variation. (See Appendix Tables A-4 and A-5 and Figures A-5 and A-6.)

The Pacific Northwest Order had 7,487 observations in 2009. This year's regressions are similar to other Federal order publications. [4] Appendix Figures A-5 and A-6 show graphical representations of the linear regressions for May and November 2009.

The butterfat and protein regression equations for the Pacific Northwest Order were calculated for 2000 through 2009. (See Table 7 below.) Over the 2000 - 2009 periods, the general trend of the regression is toward a lower intercept but a steeper slope. This would suggest that, in general, a change in the butterfat level is associated with a larger change in the protein level in 2009 compared to previous years.

Table 7
Pacific Northwest Order
Comparison of Regression Results: Butterfat Level as a Predictor of Protein Levels
2000 through 2009

Year	Equation	Correlation
2000	TRUE PRO% = 1.526 + 0.414 BF%	$R^2 = 0.600$
2001	TRUE PRO% = 1.535 + 0.417 BF%	$R^2 = 0.599$
2002	TRUE PRO% = 1.488 + 0.426 BF%	$R^2 = 0.649$
2003	TRUE PRO% = 1.452 + 0.432 BF%	$R^2 = 0.661$
2004	TRUE PRO% = 1.434 + 0.439 BF%	$R^2 = 0.652$
2005	TRUE PRO% = 1.438 + 0.438 BF%	$R^2 = 0.663$
2006	TRUE PRO% = 1.418 + 0.444 BF%	$R^2 = 0.626$
2007	TRUE PRO% = 1.424 + 0.447 BF%	$R^2 = 0.679$
2008	TRUE PRO% = 1.488 + 0.430 BF%	$R^2 = 0.660$
2009	TRUE PRO% = 1.486 + 0.431 BF%	$R^2 = 0.657$

[4] See *Analysis of Component Levels and Somatic Cell Count in Individual Herd Milk at the Farm Level, 2007,* Upper Midwest Marketing Area, Staff paper 08-01, December 2008.

VI. MINIMUM ORDER VALUE OF MILK PRODUCTION

The use of monthly component prices allows for the evaluation of the minimum order value of milk components in a hundredweight of milk.

The minimum order value at test of producer milk pooled on the Pacific Northwest Order in 2009 averaged $12.30 per hundredweight. The weighted average value of each component comprising the $12.30 per hundredweight was: $4.66 for butterfat; $6.84 for protein; $0.34 for other solids; and a producer price differential of $0.45.[5]

The value of producers' milk at test pooled on the Arizona Order in 2009 averaged $12.06 per hundredweight. The weighted average value of skim and butterfat portions of the $12.06 per hundredweight was: $4.39 for butterfat; and $7.67 for skim.[6]

There is an apparent inverse relationship between the size-range of producers' production and the butterfat and protein levels in their milk. An inverse relationship between size-range and certain component levels may be due to the relative prevalence of high component testing breeds among smaller herd sizes (e.g. Jerseys) compared to lower component testing breeds (e.g. Holsteins). Another possible reason for this inverse relationship is that smaller herds may be fed differently than larger herds. The weighted average component levels by size-range of milk production are summarized in Appendix Table A-7 and Figure A-7. The inverse relationship between size-range and producer butterfat and protein levels is more apparent on the Pacific Northwest Order than in the levels of butterfat on the Arizona Order. On the Pacific Northwest Order, there appears to be a positive relationship between the size-range of a producer's production and the other solids levels in their milk. The difference in component levels, in turn, translates to an inverse relationship between size-range and minimum order value per hundredweight.

The aggregated value of milk production by size-range of milk production is summarized in Appendix Table A-8 and Figure A-8. For the Pacific Northwest Order, on average, using 2009 Federal order prices, producers with less than 50,000 pounds of production were valued more per hundredweight, $13.15, than other producers. Producers with 4-6 million pounds of production averaged the lowest amount per hundredweight, at $12.11. This relationship is generally indicative of the fact that smaller herds typically have higher component levels than larger herds. On the Arizona Order, using skim-butterfat values, a relationship between size-range and value per hundredweight was less evident. The Arizona Order data was broken down further for producers over one million pounds into smaller increments (e.g. 4-5 million pounds, 5-6 million pounds, 6-7 million pounds) to determine whether the size-range categories used masked any relationships. Using smaller increments does not indicate producers pooled on the Arizona Order who have more milk deliveries have a lower value of milk per hundredweight.

[5] The producer price differentials for the Pacific Northwest Order are subject to applicable location adjustments. The effects of the location adjustments are not dealt with in this study.

[6] The producer prices for the Arizona Order are subject to applicable location adjustments. The effects of the location adjustment are not dealt with in this study.

VII. SUMMARY

This paper analyzes milk components associated with the Pacific Northwest and Arizona Orders. Handlers regulated under the Pacific Northwest Order report butterfat, protein, and other solids. Handlers regulated under the Arizona Order report butterfat, only. For each order, producer information was collected from handler payrolls submitted to the market administrator's office. Component levels were examined using a variety of measures including: annual averages, seasonal and regional averages, relationships between components, frequency distributions and scatter plots of regressions, and the value of milk components by size-range of production.

Weighted average component levels for the Pacific Northwest Order in 2009 were: 3.71% butterfat, 3.11% protein, and 5.69% other solids. Butterfat percentages peaked in December and reached a low in June and August. Protein percentages peaked in November and reached a low in August. Other solids demonstrated very little seasonal change.

Although the volume of producer milk, number of producers, and average milk production per producer varies greatly between regions, differences in aggregate component levels between geographic regions within the milk sheds of the two orders are comparatively small.

The linear relationship between butterfat and protein on the Pacific Northwest Order was:

$$\text{Protein} = 1.48591 + 0.4310 * \text{Butterfat} \qquad (R^2 = 0.6569)$$

In 2009, the Pacific Northwest Order's weighted average price received for milk was $12.30 per hundredweight, at test.

The annual average butterfat level for the Arizona Order in 2009 was 3.49%. Butterfat levels peaked in December and reached a low in August. In 2009, the Federal order weighted average price received for milk was $12.06 per hundredweight, at test.

In general, for the Pacific Northwest Order, as producers' monthly deliveries increase, the weighted average value of the milk, at Federal order prices, decreases.

APPENDIX

Table A-1

STATISTICAL DATA FOR PRODUCERS ON THE PACIFIC NORTHWEST ORDER INCLUDED IN COMPONENT ANALYSIS

2009

Butterfat

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.77	3.94	0.41	3.84	2.90	5.57	680
February	3.74	3.90	0.40	3.81	2.98	5.25	666
March	3.75	3.92	0.40	3.83	3.10	5.24	651
April	3.67	3.81	0.36	3.72	2.84	5.23	535
May	3.65	3.77	0.38	3.67	2.74	5.00	657
June	3.59	3.73	0.37	3.64	2.77	5.00	656
July	3.60	3.75	0.36	3.65	2.80	5.10	644
August	3.59	3.76	0.38	3.67	2.67	5.03	635
September	3.66	3.83	0.37	3.74	2.70	5.17	466
October	3.78	3.97	0.43	3.85	2.62	5.37	636
November	3.84	4.03	0.44	3.93	3.02	5.78	637
December	3.85	4.05	0.45	3.93	3.17	5.83	624
For the Year	3.71	3.87	0.41	3.78	2.62	5.83	7,487

Protein

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.16	3.18	0.21	3.14	2.65	4.01	680
February	3.13	3.16	0.21	3.11	2.71	3.91	666
March	3.11	3.15	0.20	3.11	2.72	3.92	651
April	3.06	3.09	0.19	3.05	2.76	3.86	535
May	3.08	3.12	0.21	3.07	2.71	3.90	657
June	3.03	3.07	0.20	3.02	2.70	3.78	656
July	3.02	3.06	0.20	3.01	2.64	3.83	644
August	3.01	3.08	0.20	3.03	2.63	3.87	635
September	3.09	3.14	0.19	3.09	2.80	3.88	466
October	3.22	3.26	0.21	3.21	2.89	4.06	636
November	3.24	3.28	0.22	3.23	2.83	4.09	637
December	3.21	3.26	0.22	3.21	2.83	4.08	624
For the Year	3.11	3.16	0.22	3.11	2.63	4.09	7,487

Table A-1 (Continued)

STATISTICAL DATA FOR PRODUCERS ON THE
PACIFIC NORTHWEST ORDER INCLUDED IN COMPONENT ANALYSIS

2009

Other Solids

Month	Weighted Average	Mean	Standard Deviation	Median	Minimum	Maximum	Number of Observations
	- % -	- % -	- % -	- % -	- % -	- % -	
January	5.68	5.65	0.09	5.67	5.15	5.87	680
February	5.67	5.65	0.09	5.67	5.21	5.84	666
March	5.70	5.68	0.08	5.69	5.22	5.85	651
April	5.68	5.66	0.08	5.67	5.32	5.85	535
May	5.70	5.68	0.08	5.69	5.19	5.86	657
June	5.70	5.68	0.08	5.69	5.21	5.84	656
July	5.71	5.68	0.08	5.69	5.23	5.84	644
August	5.69	5.66	0.09	5.68	5.03	5.85	635
September	5.69	5.65	0.09	5.67	5.16	5.84	466
October	5.69	5.66	0.09	5.68	5.13	5.84	636
November	5.70	5.67	0.09	5.70	5.17	5.84	637
December	5.72	5.69	0.10	5.72	4.96	5.87	624
For the Year	5.69	5.67	0.09	5.68	4.96	5.87	7,487

Table A-2

STATISTICAL DATA FOR PRODUCERS ON THE ARIZONA ORDER INCLUDED IN COMPONENT ANALYSIS

2009

Butterfat

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.60	3.64	0.33	3.56	3.04	4.86	99
February	3.53	3.59	0.31	3.52	3.05	4.78	100
March	3.45	3.51	0.31	3.43	3.06	4.66	100
April	3.43	3.49	0.32	3.43	3.01	4.66	101
May	3.41	3.44	0.32	3.39	2.59	4.69	100
June	3.42	3.46	0.30	3.38	2.91	4.82	97
July	3.43	3.48	0.31	3.44	2.81	4.92	94
August	3.39	3.44	0.31	3.38	2.93	5.00	95
September	3.45	3.50	0.31	3.43	3.02	5.12	94
October	3.54	3.61	0.32	3.57	3.07	5.27	93
November	3.58	3.67	0.35	3.57	3.19	5.47	95
December	3.63	3.72	0.35	3.65	3.18	5.60	94
For the Year	3.49	3.54	0.33	3.48	2.59	5.60	1,162

Table A-3

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION

2009

Butterfat

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	3.74	287	3.73	102	3.67	37	3.77	8
February	3.71	280	3.69	100	3.63	36	3.77	7
March	3.74	280	3.70	100	3.77	34	3.83	7
April	3.69	281	3.64	101	3.71	33	3.79	7
May	3.62	280	3.57	102	3.60	37	3.72	7
June	3.58	279	3.49	102	3.52	38	3.65	7
July	3.61	271	3.50	101	3.57	37	3.66	6
August	3.59	271	3.50	101	3.61	33	3.71	6
September	3.68	267	3.63	54	3.73	30	3.83	6
October	3.73	266	3.73	101	3.79	37	4.00	6
November	3.76	265	3.79	102	3.82	36	3.96	6
December	3.78	264	3.83	101	3.92	32	3.94	4
For the Year	3.68	274	3.65	97	3.68	35	3.79	6

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	3.91	211	3.79	35	3.60	99
February	3.90	208	3.78	35	3.53	100
March	3.91	209	3.68	21	3.45	100
April	3.73	93	3.64	20	3.43	101
May	3.83	207	3.67	24	3.41	100
June	3.79	206	3.63	24	3.42	97
July	3.79	204	3.64	25	3.43	94
August	3.81	204	3.52	20	3.39	95
September	3.70	91	3.53	18	3.45	94
October	3.95	203	3.79	23	3.54	93
November	4.00	204	3.96	24	3.58	95
December	4.03	204	3.73	19	3.63	94
For the Year	3.87	187	3.72	24	3.49	97

Table A-3 (Continued)

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION

2009

Protein

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	3.11	287	3.14	102	3.20	37	3.17	8
February	3.08	280	3.10	100	3.14	36	3.19	7
March	3.08	280	3.10	100	3.18	34	3.18	7
April	3.04	281	3.05	101	3.10	33	3.15	7
May	3.04	280	3.03	102	3.06	37	3.14	7
June	3.00	279	2.98	102	2.99	38	3.11	7
July	3.00	271	2.96	101	2.96	37	3.13	6
August	3.01	271	2.97	101	3.01	33	3.09	6
September	3.09	267	3.10	54	3.12	30	3.16	6
October	3.17	266	3.19	101	3.21	37	3.28	6
November	3.19	265	3.22	102	3.24	36	3.25	6
December	3.16	264	3.21	101	3.25	32	3.24	4
For the Year	3.08	274	3.09	97	3.12	35	3.17	6

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	3.21	211	3.22	35	N/A	N/A
February	3.20	208	3.20	35	N/A	N/A
March	3.19	209	3.07	21	N/A	N/A
April	3.12	93	3.03	20	N/A	N/A
May	3.18	207	3.17	24	N/A	N/A
June	3.12	206	3.11	24	N/A	N/A
July	3.12	204	3.09	25	N/A	N/A
August	3.13	204	2.94	20	N/A	N/A
September	3.12	91	3.02	18	N/A	N/A
October	3.26	203	3.32	23	N/A	N/A
November	3.28	204	3.36	24	N/A	N/A
December	3.27	204	3.15	19	N/A	N/A
For the Year	3.19	187	3.17	24	N/A	N/A

Table A-3 (Continued)

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION

2009

Other Solids

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	5.68	287	5.67	102	5.65	37	5.67	8
February	5.67	280	5.67	100	5.65	36	5.67	7
March	5.70	280	5.69	100	5.69	34	5.68	7
April	5.68	281	5.67	101	5.67	33	5.67	7
May	5.69	280	5.69	102	5.68	37	5.67	7
June	5.69	279	5.70	102	5.70	38	5.67	7
July	5.70	271	5.71	101	5.70	37	5.66	6
August	5.68	271	5.68	101	5.70	33	5.64	6
September	5.69	267	5.68	54	5.70	30	5.62	6
October	5.69	266	5.69	101	5.68	37	5.61	6
November	5.70	265	5.69	102	5.69	36	5.63	6
December	5.72	264	5.72	101	5.71	32	5.69	4
For the Year	5.69	274	5.69	97	5.68	35	5.66	6

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	5.69	211	5.67	35	N/A	N/A
February	5.71	208	5.67	35	N/A	N/A
March	5.72	209	5.69	21	N/A	N/A
April	5.69	93	5.68	20	N/A	N/A
May	5.73	207	5.71	24	N/A	N/A
June	5.72	206	5.71	24	N/A	N/A
July	5.72	204	5.70	25	N/A	N/A
August	5.72	204	5.69	20	N/A	N/A
September	5.71	91	5.69	18	N/A	N/A
October	5.72	203	5.70	23	N/A	N/A
November	5.74	204	5.70	24	N/A	N/A
December	5.75	204	5.74	19	N/A	N/A
For the Year	5.72	187	5.69	24	N/A	N/A

* Number of producers included in monthly average component level.
N/A = not applicable, Arizona Order, Area 7, did not use protein and other solids.

Table A-4

LINEAR RELATIONSHIPS BETWEEN VARIOUS MILK COMPONENTS

2009

Butterfat Levels as a Predictor of Protein
Protein = c + b (Butterfat)

Pacific Northwest Order

	c Constant	b Butterfat Coefficient	Standard Error of b	R-Squared (Adjusted)	Standard Error	Number of Comparisons
January	1.56482	0.41081	0.01254	0.61224	0.13263	680
February	1.54005	0.41416	0.01275	0.61301	0.13087	666
March	1.61348	0.39195	0.01319	0.57585	0.13283	651
April	1.62028	0.38668	0.01493	0.55624	0.12403	535
May	1.50907	0.42847	0.01298	0.62412	0.12715	657
June	1.47793	0.42659	0.01245	0.64159	0.11758	656
July	1.36480	0.45308	0.01245	0.67306	0.11403	644
August	1.43027	0.43701	0.01210	0.67285	0.11496	635
September	1.63087	0.39456	0.01405	0.62863	0.11358	466
October	1.64285	0.40800	0.01087	0.68911	0.11743	636
November	1.61866	0.41147	0.01120	0.67963	0.12435	637
December	1.59490	0.41111	0.01127	0.68084	0.12639	624
For the Year	1.48591	0.43102	0.00360	0.65692	0.12812	7,487

Table A-5

LINEAR RELATIONSHIPS BETWEEN VARIOUS MILK COMPONENTS

2009

Butterfat Levels as a Predictor of Other Solids
Other Solids = c + b (Butterfat)

Pacific Northwest Order

	c Constant	b Butterfat Coefficient	Standard Error of b	R-Squared (Adjusted)	Standard Error	Number of Comparisons
January	6.02981	-0.09558	0.00761	0.18736	0.08053	680
February	5.97070	-0.08116	0.00821	0.12703	0.08422	666
March	5.96871	-0.07420	0.00773	0.12291	0.07789	651
April	6.01546	-0.09424	0.00827	0.19459	0.06864	535
May	5.84812	-0.04391	0.00775	0.04529	0.07591	657
June	5.85748	-0.04766	0.00790	0.05131	0.07456	656
July	5.89301	-0.05804	0.00847	0.06670	0.07759	644
August	5.86307	-0.05353	0.00926	0.04861	0.08803	635
September	6.14735	-0.13085	0.00987	0.27336	0.07973	466
October	6.01155	-0.08876	0.00802	0.16067	0.08661	636
November	6.02914	-0.08817	0.00774	0.16851	0.08591	637
December	6.11224	-0.10396	0.00795	0.21424	0.08917	624
For the Year	5.95487	-0.07402	0.00233	0.11837	0.08305	7,487

Table A-6

MONTHLY PRODUCER COMPONENT PRICES

2009

Pacific Northwest Order

Month	Butterfat Price $ / pound	Protein Price $ / pound	Other Solids Price $ / pound	Producer Price Differential 1/ $ / hundredweight
January	1.1084	2.3638	(0.0304)	1.34
February	1.0941	1.9139	(0.0437)	1.00
March	1.1594	2.1973	(0.0339)	0.04
April	1.2049	2.2009	(0.0043)	0.23
May	1.2648	1.7454	0.0336	0.99
June	1.2544	1.7283	0.0723	0.73
July	1.2438	1.6970	0.0949	0.77
August	1.2491	2.1009	0.0962	0.05
September	1.2226	2.4243	0.1018	(0.22)
October	1.2752	2.5584	0.1228	0.04
November	1.4656	2.6991	0.1524	(0.16)
December	1.5433	2.8751	0.1727	0.07
Simple Average	1.2571	2.2087	0.0612	0.41

1/ The producer price differentials for the Pacific Northwest Order are subject to applicable location adjustments. The effects of the location adjustments are not dealt with in this study.

Arizona Order

Month	Skim Price 2/ $ / hundredweight	Butterfat Price 2/ $ / pound
January	8.73	1.1618
February	7.08	1.1031
March	6.83	1.1532
April	7.11	1.2007
May	6.98	1.2598
June	6.78	1.2601
July	6.95	1.2561
August	7.44	1.2489
September	8.32	1.2400
October	9.27	1.2667
November	9.71	1.4327
December	10.52	1.5280
Simple Average	7.98	1.2593

2/ The producer prices for the Arizona Order are subject to applicable location adjustments. The effects of the location adjustments are not dealt with in this study.

Table A-7

AGGREGATED COMPONENT TESTS BY SIZE-RANGE OF PRODUCER MILK DELIVERIES

2009

(See Figure A-7)

Pacific Northwest Order

Size Range				
Equal to or more than	Less than	Butterfat	Protein	Other Solids
- pounds -	- pounds -	- % -	- % -	- % -
	50,000	4.11	3.22	5.55
50,000	100,000	4.06	3.20	5.60
100,000	200,000	4.07	3.22	5.64
200,000	300,000	3.93	3.16	5.66
300,000	400,000	3.94	3.18	5.68
400,000	500,000	3.90	3.19	5.68
500,000	600,000	3.88	3.18	5.70
600,000	700,000	3.75	3.11	5.69
700,000	1,000,000	3.73	3.11	5.71
1,000,000	2,000,000	3.66	3.09	5.71
2,000,000	3,000,000	3.68	3.09	5.70
3,000,000	4,000,000	3.74	3.12	5.69
4,000,000	6,000,000	3.60	3.05	5.69
6,000,000		3.64	3.12	5.69
Weighted Average		3.71	3.11	5.69

Table A-7 (Continued)

AGGREGATED COMPONENT TESTS BY SIZE-RANGE OF PRODUCER MILK DELIVERIES

2009

(See Figure A-7)

Arizona Order

Size Range		
Equal to or more than	Less than	Butterfat
- pounds -	- pounds -	- % -
	100,000	3.65
100,000	200,000	3.47
200,000	300,000	3.52
300,000	400,000	3.84
400,000	500,000	3.89
500,000	600,000	3.47
600,000	700,000	3.47
700,000	1,000,000	3.61
1,000,000	2,000,000	3.59
2,000,000	3,000,000	3.56
3,000,000	4,000,000	3.55
4,000,000	5,000,000	3.43
5,000,000	6,000,000	3.41
6,000,000	7,000,000	3.50
7,000,000		3.46
Weighted Average		3.49

Table A-8

AGGREGATED COMPONENT VALUES BY SIZE-RANGE OF PRODUCER MILK DELIVERIES

2009

(See Figure A-8)

Pacific Northwest Order

Size Range								
Equal to or more than	Less than	Aggregated Component Values 1/	Producer Milk	Percent of Producer Milk	Producers	Percent of Producers	Weighted Average Value
- pounds -	- pounds -	- dollars -	- pounds -	- % -	- % -	- % -	- dollars/cwt. -
	50,000	$ 1,570,197.19	11,944,870	0.16%	386	5.16%	13.15
50,000	100,000	5,851,256.04	45,441,275	0.62%	605	8.08%	12.88
100,000	200,000	22,569,395.59	173,972,734	2.36%	1,183	15.80%	12.97
200,000	300,000	27,679,940.18	218,189,184	2.95%	879	11.74%	12.69
300,000	400,000	22,432,812.00	175,470,908	2.38%	507	6.77%	12.78
400,000	500,000	23,887,957.66	186,246,114	2.52%	409	5.46%	12.83
500,000	600,000	31,026,278.02	244,238,846	3.31%	446	5.96%	12.70
600,000	700,000	24,887,609.11	202,431,416	2.74%	313	4.18%	12.29
700,000	1,000,000	71,514,259.18	581,035,440	7.87%	692	9.24%	12.31
1,000,000	2,000,000	203,347,883.10	1,667,649,819	22.58%	1,165	15.56%	12.19
2,000,000	3,000,000	119,778,143.04	982,755,036	13.31%	408	5.45%	12.19
3,000,000	4,000,000	73,878,002.62	591,672,411	8.01%	175	2.34%	12.49
4,000,000	6,000,000	87,397,517.94	721,708,720	9.77%	149	1.99%	12.11
6,000,000		192,152,503.91	1,581,789,756	21.42%	170	2.27%	12.15
Total/Weighted Average		$ 907,973,755.56	7,384,546,529	100.00%	7,487	100.00%	12.30

Table A-8 (Continued)

AGGREGATED COMPONENT VALUES BY SIZE-RANGE OF PRODUCER MILK DELIVERIES

2009

(See Figure A-8)

Arizona Order

Size Range							
Equal to or more than	Less than	Aggregated Component Values 1/	Producer Milk	Percent of Producer Milk	Producers	Percent of Producers	Weighted Average Value
- pounds -	- pounds -	- dollars -	- pounds -	- % -	- % -	- % -	- dollars/cwt. -
	100,000	$ 168,936.40	1,347,784	0.03%	22	1.89%	12.53
100,000	200,000	328,609.83	2,763,326	0.07%	18	1.55%	11.89
200,000	300,000	243,504.04	2,016,454	0.05%	8	0.69%	12.08
300,000	400,000	589,697.42	4,557,700	0.11%	13	1.12%	12.94
400,000	500,000	1,888,140.00	15,199,441	0.38%	34	2.93%	12.42
500,000	600,000	1,310,212.54	10,720,371	0.27%	20	1.72%	12.22
600,000	700,000	1,649,045.96	14,336,821	0.35%	22	1.89%	11.50
700,000	1,000,000	7,944,382.27	64,148,665	1.59%	74	6.37%	12.38
1,000,000	2,000,000	49,456,037.59	401,983,733	9.94%	265	22.81%	12.30
2,000,000	3,000,000	49,341,648.23	415,057,712	10.27%	168	14.46%	11.89
3,000,000	4,000,000	62,786,399.14	504,064,960	12.47%	145	12.48%	12.46
4,000,000	5,000,000	55,199,218.46	466,621,285	11.54%	103	8.86%	11.83
5,000,000	6,000,000	64,693,073.00	554,973,293	13.73%	102	8.78%	11.66
6,000,000	7,000,000	41,824,309.83	337,739,735	8.36%	53	4.56%	12.38
7,000,000		150,021,720.70	1,246,795,310	30.84%	115	9.90%	12.03
Total/Weighted Average		$ 487,444,935.43	4,042,326,590	100.00%	1,162	100.00%	12.06

1/ Based on Federal order minimum prices. Producer prices for the two orders are subject to location adjustments. The effects of the location adjustments are not dealt with in this study.

Figure A-1
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE BUTTERFAT LEVELS
2009
Pacific Northwest Order

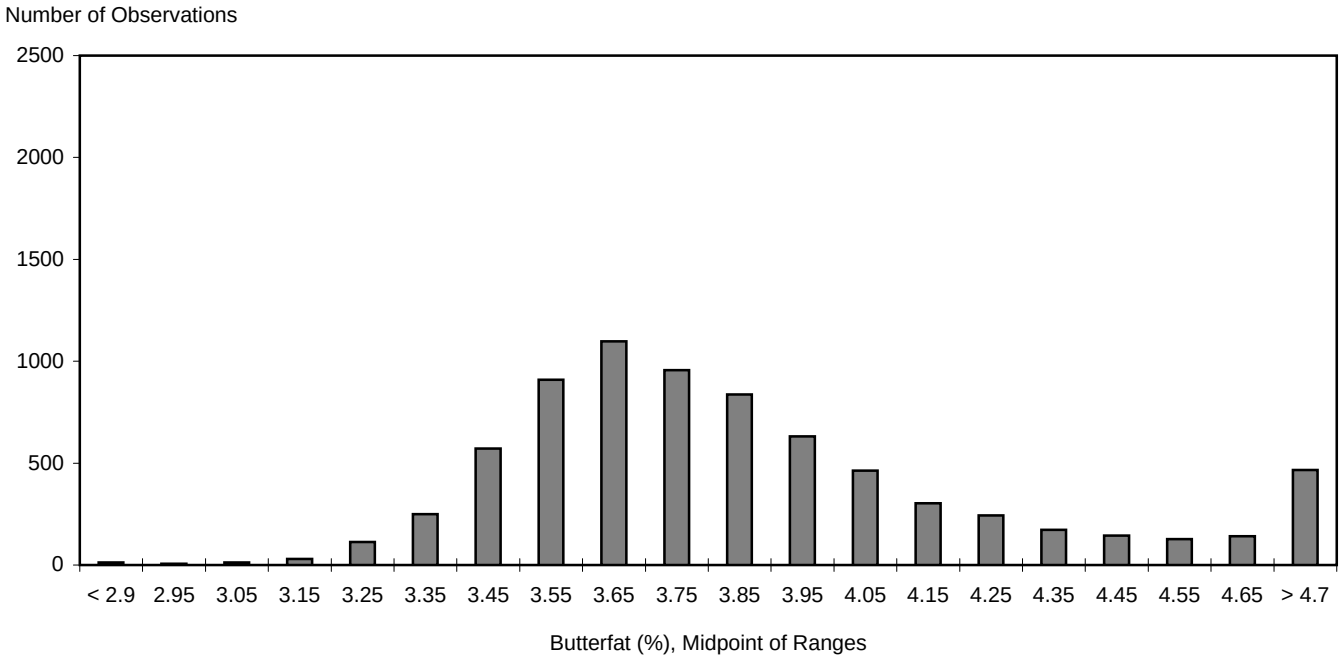


Figure A-2
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE PROTEIN LEVELS
2009
Pacific Northwest Order

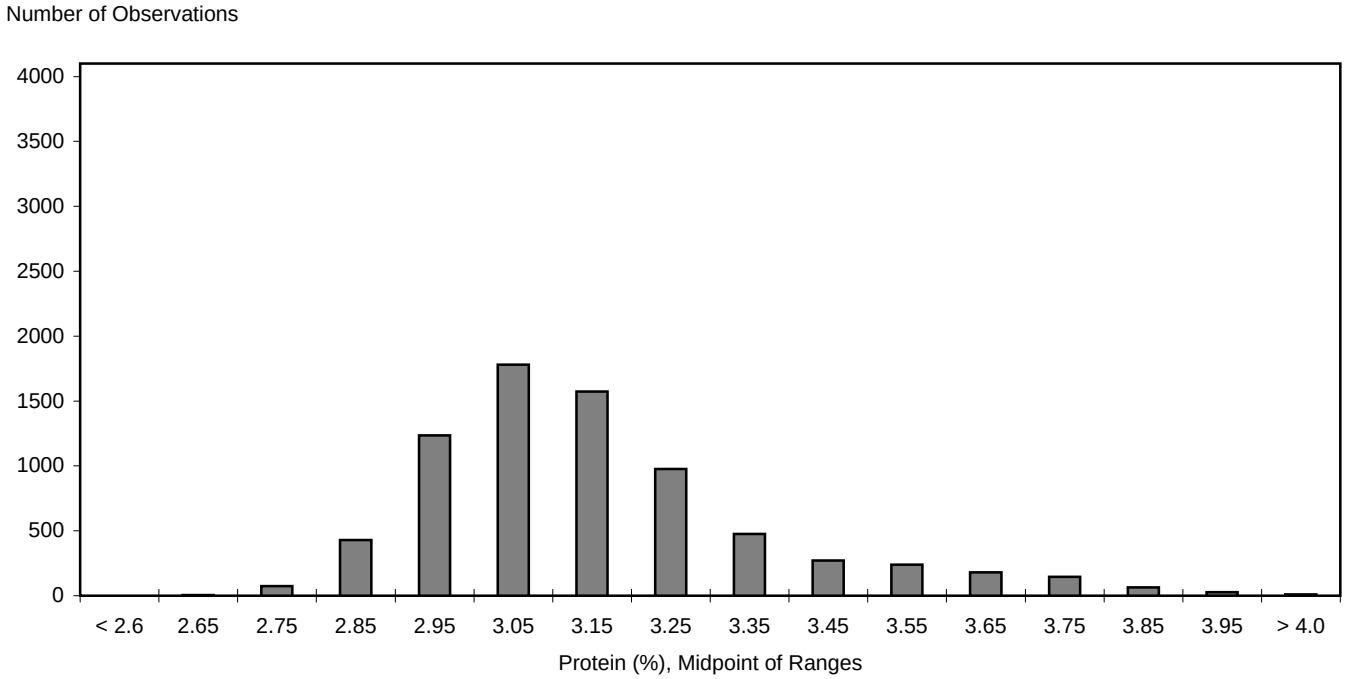


Figure A-3
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE
OTHER SOLIDS LEVELS
2009
Pacific Northwest Order

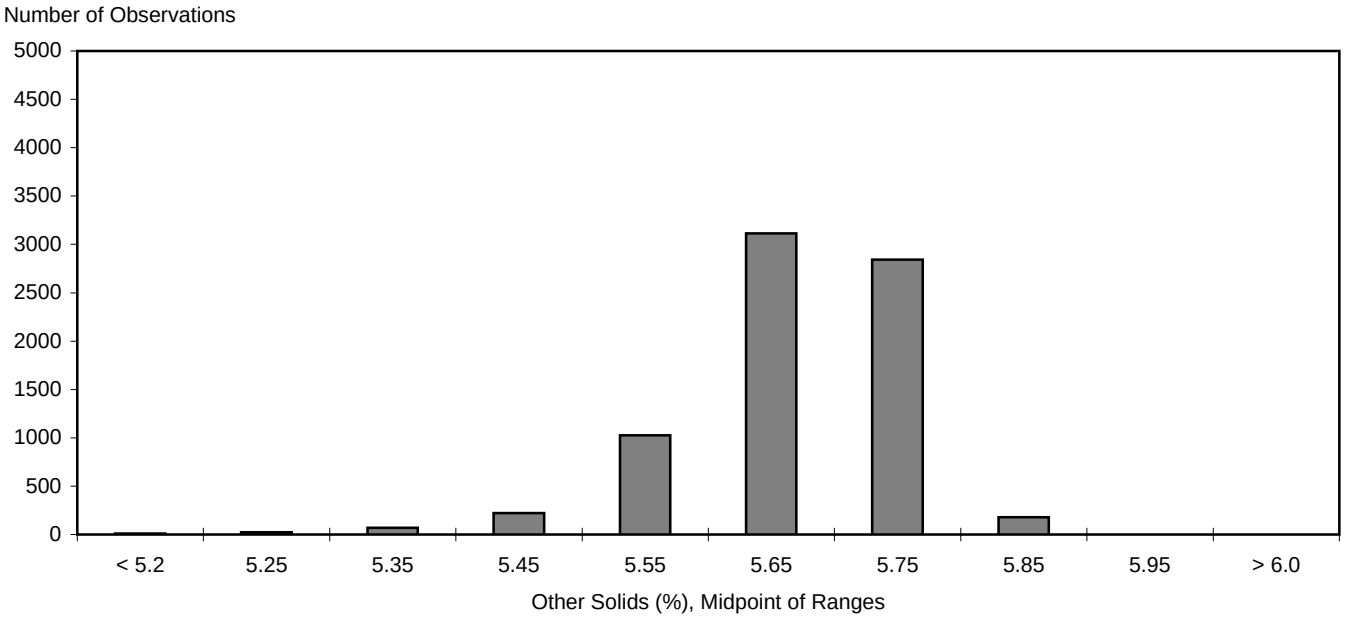


Figure A-4
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE BUTTERFAT LEVELS
2009
Arizona Order

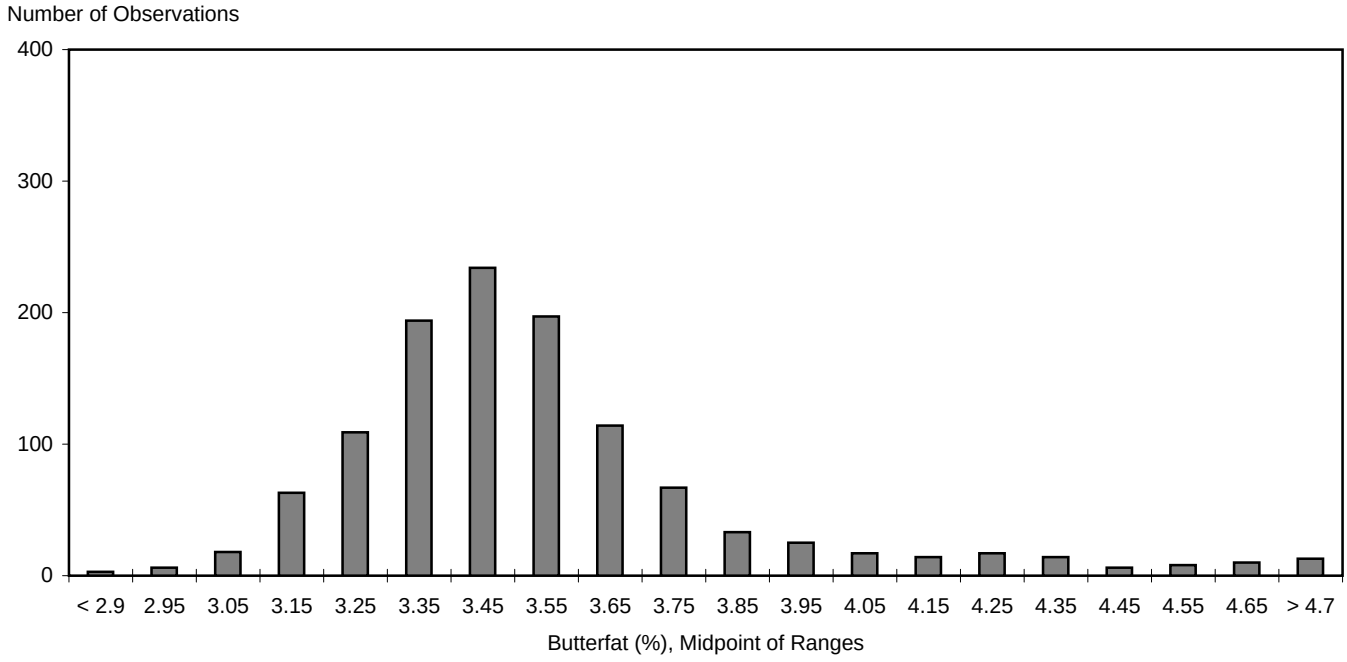
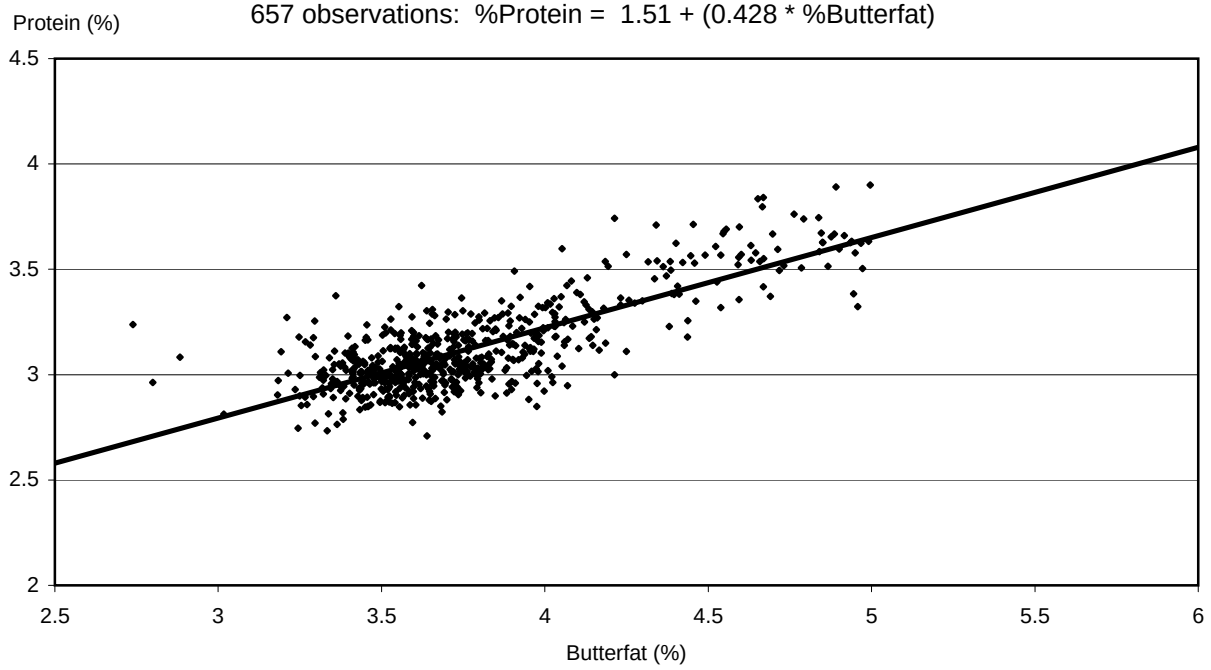


Figure A-5
SCATTER PLOT OF PROTEIN AND BUTTERFAT
MAY AND NOVEMBER 2009
Pacific Northwest Order

May 2009

657 observations: %Protein = 1.51 + (0.428 * %Butterfat)



November 2009

637 observations: %Protein = 1.62 + (0.411 * %Butterfat)

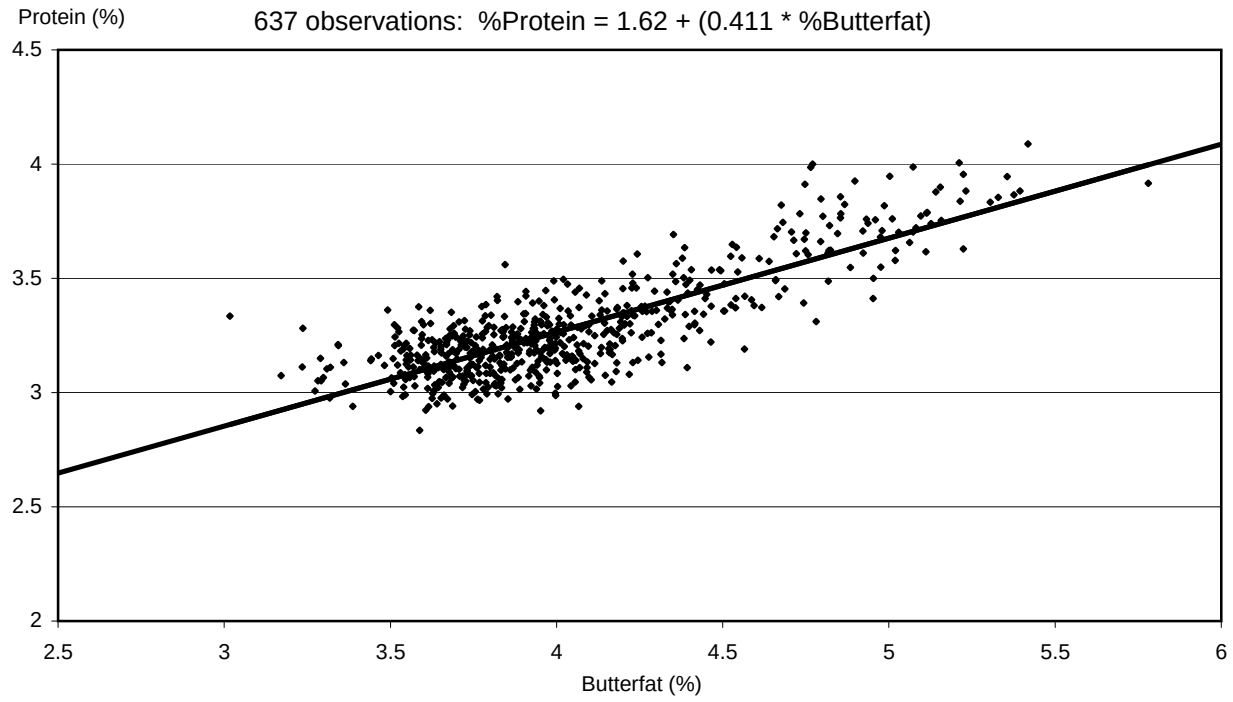
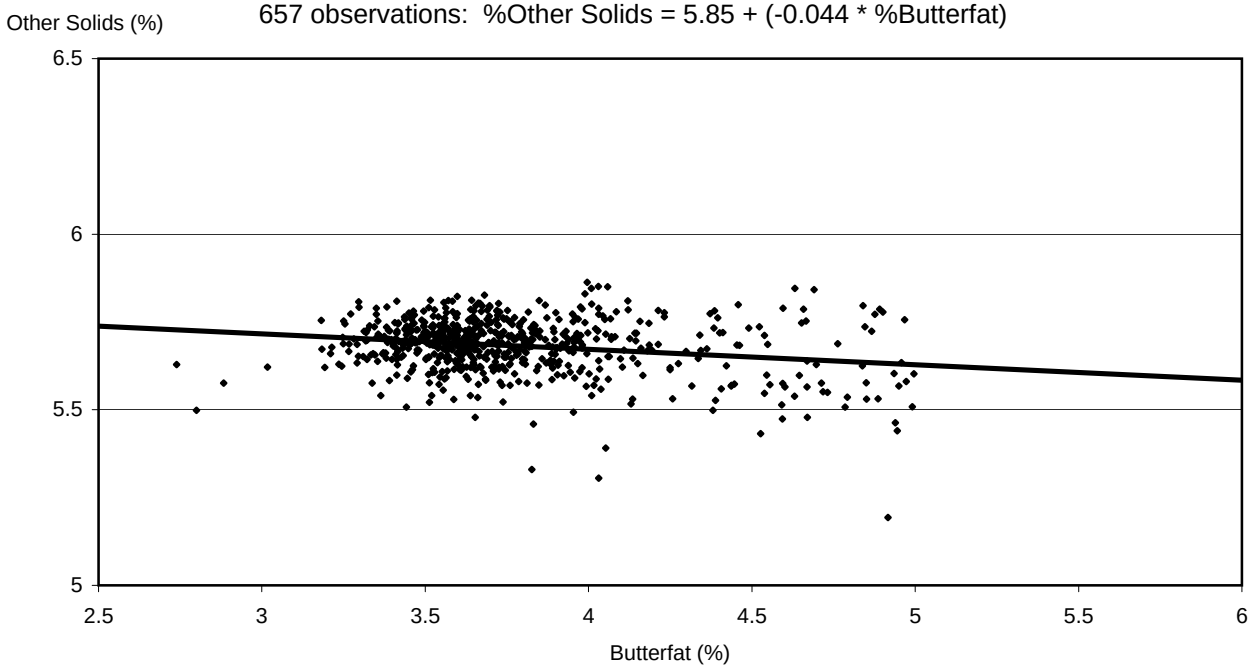


Figure A-6
SCATTER PLOT OF OTHER SOLIDS AND BUTTERFAT
MAY AND NOVEMBER 2009
Pacific Northwest Order

May 2009



November 2009

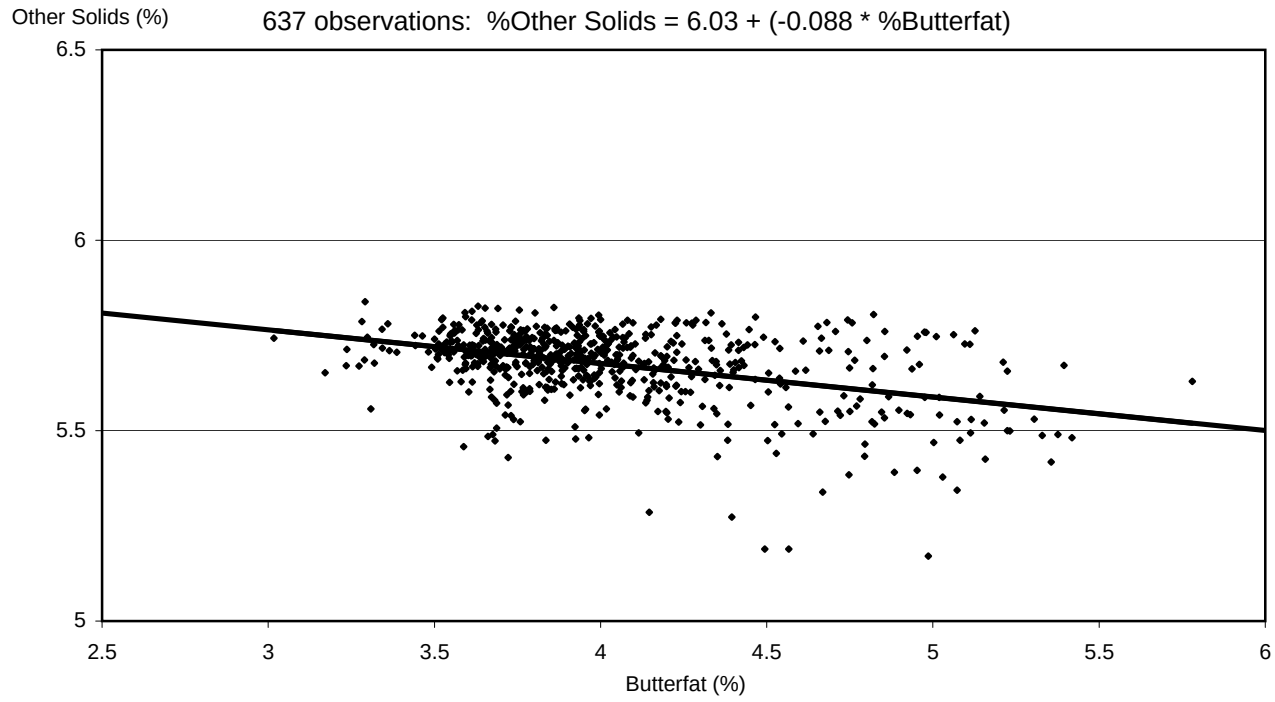
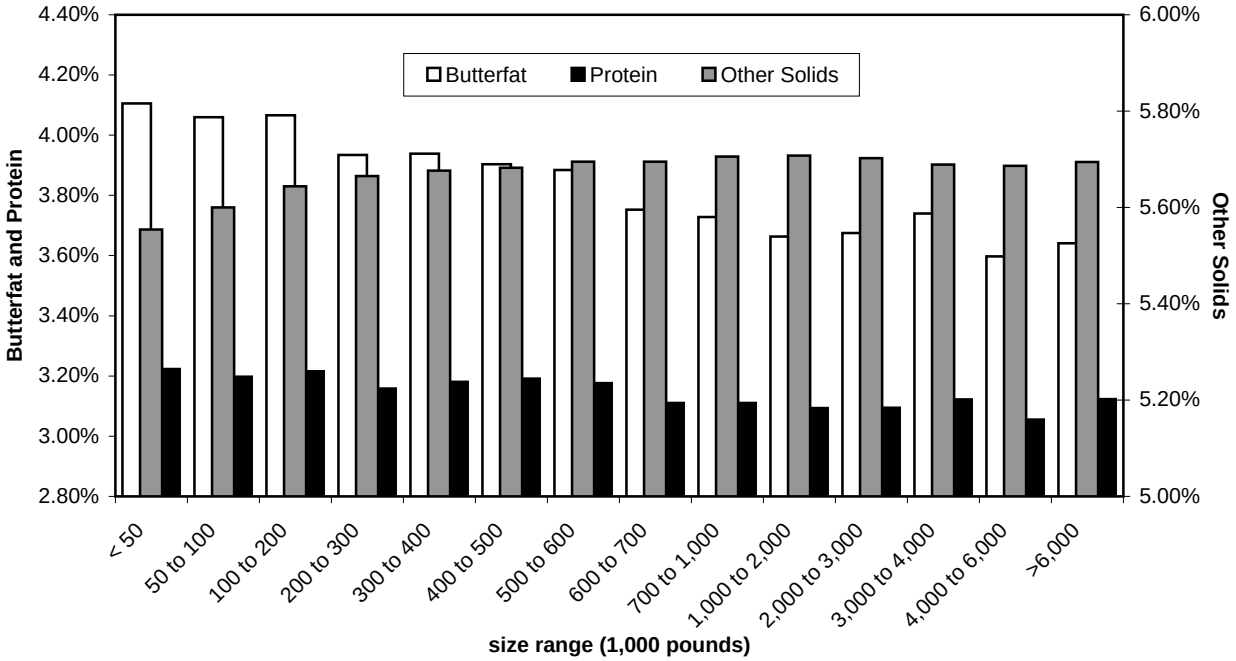


Figure A-7
WEIGHTED AVERAGE COMPONENT LEVELS
BY SIZE-RANGE OF PRODUCER MILK DELIVERIES
2009

Pacific Northwest Order



Arizona Order

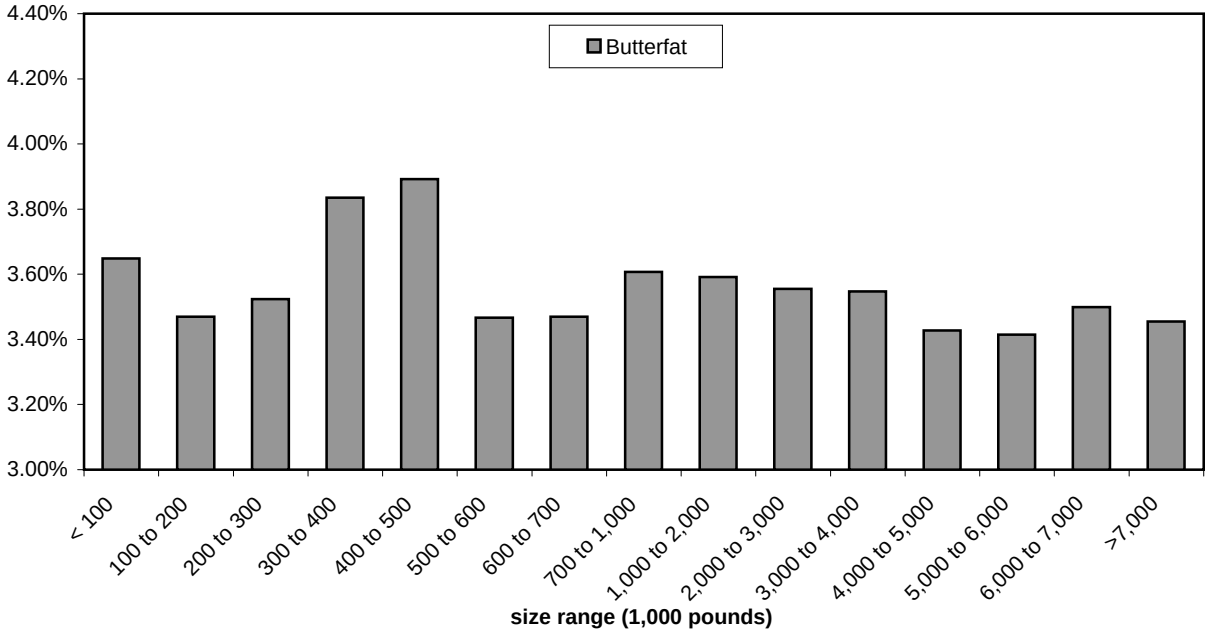
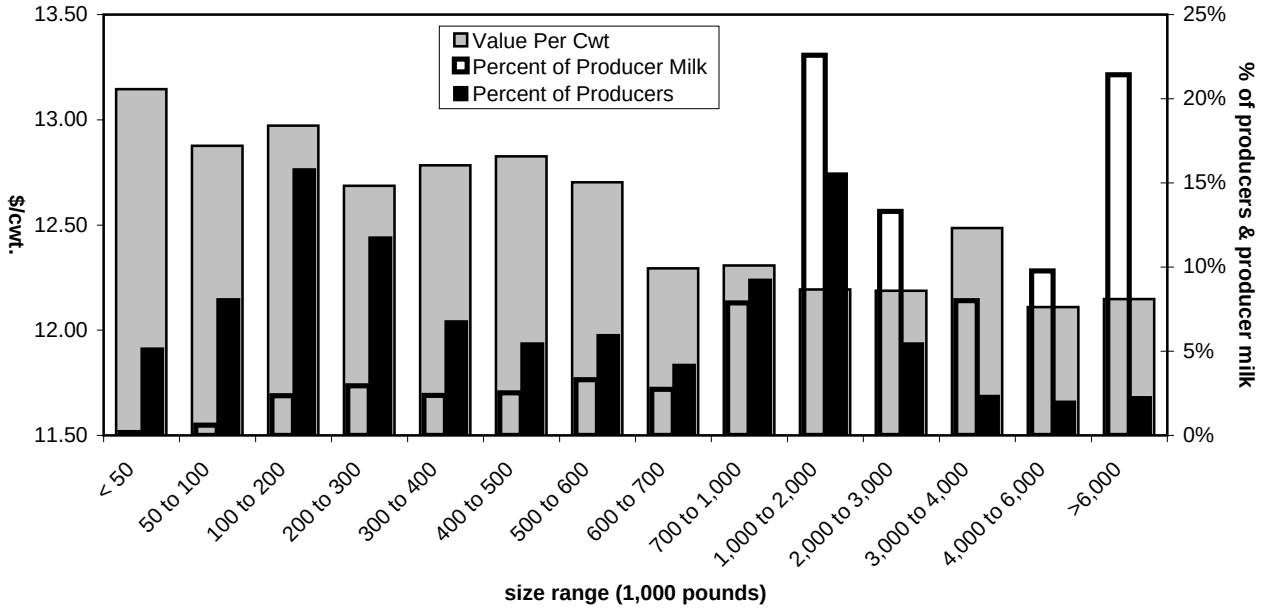
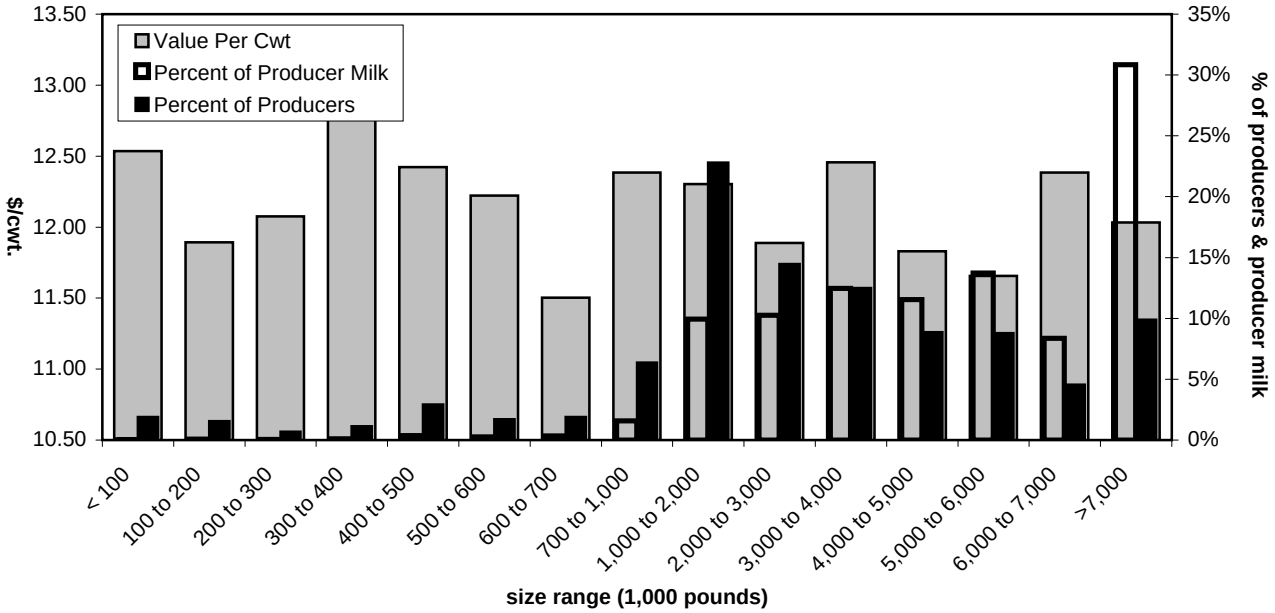


Figure A-8
WEIGHTED AVERAGE VALUES AND PERCENT OF PRODUCERS & PRODUCER MILK
BY SIZE-RANGE OF PRODUCER MILK DELIVERIES
2009

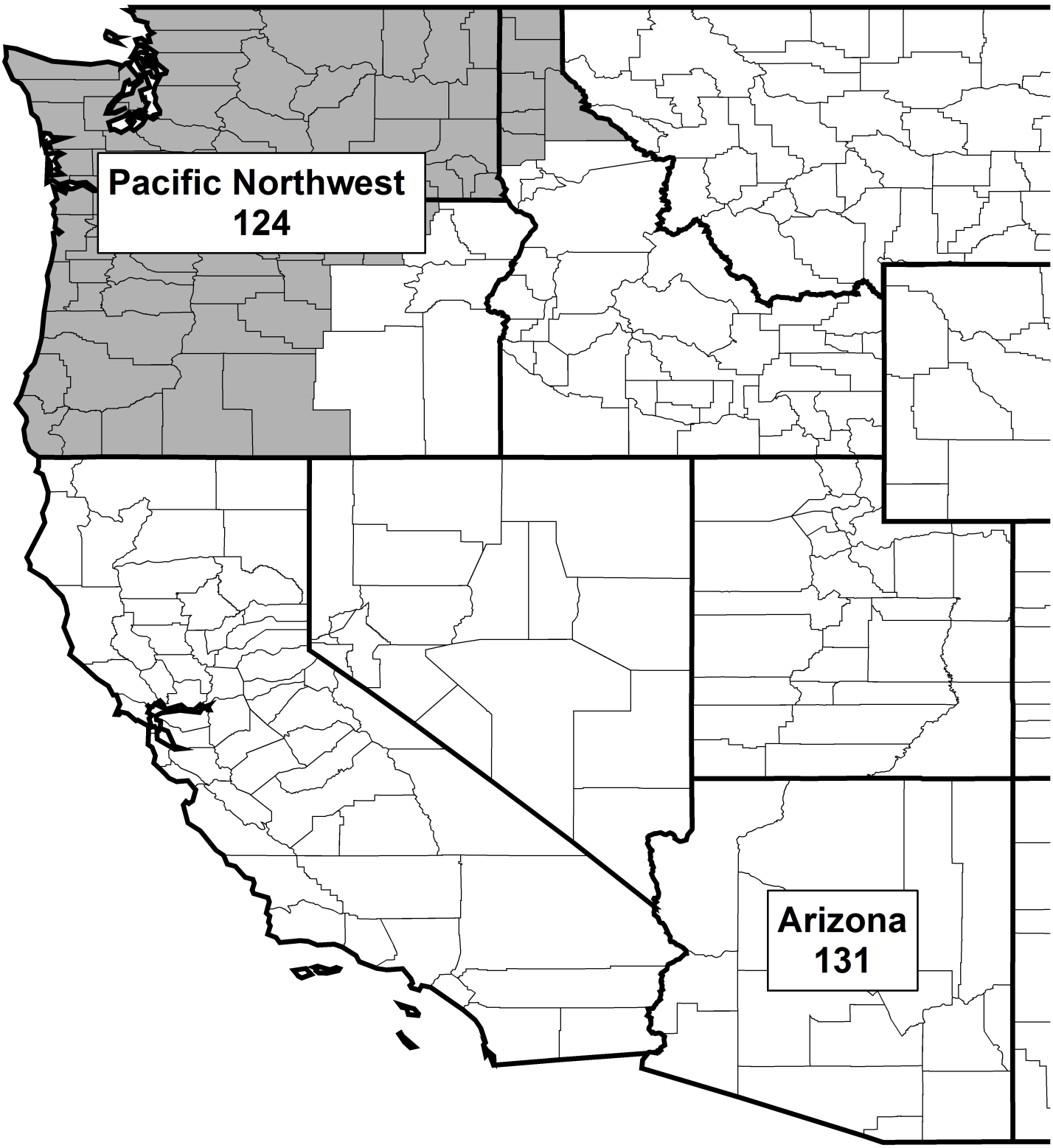
Pacific Northwest Order



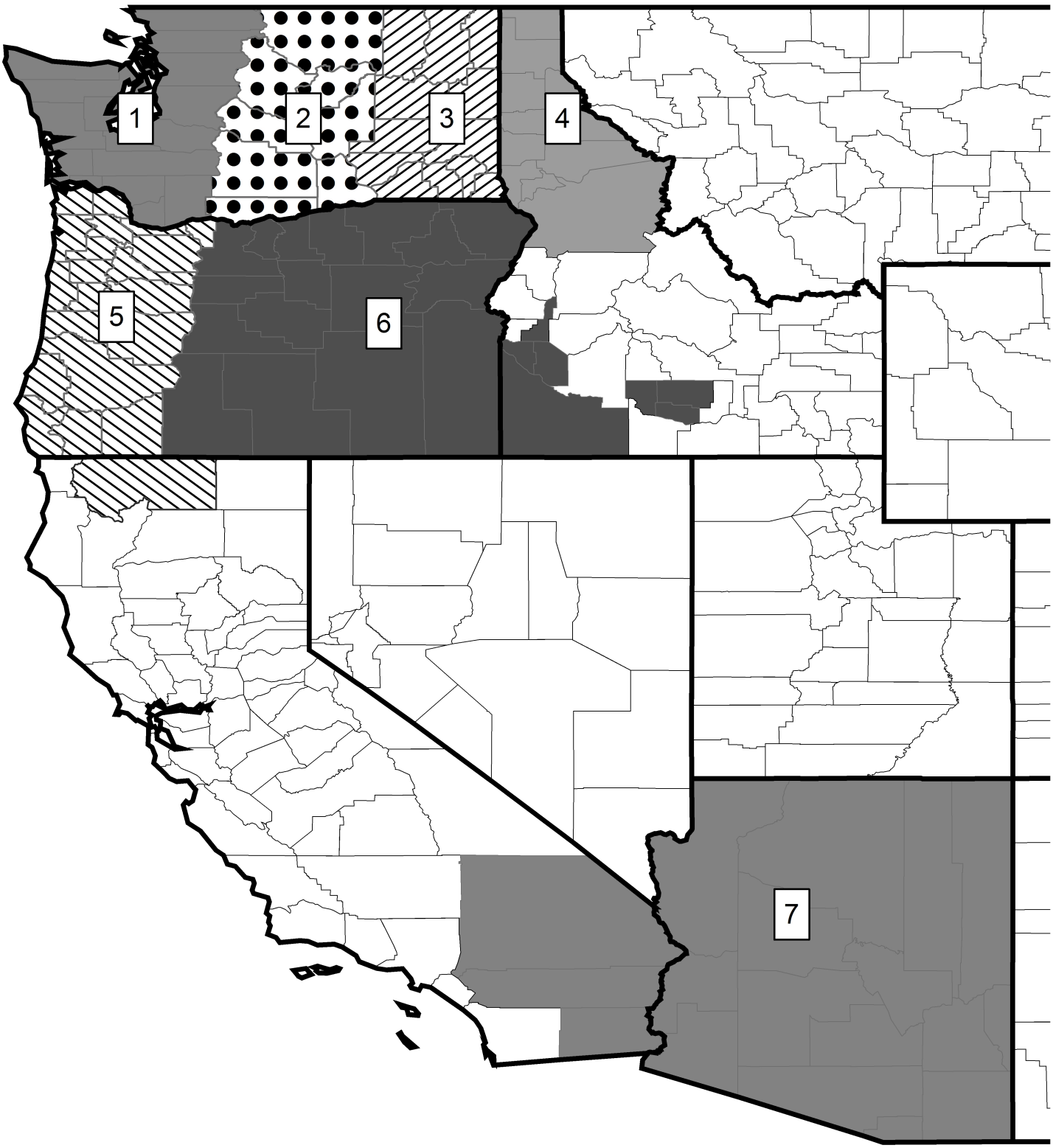
Arizona Order



MAP A-1
Marketing Areas of the Pacific Northwest (FO 124)
and Arizona (FO 131) Orders



MAP A-2
Geographic Regions Encompassing The Pacific Northwest and Arizona Order Milk Sheds, 2009



* Note: Region 7 also includes Bailey County, Texas. It was not included on this map due to space limitations.