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

PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS

2008

Staff Paper 09-02

Lori Espe

October 2009

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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 2008 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 2008, a monthly average total of 709 producers were pooled on the Pacific Northwest and Arizona Orders. During 2008, these producers delivered 11.0 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 2008 average component levels for the Pacific Northwest Order were 3.67% butterfat, 3.09% true protein, and 5.70% other solids. The 2008 average butterfat level for the Arizona Order was 3.56%.
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 2008 for protein is PRO% = 1.488 + 0.430 * 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 (R-squared of less than 0.1). The monthly regressions show a negative relationship; other solids levels appear to be independent of butterfat levels.

TABLE OF CONTENTS

APPENDIX Page Number

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

PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS

2008

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 2008. 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 2008, 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 2008 was valued using Federal order minimum producer prices for the respective orders.

For 2008, a monthly average total of 709 producers were pooled on the Pacific Northwest and Arizona Orders. During 2008, these producers delivered 11.0 billion pounds to the two markets.

Beginning January 2000, true protein was used as a basis for pricing milk under the Pacific Northwest Order. Prior to January 2000, crude (Total Nitrogen) protein was used. True protein does not include non-protein nitrogen which is included in crude protein. Due to this change, references to protein levels prior to January 2000 are not directly comparable to protein levels after January 2000 without taking into account the effects of the change in testing for protein. 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 2008, 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,

[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.

Pacific Ocean, and Columbia River provide general geographic and climate demarcations that may impact how dairy operations are managed.

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 2008, and handlers were not obligated under the order to report information on protein and other solids levels. Up until February 1997, the Pacific Northwest Order did not require handlers to report protein and other solids. Under the previous pricing system, butterfat and nonfat solids were the components used in determining minimum order values. Any reference to 1997 annual averages for protein and other solids for the Pacific Northwest Order does not include data for January 1997.

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), 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 many days with average temperatures much higher than the other regions studied.

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

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

III. SEASONAL VARIATION IN MILK COMPONENT LEVELS

In 2008, producers associated with the Pacific Northwest Order delivered 6.80 billion pounds. For 2008, producer milk tested, on average, 3.67% butterfat, 3.09% protein, and 5.70% 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-2008 were the highest in January at 3.81% and lowest in June and July at 3.56%.

The seasonal cycle of protein levels is similar to butterfat but with a lesser degree of variation. Protein levels in 2008 were highest in November and December at 3.18% and lowest in July at 2.98%. 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 5.73% in January, a low of 5.67% in March, October, and November, and showed very little seasonality.

Table 1
Monthly Component Levels
Pacific Northwest Order
2008

Month	Butterfat	Protein	Other Solids
	- percent -	- percent -	- percent -
January	3.81	3.13	5.73
February	3.74	3.10	5.69
March *	3.71	3.11	5.67
April	3.70	3.10	5.71
May *	3.59	3.04	5.72
June *	3.56	3.01	5.71
July	3.56	2.98	5.72
August	3.58	3.03	5.72
September	3.63	3.09	5.70
October *	3.70	3.16	5.67
November	3.76	3.18	5.67
December *	3.78	3.18	5.69
Weighted Average	3.67	3.09	5.70

* Eligible milk not pooled.

Table 2 Monthly Component Levels Arizona Order 2008	
Month	Butterfat - percent -
January	3.70
February	3.65
March	3.55
April	3.50
May	3.48
June	3.51
July	3.50
August	3.51
September	3.53
October	3.55
November	3.60
December	3.61
Weighted Average	3.56

In 2008, producers associated with the Arizona Order delivered 4.2 billion pounds. For 2008, producer milk tested, on average, 3.56% 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 2008 were highest in January at 3.70% and lowest in May at 3.48%.

For 2008, 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 2008, for the Pacific Northwest Order, producers' individual monthly average butterfat tests ranged from 2.60% to 5.65%; protein tests ranged from 2.58% to 4.28%, and other solids levels ranged from 4.86% to 5.99%. (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 3.45% to 4.23%. Similarly, most protein tests ranged from 2.93% to 3.35%, 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 2008, Arizona Order producers' butterfat tests ranged from 2.87% to 5.07%. (See Table 4.) Based on the definition of a standard deviation, most producers had butterfat tests ranging from 3.26% to 3.92%. (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
2008

	Butterfat	Protein	Other Solids
	%	%	%
Weighted Average	3.67	3.09	5.70
Mean	3.84	3.14	5.67
Median	3.75	3.10	5.69
Standard Deviation	0.39	0.21	0.09
Minimum	2.60	2.58	4.86
Maximum	5.65	4.28	5.99

Table 4
Component Levels: Weighted Average, Mean, Median, Standard Deviation, Minimum, and Maximum
Arizona Order
2008

	Butterfat
	%
Weighted Average	3.56
Mean	3.59
Median	3.53
Standard Deviation	0.33
Minimum	2.87
Maximum	5.07

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. Table 5, below, provides 2008 milk production, average number of producers, and component tests for each region. In 2008, the region with the most milk

associated with the Pacific Northwest Order was Region 1 followed by Regions 2, 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 2008

Region 1 (Western Washington)		**Region 2 (Central Washington)**	
Milk Production	2,233,272,404	Milk Production	2,217,699,073
Average Number of Producers	294	Average Number of Producers	87
Average Pounds Per Producer	7,596,165	Average Pounds Per Producer	25,490,794
Butterfat Test	3.67%	Butterfat Test	3.62%
Protein Test	3.07%	Protein Test	3.07%
Other Solids Test	5.69%	Other Solids Test	5.70%
Region 3 (Eastern Washington)		**Region 4 (Northern Idaho)**	
Milk Production	480,849,593	Milk Production	11,797,410
Average Number of Producers	36	Average Number of Producers	8
Average Pounds Per Producer	13,356,933	Average Pounds Per Producer	1,474,676
Butterfat Test	3.66%	Butterfat Test	3.78%
Protein Test	3.11%	Protein Test	3.12%
Other Solids Test	5.69%	Other Solids Test	5.70%
Region 5 (Western Oregon, Northern California)		**Region 6 (Central/Eastern Oregon, Southern Idaho)**	
Milk Production	1,110,600,899	Milk Production	748,078,102
Average Number of Producers	169	Average Number of Producers	17
Average Pounds Per Producer	6,571,603	Average Pounds Per Producer	44,004,594
Butterfat Test	3.85%	Butterfat Test	3.60%
Protein Test	3.17%	Protein Test	3.10%
Other Solids Test	5.73%	Other Solids Test	5.69%
Region 7 (Arizona/Southern California/Texas)			
Milk Production	4,156,572,395		
Average Number of Producers	99		
Average Pounds Per Producer	41,985,580		
Butterfat Test	3.56%		
Protein Test	n/a		
Other Solids Test	n/a		

n/a = not applicable

Region 7 represents the Arizona Order. In general, comparing all the regions, Region 7 had the most milk pooled in 2008, with 4.2 billion pounds, while Region 1 had the most producers (294 producers on average). Average milk production per producer was the highest in Region 6 with an average of 44.0 million pounds per producer for the year. The highest butterfat levels in 2008 were in Region 5 with annual tests of 3.85%, while Region 7 had the lowest annual butterfat test of 3.56%. Protein levels in Region 5 (3.17%) and other solids levels in Region 5 (5.73%) 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 2008, 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 0.10% higher than Region 1. Other solids levels by region varied only 0.04% between the high and low for the year 2008; ranging from 5.69% in Regions 1, 3, and 6 to 5.73% in Region 5.

Changes in producer numbers and milk marketed between November 2007 and November 2008 followed the national trend of increased milk production by fewer producers. Although November is a representative month, this comparison shows effects of handlers' pooling decisions between 2007 and 2008. On a regional basis, the historical shift of movement of milk production in Washington State from Western Washington to Central Washington steadied, while production in Eastern Washington increased. Region 3, Eastern Washington, increased in milk production by 3.1 million pounds between November of 2007 and 2008, with a decrease of two producers. Region 1, Western Washington, decreased by 6.5 million pounds of milk and decreased by 20 producers. (See Table 6.) For Region 6, the area covering Central/Eastern Oregon and Southern Idaho, changes in producer numbers and producer milk are a result of handler pooling decisions and not indicative of changes in production in those areas. Producer milk in Arizona, Southern California, and Texas, grouped as Region 7, increased by 27.7 million pounds in 2008 and had an increase of eight producers. Region 5, Western Oregon, faces many of the same environmental issues and urban encroachment problems as Region 1, Western Washington; however, Region 5 was able to maintain production levels despite decreasing producer counts in 2008.

Table 6
Producer Milk and Producers by Region for November 2008 and 2007

	Producer Milk			Producers		
	November 2008	November 2007	Change	November 2008	November 2007	Change
Region 1	172,863,936	179,397,704	-6,533,768	286	306	-20
Region 2	219,260,931	222,588,558	-3,327,627	100	103	-3
Region 3	43,895,376	40,788,087	3,107,289	36	38	-2
Region 4	963,514	948,598	14,916	8	8	0
Region 5	106,333,470	105,171,153	1,162,317	216	220	-4
Region 6	71,618,892	8,044,812	63,574,080	21	11	10
Region 7	336,032,616	308,359,879	27,672,737	102	94	8
Total	950,968,735	865,298,791	85,669,944	769	780	-11

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 7,319 observations in 2008. 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 2008.

The butterfat and protein regression equations for the Pacific Northwest Order were calculated for 2000 through 2008. (See Table 7 below.) Over the 2000 - 2008 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 2008 compared to previous years.

Table 7
Pacific Northwest Order
Comparison of Regression Results: Butterfat Level as a Predictor of Protein Levels
2000 through 2008

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%	$R^2 = 0.660$

[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 2008 averaged $17.62 per hundredweight. The weighted average value of each component comprising the $17.62 per hundredweight was: $5.76 for butterfat; $11.95 for protein; $0.33 for other solids; and a producer price differential of negative $0.42.[5]

The value of producers' milk at test pooled on the Arizona Order in 2008 averaged $17.51 per hundredweight. The weighted average value of skim and butterfat portions of the $17.51 per hundredweight was: $5.56 for butterfat; and $11.95 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). 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 2008 Federal order prices, producers with less than 50,000 pounds of production were valued more per hundredweight, $18.88, than other producers. Producers with 4-6 million pounds of production averaged the lowest amount per hundredweight, at $17.32. 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 2008 were: 3.67% butterfat, 3.09% protein, and 5.70% other solids. Butterfat percentages peaked in January and reached a low in June and July. Protein percentages peaked in November and December and reached a low in July. 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:

$$\text{Protein} = 1.48833 + 0.4296 * \text{Butterfat} \qquad (R^2 = 0.6605)$$

In 2008, the Pacific Northwest Order's weighted average price received for milk was $17.62 per hundredweight, at test.

The annual average butterfat level for the Arizona Order in 2008 was 3.56%. Butterfat levels peaked in January and reached a low in May. In 2008, the Federal order weighted average price received for milk was $17.51 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

2008

Butterfat

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.81	3.98	0.40	3.88	3.18	5.40	674
February	3.74	3.91	0.38	3.82	3.05	5.16	678
March	3.71	3.84	0.36	3.75	3.06	5.08	528
April	3.70	3.88	0.39	3.79	2.81	5.13	685
May	3.59	3.71	0.34	3.63	2.60	5.00	531
June	3.56	3.68	0.33	3.58	2.75	5.01	525
July	3.56	3.71	0.35	3.62	2.92	4.99	677
August	3.58	3.75	0.36	3.66	2.96	5.09	669
September	3.63	3.83	0.39	3.74	3.10	5.29	664
October	3.70	3.87	0.40	3.77	2.84	5.65	509
November	3.76	3.94	0.41	3.84	2.90	5.48	667
December	3.78	3.94	0.40	3.84	3.09	5.45	512
For the Year	3.67	3.84	0.39	3.75	2.60	5.65	7,319

Protein

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.13	3.19	0.21	3.13	2.64	4.04	674
February	3.10	3.15	0.20	3.10	2.77	3.92	678
March	3.11	3.13	0.18	3.09	2.74	3.89	528
April	3.10	3.15	0.20	3.10	2.75	3.93	685
May	3.04	3.08	0.18	3.03	2.72	3.92	531
June	3.01	3.04	0.18	3.01	2.69	3.75	525
July	2.98	3.05	0.19	2.99	2.66	3.73	677
August	3.03	3.08	0.20	3.04	2.58	3.79	669
September	3.09	3.15	0.20	3.10	2.68	3.97	664
October	3.16	3.21	0.20	3.16	2.73	4.26	509
November	3.18	3.22	0.21	3.17	2.76	4.28	667
December	3.18	3.21	0.21	3.17	2.80	3.99	512
For the Year	3.09	3.14	0.21	3.10	2.58	4.28	7,319

Table A-1 (Continued)

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

2008

Other Solids

Month	Weighted Average	Mean	Standard Deviation	Median	Minimum	Maximum	Number of Observations
	- % -	- % -	- % -	- % -	- % -	- % -	
January	5.73	5.71	0.09	5.72	5.09	5.99	674
February	5.69	5.67	0.08	5.69	5.01	5.86	678
March	5.67	5.65	0.08	5.66	5.12	5.83	528
April	5.71	5.69	0.08	5.71	5.26	5.85	685
May	5.72	5.70	0.07	5.71	5.44	5.86	531
June	5.71	5.68	0.07	5.70	5.28	5.83	525
July	5.72	5.69	0.08	5.70	5.08	5.85	677
August	5.72	5.69	0.09	5.70	4.86	5.87	669
September	5.70	5.66	0.09	5.68	5.20	5.85	664
October	5.67	5.63	0.10	5.65	5.22	5.82	509
November	5.67	5.65	0.10	5.67	5.11	5.85	667
December	5.69	5.66	0.09	5.67	5.21	5.89	512
For the Year	5.70	5.67	0.09	5.69	4.86	5.99	7,319

Table A-2

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

2008

Butterfat

Month	Weighted Average	Mean	Standard Deviation	Median	Minimum	Maximum	Number of Observations
	- % -	- % -	- % -	- % -	- % -	- % -	
January	3.70	3.76	0.35	3.70	2.98	4.92	96
February	3.65	3.70	0.35	3.64	3.05	4.95	96
March	3.55	3.60	0.33	3.52	3.03	4.87	96
April	3.50	3.54	0.30	3.48	3.03	4.78	96
May	3.48	3.50	0.30	3.47	2.88	4.73	99
June	3.51	3.53	0.29	3.49	3.05	4.73	101
July	3.50	3.53	0.31	3.47	2.89	4.88	100
August	3.51	3.53	0.31	3.49	2.89	4.91	100
September	3.53	3.56	0.31	3.51	2.87	4.85	101
October	3.55	3.59	0.33	3.52	2.87	4.98	100
November	3.60	3.63	0.34	3.56	2.96	5.01	102
December	3.61	3.65	0.36	3.59	3.03	5.07	100
For the Year	3.56	3.59	0.33	3.53	2.87	5.07	1,187

Table A-3

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION
2008

Butterfat

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	3.76	300	3.76	102	3.78	37	3.84	8
February	3.70	299	3.70	102	3.73	37	3.74	8
March	3.70	299	3.66	66	3.71	38	3.79	8
April	3.70	299	3.59	100	3.69	39	3.81	8
May	3.60	298	3.54	68	3.56	38	3.64	8
June	3.57	296	3.51	67	3.59	35	3.56	8
July	3.58	295	3.48	99	3.48	38	3.60	8
August	3.60	293	3.50	97	3.51	37	3.68	7
September	3.64	289	3.55	99	3.55	37	3.83	7
October	3.70	285	3.66	71	3.85	30	3.93	7
November	3.73	286	3.73	100	3.79	36	3.94	8
December	3.75	285	3.80	67	3.95	32	3.96	8
For the Year	3.67	294	3.62	87	3.66	36	3.78	8

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	4.01	218	3.82	9	3.70	96
February	3.95	217	3.61	15	3.65	96
March	3.81	99	3.69	18	3.55	96
April	3.95	221	3.65	18	3.50	96
May	3.73	102	3.53	17	3.48	99
June	3.67	102	3.45	17	3.51	101
July	3.77	219	3.43	18	3.50	100
August	3.79	218	3.46	17	3.51	100
September	3.85	215	3.58	17	3.53	101
October	3.75	98	3.65	18	3.55	100
November	3.90	216	3.74	21	3.60	102
December	3.80	98	3.75	22	3.61	100
For the Year	3.85	169	3.60	17	3.56	99

Table A-3 (Continued)

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION
2008

Protein

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	3.10	300	3.12	102	3.16	37	3.15	8
February	3.07	299	3.08	102	3.13	37	3.12	8
March	3.08	299	3.09	66	3.13	38	3.10	8
April	3.07	299	3.08	100	3.11	39	3.07	8
May	3.02	298	3.02	68	3.06	38	3.01	8
June	3.00	296	2.99	67	3.05	35	3.06	8
July	2.98	295	2.94	99	2.99	38	3.04	8
August	3.02	293	3.00	97	3.04	37	3.10	7
September	3.06	289	3.06	99	3.10	37	3.16	7
October	3.14	285	3.16	71	3.20	30	3.24	7
November	3.13	286	3.18	100	3.24	36	3.22	8
December	3.14	285	3.20	67	3.30	32	3.22	8
For the Year	3.07	294	3.07	87	3.11	36	3.12	8

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	3.21	218	3.20	9	N/A	N/A
February	3.18	217	3.12	15	N/A	N/A
March	3.15	99	3.16	18	N/A	N/A
April	3.20	221	3.12	18	N/A	N/A
May	3.09	102	3.05	17	N/A	N/A
June	3.08	102	3.01	17	N/A	N/A
July	3.11	219	2.96	18	N/A	N/A
August	3.14	218	3.01	17	N/A	N/A
September	3.19	215	3.10	17	N/A	N/A
October	3.20	98	3.18	18	N/A	N/A
November	3.23	216	3.20	21	N/A	N/A
December	3.20	98	3.20	22	N/A	N/A
For the Year	3.17	169	3.10	17	N/A	N/A

Table A-3 (Continued)

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION
2008

Other Solids

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	5.73	300	5.73	102	5.72	37	5.75	8
February	5.69	299	5.68	102	5.67	37	5.70	8
March	5.66	299	5.67	66	5.65	38	5.68	8
April	5.70	299	5.70	100	5.70	39	5.73	8
May	5.71	298	5.72	68	5.71	38	5.73	8
June	5.70	296	5.71	67	5.70	35	5.71	8
July	5.70	295	5.71	99	5.71	38	5.71	8
August	5.71	293	5.71	97	5.71	37	5.72	7
September	5.69	289	5.69	99	5.69	37	5.69	7
October	5.66	285	5.68	71	5.65	30	5.66	7
November	5.67	286	5.67	100	5.65	36	5.64	8
December	5.69	285	5.69	67	5.66	32	5.67	8
For the Year	5.69	294	5.70	87	5.69	36	5.70	8

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	5.74	218	5.76	9	N/A	N/A
February	5.72	217	5.68	15	N/A	N/A
March	5.70	99	5.65	18	N/A	N/A
April	5.74	221	5.69	18	N/A	N/A
May	5.74	102	5.71	17	N/A	N/A
June	5.73	102	5.71	17	N/A	N/A
July	5.74	219	5.72	18	N/A	N/A
August	5.74	218	5.72	17	N/A	N/A
September	5.72	215	5.70	17	N/A	N/A
October	5.71	98	5.67	18	N/A	N/A
November	5.72	216	5.64	21	N/A	N/A
December	5.70	98	5.67	22	N/A	N/A
For the Year	5.73	169	5.69	17	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
2008

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

Pacific Northwest Order

	c	b				
	Constant	Butterfat Coefficient	Standard Error of b	R-Squared (Adjusted)	Standard Error	Number of Comparisons
January	1.48676	0.42683	0.01145	0.67357	0.11931	674
February	1.50324	0.42098	0.01201	0.64473	0.11910	678
March	1.61970	0.39260	0.01450	0.58153	0.11966	528
April	1.54486	0.41448	0.01191	0.63882	0.12051	685
May	1.50950	0.42211	0.01462	0.61111	0.11425	531
June	1.47870	0.42589	0.01394	0.64012	0.10581	525
July	1.31110	0.46742	0.01146	0.71085	0.10484	677
August	1.43225	0.43999	0.01202	0.66708	0.11324	669
September	1.54701	0.41803	0.01143	0.66850	0.11515	664
October	1.67373	0.39680	0.01344	0.63153	0.12093	509
November	1.57572	0.41708	0.01177	0.65337	0.12534	667
December	1.62329	0.40302	0.01412	0.61425	0.12849	512
For the Year	1.48833	0.42959	0.00360	0.66046	0.12035	7,319

Table A-5

LINEAR RELATIONSHIPS BETWEEN VARIOUS MILK COMPONENTS
2008

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

Pacific Northwest Order

	c	b				
	Constant	Butterfat Coefficient	Standard Error of b	R-Squared (Adjusted)	Standard Error	Number of Comparisons
January	6.04794	-0.08536	0.00752	0.15952	0.07839	674
February	5.92268	-0.06376	0.00794	0.08574	0.07876	678
March	6.00974	-0.09408	0.00880	0.17681	0.07267	528
April	5.89645	-0.05258	0.00722	0.07068	0.07305	685
May	6.04013	-0.09265	0.00807	0.19783	0.06310	531
June	6.06648	-0.10441	0.00871	0.21392	0.06612	525
July	5.91532	-0.06108	0.00868	0.06694	0.07941	677
August	5.93832	-0.06714	0.00901	0.07540	0.08491	669
September	5.97283	-0.08142	0.00859	0.11811	0.08658	664
October	6.16511	-0.13804	0.00887	0.32178	0.07984	509
November	6.04023	-0.09952	0.00830	0.17658	0.08840	667
December	6.19113	-0.13590	0.00790	0.36593	0.07189	512
For the Year	6.00312	-0.08574	0.00243	0.14499	0.08133	7,319

Table A-6

MONTHLY PRODUCER COMPONENT PRICES
2008

Pacific Northwest Order

Month	Butterfat Price $ / pound	Protein Price $ / pound	Other Solids Price $ / pound	Producer Price Differential 1/ $ / hundredweight
January	1.3319	4.4994	0.2097	0.07
February	1.3010	4.0180	0.0803	0.44
March	1.3604	4.3331	0.0493	(2.06)
April	1.4748	3.7579	0.0622	0.19
May	1.5562	4.1108	0.0766	(1.35)
June	1.6160	4.7193	0.0826	(2.22)
July	1.6774	4.0025	0.0707	0.70
August	1.7413	3.6497	0.0529	0.71
September	1.8196	3.2689	0.0234	0.79
October	1.8507	3.5490	(0.0047)	(1.57)
November	1.7730	3.1301	(0.0099)	(0.22)
December	1.2998	3.6390	(0.0269)	(2.28)
Simple Average	1.5668	3.8898	0.0555	(0.57)

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	15.52	1.3566
February	13.87	1.3178
March	12.55	1.3575
April	12.62	1.4580
May	12.22	1.5459
June	13.48	1.6127
July	13.95	1.6710
August	12.88	1.7352
September	11.74	1.8092
October	10.54	1.8350
November	9.91	1.7913
December	9.41	1.3961
Simple Average	12.39	1.5739

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
PRODUCER MILK DELIVERIES
2008
(See Figure A-7)
Pacific Northwest Order

Size Range				
Equal to or more than	Less than	Butterfat	Protein	Other Solids
- pounds -	- pounds -	- % -	- % -	- % -
	50,000	4.14	3.25	5.56
50,000	100,000	4.03	3.20	5.62
100,000	200,000	3.98	3.18	5.65
200,000	300,000	3.91	3.15	5.67
300,000	400,000	3.91	3.15	5.68
400,000	500,000	3.85	3.15	5.69
500,000	600,000	3.82	3.14	5.70
600,000	700,000	3.73	3.10	5.71
700,000	1,000,000	3.71	3.09	5.70
1,000,000	2,000,000	3.65	3.09	5.71
2,000,000	3,000,000	3.67	3.10	5.70
3,000,000	4,000,000	3.65	3.07	5.70
4,000,000	6,000,000	3.61	3.05	5.70
6,000,000		3.53	3.07	5.70
Weighted Average		3.67	3.09	5.70

Table A-7 (Continued)

AGGREGATED COMPONENT TESTS BY SIZE-RANGE
PRODUCER MILK DELIVERIES
2008
(See Figure A-7)
Arizona Order

Size Range		
Equal to or more than	Less than	Butterfat
- pounds -	- pounds -	- % -
	100,000	3.62
100,000	200,000	3.60
200,000	300,000	3.65
300,000	400,000	3.74
400,000	500,000	3.63
500,000	600,000	3.62
600,000	700,000	3.52
700,000	1,000,000	3.55
1,000,000	2,000,000	3.65
2,000,000	3,000,000	3.54
3,000,000	4,000,000	3.68
4,000,000	5,000,000	3.61
5,000,000	6,000,000	3.53
6,000,000	7,000,000	3.51
7,000,000		3.48
Weighted Average		3.56

Table A-8

AGGREGATED COMPONENT VALUES BY SIZE-RANGE
PRODUCER MILK DELIVERIES
2008
(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	$ 1,810,633.01	9,589,656	0.14%	313	4.28%	18.88
50,000	100,000	8,469,726.86	45,715,473	0.67%	594	8.12%	18.53
100,000	200,000	34,716,397.67	188,055,742	2.76%	1,273	17.39%	18.46
200,000	300,000	38,456,127.77	210,220,872	3.09%	841	11.49%	18.29
300,000	400,000	32,220,760.08	175,860,741	2.59%	513	7.01%	18.32
400,000	500,000	36,634,720.78	202,627,178	2.98%	448	6.12%	18.08
500,000	600,000	35,776,828.99	198,899,138	2.92%	364	4.97%	17.99
600,000	700,000	39,255,838.33	221,706,889	3.26%	342	4.67%	17.71
700,000	1,000,000	104,342,007.65	590,096,340	8.67%	701	9.58%	17.68
1,000,000	2,000,000	283,982,126.65	1,621,391,593	23.84%	1,141	15.59%	17.51
2,000,000	3,000,000	164,802,461.23	932,791,816	13.71%	385	5.26%	17.67
3,000,000	4,000,000	102,896,212.43	588,563,934	8.65%	173	2.36%	17.48
4,000,000	6,000,000	80,839,001.11	466,657,108	6.86%	97	1.33%	17.32
6,000,000		234,635,170.07	1,350,121,001	19.85%	134	1.83%	17.38
Total/Weighted Average		$ 1,198,838,012.63	6,802,297,481	100.00%	7,319	100.00%	17.62

Table A-8 (Continued)

AGGREGATED COMPONENT VALUES BY SIZE-RANGE
PRODUCER MILK DELIVERIES
2008
(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	$ 174,943.36	991,839	0.02%	14	1.18%	17.64
100,000	200,000	17,136.89	100,924	0.00%	1	0.08%	16.98
200,000	300,000	792,896.49	4,371,169	0.11%	17	1.43%	18.14
300,000	400,000	1,749,867.29	9,879,755	0.24%	28	2.36%	17.71
400,000	500,000	2,275,489.77	12,796,388	0.31%	28	2.36%	17.78
500,000	600,000	2,641,476.50	14,839,642	0.36%	27	2.27%	17.80
600,000	700,000	2,328,680.24	13,548,727	0.33%	21	1.77%	17.19
700,000	1,000,000	11,755,415.12	67,274,802	1.62%	79	6.66%	17.47
1,000,000	2,000,000	67,196,812.21	379,498,891	9.13%	257	21.65%	17.71
2,000,000	3,000,000	73,049,201.04	416,713,856	10.03%	173	14.57%	17.53
3,000,000	4,000,000	86,607,946.04	491,345,967	11.82%	142	11.96%	17.63
4,000,000	5,000,000	104,085,319.05	588,548,738	14.16%	131	11.04%	17.69
5,000,000	6,000,000	101,126,861.71	581,510,802	13.99%	107	9.01%	17.39
6,000,000	7,000,000	51,037,544.51	295,254,102	7.10%	46	3.88%	17.29
7,000,000		222,963,997.12	1,279,896,793	30.79%	116	9.77%	17.42
Total/Weighted Average		$ 727,803,587.34	4,156,572,395	100.00%	1,187	100.00%	17.51

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
PACIFIC NORTHWEST ORDER
2008

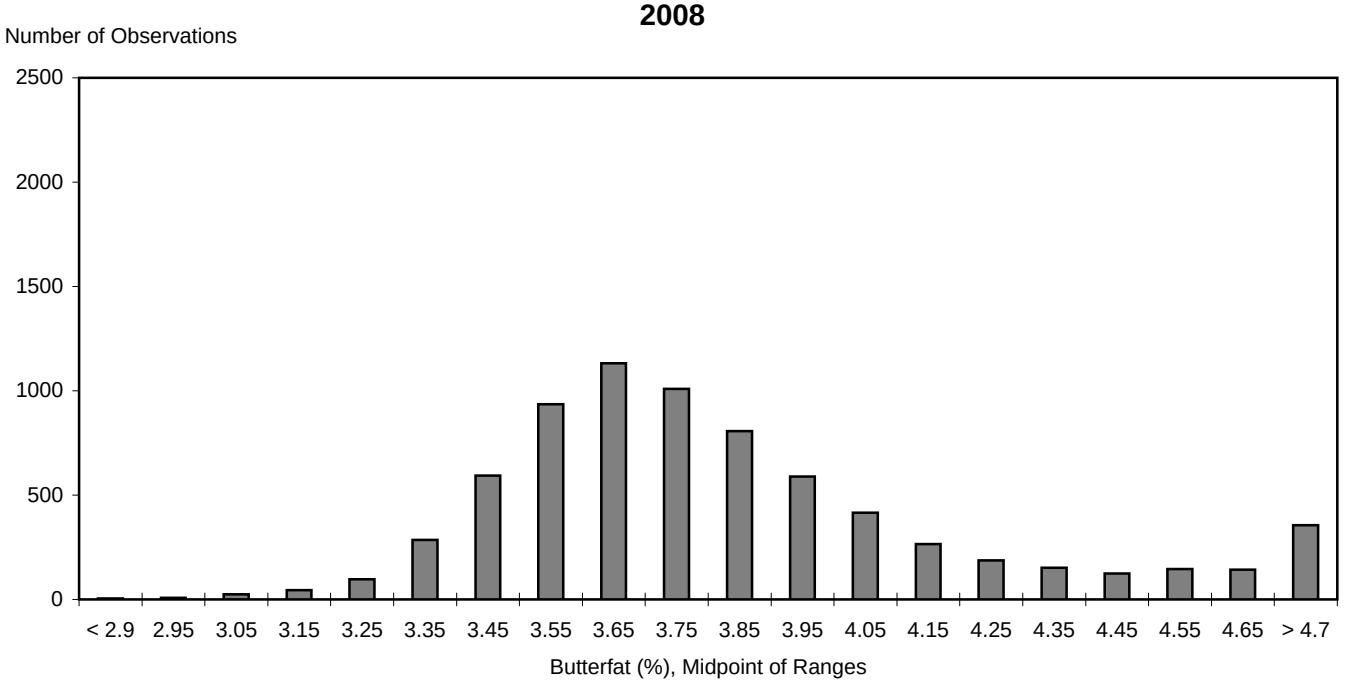


Figure A-2
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE PROTEIN LEVELS
PACIFIC NORTHWEST ORDER
2008

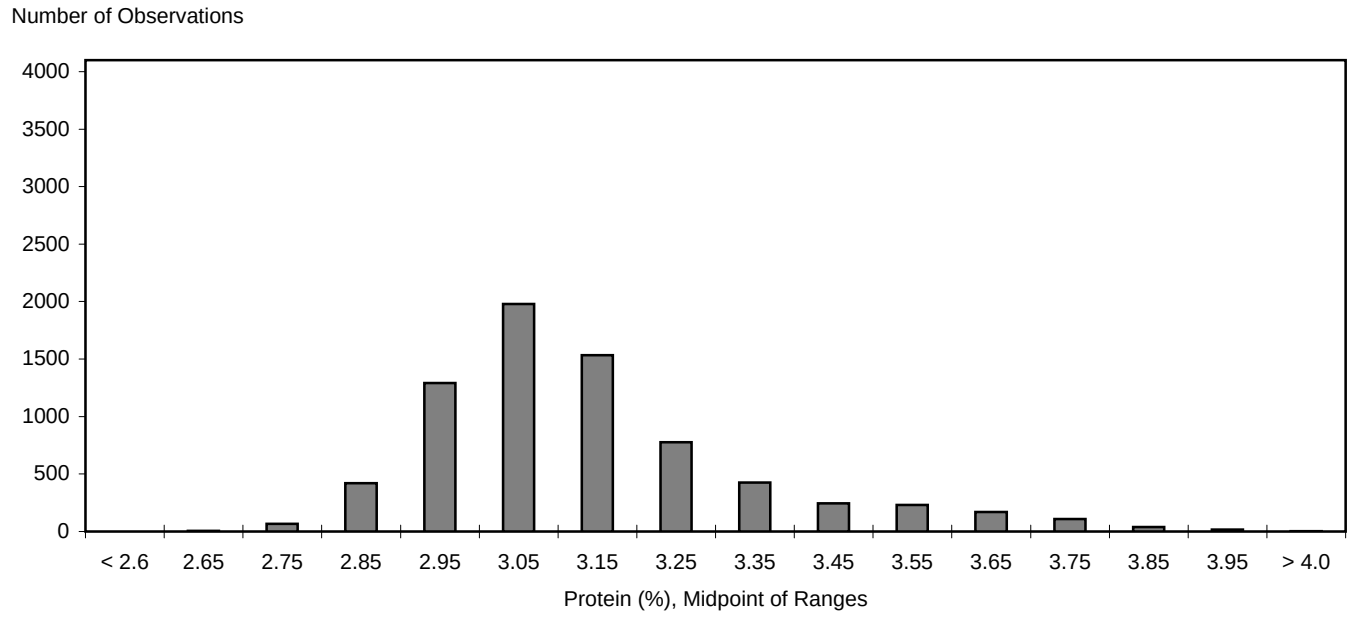


Figure A-3
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE OTHER SOLIDS LEVELS: PACIFIC NORTHWEST ORDER
2008

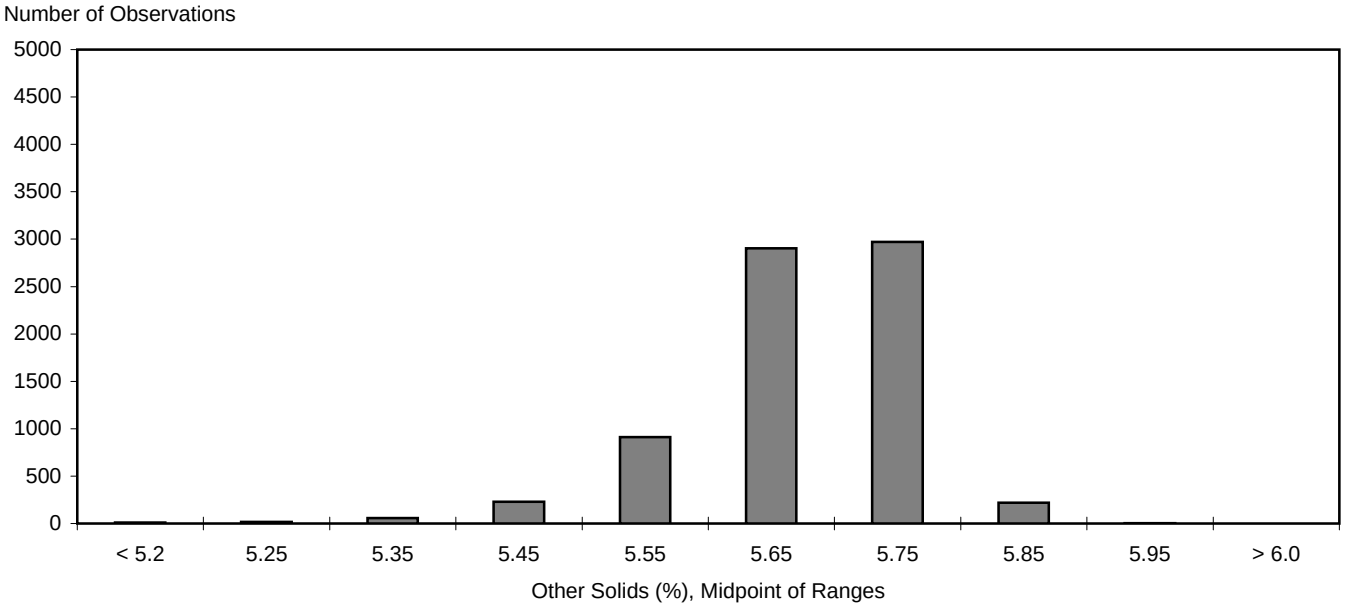


Figure A-4
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE BUTTERFAT LEVELS
ARIZONA ORDER
2008

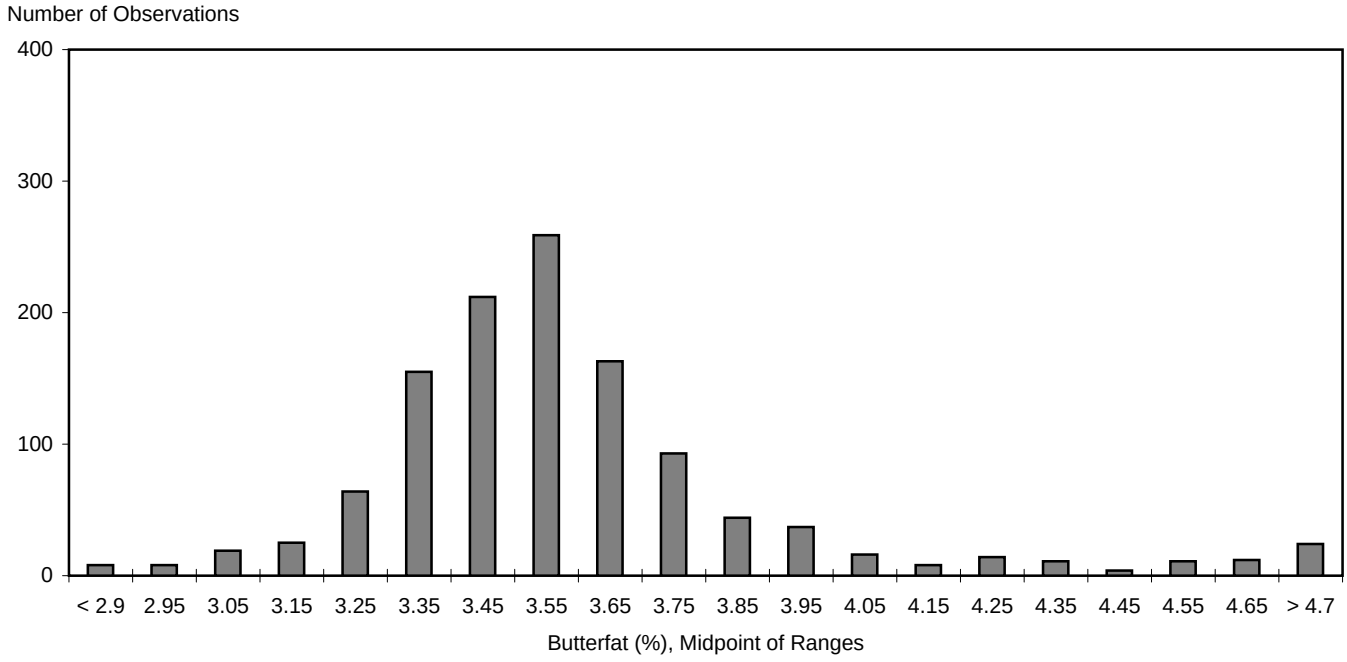
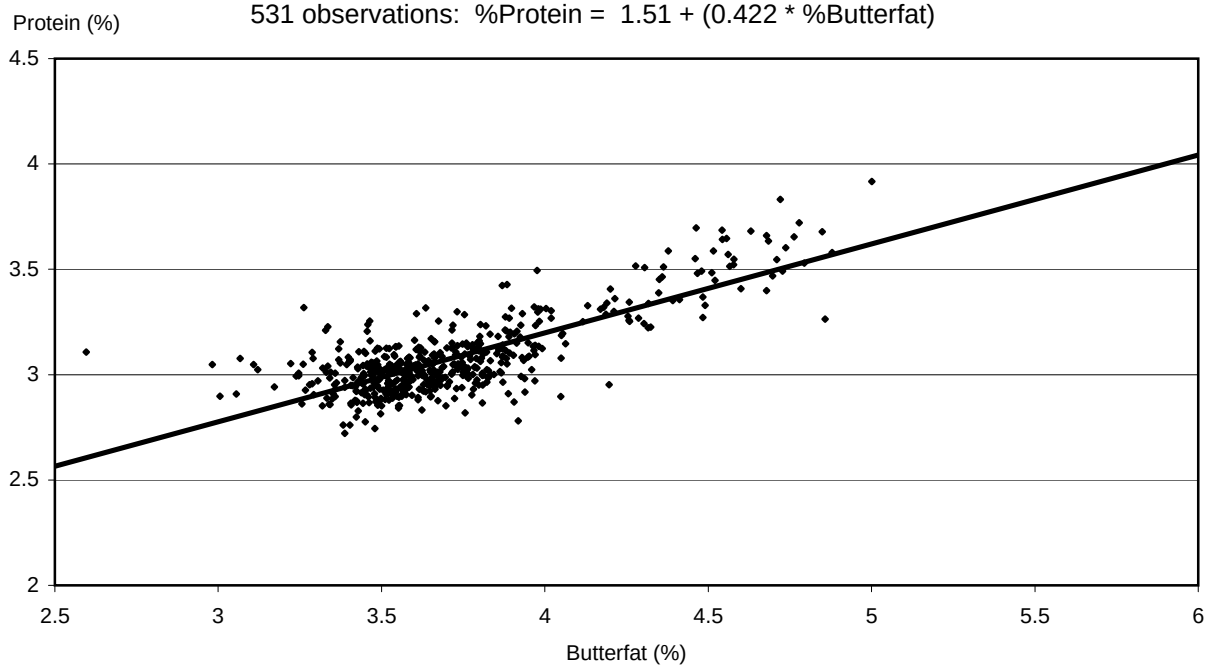


Figure A-5
SCATTER PLOT OF PROTEIN AND BUTTERFAT
MAY AND NOVEMBER 2008
Pacific Northwest Order

May 2008



November 2008

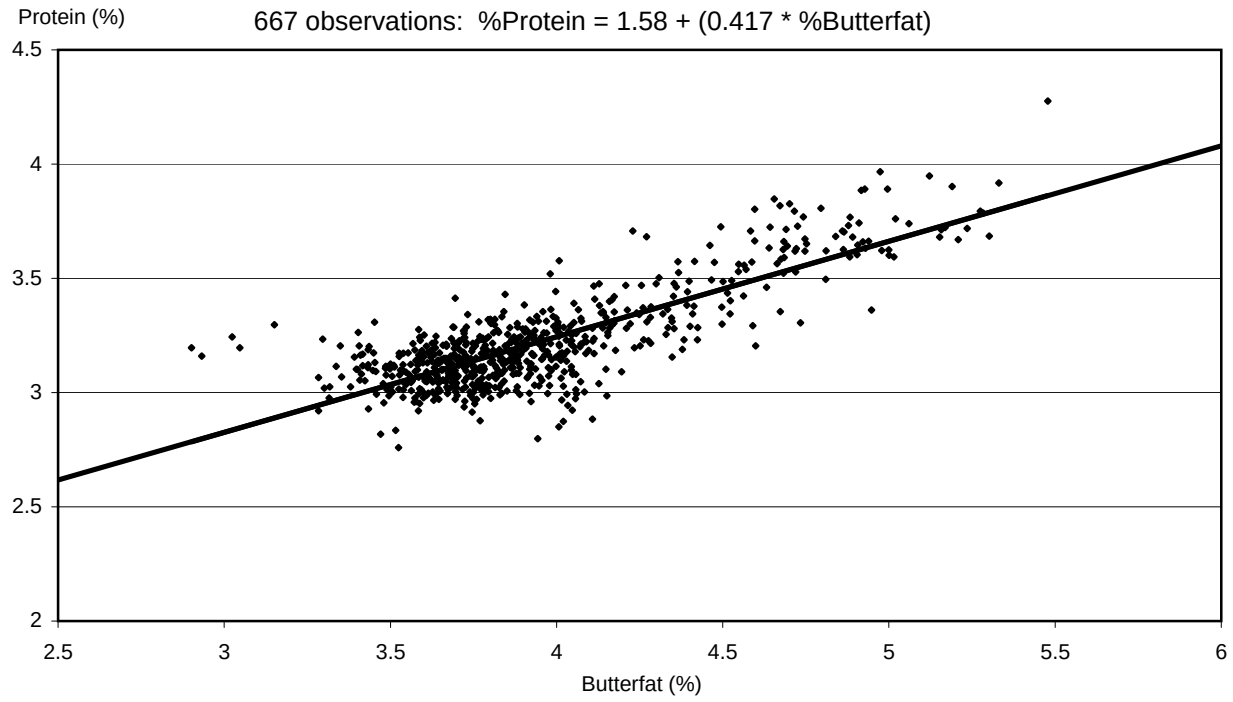
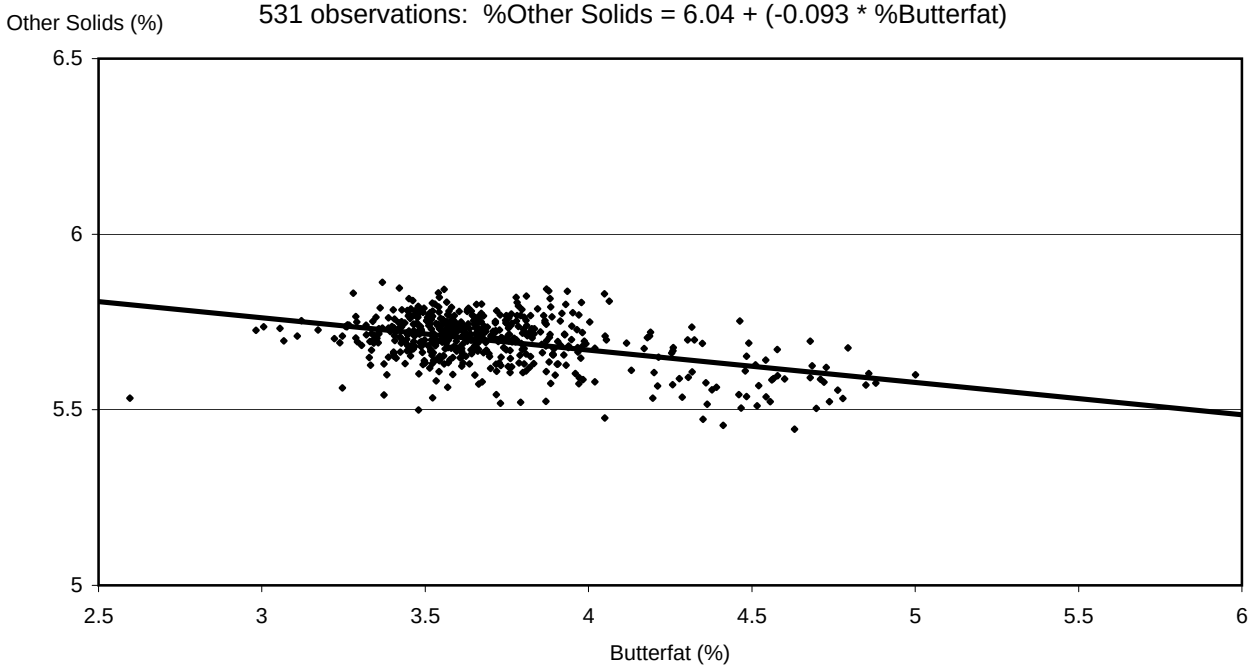


Figure A-6
SCATTER PLOT OF OTHER SOLIDS AND BUTTERFAT
MAY AND NOVEMBER 2008
Pacific Northwest Order

May 2008



November 2008

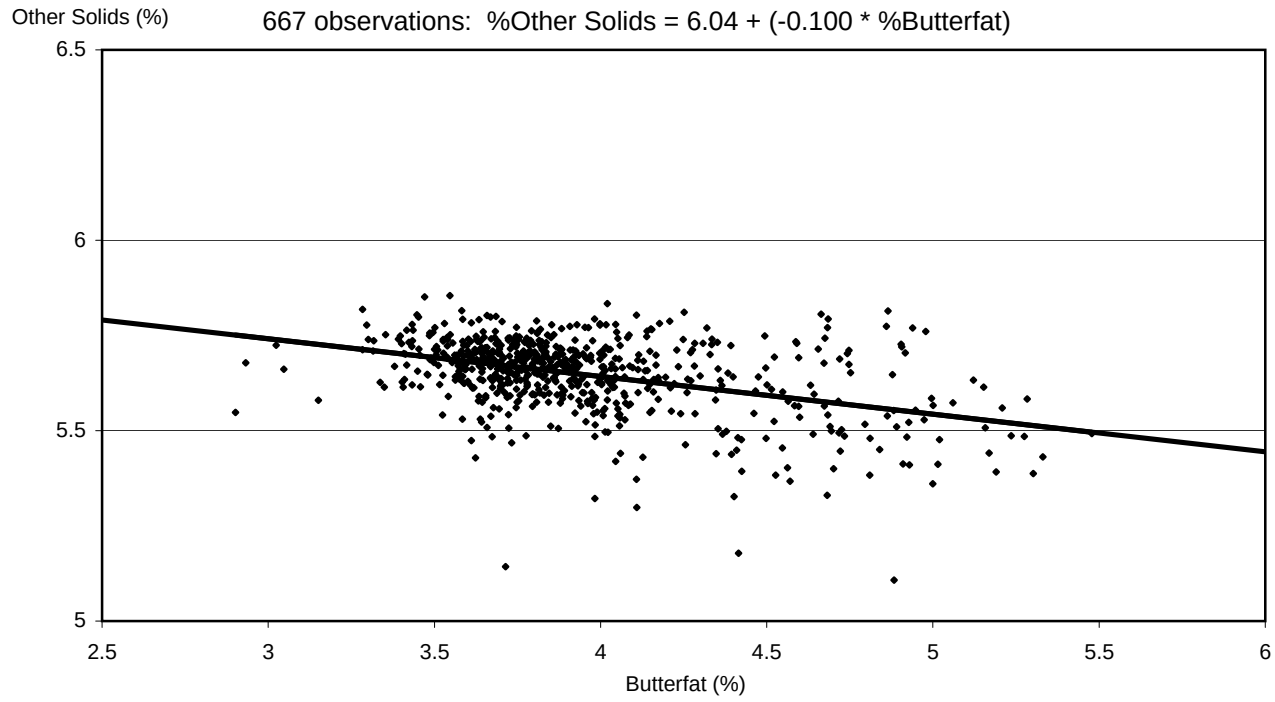
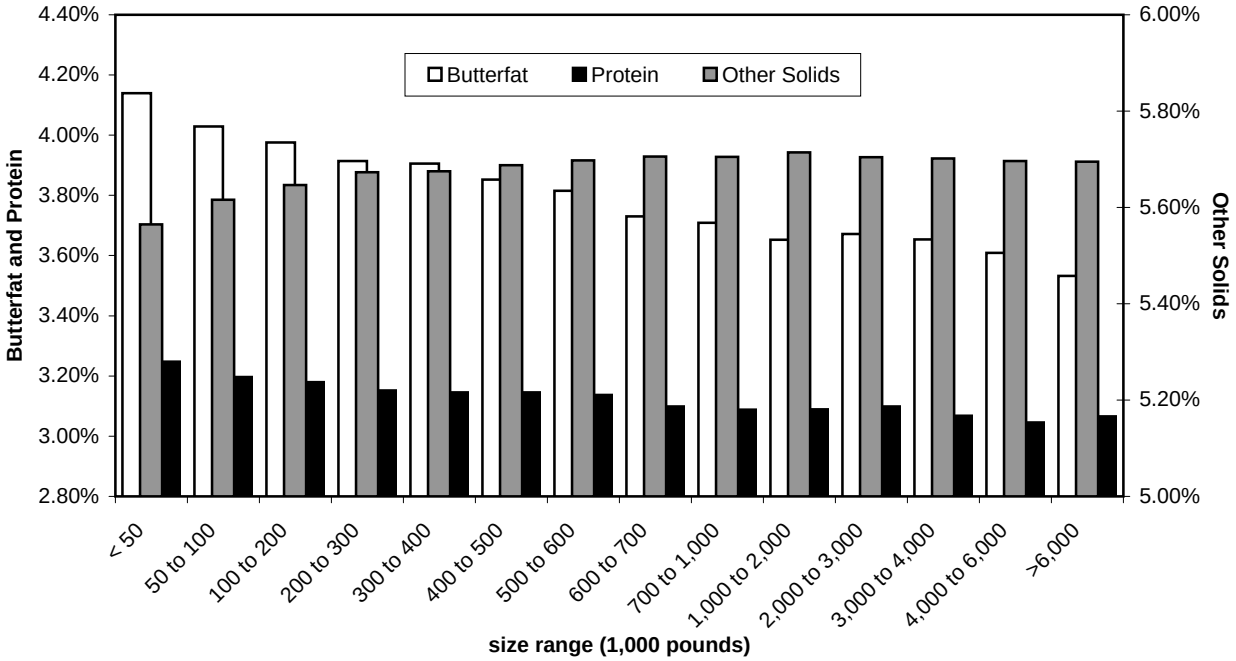


Figure A-7
WEIGHTED AVERAGE COMPONENT LEVELS
BY SIZE-RANGE OF PRODUCER MILK DELIVERIES
2008

Pacific Northwest Order



Arizona Order

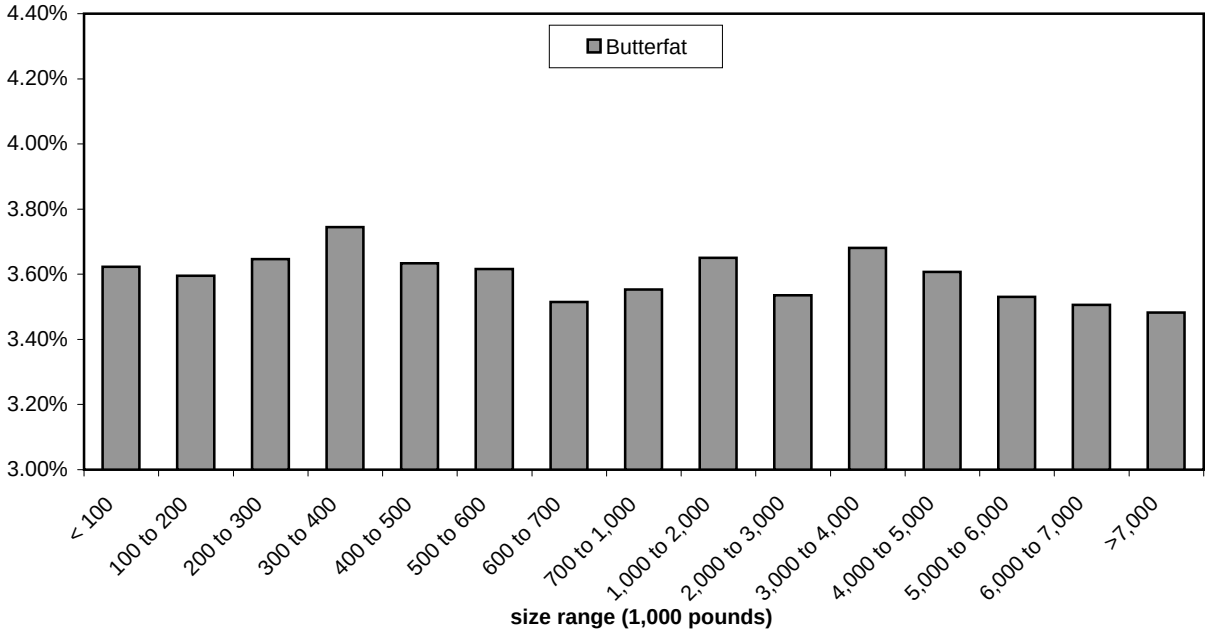
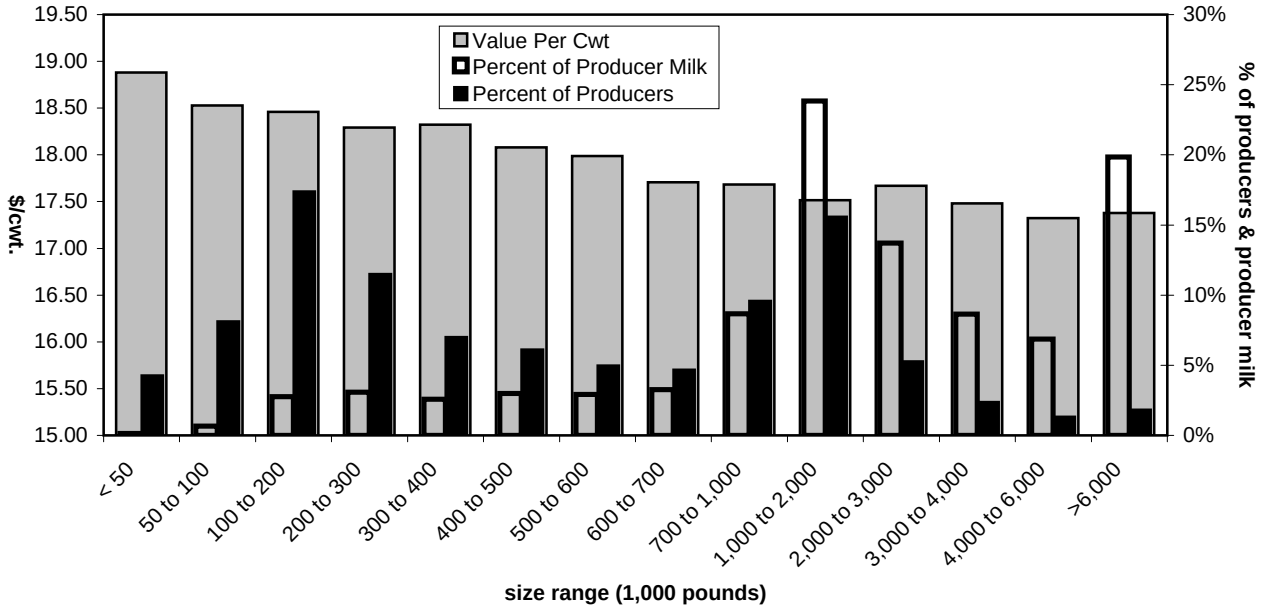
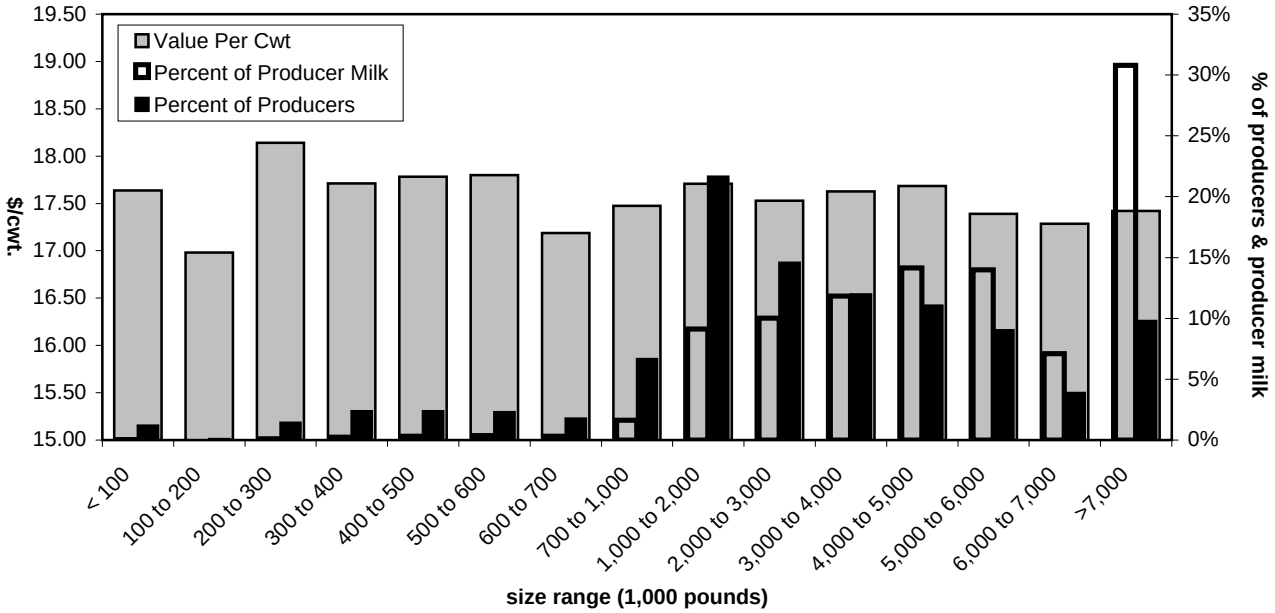


Figure A-8
WEIGHTED AVERAGE VALUES AND PERCENT OF PRODUCERS & PRODUCER MILK
BY SIZE-RANGE OF PRODUCER MILK DELIVERIES
2008

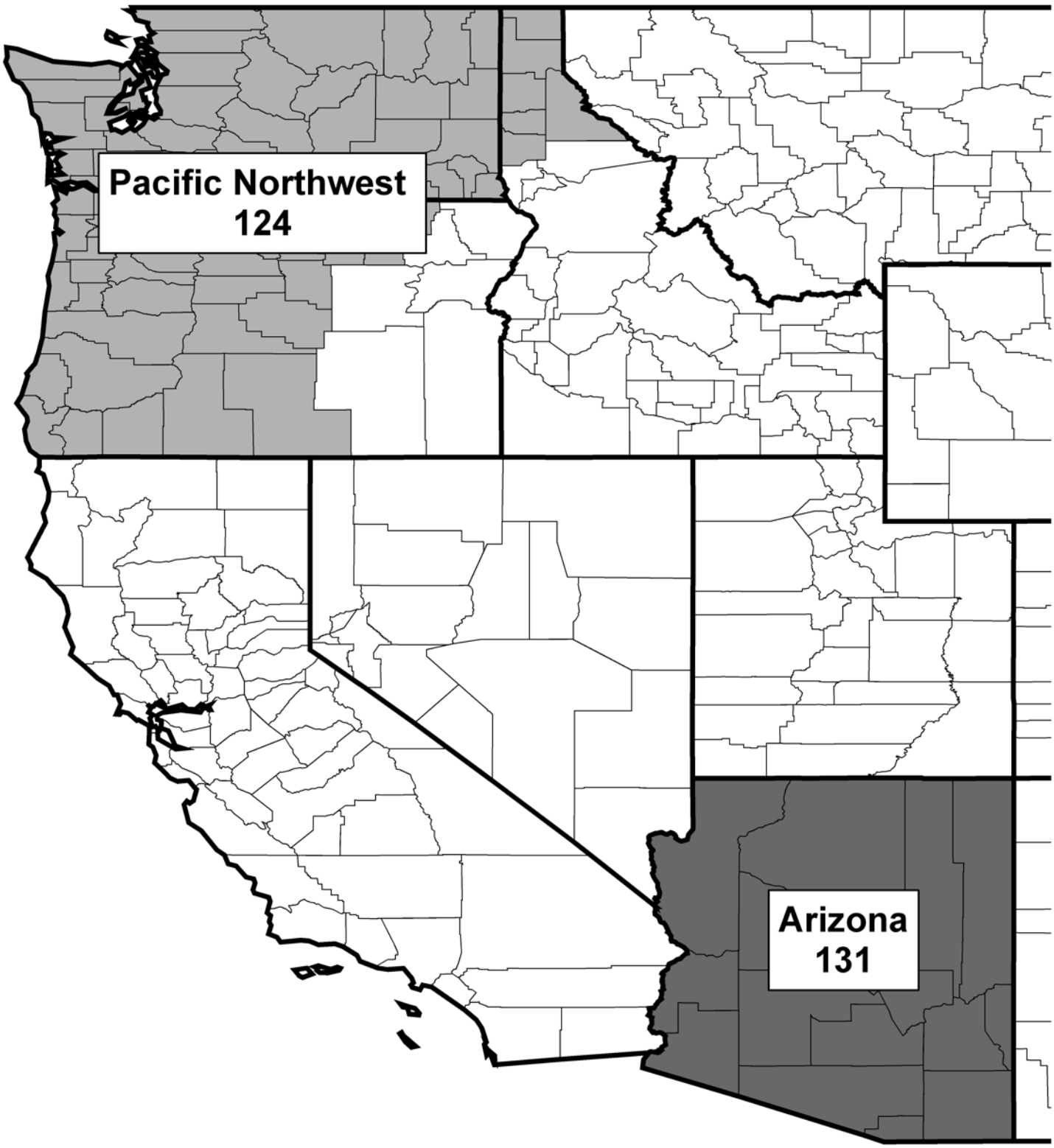
Pacific Northwest Order



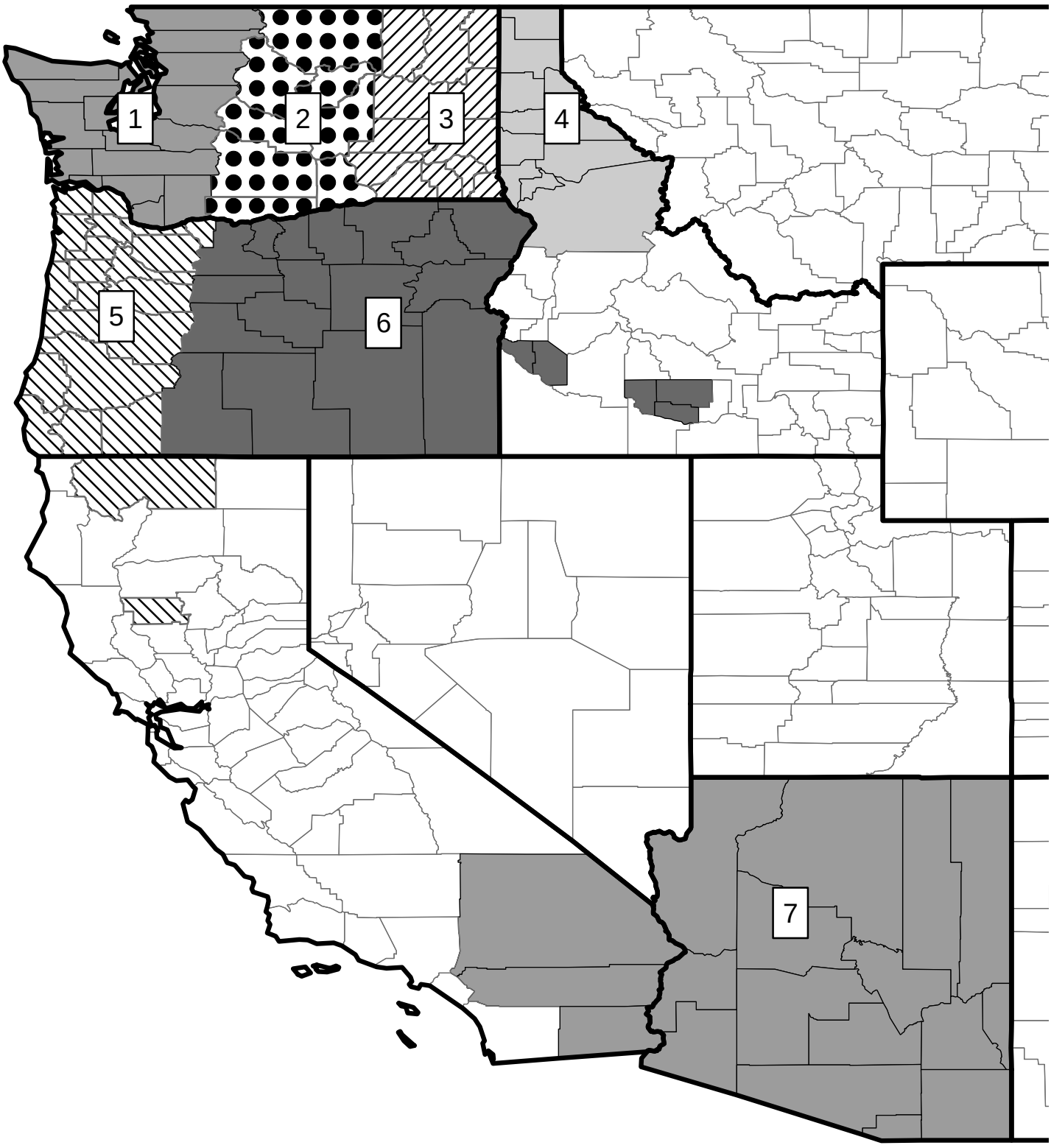
Arizona Order



MAP A-1
Marketing Area of the Pacific Northwest (FO 124)
and Arizona (FO131) Federal Orders



MAP A-2
Geographic Regions Encompassing The Pacific Northwest and Arizona Order Milk Sheds, 2008



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