UNITED STATES DEPARTMENT OF AGRICULTURE

1930-220th St. SE, Ste. 102
Bothell, WA 98021-8471
Phone: (425) 487-6009
Fax: (425) 487-2775
E-mail: fmmaseattle@fmmaseattle.com

Agricultural Marketing Service
Dairy Programs

FEDERAL MILK ORDERS 124 & 131

10050 N 25th Ave., Ste. 302
Phoenix, AZ 85021-1664
Phone: (602) 547-2909
Fax: (602) 547-2906
E-mail: ma@fmma.net

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

PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS

2010

Staff Paper 11-02

Lori Espe

September 2011

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

PACIFIC NORTHWEST AND ARIZONA FEDERAL MILK MARKETING ORDERS

2010

Lori Espe

Abstract

Component levels in producer milk pooled on the Pacific Northwest (FO 124) and Arizona (FO 131) Federal Milk Marketing Orders were analyzed for 2010 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 2010, a monthly average total of 729 producers were pooled on the Pacific Northwest and Arizona Orders. During 2010, these producers delivered 12.2 billion pounds to the two markets. The milk shed of the two Federal orders includes Arizona, California, Idaho, Oregon, Texas and Washington.

Major findings of this study include:

1. The 2010 average component levels for the Pacific Northwest Order were 3.73% butterfat, 3.15% true protein, and 5.71% other solids. The 2010 average butterfat level for the Arizona Order was 3.50%.
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 2010 for protein is PRO% = 1.546 + 0.419 * BF%, with an R-squared of 0.68.
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 0.16. 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

2010

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 2010. 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 2010, 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 2010 was valued using Federal order minimum producer prices for the respective orders.

For 2010, a monthly average total of 729 producers were pooled on the Pacific Northwest and Arizona Orders. During 2010, these producers delivered 12.2 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 2010, 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 2010, 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 and Southern California 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 2010, producers associated with the Pacific Northwest Order delivered 8.01 billion pounds. For 2010, producer milk tested, on average, 3.73% butterfat, 3.15% protein, and 5.71% 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 2010 were the highest in December at 3.94% and lowest in July at 3.60%.

The seasonal cycle of protein levels is similar to butterfat but with a lesser degree of variation. Protein levels in 2010 were highest in November at 3.25% and lowest in July at 3.06%. 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 May and July, a low of 5.68% in February, and showed very little seasonality.

Table 1
Monthly Component Levels
Pacific Northwest Order
2010

Month	Butterfat	Protein	Other Solids
	- percent -	- percent -	- percent -
January	3.78	3.15	5.69
February	3.71	3.12	5.68
March	3.72	3.14	5.69
April	3.74	3.15	5.71
May	3.68	3.12	5.73
June	3.63	3.10	5.72
July	3.60	3.06	5.73
August	3.62	3.08	5.72
September	3.71	3.15	5.71
October	3.78	3.21	5.70
November	3.91	3.25	5.71
December	3.94	3.24	5.70
Weighted Average	3.73	3.15	5.71

Table 2 Monthly Component Levels Arizona Order 2010	
Month	Butterfat - percent -
January	3.60
February	3.54
March	3.51
April	3.41
May	3.41
June	3.41
July	3.41
August	3.42
September	3.44
October	3.51
November	3.65
December	3.69
Weighted Average	3.50

In 2010, producers associated with the Arizona Order delivered 4.23 billion pounds. For 2010, producer milk tested, on average, 3.50% 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 2010 were highest in December at 3.69% and lowest in April through July at 3.41%.

For 2010, the monthly and annual weighted average butterfat levels were less than the mean averages for both orders; the same is true for the Pacific Northwest Order's protein levels. (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 2010, for the Pacific Northwest Order, producers' individual monthly average butterfat tests ranged from 2.74% to 6.10%; protein tests ranged from 2.13% to 4.40%, and other solids levels ranged from 4.71% to 5.92%. (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 4.32%. Similarly, most protein tests ranged from 2.96% to 3.40%, and most other solids tests ranged from 5.59% to 5.77%. (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 2010, Arizona Order producers' butterfat tests ranged from 2.36% to 5.45%. (See Table 4.) Based on the definition of a standard deviation, most producers had butterfat tests ranging from 3.19% to 3.91%. (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
2010

	Butterfat	Protein	Other Solids
	%	%	%
Weighted Average	3.73	3.15	5.71
Mean	3.89	3.18	5.68
Median	3.79	3.13	5.70
Standard Deviation	0.43	0.22	0.09
Minimum	2.74	2.13	4.71
Maximum	6.10	4.40	5.92

Table 4
Component Levels: Weighted Average, Mean, Median, Standard Deviation, Minimum, and Maximum
Arizona Order
2010

	Butterfat
	%
Weighted Average	3.50
Mean	3.55
Median	3.51
Standard Deviation	0.36
Minimum	2.36
Maximum	5.45

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. In 2010, 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 6, component levels for each region appear to vary only slightly. Table 5, below, provides 2010 milk production, average number of producers, and component tests for each region.

Table 5
Various Statistics by Region For 2010

Region 1 (Western Washington)		**Region 2 (Central Washington)**	
Milk Production	2,086,923,987	Milk Production	3,050,032,583
Average Number of Producers	272	Average Number of Producers	103
Average Pounds Per Producer	7,672,515	Average Pounds Per Producer	29,611,967
Butterfat Test	3.69%	Butterfat Test	3.66%
Protein Test	3.10%	Protein Test	3.11%
Other Solids Test	5.70%	Other Solids Test	5.70%
Region 3 (Eastern Washington)		**Region 4 (Northern Idaho)**	
Milk Production	629,918,854	Milk Production	5,001,629
Average Number of Producers	35	Average Number of Producers	3
Average Pounds Per Producer	17,997,682	Average Pounds Per Producer	1,667,210
Butterfat Test	3.67%	Butterfat Test	3.87%
Protein Test	3.13%	Protein Test	3.17%
Other Solids Test	5.70%	Other Solids Test	5.67%
Region 5 (Western Oregon, Northern California)		**Region 6 (Central/Eastern Oregon, Southern Idaho)**	
Milk Production	1,361,911,013	Milk Production	872,698,636
Average Number of Producers	201	Average Number of Producers	18
Average Pounds Per Producer	6,775,677	Average Pounds Per Producer	48,483,258
Butterfat Test	3.89%	Butterfat Test	3.90%
Protein Test	3.20%	Protein Test	3.34%
Other Solids Test	5.74%	Other Solids Test	5.71%
Region 7 (Arizona, Southern California, Texas)			
Milk Production	4,231,673,139		
Average Number of Producers	96		
Average Pounds Per Producer	44,079,929		
Butterfat Test	3.50%		
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 2010, with 4.23 billion pounds, while Region 1 had the most producers (272 producers on average). Average milk production per producer was the highest in Region 6 with an average of 48.5 million pounds per producer for the year. The highest butterfat levels in 2010 were in Region 6 with annual tests of 3.90%, while Region 7 had the lowest annual butterfat test of 3.50%. Protein levels in Region 6 (3.34%) and other solids levels in Region 5 (5.74%) 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 2010, butterfat levels in Regions 4, 5, and 6 were noticeably higher than the other regions, while Region 7 was much lower than the other regions. Protein levels in Region 6 were 0.24% higher than Region 1. Other solids levels by region varied only 0.07% between the high and low for the year 2010; ranging from 5.67% in Region 4 to 5.74% in Region 5.

On the Pacific Northwest Order, changes in producer numbers and milk marketed between November 2009 and November 2010 followed the national trend of increased milk production; however there were more producers instead of fewer. The Arizona Order's producer numbers and milk marketed were higher in November 2010 when compared to previous year levels. Table 6, below, provides a brief comparison of producer numbers and milk marketed for November 2009 and 2010. 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 increased by only 3.7 million pounds, while production in Region 2 increased by over 12.8 million pounds. Production in Eastern Washington (Region 3) increased milk production by 5.2 million pounds between November of 2009 and 2010, even with a slight decrease in the number of producers. The number of producers in Northern Idaho (Region 4) decreased by three, and production dropped to 355,400 pounds for November 2010. Region 5, Western Oregon, faces many of the same environmental issues and urban encroachment problems as Region 1, Western Washington; similar to Region 1, the producer milk marketed increased modestly in November 2010 for Region 5, although the producer count for Region 5 was down slightly. The area covering Central/Eastern Oregon and Southern Idaho (Region 6) showed the greatest decrease on the Pacific Northwest Order, with an 18.1 million pound decrease from November 2009 to 2010. Despite the large decrease in production, there were 6 more producers in Region 6 for November 2010 than the same month a year ago. Producer milk in Arizona, Southern California and Texas, grouped as Region 7, increased by 28.2 million pounds in 2010 and the number of producers increased by six.

Table 6
Producer Milk and Producers by Region for November 2010 and 2009

	Producer Milk			Producers		
	November 2010	November 2009	Change	November 2010	November 2009	Change
Region 1	165,327,358	161,589,486	3,737,872	276	265	11
Region 2	244,994,750	232,154,310	12,840,440	104	102	2
Region 3	51,632,400	46,390,944	5,241,456	34	36	-2
Region 4	355,400	579,335	-223,935	3	6	-3
Region 5	108,076,403	105,183,260	2,893,143	200	204	-4
Region 6	67,075,763	85,131,213	-18,055,450	30	24	6
Region 7	347,002,138	318,774,111	28,228,027	101	95	6
Total	984,464,212	949,802,659	34,661,553	748	732	16

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 7,588 observations in 2010. Appendix Figures A-5 and A-6 show graphical representations of the linear regressions for May and November 2010.

The butterfat and protein regression equations for the Pacific Northwest Order were calculated for 2000 through 2010. (See Table 7 below.) Over the 2000 - 2009 periods, the general trend of the regression is toward a lower intercept but a steeper slope, suggesting that, in general, for those years a change in the butterfat level is associated with a larger change in the protein level. The data for 2010, though, indicates a higher intercept with a slope similar to ten years ago. The reversed trend is likely due to handler pooling patterns that were different in 2010 than previous years.

Table 7
Pacific Northwest Order
Comparison of Regression Results: Butterfat Level as a Predictor of Protein Levels
2000 through 2010

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%	$R^2 = 0.657$
2010	TRUE PRO% = 1.546 + 0.419 BF%	$R^2 = 0.678$

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 2010 averaged $16.21 per hundredweight. The weighted average value of each component comprising the $16.21 per hundredweight was: $6.92 for butterfat; $7.26 for protein; $1.01 for other solids; and a producer price differential of $1.02.[4]

The value of producers' milk at test pooled on the Arizona Order in 2010 averaged $15.82 per hundredweight. The weighted average value of skim and butterfat portions of the $15.82 per hundredweight was: $6.46 for butterfat; and $9.36 for skim.[5]

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 2010 Federal order prices, producers in the 50,000-100,000 pounds range of production were valued more per hundredweight, $17.16, than other producers. Producers with 2-3 million pounds of production averaged the lowest amount per hundredweight, at $15.92. This relationship, as earlier mentioned, 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.

[4] 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.

[5] 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 2010 were: 3.73% butterfat, 3.15% protein, and 5.71% other solids. Butterfat percentages peaked in December and reached a low in July. Protein percentages peaked in November 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:

$$\text{Protein} = 1.54649 + 0.4188 * \text{Butterfat} \qquad (R^2 = 0.6785)$$

In 2010, the Pacific Northwest Order's weighted average price received for milk was $16.21 per hundredweight, at test.

The annual average butterfat level for the Arizona Order in 2010 was 3.50%. Butterfat levels peaked in December and reached a low in April-July. In 2010, the Federal order weighted average price received for milk was $15.82 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

2010

Butterfat

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.78	3.95	0.43	3.84	3.05	5.71	632
February	3.71	3.88	0.40	3.77	3.07	5.26	631
March	3.72	3.89	0.40	3.78	3.08	5.32	635
April	3.74	3.90	0.41	3.78	2.99	5.41	629
May	3.68	3.82	0.40	3.71	2.98	5.15	631
June	3.63	3.78	0.40	3.69	2.76	5.07	629
July	3.60	3.73	0.39	3.63	2.86	5.04	631
August	3.62	3.78	0.40	3.68	2.82	5.05	626
September	3.71	3.87	0.42	3.77	2.81	5.37	631
October	3.78	3.93	0.45	3.83	2.78	5.79	633
November	3.91	4.06	0.45	3.94	2.74	5.80	647
December	3.94	4.08	0.45	3.95	3.15	6.10	633
For the Year	3.73	3.89	0.43	3.79	2.74	6.10	7,588

Protein

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.15	3.17	0.22	3.12	2.13	4.20	632
February	3.12	3.15	0.21	3.10	2.22	3.91	631
March	3.14	3.17	0.20	3.12	2.34	3.91	635
April	3.15	3.18	0.20	3.13	2.61	3.89	629
May	3.12	3.16	0.20	3.11	2.64	3.77	631
June	3.10	3.13	0.19	3.09	2.69	3.78	629
July	3.06	3.10	0.20	3.06	2.71	3.74	631
August	3.08	3.12	0.21	3.07	2.74	3.85	626
September	3.15	3.18	0.21	3.12	2.29	4.06	631
October	3.21	3.24	0.23	3.18	2.83	4.19	633
November	3.25	3.27	0.24	3.20	2.81	4.23	647
December	3.24	3.24	0.24	3.19	2.64	4.40	633
For the Year	3.15	3.18	0.22	3.13	2.13	4.40	7,588

Table A-1 (Continued)

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

2010

Other Solids

Month	Weighted Average	Mean	Standard Deviation	Median	Minimum	Maximum	Number of Observations
	- % -	- % -	- % -	- % -	- % -	- % -	
January	5.69	5.67	0.10	5.69	4.71	5.85	632
February	5.68	5.66	0.09	5.68	4.96	5.83	631
March	5.69	5.68	0.08	5.69	5.23	5.84	635
April	5.71	5.69	0.08	5.70	5.18	5.88	629
May	5.73	5.71	0.08	5.72	5.09	5.92	631
June	5.72	5.70	0.08	5.71	5.15	5.87	629
July	5.73	5.70	0.08	5.71	5.16	5.88	631
August	5.72	5.68	0.08	5.70	5.17	5.85	626
September	5.71	5.67	0.10	5.69	5.05	5.89	631
October	5.70	5.67	0.10	5.68	4.93	5.86	633
November	5.71	5.68	0.09	5.69	5.11	5.89	647
December	5.70	5.68	0.09	5.69	5.21	5.88	633
For the Year	5.71	5.68	0.09	5.70	4.71	5.92	7,588

Table A-2

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

2010

Butterfat

Month	Weighted Average - % -	Mean - % -	Standard Deviation - % -	Median - % -	Minimum - % -	Maximum - % -	Number of Observations
January	3.60	3.68	0.34	3.58	3.20	5.45	94
February	3.54	3.59	0.36	3.53	2.74	5.37	93
March	3.51	3.53	0.39	3.49	2.36	5.31	93
April	3.41	3.46	0.38	3.42	2.56	5.25	95
May	3.41	3.45	0.36	3.39	2.65	5.07	96
June	3.41	3.46	0.32	3.43	2.95	5.04	96
July	3.41	3.46	0.33	3.45	2.71	4.94	97
August	3.42	3.46	0.32	3.42	2.90	4.75	97
September	3.44	3.49	0.33	3.47	2.90	4.92	97
October	3.51	3.56	0.34	3.54	2.75	5.01	98
November	3.65	3.73	0.33	3.66	3.14	4.98	101
December	3.69	3.77	0.33	3.70	3.24	4.94	100
For the Year	3.50	3.55	0.36	3.51	2.36	5.45	1,157

Table A-3

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION

2010

Butterfat

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	3.69	266	3.76	102	3.72	36	3.87	3
February	3.65	264	3.68	102	3.61	36	3.88	3
March	3.69	269	3.65	102	3.66	36	3.89	3
April	3.70	271	3.65	103	3.67	36	3.95	3
May	3.65	272	3.58	103	3.66	36	3.80	3
June	3.62	271	3.54	103	3.53	36	3.78	3
July	3.58	272	3.51	103	3.50	36	3.62	3
August	3.62	272	3.52	102	3.53	35	3.68	3
September	3.68	275	3.62	102	3.68	35	3.85	3
October	3.72	276	3.70	103	3.75	34	4.01	3
November	3.84	276	3.85	104	3.82	34	4.07	3
December	3.86	277	3.89	104	3.88	35	4.08	3
For the Year	3.69	272	3.66	103	3.67	35	3.87	3

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	3.94	202	3.88	23	3.60	94
February	3.88	202	3.79	24	3.54	93
March	3.90	202	3.76	23	3.51	93
April	3.92	202	3.94	14	3.41	95
May	3.87	203	3.85	14	3.41	96
June	3.80	202	3.83	14	3.41	96
July	3.75	203	3.82	14	3.41	97
August	3.79	199	3.75	15	3.42	97
September	3.86	200	3.89	16	3.44	97
October	3.91	200	4.03	17	3.51	98
November	4.03	200	4.20	30	3.65	101
December	4.03	199	4.22	15	3.69	100
For the Year	3.89	201	3.90	18	3.50	96

Table A-3 (Continued)

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION

2010

Protein

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	3.08	266	3.13	102	3.13	36	3.19	3
February	3.07	264	3.09	102	3.10	36	3.14	3
March	3.10	269	3.11	102	3.12	36	3.14	3
April	3.10	271	3.10	103	3.14	36	3.14	3
May	3.08	272	3.06	103	3.09	36	3.13	3
June	3.06	271	3.04	103	3.08	36	3.12	3
July	3.04	272	3.00	103	3.03	36	3.06	3
August	3.05	272	3.01	102	3.04	35	3.14	3
September	3.10	275	3.11	102	3.14	35	3.23	3
October	3.15	276	3.18	103	3.19	34	3.26	3
November	3.17	276	3.23	104	3.24	34	3.25	3
December	3.16	277	3.23	104	3.24	35	3.26	3
For the Year	3.10	272	3.11	103	3.13	35	3.17	3

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	3.19	202	3.29	23	N/A	N/A
February	3.17	202	3.23	24	N/A	N/A
March	3.19	202	3.24	23	N/A	N/A
April	3.21	202	3.35	14	N/A	N/A
May	3.19	203	3.31	14	N/A	N/A
June	3.17	202	3.29	14	N/A	N/A
July	3.15	203	3.27	14	N/A	N/A
August	3.17	199	3.32	15	N/A	N/A
September	3.20	200	3.39	16	N/A	N/A
October	3.25	200	3.46	17	N/A	N/A
November	3.26	200	3.52	30	N/A	N/A
December	3.24	199	3.49	15	N/A	N/A
For the Year	3.20	201	3.34	18	N/A	N/A

Table A-3 (Continued)

WEIGHTED AVERAGE COMPONENT LEVELS BY REGION

2010

Other Solids

	Region 1	No.*	Region 2	No.*	Region 3	No.*	Region 4	No.*
	-% -		-% -		-% -		-% -	
January	5.69	266	5.68	102	5.68	36	5.66	3
February	5.68	264	5.67	102	5.67	36	5.65	3
March	5.69	269	5.68	102	5.68	36	5.65	3
April	5.70	271	5.70	103	5.69	36	5.67	3
May	5.72	272	5.72	103	5.72	36	5.69	3
June	5.71	271	5.72	103	5.71	36	5.68	3
July	5.71	272	5.73	103	5.73	36	5.70	3
August	5.71	272	5.72	102	5.72	35	5.68	3
September	5.69	275	5.71	102	5.70	35	5.65	3
October	5.69	276	5.70	103	5.70	34	5.64	3
November	5.70	276	5.71	104	5.72	34	5.65	3
December	5.70	277	5.70	104	5.71	35	5.66	3
For the Year	5.70	272	5.70	103	5.70	35	5.67	3

	Region 5	No.*	Region 6	No.*	Region 7	No.*
	-% -		-% -		-% -	
January	5.72	202	5.69	23	N/A	N/A
February	5.72	202	5.68	24	N/A	N/A
March	5.73	202	5.71	23	N/A	N/A
April	5.74	202	5.73	14	N/A	N/A
May	5.76	203	5.76	14	N/A	N/A
June	5.75	202	5.73	14	N/A	N/A
July	5.75	203	5.75	14	N/A	N/A
August	5.73	199	5.71	15	N/A	N/A
September	5.75	200	5.72	16	N/A	N/A
October	5.74	200	5.70	17	N/A	N/A
November	5.73	200	5.69	30	N/A	N/A
December	5.72	199	5.68	15	N/A	N/A
For the Year	5.74	201	5.71	18	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

2010

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	1.49838	0.42368	0.01211	0.65973	0.12968	632
February	1.55756	0.40941	0.01242	0.63266	0.12484	631
March	1.65992	0.38675	0.01215	0.61502	0.12382	635
April	1.63536	0.39617	0.01139	0.65798	0.11751	629
May	1.59699	0.40855	0.01137	0.67185	0.11460	631
June	1.66692	0.38711	0.01181	0.63082	0.11738	629
July	1.48104	0.43488	0.01131	0.70097	0.11003	631
August	1.43769	0.44597	0.01123	0.71621	0.11255	626
September	1.57112	0.41495	0.01163	0.66896	0.12306	631
October	1.59151	0.41878	0.01119	0.68899	0.12646	633
November	1.48862	0.43756	0.01165	0.68590	0.13294	647
December	1.44943	0.44036	0.01156	0.69639	0.12998	633
For the Year	1.54649	0.41880	0.00331	0.67846	0.12371	7,588

Table A-5

LINEAR RELATIONSHIPS BETWEEN VARIOUS MILK COMPONENTS

2010

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	5.99993	-0.08420	0.00858	0.13130	0.09186	632
February	5.94578	-0.07337	0.00848	0.10500	0.08518	631
March	5.91206	-0.06050	0.00771	0.08716	0.07863	635
April	5.92992	-0.06217	0.00763	0.09439	0.07866	629
May	5.93317	-0.05889	0.00778	0.08209	0.07838	631
June	5.96290	-0.06954	0.00752	0.11874	0.07469	629
July	5.99667	-0.07964	0.00795	0.13618	0.07734	631
August	6.02159	-0.08924	0.00728	0.19275	0.07300	626
September	5.98610	-0.08093	0.00867	0.12018	0.09182	631
October	6.03092	-0.09260	0.00766	0.18688	0.08655	633
November	6.09180	-0.10246	0.00703	0.24659	0.08025	647
December	6.10340	-0.10503	0.00672	0.27774	0.07559	633
For the Year	5.99704	-0.08119	0.00220	0.15227	0.08216	7,588

Table A-6

MONTHLY PRODUCER COMPONENT PRICES

2010

Pacific Northwest Order

Month	Butterfat Price $ / pound	Protein Price $ / pound	Other Solids Price $ / pound	Producer Price Differential 1/ $ / hundredweight
January	1.4405	2.7916	0.1946	0.38
February	1.4404	2.7066	0.1992	0.35
March	1.5347	2.1311	0.1823	1.08
April	1.5813	2.1449	0.1702	0.87
May	1.7058	2.1523	0.1704	1.22
June	1.7234	2.2040	0.1748	1.56
July	1.8964	2.0515	0.1700	1.93
August	2.0336	2.3788	0.1647	0.98
September	2.4044	2.3057	0.1673	0.68
October	2.4436	2.4739	0.1736	0.41
November	2.2422	2.1981	0.1797	1.27
December	1.7952	2.1706	0.1852	1.49
Simple Average	1.8535	2.3091	0.1777	1.02

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	10.43	1.4709
February	10.19	1.4408
March	9.27	1.5263
April	8.94	1.5756
May	9.44	1.6921
June	9.98	1.7281
July	9.97	1.8629
August	9.90	2.0127
September	9.51	2.3306
October	9.63	2.4344
November	9.64	2.2858
December	9.61	1.8874
Simple Average	9.71	1.8540

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

2010

(See Figure A-7)

Pacific Northwest Order

Size Range				
Equal to or more than	Less than	Butterfat	Protein	Other Solids
- pounds -	- pounds -	- % -	- % -	- % -
	50,000	4.10	3.24	5.56
50,000	100,000	4.11	3.25	5.62
100,000	200,000	4.08	3.23	5.65
200,000	300,000	3.96	3.18	5.68
300,000	400,000	3.95	3.19	5.70
400,000	500,000	3.95	3.21	5.70
500,000	600,000	3.94	3.19	5.70
600,000	700,000	3.84	3.17	5.70
700,000	1,000,000	3.74	3.11	5.72
1,000,000	2,000,000	3.66	3.11	5.72
2,000,000	3,000,000	3.65	3.10	5.71
3,000,000	4,000,000	3.75	3.15	5.72
4,000,000	6,000,000	3.66	3.11	5.70
6,000,000		3.72	3.20	5.71
Weighted Average		3.73	3.15	5.71

Table A-7 (Continued)

AGGREGATED COMPONENT TESTS BY SIZE-RANGE OF PRODUCER MILK DELIVERIES

2010

(See Figure A-7)

Arizona Order

Size Range		
Equal to or more than	Less than	Butterfat
- pounds -	- pounds -	- % -
	100,000	3.48
100,000	200,000	3.72
200,000	300,000	3.66
300,000	400,000	4.17
400,000	500,000	3.62
500,000	600,000	3.56
600,000	700,000	3.63
700,000	1,000,000	3.43
1,000,000	2,000,000	3.62
2,000,000	3,000,000	3.59
3,000,000	4,000,000	3.58
4,000,000	5,000,000	3.45
5,000,000	6,000,000	3.45
6,000,000	7,000,000	3.46
7,000,000		3.45
Weighted Average		3.50

Table A-8

AGGREGATED COMPONENT VALUES BY SIZE-RANGE OF PRODUCER MILK DELIVERIES

2010

(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	$ 1,907,824.84	11,201,498	0.14%	367	4.84%	17.03
50,000	100,000	7,652,648.15	44,584,515	0.56%	593	7.81%	17.16
100,000	200,000	28,295,674.09	165,921,980	2.07%	1,129	14.88%	17.05
200,000	300,000	35,495,186.12	211,445,795	2.64%	850	11.20%	16.79
300,000	400,000	30,290,440.80	182,427,539	2.28%	530	6.98%	16.60
400,000	500,000	34,936,770.22	207,755,946	2.59%	461	6.08%	16.82
500,000	600,000	42,355,151.21	254,154,838	3.17%	462	6.09%	16.67
600,000	700,000	37,328,164.28	226,307,768	2.83%	350	4.61%	16.49
700,000	1,000,000	96,499,308.22	595,943,401	7.44%	710	9.36%	16.19
1,000,000	2,000,000	261,680,964.21	1,638,402,716	20.46%	1,133	14.93%	15.97
2,000,000	3,000,000	173,197,684.75	1,087,867,764	13.59%	452	5.96%	15.92
3,000,000	4,000,000	110,046,942.51	680,804,955	8.50%	194	2.56%	16.16
4,000,000	6,000,000	127,590,039.12	795,574,966	9.94%	171	2.25%	16.04
6,000,000		310,753,238.49	1,904,093,021	23.78%	186	2.45%	16.32
Total/Weighted Average		$ 1,298,030,037.02	8,006,486,702	100.00%	7,588	100.00%	16.21

Table A-8 (Continued)

AGGREGATED COMPONENT VALUES BY SIZE-RANGE OF PRODUCER MILK DELIVERIES

2010

(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	$ 98,746.54	641,890	0.02%	9	0.78%	15.38
100,000	200,000	201,668.22	1,214,170	0.03%	8	0.69%	16.61
200,000	300,000	467,380.85	2,998,336	0.07%	12	1.04%	15.59
300,000	400,000	950,864.93	5,604,898	0.13%	16	1.38%	16.96
400,000	500,000	1,389,189.50	8,736,918	0.21%	20	1.73%	15.90
500,000	600,000	1,481,445.22	9,154,603	0.22%	17	1.47%	16.18
600,000	700,000	1,185,911.65	7,182,182	0.17%	11	0.95%	16.51
700,000	1,000,000	6,089,670.19	37,591,664	0.89%	43	3.72%	16.20
1,000,000	2,000,000	71,506,088.02	441,361,649	10.43%	299	25.84%	16.20
2,000,000	3,000,000	82,192,748.26	513,153,785	12.13%	207	17.89%	16.02
3,000,000	4,000,000	80,289,209.75	498,225,938	11.77%	143	12.36%	16.12
4,000,000	5,000,000	62,051,736.87	394,042,288	9.31%	87	7.52%	15.75
5,000,000	6,000,000	86,858,370.29	559,753,662	13.23%	103	8.90%	15.52
6,000,000	7,000,000	56,172,344.25	356,902,348	8.43%	55	4.75%	15.74
7,000,000		218,358,779.87	1,395,108,808	32.97%	127	10.98%	15.65
Total/Weighted Average		$ 669,294,154.41	4,231,673,139	100.00%	1,157	100.00%	15.82

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
2010
Pacific Northwest Order

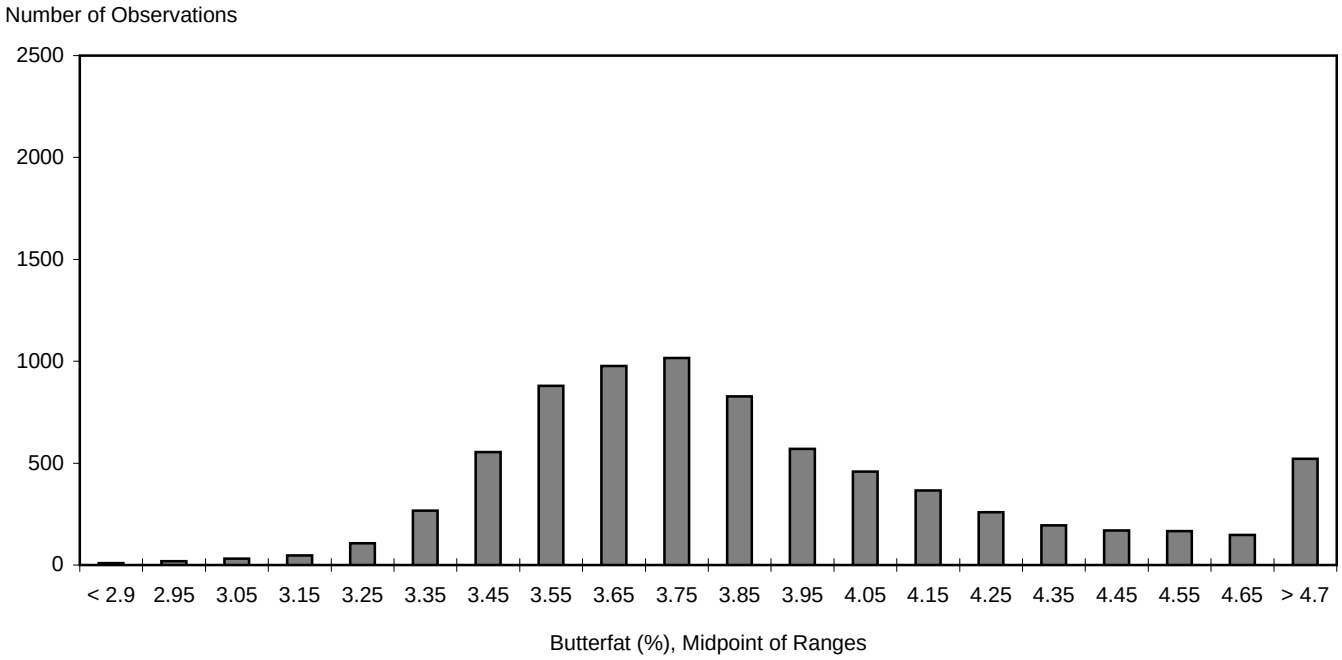


Figure A-2
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE PROTEIN LEVELS
2010
Pacific Northwest Order

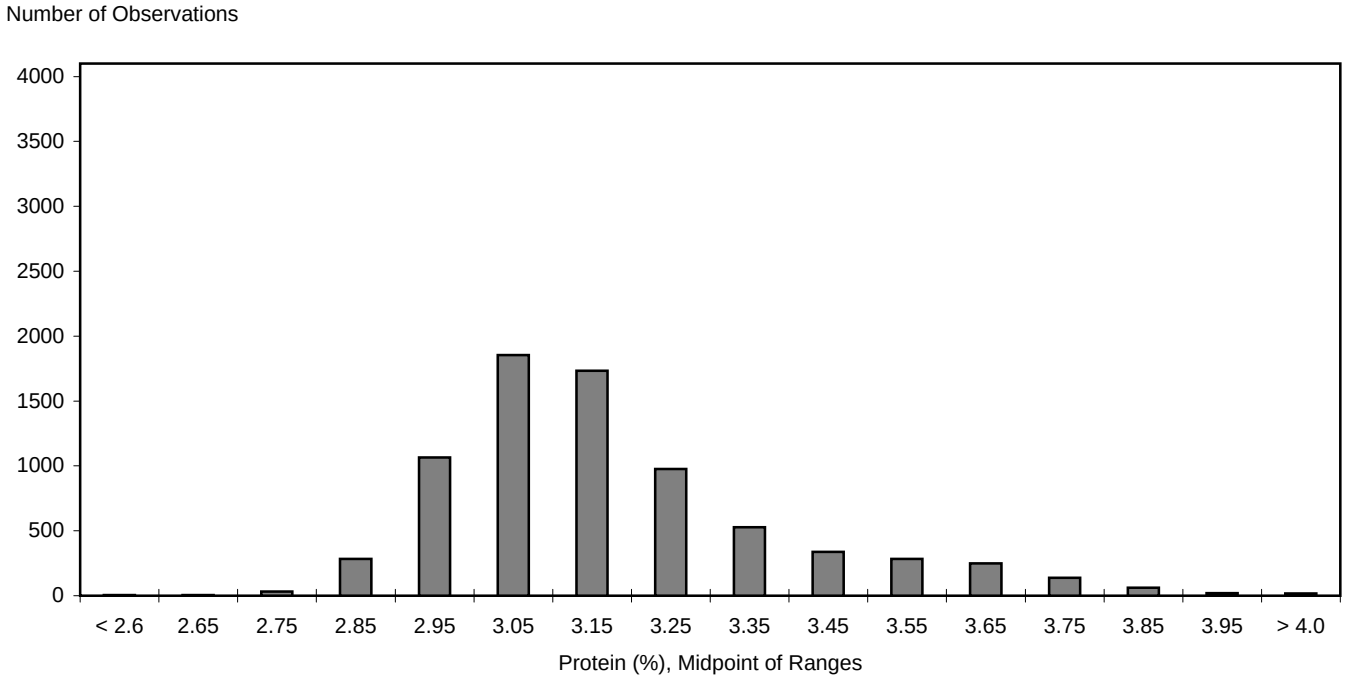


Figure A-3
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE
OTHER SOLIDS LEVELS
2010
Pacific Northwest Order

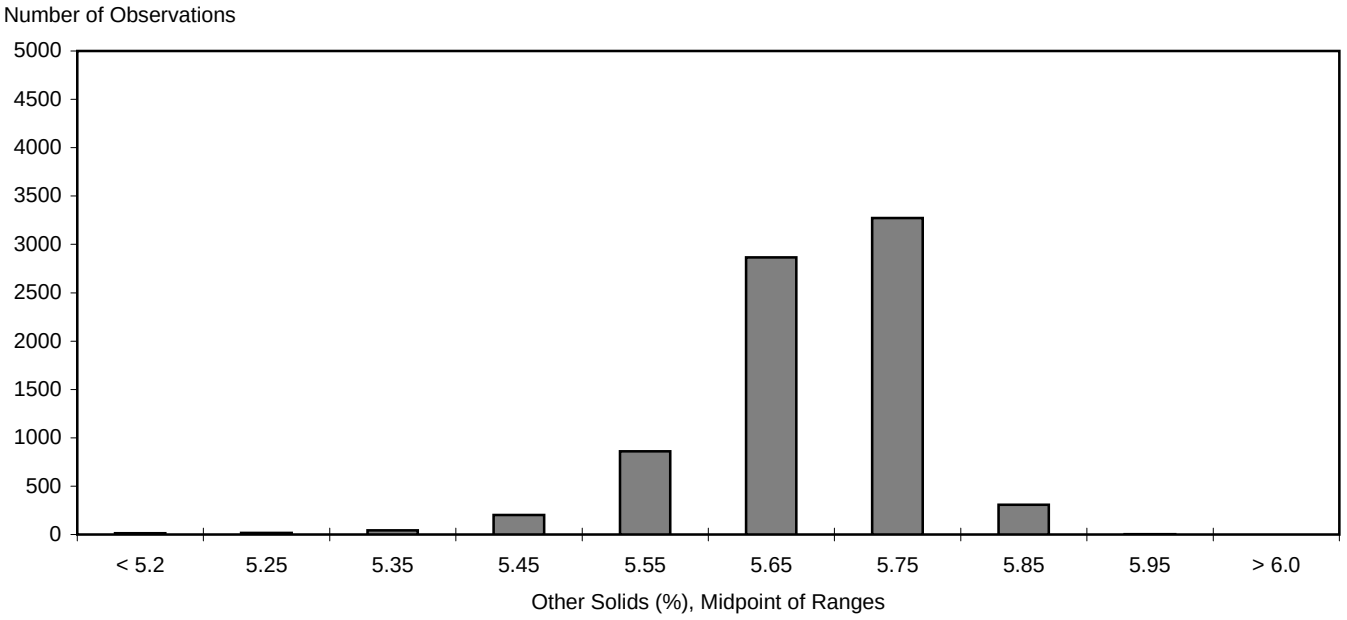


Figure A-4
FREQUENCY DISTRIBUTION OF MONTHLY AVERAGE BUTTERFAT LEVELS
2010
Arizona Order

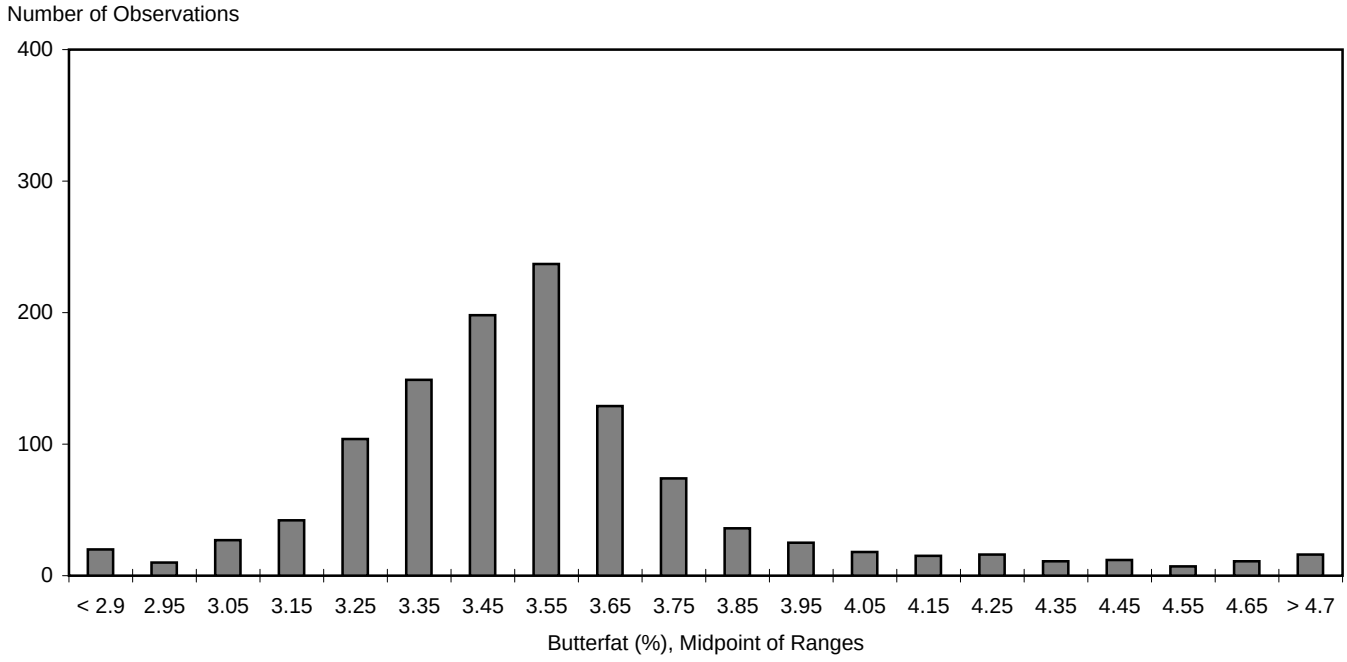
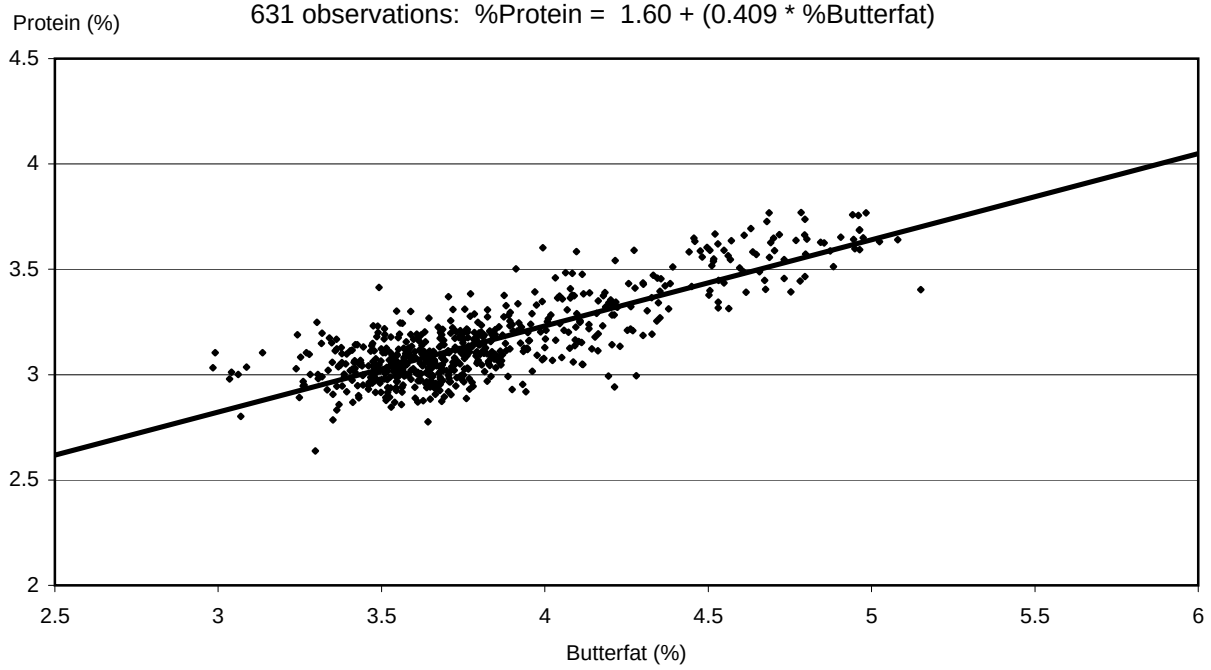


Figure A-5
SCATTER PLOT OF PROTEIN AND BUTTERFAT
MAY AND NOVEMBER 2010
Pacific Northwest Order

May 2010

631 observations: %Protein = 1.60 + (0.409 * %Butterfat)



November 2010

647 observations: %Protein = 1.49 + (0.438 * %Butterfat)

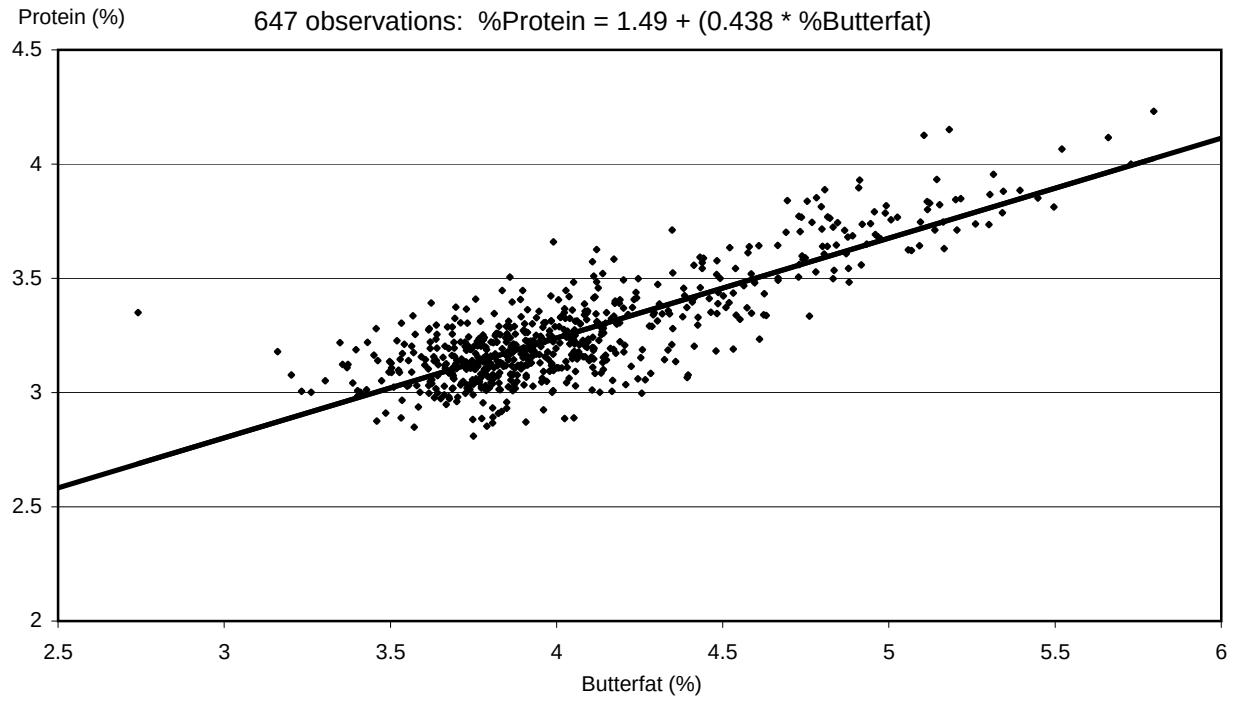
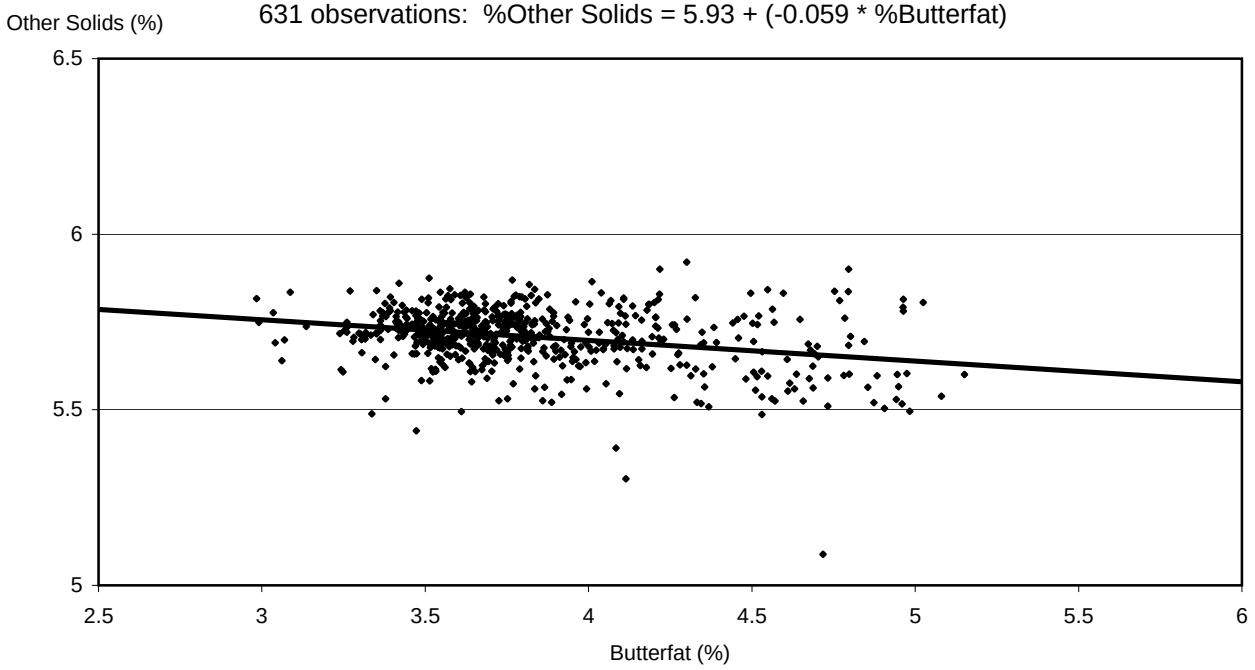


Figure A-6
SCATTER PLOT OF OTHER SOLIDS AND BUTTERFAT
MAY AND NOVEMBER 2010
Pacific Northwest Order

May 2010

631 observations: %Other Solids = 5.93 + (-0.059 * %Butterfat)



November 2010

647 observations: %Other Solids = 6.09 + (-0.102 * %Butterfat)

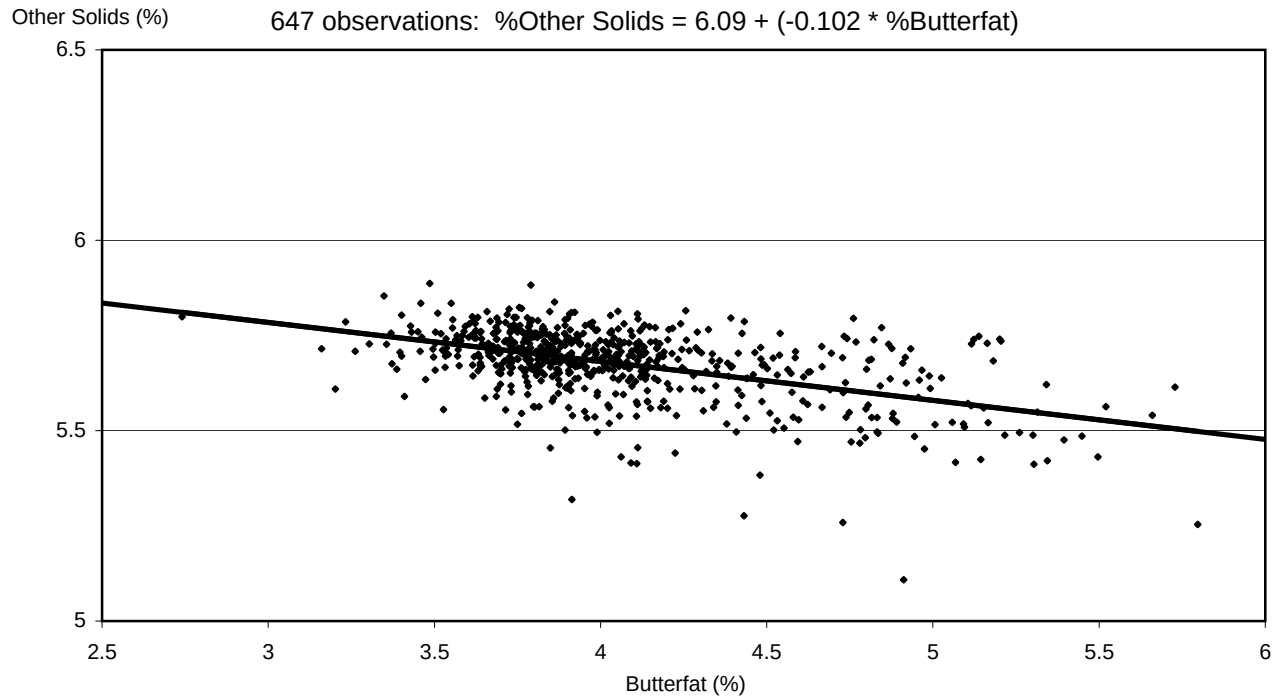
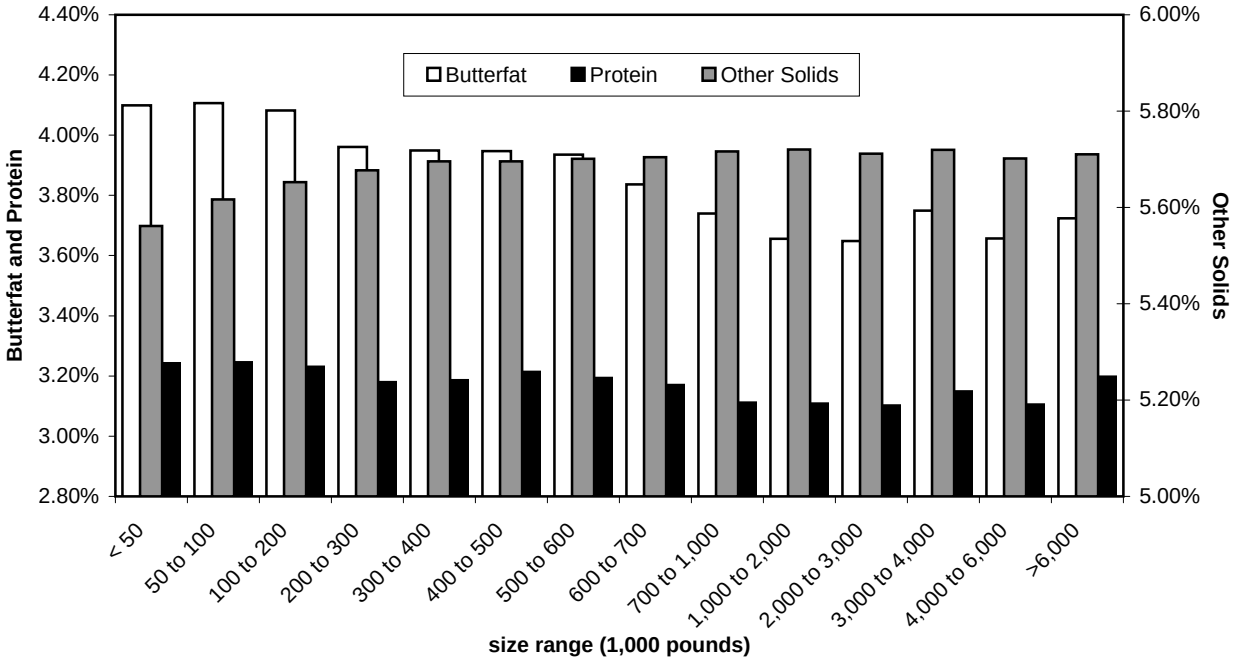


Figure A-7
WEIGHTED AVERAGE COMPONENT LEVELS
BY SIZE-RANGE OF PRODUCER MILK DELIVERIES
2010

Pacific Northwest Order



Arizona Order

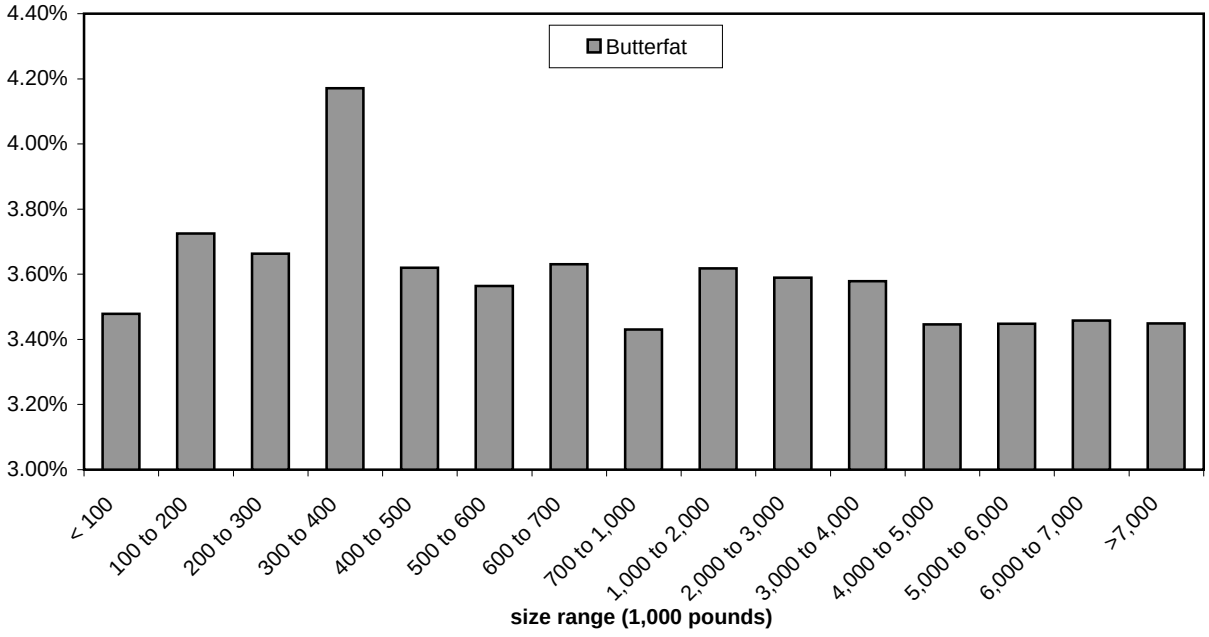
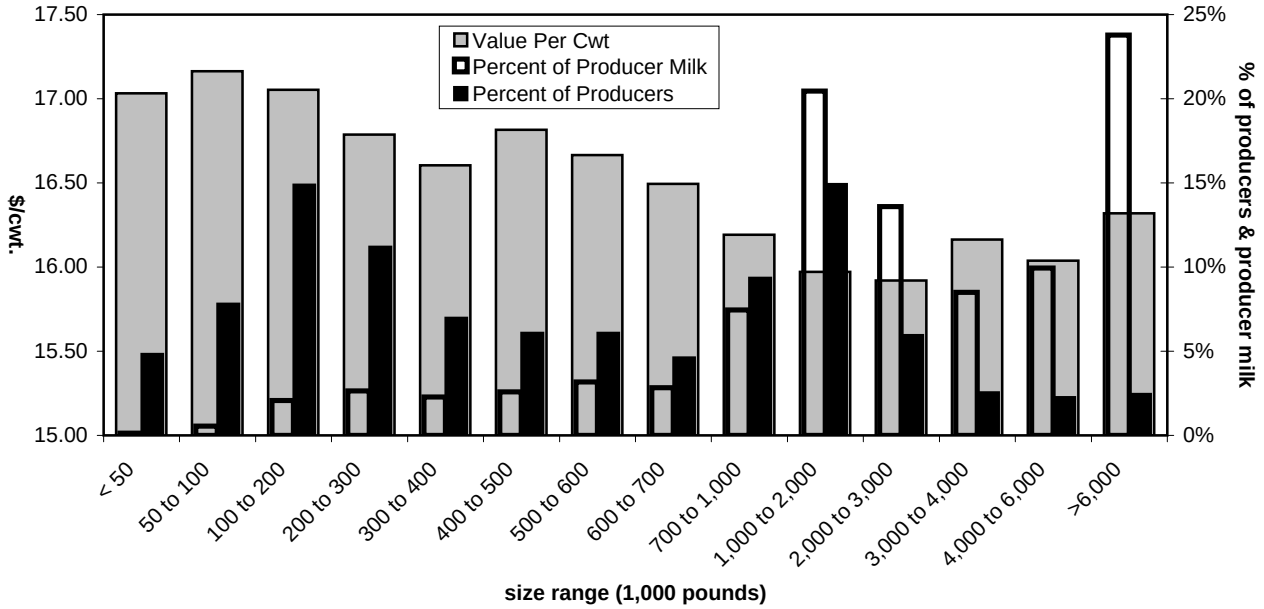
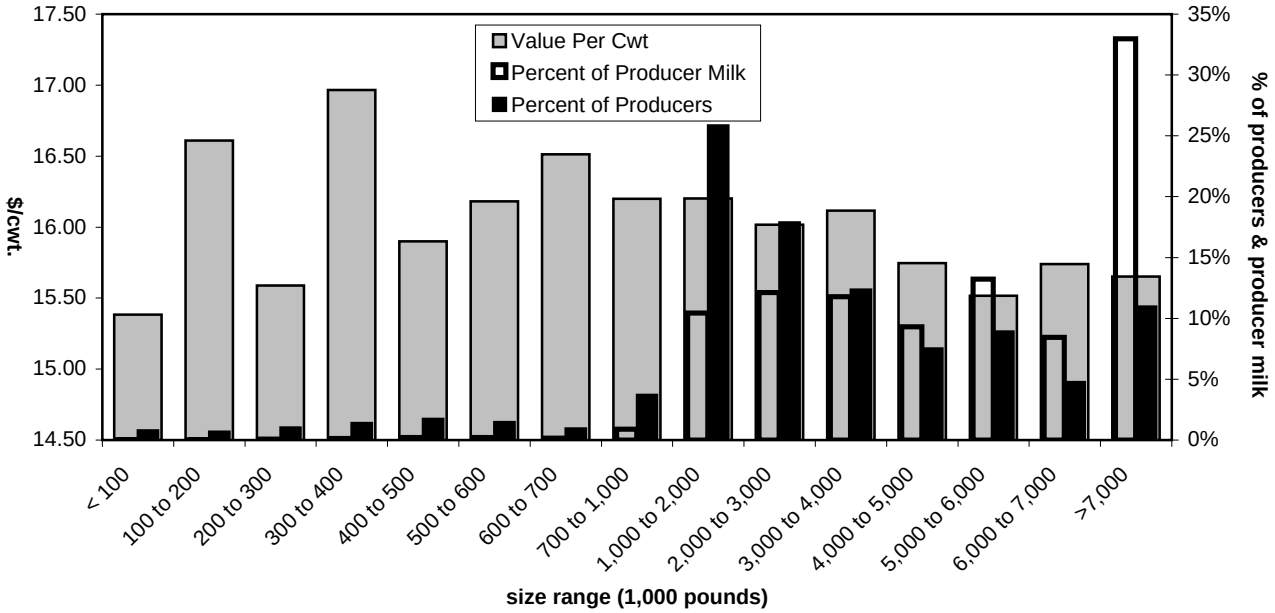


Figure A-8
WEIGHTED AVERAGE VALUES AND PERCENT OF PRODUCERS & PRODUCER MILK
BY SIZE-RANGE OF PRODUCER MILK DELIVERIES
2010

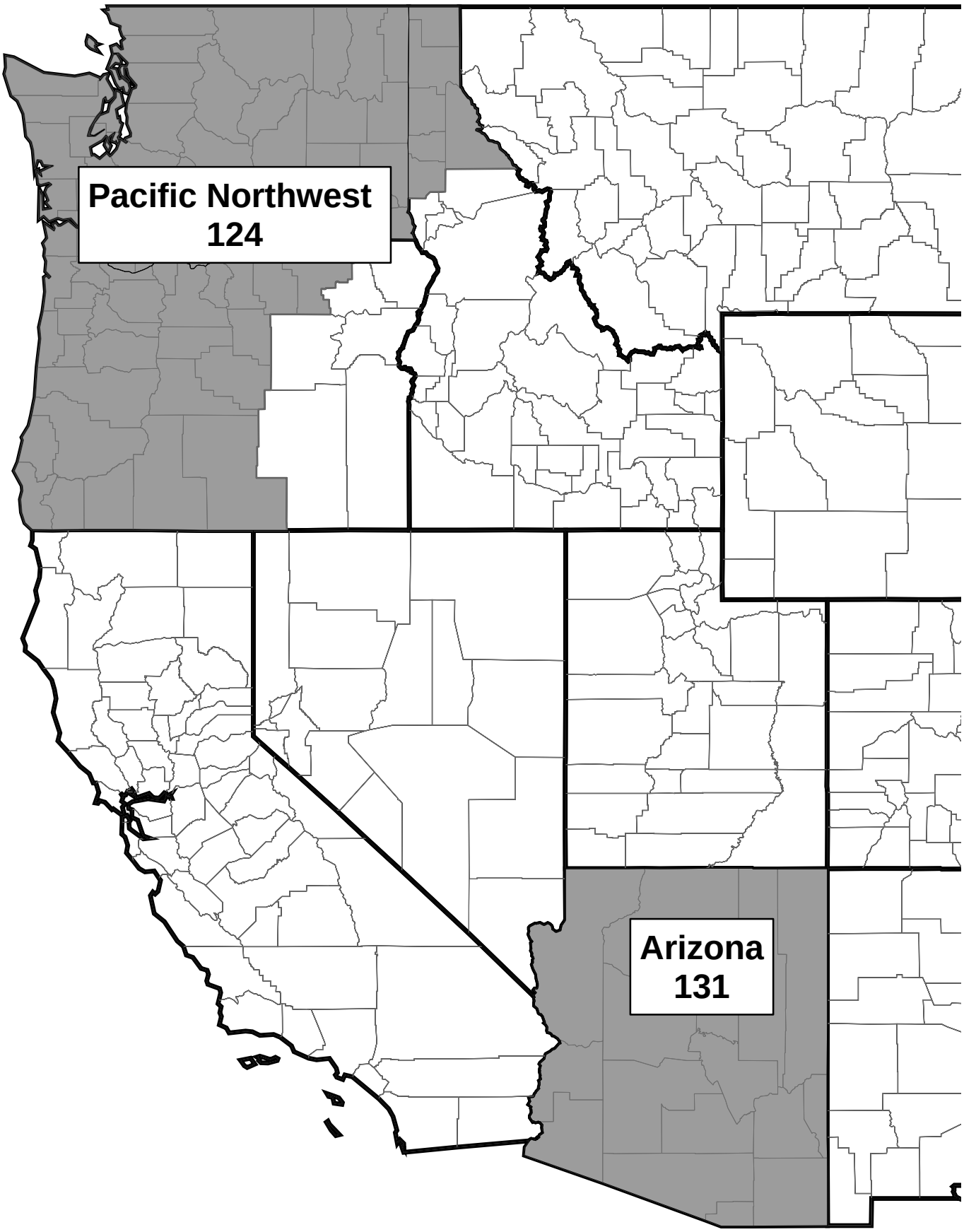
Pacific Northwest Order



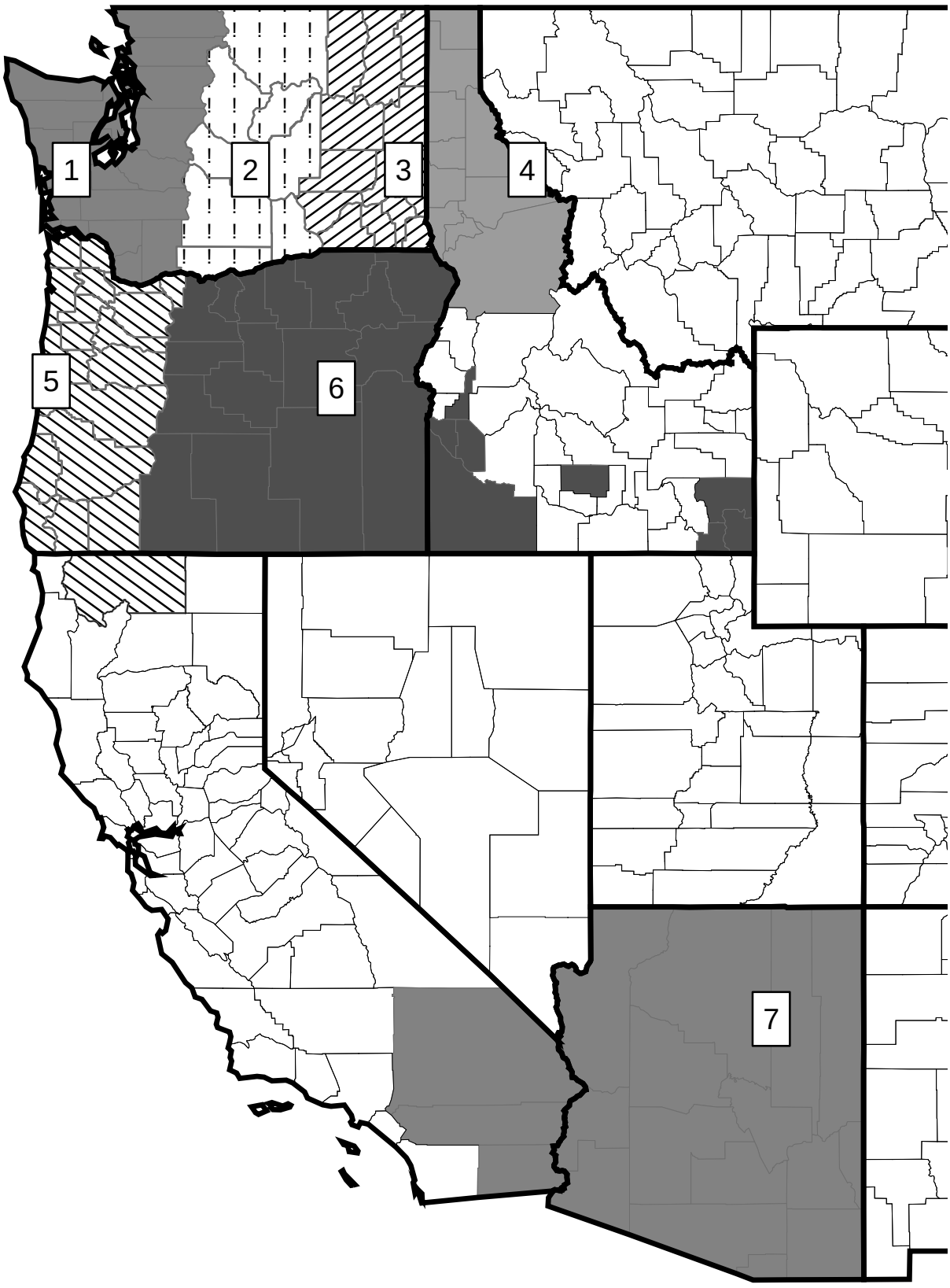
Arizona Order



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, 2010



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