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ANALYSIS OF CHANGES IN COMPONENT TESTS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL

PACIFIC NORTHWEST ORDER: 2000-2012

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Abstract

Average component tests for milk from producers historically and consistently associated with the Pacific Northwest (FO 124) Federal Milk Marketing Order increased by 0.186 butterfat, 0.169 true protein, and 0.030 other solids between 2000 and 2012. These changes are not substantively different than published pool data. This study analyzes changes in milk component tests using a form of contribution analysis to determine how tests have changed. Specifically, changes in market level component tests and the ratio of butterfat to protein are traced to changes in seasonal component tests, the size of farms in terms of annual average daily deliveries, the variability of monthly average daily deliveries across the year, and the location of farms.

In summary, increases in component tests between 2000 and 2012 in the Pacific Northwest are associated with:

- the Fall and Winter months more than the Spring and Summer months;
- producers with daily deliveries of more than 60,000 pounds on average;
- producers who have generally less variable production;
- producers in Central/Eastern Oregon, Central Washington, Eastern Washington, Western Oregon, and Western Washington, in rank order of contribution;
- a decline and a partial recovery in the ratio of butterfat to protein; and
- a shift to a lower average change per year in production per cow.

Additionally, the ratio of butterfat to protein tests decreased 0.54 percentage points between 2000 and 2012 with what appears to be a low trough in 2009-11. By 2012, the ratio of butterfat to protein recovered somewhat. An analysis of the ratio using the previously mentioned categories suggests that the 0.54 percentage point decline in the ratio is associated with milk produced in January through July, with the largest producers (≥160,000 pounds), generally with producers with less variable production, and producers who are located east of the Cascades.

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ANALYSIS OF CHANGES IN COMPONENT TESTS IN INDIVIDUAL HERD MILK AT THE FARM LEVEL

PACIFIC NORTHWEST ORDER: 2000-2012

John Mykrantz[1]

I. INTRODUCTION

Average component tests for milk from producers historically and consistently associated with the Pacific Northwest (FO 124) Federal Milk Marketing Order increased by 0.186 butterfat, 0.169 true protein, and 0.030 other solids between 2000 and 2012. [2] These changes are not substantively different than published pool data. This study analyzes changes in milk component tests using a form of contribution analysis to determine how tests have changed. Specifically, changes in market level component tests and the ratio of butterfat to protein are traced to changes in seasonal component tests, the size of farms in terms of annual average daily deliveries, the variability of monthly average daily deliveries across the year, and the location of farms. No attempt was made to determine why changes occurred, only how market level changes in component tests related to the milk component tests of individual herd milk.

Data is examined on a triennial basis between 2000 and 2012. Data for 2010 and 2011 are also examined. Milk that was historically associated with the order but was not pooled due to price relationships is included in this analysis. Certain milk pooled during the 2000 and 2003 periods was considered to be not historically associated with the order and was excluded from the analysis. Only producers with a full twelve months of records in a year are included in the analysis. The preceding criteria resulted in an amended data set representing an annual average 7.3 billion pounds and 679 producers.

II. DATA AND METHODOLOGY

The data included in this study comprises milk historically associated with the Pacific Northwest Order. The data was collected from producer payrolls submitted by handlers to the market administrator's office. Components available for the Pacific Northwest Order are butterfat, protein, and other solids (other solids is nonfat solids less protein). The payroll data includes producers who do not have 12 months of data in a calendar year, and who are not consistently or historically associated with the Pacific

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[1] John Mykrantz is an Agricultural Economist with the Market Administrator's Office, Bothell, Washington.
Special thanks are due several staff of the Bothell MA office, including Lori Espe, Dan Nguyen, Alyce Owen, John Priest, Eric Talarico, and Lisa Wyatt, for editorial comments on early drafts.
[2] This study is an extension of "Analysis of Component Levels in Individual Herd Milk at The Farm Level: 2011" in which long term trends were identified in data for the Pacific Northwest Order. The study is available at: http://www.fmmaseattle.com/statistics/componentanalysis11.pdf.

Northwest Order. The group of producers with partial year's data is excluded from the dataset. Milk of producers historically associated with the order but not pooled due to price relationships is included in the dataset.

Comparisons between the amended dataset and published data are shown in Table 1 and do not suggest substantive differences that would bias the results. Characteristics of the amended database are shown in Appendix A, Table A-1 through A-5. All subsequent references to a dataset refer to the amended dataset.

The triennial years of 2000, 2003, 2006, 2009 and 2012 were chosen to reduce the amount of data analyzed while tracking the trend of changes in market level component tests. Data for 2010 and 2011 were included to identify changes in the last three years of the period.

Table 1: Selected Characteristics of Published and Amended Datasets

Dataset	Percent of Published	Average Annual Pounds of Milk (Billion)	Average Annual Number of Producers	Average Annual Daily Delivery	Average		
					Butterfat	Protein	Other Solids
Published	100%	7.27	726	28,984	3.720%	3.107%	5.711%
Amended	100%	7.31	679	30,475	3.729%	3.115%	5.712%
Amended less Published		0.03	-47	1,490	0.009	0.008	0.001

The dataset is analyzed using a simple mathematical form of contribution analysis. Contribution analysis is typically used in business to examine how a product or service contributes to the overall financial position of a business based on certain assumptions. The present use of contribution analysis does not make any assumptions but simply reflects purely mathematical relationships between changes in weighted averages and the contribution of various categorizations of milk from individual herds to the weighted average change. The contribution of category C_{it} to the weighted average test of the market is simply $C_{it} \times P_{it}$, where C_{it} is the component test of category i in year t and P_{it} is the percent of pounds in category i in year t. By subtracting the contribution value for one year from another year, the contribution of that category to the weighted average change in the market between years can be calculated. The sum of each category's contribution equals the weighted average change.

The changes identified are relative and/or absolute. Relative positive changes indicate different levels of absolute positive contributions to the weighted average change which can be greater or less than the weighted average change. Absolute negative contributions counterbalance the absolute positive contributions. By comparing contributions of each category or aggregations of contributions of multiple categories, the relative importance of the contributions can be gauged.

The following is a simple illustration of how to interpret the contributions using sample data (See illustration table below). Assume butterfat tests for the market increased by 0.1375 percentage points from 3.6350 to 3.7725 percent between two periods. Assume also that Small, Medium, Large and Very Large farms, however defined, represent 40, 40, 15 and 5 percent of total production, respectively, in the period one, and 20, 35, 25 and 20 percent of total production in period two. An example of a relative negative contribution in the example is Small farms. Milk production coming from Small farms decreased from 40% to 20% between periods one and two but the test of milk from this category of farms increased from 3.70% to 4.10%. These two changes combined result in a -0.66 percentage point contribution to the weighted average change. An example of a relative and absolute negative contribution in the example is Medium farms as both the percent of milk and test of milk in the category decreased. Combined, Large and Very Large farms contributed a total of 0.995 percentage points to the market-wide increase of 0.1375. Small and Medium farms contributed -0.8575 to the 0.1375 increase. Adding the aggregated contributions of 0.995 and -0.8575 equals 0.1375. This implies that the relative contribution of butterfat to the market average test has shifted from Small and Medium farms to Large and Very Large farms and that the change in contribution of butterfat from Small farms is relatively greater than Medium farms and the change in contribution of butterfat by Very Large farms is greater than for Large farms.

Illustration of Contribution Analysis: Sample Data

	Period 1		Period 2		Change	Category
Category	Milk Lbs %	BF %	Milk Lbs %	BF %	in BF %	Contribution
Small	40.0%	3.70%	20.0%	4.10%	0.40%	-0.6600
Medium	40.0%	3.60%	35.0%	3.55%	-0.05%	-0.1975
Large	15.0%	3.60%	25.0%	3.80%	0.20%	0.4100
Very Large	5.0%	3.50%	20.0%	3.80%	0.30%	0.5850
Total						0.1375
Market		3.6350%		3.7725%		0.1375

The categories of month (and season), size of average daily delivery, variation in monthly average daily delivery and region are used to determine how each category contributes to the weighted average change in component tests between 2000 and 2012. In the case of across the board increases or decreases, the calculation of the contribution of each category is simple. In the event of changes that are the net effect of increases and decreases, absolute values of changes are weighted and apportioned into positive and negative effects.

Categories to reflect seasonal differences were constructed to reflect general differences in the seasonal climate conditions and day length. [3] Across the Pacific Northwest, average daily highs are generally above 60 degrees from April through September and below 60 degrees October through March. Similarly, daylight hours are above 12 hours

[3] Climate information: http://www.weather.com/. Daylight hour information: http://www.timeanddate.com/.

from April through September and below 12 hours from October through March. Consequently, two periods were defined: Spring/Summer (April-June & July-September) and Fall/Winter (October-December & January-March). The goal of this measure is to identify monthly and/or seasonal changes in component tests across the period.

Categories of size-range of annual average daily delivery were constructed to reflect different levels of average daily production. Annual average daily deliveries for a producer in a year define the size category with which the producer is identified for that year. The goal of this measure is to determine whether component changes across the period are associated with differences between and/or changes in the size of milk production operations.

Categories of variation in production were based on the coefficient of variation (CV) of monthly average daily deliveries. The coefficient of variation is a normalized measure of dispersion of a data series. Specifically, the CV for a producer is the producer's standard deviation of monthly average daily deliveries (σ) divided by the producer's daily average delivery for the year (μ), multiplied by 100, i.e., $(\sigma/\mu)x100$. The goal of this measure is to determine if changes in component tests can be traced to general differences in variability of production between producers and/or changes in the variability across the period.

The Pacific Northwest Order was divided into five regions generally reflective of climate conditions and geography. The Cascade Mountain Range divides the Western and Central/Eastern regions. In the Pacific Northwest, the region west of the Cascade Mountain Range has more precipitation and is characterized by a milder climate than the eastern side of the Cascades.[4] The region east of the Cascade Mountain Range has a drier climate with warmer summers and colder winters. The regions are: 1) Western Washington; 2) Central Washington; 3) Eastern Washington (and Northern Idaho)[5]; 4) Western Oregon (and Northern California); and 5) Central/Eastern Oregon. The goal of using this categorization of farms is to determine if changes in component tests can be traced to particular regions and/or changes in the location of milk production.

Lastly, the preceding categories were used to understand how the ratio of butterfat to protein has changed across the period. The ratio of butterfat to protein is a primary determinant of cheese yield.

[4] Climate information based on Western Regional Climate Center precipitation maps (http://www.wrcc.dri.edu/).
[5] Eastern Washington is comprised of those Counties east of Okanagon, Grant and Benton County.

III. CHANGES IN SEASONAL VARIATION IN MILK COMPONENT TESTS

In the Pacific Northwest Order, milk production and butterfat, protein and other solids tests change seasonally. Milk production per cow typically increases to a peak in the spring and decreases to a low point in the fall. Butterfat and protein tests also demonstrate a similar but opposite seasonality, decreasing to a low in the spring and increasing to a peak in the fall. The seasonality of milk production and component tests is a function of breed, daylight hours, temperature, feed quality and type, and the biological cycle of cows. Butterfat and protein tests show pronounced seasonal variation. Other solids tests are much more consistent throughout the year when compared to the seasonal changes in butterfat and protein tests but still show some seasonality. Other solids, which are primarily lactose, are correlated with the portion of milk which is water. Lactose is the major osmotic regulator of milk production.

Between 2000 and 2012, component tests have increased across the year (See Appendix B, Tables B-1 through B-3). As shown in Table 2, while the weighted average monthly butterfat tests have increased 0.186 percentage points, the tests in the Fall/Winter period have increased proportionally more than those in the Spring/Summer period. Higher Fall/Winter tests represent about 65% of the 0.186 increase, while increases for Spring/Summer accounted for about 35% of the increase. In the case of protein, 63% of the 0.169 percentage point increase can be attributed to increased tests in the Fall/Winter period and 37% to the Spring/Summer. Changes in other solids present some issues as far as interpretation as they are dissimilar in some respects to changes in butterfat and protein tests. For other solids tests, the months of November through May had positive contributions to the 0.030 increase, while the months of June through October had negative contributions. The shift in other solids tests roughly matches the shift in pounds of milk between seasons.

These changes reflect a slight cross-seasonal percentage point shift of component production (See Appendix B, Table B-4). Butterfat pounds shifted from summer (-0.68) and spring (-0.06) to winter (+0.21) and fall (+0.53). Protein pounds shifted from summer (-0.83) to spring (+0.12), fall (+0.23) and winter (+0.48). Other solids pounds shifted from summer (-0.51) to spring (+0.07) and winter (+0.44).

However, in general, slightly more than 25 percent of the annual pounds of butterfat and protein produced occur in each of the three periods Spring, Fall and Winter, with slightly more than 24% produced in the Summer. Other solids is somewhat different with about 25% or more produced in each of the Spring and Summer and slightly less than 25% produced during each of the Fall and Winter.

Table 2: Distribution of Changes by Season

Season 1/	Pounds 2/		Portion of Component Pounds 2/ 3/		
	2000	2012	Butterfat	Protein	Other Solids
Winter	24.6%	24.9%	25.1%	25.1%	24.9%
Spring	25.7%	25.8%	25.3%	25.4%	25.9%
Summer	25.4%	24.9%	24.3%	24.4%	25.0%
Fall	24.3%	24.4%	25.3%	25.1%	24.3%
Spring/Summer	51.2%	50.7%	49.6%	49.8%	50.8%
Fall/Winter	48.8%	49.3%	50.4%	50.2%	49.2%
			Contribution by Season		
Spring/Summer			0.065	0.063	-0.010
Fall/Winter			0.121	0.106	0.040
Change in Tests (2000-2012)			0.186	0.169	0.030

1/ Winter: January-March; Spring: April-June; Summer: July-September; Fall: October-December.

2/ Percentage of pounds are adjusted to an even day month and daily basis.

3/ Data for 2012.

IV. CHANGES IN COMPONENT TESTS BY SIZE-RANGE OF AVERAGE ANNUAL DAILY DELIVERY

In the Pacific Northwest, the average annual daily delivery per producer increased substantially since 2000. The size distribution of producers has changed from many small to medium size farms and a few larger farms, to fewer smaller and medium size producers and proportionally more large and very large farms. The portion of milk produced by each category in the Pacific Northwest has similarly changed with the majority of milk now produced by the larger farms in the region. These changes in the size of producers across the period are summarized in Appendix A, Table A-3.

The contribution of each farm size category to the increase in overall market component tests parallels the change in distribution of producers. See Table 3. For butterfat, which experienced the largest increase over the period (+0.186 percentage points), very large farms contributed the largest portion (39% of production in 2012, +1.134 percentage points) followed by large farms (23%, +0.163), medium farms (19%, -0.270), and small farms (19%, -0.840). The source of changes in protein and other solids tests showed similar patterns. Details of changes in component tests associated with size of the annual average daily delivery are summarized in Appendix C.

Table 3: Distribution of Pounds by Size of Average Annual Daily Delivery

Size	2000	2012	Butterfat		Protein		Other Solids	
Category 1/	Pounds	Pounds	Pounds 2/	% Points	Pounds 2/	% Points	Pounds 2/	% Points
Small	42.7%	18.9%	19.7%	-0.840	19.0%	-0.700	18.9%	-1.350
Medium	27.0%	18.6%	18.4%	-0.270	18.3%	-0.229	18.7%	-0.476
Large	19.9%	23.0%	22.7%	0.163	22.9%	0.138	23.0%	0.182
Very Large	10.4%	39.4%	39.2%	1.134	39.7%	0.960	39.5%	1.673
Total 3/	100.0%	100.0%	100.0%	0.186	100.0%	0.169	100.0%	0.030

1/ Small <30,000; 30,000≤Medium<60,000; 60,000≤Large<120,000; Very Large≥120,000.

2/ Data for 2012.

3/ May not add due to rounding.

V. CHANGES IN COMPONENT TESTS BY VARIABILITY OF MONTHLY AVERAGE DAILY DELIVERY

The monthly average daily delivery of each producer varies across the year. A measure of this variation is the coefficient of variation which is the standard deviation of the observations divided by the average of the observations. This measure of variability can be represented as a percentage. In a rough manner, the percentage reflects that approximately two thirds of the monthly observations are within that percent of the annual average daily delivery. The use of this measurement of variability is somewhat arbitrary but it is sufficient to categorize a complex data series in an attempt to identify factors that may be associated with changes in market level component tests.

The variability of production as measured by the coefficient of variation decreased between 2000 and 2012. The proportion of production in the lower variability production groups increased by 4.9 (Low) and 8.0 (Medium) and 2.5 (High) percentage points, respectively. The proportion of production in the Very High variability group decreased 15.4 percentage points. Aspects of the changes in the variability of monthly average daily delivery are summarized in Table 4 and Appendix A, Table A-4.

The decrease in variability of production appears to be associated with increases in component tests. As is shown in Table 4, the group with a very high coefficient of variation (≥7%) contributed negatively to the increase in market test of butterfat, protein, and other solids tests. The categories with lower level coefficients of variation (<7%), with two exceptions, contributed positively to the change in market level component tests, i.e., they counter-balanced the effect of the group with very high levels of variation in production. Details of changes in component tests associated with variability of production are summarized in Appendix D.

Table 4: Distribution of Pounds by Variability of Monthly Daily Delivery

Variability	2000	2012	Butterfat		Protein		Other Solids	
Category 1/	Pounds	Pounds	Pounds 2/	% Points	Pounds 2/	% Points	Pounds 2/	% Points
Low	8.5%	13.4%	12.9%	0.188	13.0%	0.163	13.5%	0.287
Medium	24.1%	32.0%	31.6%	0.346	31.9%	0.296	32.0%	0.462
High	33.6%	36.1%	36.7%	0.183	36.6%	0.152	36.1%	0.152
Very High	33.8%	18.4%	18.8%	-0.530	18.5%	-0.441	18.4%	-0.872
Total 3/	100.0%	100.0%	100.0%	0.186	100.0%	0.169	100.0%	0.030

1/ Coefficient of Variation: Low ≤3%; 3%<Medium<4.5%; 4.5%≤High<7%; Very High≥7%.
2/ Data for 2012.
3/ May not add due to rounding.

VI. CHANGES IN COMPONENT TESTS BY REGION

Many changes have occurred in the milkshed of the Pacific Northwest Order since 2000. Milk production west of the Cascades has declined and become a smaller portion of total milk production of the region. The percentage decrease has occurred due to the absolute decline in producers west of the Cascades and in eastern Washington and the large absolute and relative increase in milk production east of the Cascades. The farms east of the Cascades are generally larger than the farms that characterize the region west of the Cascades. It should be noted that a fair number of producers and milk in Eastern Oregon are associated with plants in Southwestern Idaho which are not included in the data set. Changes in milk production by region are shown in Table 5 and Appendix A, Table A-5.

The changes in market level component tests can be traced back to changes in the milkshed of the region. There has been a 21 percentage point shift in milk production between the region west of the Cascades to the region east of the Cascades. The shift in production between regions paralleled an increase in market level component tests east of the Cascades relative to the region west of the Cascades since 2000.

Increases in component tests can be traced to the net changes in each region's contribution to the market. For butterfat, milk production east of the Cascades contributed 0.877 percentage points while milk production west of the Cascades contributed -0.691 percentage points, for a net increase of 0.186 percentage points. For protein, milk production east of the Cascades contributed 0.752 percentage points while milk production west of the Cascades contributed -0.583 percentage points for a net increase of 0.169 percentage points. For other solids, milk production east of the Cascades contributed 1.220 percentage points while milk production west of the Cascades contributed -1.190 percentage points for a net increase of 0.030 percentage points. Details of changes in component tests by region can be found in Appendix E.

Table 5: Distribution of Producers by Region

Region	2000 Pounds	2012 Pounds	Butterfat		Protein		Other Solids	
			Pounds 1/	% Points	Pounds 1/	% Points	Pounds 1/	% Points
Western WA	40.1%	25.6%	25.6%	-0.476	25.2%	-0.402	25.5%	-0.819
Central WA	29.4%	38.0%	37.0%	0.368	37.4%	0.315	38.0%	0.502
Eastern WA 2/	5.8%	9.2%	8.9%	0.134	9.1%	0.116	9.2%	0.197
Western OR 3/	22.9%	16.3%	16.9%	-0.215	16.5%	-0.181	16.4%	-0.371
Central/Eastern OR	1.7%	10.8%	11.5%	0.375	11.7%	0.321	10.8%	0.520
Total 4/	100.0%	100.0%	100.0%	0.186	100.0%	0.169	100.0%	0.030
Eastern/Central OR/WA	37.0%	58.0%	57.4%	0.877	58.3%	0.752	58.1%	1.220
Western OR/WA	63.0%	42.0%	42.6%	-0.691	41.7%	-0.583	41.9%	-1.190
Total 4/	100.0%	100.0%	100.0%	0.186	100.0%	0.169	100.0%	0.030

1/ Data for 2012.

2/ Includes Northern Idaho.

3/ Includes Northern California.

4/ May not add due to rounding.

VII. CHANGES IN THE RATIO OF BUTTERFAT TO PROTEIN

Between 2000 and 2012, changes have occurred in the ratio of butterfat to protein in the Pacific Northwest. Tables 6 through 9 summarize these changes. Appendix F shows the detail of the data in Tables 6 through 9 and information on how each category contributes to the change in the ratio. The ratio of butterfat to protein has a seasonal pattern, reaching a low in August through October. After increasing slightly on an annual basis between 2000 and 2003, the ratio declined in 2006, and declined further in 2009 and 2010 before recovering in 2011 and 2012. The ratio of butterfat to protein appears to be higher for producers with lower average annual daily deliveries (See Table 7). Changes in the ratio through the lens of variability of production across the year, suggests a roughly positive relationship, that is, larger changes in production seasonally are associated with a higher ratio (See Table 8). On a regional basis, decreases in the ratio east of the Cascades are not quite counterbalanced by increases in the ratio west of the Cascades (See Table 9). The relative contributions by different categorizations of dairy farms to the change in the ratio of butterfat to protein are similar to those for butterfat and protein, individually.

Table 6: Ratio of Butterfat to Protein by Season and Change

Season 1/	2000	2003	2006	2009	2010	2011	2012	2012-2000
Winter	1.2200	1.2197	1.2242	1.1950	1.1924	1.2148	1.2014	-0.019
Spring	1.2075	1.2092	1.2046	1.1890	1.1804	1.1889	1.1934	-0.014
Summer	1.1952	1.1993	1.1943	1.1859	1.1740	1.1746	1.1967	0.002
Fall	1.2007	1.2072	1.2002	1.1848	1.1968	1.1836	1.2097	0.009
Total	1.2057	1.2088	1.2056	1.1886	1.1858	1.1901	1.2003	-0.0054

1/ Winter: January-March; Spring: April-June; Summer: July-September; Fall: October-December.

Table 7: Ratio of Butterfat to Protein by Size of Annual Average Daily Delivery and Change

Size Category 1/	2000	2003	2006	2009	2010	2011	2012	2012-2000
Small	1.2207	1.2219	1.2273	1.2275	1.2295	1.2386	1.2438	0.0231
Medium	1.1992	1.1963	1.2013	1.1855	1.1813	1.1944	1.2074	0.0082
Large	1.1897	1.1966	1.2017	1.1921	1.1772	1.1871	1.1885	-0.0012
Very Large	1.1901	1.2140	1.1835	1.1660	1.1684	1.1651	1.1830	-0.0070
Total	1.2057	1.2088	1.2056	1.1886	1.1858	1.1901	1.2003	-0.0054

1/ Small <30,000; 30,000≤Medium<60,000; 60,000≤Large<120,000; Very Large≥120,000.

Table 8: Ratio of Butterfat to Protein by Variability of Monthly Average Daily Delivery and Change

Variability Category 1/	2000	2003	2006	2009	2010	2011	2012	2012-2000
Low	1.2105	1.2068	1.2259	1.1762	1.1907	1.1783	1.1892	-0.0213
Medium	1.1969	1.1966	1.2031	1.1801	1.1741	1.1987	1.1887	-0.0082
High	1.2039	1.2162	1.1991	1.1893	1.1815	1.1829	1.2043	0.0004
Very High	1.2126	1.2132	1.2099	1.2078	1.2070	1.1938	1.2204	0.0078
Total	1.2057	1.2088	1.2056	1.1886	1.1858	1.1901	1.2003	-0.0054

1/ Coefficient of Variation: Low≤3%; 3%<Medium<4.5%; 4.5%≤High<7%; Very High≥7%.

Table 9: Change in Ratio of Butterfat to Protein by Region

Region	2000	2003	2006	2009	2010	2011	2012	2012-2000
Western WA	1.2084	1.1970	1.2045	1.1967	1.1913	1.2067	1.2204	0.0120
Central WA	1.1950	1.2050	1.1957	1.1832	1.1780	1.1756	1.1881	-0.0069
Eastern WA 1/	1.1820	1.1886	1.2017	1.1754	1.1715	1.1646	1.1708	-0.0112
Western OR 2/	1.2171	1.2310	1.2315	1.2170	1.2158	1.2311	1.2284	0.0113
Central/Eastern OR	1.2517	1.2350	1.1820	1.1609	1.1611	1.1622	1.1796	-0.0721
Total	1.2057	1.2088	1.2056	1.1886	1.1858	1.1901	1.2003	-0.0054

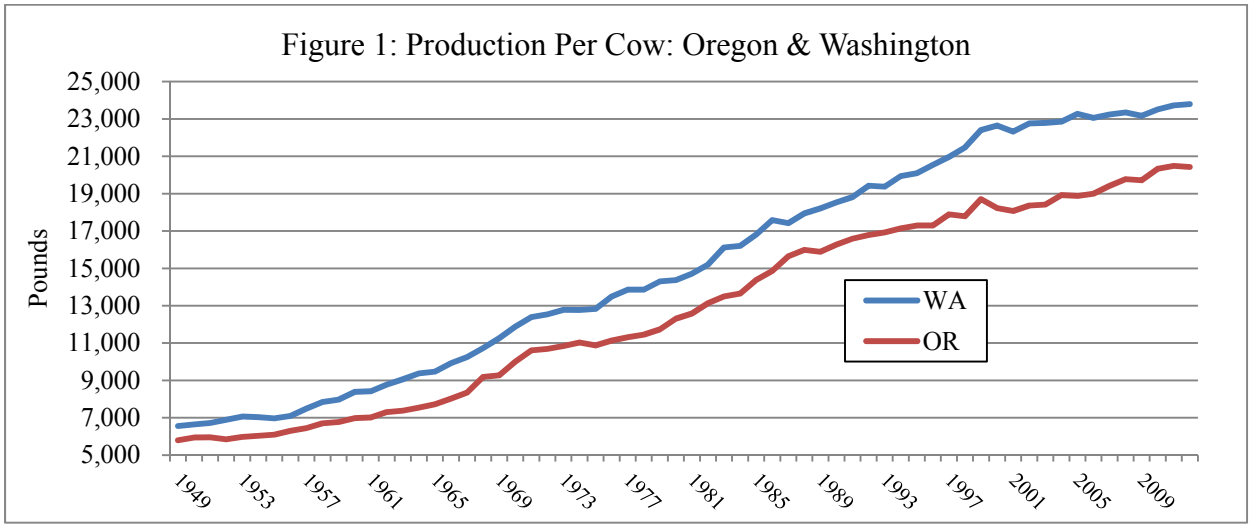
1/ Includes Northern Idaho.

2/ Includes Northern California.

VIII. CHANGES IN MILK PRODUCTION PER COW

Changes in the trend of production per cow appear to parallel the changes in component tests in Pacific Northwest Order. Based on data published by the National Agricultural Statistics Service, a decrease in the average increase in production per cow appears to have occurred in the early 1990's in Oregon and in the early 2000's in Washington.[6] Prior to these periods, the average change per year in production per cow in Oregon and Washington was often above 250 and 200 pounds per cow per year, respectively. After these periods, the average change per year in production per cow has fallen to under 250 pounds per year in Oregon and to about 100 pounds per year for Washington. Figure 1 illustrates the changes in the trend production per cow in Oregon and Washington.

[6] Data drawn from: http://www.nass.usda.gov/Quick_Stats/index.php.



Source: National Agricultural Statistics Service.

IX. SUMMARY

Average component tests for milk from producers historically associated with the Pacific Northwest Order and with deliveries for all twelve months increased by 0.186 butterfat, 0.169 true protein, and 0.030 other solids between 2000 and 2012. These changes are not substantively different than published pool data.

On a monthly basis, butterfat tests have increased proportionally more in the October-March period (65%) than in the April-September period (35%) between 2000 and 2012. Protein tests rose similarly, with 63% of the change in tests occurring in the October-March period. Increases in other solids tests were primarily associated with the November-May period (67%). These changes reflect a cross-seasonal percentage point shift of component production. Butterfat pounds shifted from summer (-0.7) to spring (+0.1), fall (+0.1) and winter (+0.5). Protein pounds shifted from summer (-0.7) and fall (-0.2) to spring (+0.3), and winter (+0.6). Other solids pounds shifted from summer (-0.5) and fall (-0.3) to spring (+0.3) and winter (+0.5).

Producers delivering more than 60,000 pounds on a daily average basis (62% of production in 2012) were the source of 1.30 percentage points of the increase in butterfat tests, 1.10 percentage points of the increase in protein tests, and 1.86 percentage points of the increase in other solids tests. Producers delivering less than 60,000 pounds on a daily average basis counterbalanced these increases.

Producers with a coefficient of variation in monthly average daily deliveries of less than 7% (82% of production in 2012) contributed +0.72 percentage points to the increase in butterfat tests, +0.61 percentage points to the increase in protein tests, and +0.90 percentage points to the increase in other solids tests. The other categories of variation, with two exceptions, tempered the increases.

Producers east of the Cascade mountain range (58% of production in 2012) contributed +0.88, +0.75 and +1.22 percentage points to the change in butterfat, protein and other solids tests, respectively. Producers west of the Cascades (42% of production in 2012) contributed -0.69, -0.58, -1.19 percentage points to change in butterfat, protein and other solids tests, respectively.

Despite the increases in component tests across the period, the ratio of butterfat to protein experienced a decrease in 2009 and 2010, and a partial recovery in 2011 and 2012.

Overall, changes in component tests parallel the growth in the number of large farms in Central/Eastern Oregon and Central Washington. The less seasonally variable character of milk production in the regions east of the Cascades and changes in production patterns in Western Oregon and Washington are associated with a slight smoothing of the seasonal timing of the production of milk and the associated components. The preceding component test changes have occurred at about the same time as decreases in the average increase in production per cow in Oregon and Washington.

APPENDICES

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Appendix A

Table A-1: Selected Characteristics of the Amended Dataset

Database Characteristic	2000	2003	2006	2009	2010	2011	2012	Changes 2003-2000	2006-2003	2009-2006	2010-2009	2011-2010	2012-2009	2012-2000
Number of Producers	824	841	702	605	601	605	575	17	-139	-97	-4	4	-30	-249
Pounds of Milk (Billion)	5.92	6.84	6.76	7.65	7.79	8.18	8.00	0.92	-0.08	0.89	0.13	0.39	0.35	2.08
Daily Deliveries														
Average Daily Delivery	19,629	22,285	26,396	34,652	35,495	37,031	38,032	2,656	4,111	8,256	843	1,537	3,381	18,403
Median Daily Delivery	10,653	11,372	12,570	15,955	16,195	16,963	17,887	719	1,198	3,385	240	768	1,932	7,234
Variability of Daily Deliveries 1/														
Average Variation (%)	9.31	8.66	9.46	9.22	8.56	8.63	8.64	-0.65	0.80	-0.24	-0.67	0.07	-0.59	-0.68
Median Variation (%)	7.22	6.66	6.87	6.57	6.60	6.61	6.48	-0.56	0.21	-0.31	0.03	0.00	-0.08	-0.74
Weighted Average Tests														
Butterfat (%)	3.64	3.67	3.70	3.71	3.73	3.78	3.83	0.032	0.029	0.009	0.019	0.050	0.116	0.186
Protein (%)	3.02	3.04	3.07	3.12	3.15	3.18	3.19	0.019	0.032	0.051	0.023	0.031	0.066	0.169
Other Solids (%)	5.71	5.69	5.70	5.70	5.71	5.73	5.74	-0.020	0.008	-0.001	0.014	0.024	0.043	0.030

1/ Coefficiant of Variation = 100*(Standard Deviation of Average Daily Delivery/Average Daily Delivery). Generally indicates that about two-thirds of a producer's deliveries are within a percentage (+/-) of the annual average.

Appendix A

Table A-2: Distribution of Pounds of Milk by Month 1/

Month	2000	2003	2006	2009	2010	2011	2012
January	8.09%	8.24%	8.05%	8.17%	8.09%	7.92%	8.20%
February	8.18%	8.36%	8.19%	8.23%	8.28%	8.05%	8.33%
March	8.30%	8.45%	8.30%	8.26%	8.41%	8.19%	8.42%
April	8.51%	8.53%	8.46%	8.40%	8.49%	8.38%	8.57%
May	8.60%	8.53%	8.59%	8.52%	8.47%	8.55%	8.69%
June	8.61%	8.51%	8.62%	8.56%	8.47%	8.63%	8.54%
July	8.60%	8.48%	8.42%	8.50%	8.53%	8.69%	8.35%
August	8.47%	8.40%	8.54%	8.33%	8.47%	8.60%	8.29%
September	8.36%	8.26%	8.39%	8.33%	8.40%	8.47%	8.26%
October	8.21%	8.14%	8.25%	8.22%	8.23%	8.31%	8.11%
November	8.06%	8.04%	8.09%	8.20%	8.10%	8.10%	8.07%
December	8.01%	8.06%	8.09%	8.29%	8.06%	8.13%	8.17%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

1/ Percentage of pounds are adjusted to an even day month and daily basis.

Table A-3: Distribution of Producers and Milk by Size of Average Annual Daily Delivery 1/

	Number		% Producers		Billion Pounds		% Pounds			Average Daily Delivery	
Size of Producer	2000	2012	2000	2012	2000	2012	2000	2012	Change 2/	2000	2012
Small	672	377	81.6%	65.6%	2.53	1.52	42.7%	18.9%	-23.73	10,300	11,020
Medium	103	96	12.5%	16.7%	1.60	1.49	27.0%	18.6%	-8.40	42,562	42,544
Large	39	63	4.7%	11.0%	1.18	1.84	19.9%	23.0%	3.10	82,699	79,995
Very Large	10	39	1.2%	6.8%	0.62	3.16	10.4%	39.4%	29.04	168,807	221,795
Total	824	575	100.0%	100.0%	5.92	8.00	100.0%	100.0%		19,683	38,137

1/ Small ≤30,000; 30,000≤Medium<60,000; 60,000≤Large<120,000; Very Large≥120,000.

2/ Percentage point change in pounds between 2000 and 2012.

Table A-4: Distribution of Producers and Milk by Variability of Production 1/

	Number		% Producers		Billion Pounds		% Pounds		
Variability of Production	2000	2012	2000	2012	2000	2012	2000	2012	Change 3/
Low	34	29	4.1%	5.0%	0.50	1.07	8.5%	13.4%	4.9
Medium	105	103	12.7%	17.9%	1.42	2.56	24.1%	32.0%	0.1
High	249	194	30.2%	33.7%	1.99	2.89	33.6%	36.1%	0.0
Very High	436	249	52.9%	43.3%	2.00	1.47	33.8%	18.4%	-0.2
Total 2/	824	575	100.0%	100.0%	5.92	8.00	100.0%	100.0%	

1/ Coefficient of Variation: Low ≤3%; 3%≤Medium<4.5%; 4.5%≤High<7%; Very High≥7%.

2/ May not add due to rounding.

3/ Percentage point change in pounds between 2000 and 2012.

Appendix A

Table A-5: Distribution of Producers and Milk by Region

Region	Number		% Producers		Billion Pounds		% Pounds		
	2000	2012	2000	2012	2000	2012	2000	2012	Change 2/
Western WA	371	255	45.0%	44.3%	2.37	2.05	40.1%	25.6%	-14.5%
Central WA	99	93	12.0%	16.2%	1.74	3.04	29.4%	38.0%	8.6%
Eastern WA	67	36	8.1%	6.3%	0.34	0.74	5.8%	9.2%	3.4%
Western OR	270	175	32.8%	30.4%	1.36	1.31	22.9%	16.3%	-6.6%
Central/Eastern OR	17	16	2.1%	2.8%	0.10	0.86	1.7%	10.8%	9.1%
Eastern/Central OR/WA	183	145	22.2%	25.2%	2.19	4.65	37.0%	58.0%	21.1%
Western OR/WA	641	430	77.8%	74.8%	3.73	3.36	63.0%	42.0%	-21.1%
Total 1/	824	575	100.0%	100.0%	5.92	8.00	100.0%	100.0%	0.0%

1/ May not add due to rounding.

2/ Percentage point change in pounds between 2000 and 2012.

Appendix B

Table B-1: Butterfat Tests by Month

Month	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 3/
January	3.710	3.713	3.761	3.768	3.789	3.901	3.898	0.047	0.188	0.020
February	3.699	3.695	3.759	3.742	3.718	3.855	3.840	0.035	0.141	0.016
March	3.673	3.682	3.741	3.753	3.726	3.827	3.830	0.039	0.157	0.018
April	3.632	3.658	3.692	3.709	3.736	3.788	3.807	0.044	0.175	0.017
May	3.568	3.624	3.615	3.647	3.678	3.709	3.704	0.034	0.136	0.015
June	3.561	3.570	3.584	3.588	3.630	3.672	3.736	0.044	0.175	0.012
July	3.544	3.570	3.595	3.603	3.598	3.636	3.701	0.039	0.157	0.004
August	3.571	3.562	3.604	3.588	3.611	3.654	3.703	0.033	0.132	0.004
September	3.615	3.658	3.696	3.676	3.699	3.686	3.806	0.048	0.191	0.012
October	3.659	3.707	3.761	3.775	3.770	3.805	3.922	0.066	0.264	0.018
November	3.727	3.832	3.821	3.840	3.901	3.918	3.988	0.065	0.261	0.021
December	3.757	3.828	3.825	3.858	3.927	3.952	4.013	0.064	0.256	0.028
Weighted Average	3.641	3.673	3.702	3.711	3.730	3.780	3.827	0.047	0.186	0.186

Table B-2: Protein Tests by Month

Month	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 3/
January	3.050	3.037	3.069	3.162	3.154	3.198	3.234	0.046	0.184	0.019
February	3.014	3.023	3.080	3.132	3.125	3.173	3.194	0.045	0.180	0.019
March	3.019	3.032	3.050	3.132	3.142	3.163	3.201	0.045	0.182	0.019
April	3.007	3.010	3.024	3.096	3.147	3.153	3.173	0.042	0.166	0.016
May	2.955	2.990	3.002	3.079	3.115	3.132	3.125	0.043	0.170	0.018
June	2.950	2.974	3.015	3.028	3.095	3.109	3.125	0.044	0.175	0.013
July	2.938	2.958	2.987	3.015	3.064	3.096	3.085	0.037	0.147	0.005
August	2.995	2.984	3.032	3.028	3.080	3.098	3.094	0.025	0.099	0.003
September	3.045	3.054	3.104	3.122	3.148	3.151	3.188	0.036	0.143	0.008
October	3.090	3.098	3.167	3.217	3.208	3.250	3.282	0.048	0.192	0.013
November	3.112	3.172	3.171	3.239	3.246	3.319	3.285	0.043	0.173	0.014
December	3.078	3.146	3.165	3.228	3.236	3.296	3.289	0.053	0.211	0.023
Weighted Average	3.020	3.039	3.071	3.122	3.146	3.177	3.189	0.042	0.169	0.169

Table B-3: Other Solids Tests by Month

Month	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 3/
January	5.685	5.683	5.703	5.678	5.693	5.720	5.733	0.012	0.048	0.010
February	5.690	5.687	5.724	5.677	5.682	5.721	5.745	0.014	0.055	0.013
March	5.705	5.689	5.736	5.697	5.695	5.729	5.734	0.007	0.028	0.009
April	5.711	5.696	5.748	5.686	5.709	5.732	5.754	0.011	0.042	0.007
May	5.726	5.707	5.716	5.698	5.731	5.747	5.748	0.006	0.023	0.007
June	5.732	5.706	5.676	5.704	5.725	5.751	5.747	0.004	0.015	-0.002
July	5.721	5.703	5.692	5.705	5.732	5.743	5.772	0.013	0.050	-0.010
August	5.709	5.696	5.676	5.691	5.719	5.751	5.760	0.013	0.050	-0.007
September	5.713	5.686	5.683	5.694	5.710	5.735	5.727	0.003	0.014	-0.005
October	5.708	5.671	5.679	5.694	5.702	5.726	5.716	0.002	0.007	-0.005
November	5.698	5.669	5.669	5.703	5.710	5.709	5.711	0.003	0.013	0.002
December	5.706	5.673	5.666	5.721	5.704	5.730	5.718	0.003	0.011	0.011
Weighted Average	5.709	5.689	5.697	5.696	5.710	5.733	5.739	0.007	0.030	0.030

1/ Simple average change between triennial years.

2/ Simple percentage point change from 2000 to 2012. Average of changes equals weighted average change.

3/ Sum of contributions equals the weighted average change. See Section II. Data and Methodology for an explanation of contribution.

Note: Coloration is based on Microsoft Excel's Color Scale Conditional Formatting and serves merely to highlight relative test levels/contributions.

Appendix B

Table B-4: Percentage of Pounds Produced by Season 1/

Season	Year	Seasonal Percentageof Pounds			
		Pounds	Butterfat	Protein	Other Solids
Winter	2000	24.6%	24.9%	24.6%	24.5%
January-March	2003	25.0%	25.2%	25.0%	25.0%
	2006	24.5%	24.9%	24.5%	24.6%
	2009	24.7%	24.9%	24.8%	24.6%
	2012	24.9%	25.1%	25.1%	24.9%
Spring	2000	25.7%	25.3%	25.3%	25.8%
April-June	2003	25.6%	25.2%	25.2%	25.6%
	2006	25.7%	25.2%	25.2%	25.7%
	2009	25.5%	25.0%	25.0%	25.5%
	2012	25.8%	25.3%	25.4%	25.9%
Summer	2000	25.4%	25.0%	25.2%	25.5%
July-September	2003	25.1%	24.6%	24.8%	25.2%
	2006	25.3%	24.9%	25.1%	25.3%
	2009	25.2%	24.6%	24.6%	25.2%
	2012	24.9%	24.3%	24.4%	25.0%
Fall	2000	24.3%	24.8%	24.9%	24.3%
October-December	2003	24.2%	25.0%	25.0%	24.2%
	2006	24.4%	25.1%	25.2%	24.3%
	2009	24.7%	25.5%	25.5%	24.8%
	2012	24.4%	25.3%	25.1%	24.3%

		Percentage Points			
Changes	Winter	0.38	0.21	0.48	0.44
2012 - 2000	Spring	0.09	-0.06	0.12	0.07
	Summer	-0.55	-0.68	-0.83	-0.51
	Fall	0.08	0.53	0.23	0.00

1/ Percentage of pounds are adjusted to an even day month and daily basis.

Appendix C

Table C-1: Butterfat Tests by Average Daily Delivery

Daily Delivery (Lbs)									Average		
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012	Change 1/	Change 2/	Contribution 3/
0	10,000	3.834	3.849	3.942	4.002	4.032	4.063	4.119	0.071	0.285	-0.292
10,000	20,000	3.710	3.759	3.842	3.885	3.936	4.003	3.986	0.069	0.275	-0.336
20,000	30,000	3.682	3.653	3.723	3.790	3.797	3.829	3.898	0.054	0.216	-0.212
30,000	40,000	3.616	3.652	3.686	3.664	3.666	3.724	3.836	0.055	0.221	-0.121
40,000	50,000	3.598	3.646	3.709	3.650	3.677	3.739	3.782	0.046	0.184	-0.088
50,000	60,000	3.599	3.566	3.640	3.681	3.604	3.734	3.715	0.029	0.116	-0.061
60,000	80,000	3.517	3.552	3.677	3.686	3.640	3.694	3.781	0.066	0.264	0.093
80,000	100,000	3.585	3.587	3.644	3.712	3.602	3.682	3.753	0.042	0.168	0.000
100,000	120,000	3.538	3.635	3.713	3.735	3.869	3.978	3.818	0.070	0.281	0.070
120,000	140,000	3.491	3.569	3.602	3.564	3.680	3.714	3.810	0.080	0.319	0.171
140,000	160,000	3.434	3.375	3.654	3.473	3.502	3.688	3.769	0.084	0.334	0.152
160,000		3.532	3.743	3.563	3.669	3.729	3.743	3.804	0.068	0.272	0.811

Table C-2: Protein Tests by Average Daily Delivery

Daily Delivery (Lbs)									Average		
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012	Change 1/	Change 2/	Contribution 3/
0	10,000	3.104	3.108	3.165	3.190	3.207	3.210	3.234	0.032	0.130	-0.242
10,000	20,000	3.040	3.072	3.127	3.174	3.194	3.211	3.201	0.040	0.161	-0.280
20,000	30,000	3.051	3.033	3.076	3.135	3.149	3.158	3.189	0.035	0.139	-0.178
30,000	40,000	3.002	3.034	3.059	3.086	3.077	3.103	3.144	0.035	0.142	-0.103
40,000	50,000	3.002	3.033	3.062	3.058	3.104	3.133	3.153	0.038	0.151	-0.074
50,000	60,000	3.016	3.012	3.077	3.127	3.092	3.140	3.092	0.019	0.075	-0.052
60,000	80,000	2.969	3.008	3.070	3.100	3.120	3.157	3.188	0.055	0.219	0.078
80,000	100,000	3.002	2.958	3.033	3.098	3.079	3.099	3.150	0.037	0.148	0.000
100,000	120,000	2.968	3.034	3.071	3.142	3.189	3.272	3.210	0.061	0.242	0.059
120,000	140,000	2.997	2.917	3.034	3.023	3.125	3.142	3.134	0.034	0.136	0.138
140,000	160,000	2.883	3.000	2.981	3.033	3.043	3.127	3.134	0.063	0.252	0.126
160,000		2.947	3.073	3.029	3.146	3.193	3.230	3.245	0.075	0.298	0.697

Table C-3: Other Solids Tests by Average Daily Delivery

Daily Delivery (Lbs)									Average		
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012	Change 1/	Change 2/	Contribution 3/
0	10,000	5.685	5.644	5.658	5.652	5.660	5.674	5.683	-0.001	-0.002	-0.454
10,000	20,000	5.700	5.680	5.697	5.691	5.700	5.717	5.726	0.007	0.026	-0.543
20,000	30,000	5.718	5.693	5.707	5.704	5.711	5.718	5.735	0.004	0.017	-0.352
30,000	40,000	5.716	5.708	5.712	5.712	5.723	5.748	5.747	0.008	0.031	-0.212
40,000	50,000	5.730	5.699	5.718	5.710	5.718	5.752	5.744	0.003	0.014	-0.159
50,000	60,000	5.723	5.702	5.712	5.705	5.731	5.742	5.758	0.009	0.036	-0.105
60,000	80,000	5.705	5.690	5.704	5.698	5.709	5.726	5.731	0.006	0.025	0.109
80,000	100,000	5.722	5.693	5.696	5.720	5.720	5.739	5.743	0.005	0.021	-0.019
100,000	120,000	5.711	5.695	5.692	5.683	5.713	5.729	5.740	0.007	0.029	0.092
120,000	140,000	5.708	5.636	5.698	5.675	5.714	5.746	5.737	0.007	0.029	0.247
140,000	160,000	5.701	5.713	5.688	5.705	5.721	5.745	5.748	0.012	0.047	0.227
160,000		5.696	5.713	5.686	5.692	5.707	5.740	5.746	0.013	0.050	1.199

1/ Simple average change between triennial years.

2/ Simple percentage point change from 2000 to 2012. Average of changes does not equal weighted average change due to shifts in milk between categories.

3/ Sum of contributions equals the weighted average change. See Section II. Data and Methodology for an explanation of contribution.

Note: Coloration is based on Microsoft Excel's Color Scale Conditional Formatting and serves merely to highlight relative test levels/contributions.

Appendix D

Table D-1: Butterfat Tests by Variability of Monthly Average Daily Deliveries

Variability 1/									Average Change 2/	Change 3/	Contribution 4/
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012			
0.0	2.0	3.576	3.560	3.672	3.587	3.576	3.640	3.565	-0.003	-0.011	0.068
2.0	2.5	3.658	3.565	3.761	3.510	3.518	3.551	3.874	0.054	0.217	0.030
2.5	3.0	3.590	3.594	3.697	3.571	3.901	3.674	3.668	0.020	0.078	0.090
3.0	3.5	3.532	3.610	3.699	3.705	3.619	3.706	3.778	0.062	0.246	-0.124
3.5	4.0	3.629	3.609	3.661	3.696	3.813	3.828	3.743	0.028	0.114	0.306
4.0	4.5	3.602	3.615	3.691	3.644	3.709	3.820	3.815	0.053	0.213	0.164
4.5	5.0	3.605	3.654	3.669	3.782	3.650	3.708	3.821	0.054	0.216	0.267
5.0	6.0	3.611	3.784	3.681	3.694	3.711	3.790	3.995	0.096	0.384	-0.113
6.0	7.0	3.685	3.654	3.697	3.805	3.875	3.753	3.819	0.033	0.133	0.029
7.0	10.0	3.705	3.708	3.736	3.771	3.767	3.848	3.848	0.036	0.143	-0.296
10.0	13.0	3.648	3.692	3.814	3.811	3.776	3.834	3.880	0.058	0.231	-0.104
13.0		3.732	3.798	3.763	3.832	3.966	4.120	4.124	0.098	0.392	-0.130

Table D-2: Protein Tests by Variability of Monthly Average Daily Deliveries

Variability 1/									Average Change 2/	Change 3/	Contribution 4/
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012			
0.0	2.0	2.957	2.984	3.030	3.027	3.031	3.008	3.068	0.028	0.112	0.061
2.0	2.5	2.972	2.973	3.052	3.041	3.015	3.038	3.158	0.046	0.185	0.025
2.5	3.0	3.001	2.965	3.007	3.024	3.174	3.133	3.097	0.024	0.096	0.077
3.0	3.5	2.957	3.005	3.062	3.103	3.130	3.129	3.141	0.046	0.184	-0.105
3.5	4.0	3.016	3.012	3.034	3.104	3.211	3.171	3.170	0.039	0.154	0.264
4.0	4.5	3.022	3.036	3.086	3.149	3.110	3.172	3.194	0.043	0.173	0.137
4.5	5.0	3.000	3.039	3.051	3.126	3.153	3.151	3.191	0.048	0.191	0.224
5.0	6.0	3.001	3.082	3.078	3.137	3.142	3.159	3.288	0.072	0.287	-0.098
6.0	7.0	3.053	3.031	3.078	3.215	3.228	3.202	3.185	0.033	0.132	0.026
7.0	10.0	3.040	3.062	3.073	3.133	3.129	3.243	3.166	0.031	0.125	-0.242
10.0	13.0	3.047	3.084	3.124	3.149	3.151	3.196	3.190	0.036	0.142	-0.089
13.0		3.084	3.086	3.154	3.143	3.224	3.335	3.333	0.062	0.249	-0.111

Table D-3: Other Solids Tests by Variability of Monthly Average Daily Deliveries

Variability 1/									Average Change 2/	Change 3/	Contribution 4/
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012			
0.0	2.0	5.721	5.663	5.682	5.738	5.746	5.782	5.763	0.011	0.043	0.111
2.0	2.5	5.717	5.701	5.711	5.706	5.723	5.750	5.778	0.015	0.061	0.037
2.5	3.0	5.728	5.700	5.675	5.704	5.714	5.752	5.769	0.010	0.041	0.139
3.0	3.5	5.706	5.696	5.729	5.687	5.715	5.720	5.751	0.011	0.045	-0.218
3.5	4.0	5.720	5.684	5.707	5.711	5.708	5.735	5.744	0.006	0.024	0.457
4.0	4.5	5.724	5.688	5.687	5.703	5.703	5.739	5.720	-0.001	-0.003	0.223
4.5	5.0	5.710	5.697	5.723	5.685	5.713	5.734	5.745	0.009	0.035	0.380
5.0	6.0	5.709	5.699	5.688	5.697	5.700	5.726	5.732	0.006	0.024	-0.254
6.0	7.0	5.713	5.671	5.698	5.693	5.706	5.723	5.724	0.003	0.011	0.027
7.0	10.0	5.701	5.687	5.694	5.694	5.702	5.740	5.736	0.009	0.035	-0.476
10.0	13.0	5.704	5.675	5.702	5.651	5.716	5.719	5.721	0.004	0.017	-0.174
13.0		5.694	5.683	5.675	5.693	5.678	5.680	5.703	0.002	0.009	-0.222

1/ Coefficiant of Variation = 100*(Standard Deviation of Average Daily Delivery/Average Daily Delivery).

2/ Simple average change between triennial years.

3/ Simple percentage point change from 2000 to 2012. Average of changes does not equal weighted average change due to shifts in milk between categories.

4/ Sum of contributions equals the weighted average change. See Section II. Data and Methodology for an explanation of contribution.

Note: Coloration is based on Microsoft Excel's Color Scale Conditional Formatting and serves merely to highlight relative test levels/contributions.

Appendix E

Table E-1: Annual Butterfat Tests by Region

Region	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 3/
Western WA	3.633	3.621	3.682	3.685	3.689	3.765	3.829	0.049	0.195	-0.476
Central WA	3.568	3.584	3.622	3.650	3.660	3.679	3.728	0.040	0.160	0.368
Eastern WA 4/	3.561	3.619	3.680	3.657	3.666	3.660	3.702	0.035	0.141	0.134
Western OR 5/	3.761	3.817	3.893	3.884	3.888	3.951	3.965	0.051	0.204	-0.215
Central/Eastern OR	3.734	3.963	3.672	3.741	3.900	4.017	4.072	0.084	0.338	0.375

Table E-2: Annual Protein Tests by Region

Region	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 3/
Western WA	3.007	3.025	3.057	3.079	3.096	3.120	3.137	0.033	0.130	-0.402
Central WA	2.986	2.974	3.030	3.085	3.107	3.129	3.138	0.038	0.152	0.315
Eastern WA 4/	3.013	3.045	3.063	3.112	3.129	3.143	3.162	0.037	0.149	0.116
Western OR 5/	3.090	3.101	3.161	3.191	3.198	3.210	3.227	0.034	0.137	-0.181
Central/Eastern OR	2.983	3.209	3.107	3.222	3.359	3.457	3.452	0.117	0.469	0.321

Table E-3: Annual Other Solids Tests by Region

Region	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 3/
Western WA	5.699	5.672	5.688	5.690	5.699	5.713	5.720	0.005	0.021	-0.819
Central WA	5.711	5.676	5.686	5.690	5.704	5.736	5.740	0.007	0.029	0.502
Eastern WA 4/	5.725	5.676	5.698	5.682	5.702	5.744	5.751	0.007	0.026	0.197
Western OR 5/	5.719	5.724	5.732	5.720	5.737	5.754	5.760	0.010	0.040	-0.371
Central/Eastern OR	5.722	5.746	5.703	5.701	5.718	5.732	5.735	0.003	0.014	0.520

1/ Simple average change between triennial years.

2/ Simple percentage point change from 2000 to 2012. Average of changes does not equal weighted average change due to shifts in milk between categories.

3/ Sum of contributions equals the weighted average change. See Section II. Data and Methodology for an explanation of contribution.

4/ Includes Nothern Idaho.

5/ Includes Northern California.

Note: Coloration is based on Microsoft Excel's Color Scale Conditional Formatting and serves merely to highlight relative test levels/contributions.

Appendix F

Table 1: Ratio of Butterfat to Protein Tests by Month

Month	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 3/
January	1.2165	1.2226	1.2254	1.1919	1.2012	1.2198	1.2054	-0.0028	-0.0111	0.0004
February	1.2274	1.2224	1.2205	1.1947	1.1899	1.2150	1.2024	-0.0063	-0.0250	-0.0002
March	1.2166	1.2144	1.2263	1.1984	1.1861	1.2098	1.1966	-0.0050	-0.0200	-0.0002
April	1.2078	1.2152	1.2210	1.1977	1.1874	1.2016	1.1999	-0.0020	-0.0079	0.0001
May	1.2075	1.2118	1.2041	1.1845	1.1809	1.1843	1.1853	-0.0056	-0.0222	-0.0009
June	1.2071	1.2004	1.1889	1.1849	1.1728	1.1810	1.1954	-0.0029	-0.0117	-0.0017
July	1.2061	1.2067	1.2035	1.1949	1.1744	1.1744	1.1995	-0.0017	-0.0067	-0.0036
August	1.1923	1.1934	1.1887	1.1852	1.1725	1.1794	1.1970	0.0012	0.0047	-0.0019
September	1.1870	1.1978	1.1907	1.1774	1.1751	1.1699	1.1936	0.0017	0.0067	-0.0007
October	1.1841	1.1965	1.1874	1.1735	1.1753	1.1710	1.1950	0.0027	0.0109	-0.0003
November	1.1977	1.2083	1.2051	1.1855	1.2018	1.1806	1.2137	0.0040	0.0161	0.0014
December	1.2209	1.2167	1.2086	1.1953	1.2136	1.1992	1.2203	-0.0001	-0.0006	0.0020
Weighted Average	1.2057	1.2088	1.2056	1.1886	1.1858	1.1901	1.2003	-0.0014	-0.0054	-0.0056

1/ Simple average change between triennial years.

2/ Percentage point change from 2000 to 2012.

4/ Sum of contributions does not equal the weighted average change due to shifts between categories. See section II. Data and Methodology for an explanation of Contribution.

Table 2: Ratio of Butterfat to Protein Tests by Average Daily Delivery

Daily Delivery (Lbs)									Average Change 1/	Change 2/	Contribution 3/
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012			
0	10,000	1.2352	1.2383	1.2455	1.2547	1.2573	1.2658	1.2737	0.0096	0.0385	-0.0968
10,000	20,000	1.2205	1.2237	1.2287	1.2241	1.2323	1.2466	1.2452	0.0062	0.0248	-0.1150
20,000	30,000	1.2071	1.2046	1.2101	1.2088	1.2060	1.2125	1.2224	0.0038	0.0154	-0.0735
30,000	40,000	1.2044	1.2038	1.2050	1.1873	1.1913	1.2003	1.2203	0.0040	0.0158	-0.0441
40,000	50,000	1.1984	1.2020	1.2114	1.1935	1.1847	1.1937	1.1997	0.0003	0.0012	-0.0333
50,000	60,000	1.1931	1.1839	1.1831	1.1774	1.1655	1.1889	1.2014	0.0021	0.0083	-0.0219
60,000	80,000	1.1845	1.1809	1.1978	1.1891	1.1666	1.1702	1.1860	0.0004	0.0015	0.0223
80,000	100,000	1.1943	1.2126	1.2018	1.1982	1.1698	1.1878	1.1914	-0.0007	-0.0029	-0.0045
100,000	120,000	1.1921	1.1980	1.2091	1.1887	1.2134	1.2159	1.1895	-0.0006	-0.0025	0.0188
120,000	140,000	1.1645	1.2237	1.1872	1.1788	1.1776	1.1820	1.2158	0.0128	0.0512	0.0534
140,000	160,000	1.1914	1.1250	1.2260	1.1450	1.1508	1.1793	1.2024	0.0028	0.0110	0.0474
160,000		1.1984	1.2179	1.1762	1.1661	1.1679	1.1590	1.1722	-0.0065	-0.0261	0.2421

1/ Simple average change between triennial years.

2/ Percentage point change from 2000 to 2012.

4/ Sum of contributions does not equal the weighted average change due to shifts between categories. See section II. Data and Methodology for an explanation of Contribution.

Appendix F

Table 3: Ratio of Butterfat to Protein Levels by Variability of Monthly Average Daily Deliveries

Variability 1/									Average Change 2/	Change 3/	Contribution 4/
Greater Than	Less than or equal to	2000	2003	2006	2009	2010	2011	2012			
0.0	2.0	1.2094	1.1931	1.2120	1.1851	1.1801	1.2099	1.1618	-0.0119	-0.0476	0.0213
2.0	2.5	1.2306	1.1992	1.2324	1.1541	1.1669	1.1692	1.2269	-0.0009	-0.0037	0.0074
2.5	3.0	1.1962	1.2121	1.2294	1.1809	1.2291	1.1725	1.1844	-0.0029	-0.0118	0.0278
3.0	3.5	1.1944	1.2012	1.2082	1.1940	1.1562	1.1844	1.2027	0.0021	0.0083	-0.0456
3.5	4.0	1.2034	1.1982	1.2066	1.1909	1.1875	1.2071	1.1809	-0.0056	-0.0226	0.0916
4.0	4.5	1.1920	1.1905	1.1961	1.1570	1.1926	1.2040	1.1941	0.0005	0.0021	0.0468
4.5	5.0	1.2016	1.2023	1.2026	1.2100	1.1578	1.1769	1.1974	-0.0010	-0.0041	0.0783
5.0	6.0	1.2032	1.2278	1.1959	1.1776	1.1814	1.1998	1.2150	0.0030	0.0118	-0.0527
6.0	7.0	1.2071	1.2056	1.2012	1.1833	1.2005	1.1721	1.1988	-0.0021	-0.0083	0.0047
7.0	10.0	1.2186	1.2111	1.2157	1.2035	1.2039	1.1866	1.2155	-0.0008	-0.0031	-0.1029
10.0	13.0	1.1972	1.1972	1.2208	1.2101	1.1986	1.1997	1.2164	0.0048	0.0191	-0.0360
13.0		1.2101	1.2306	1.1930	1.2190	1.2303	1.2354	1.2375	0.0069	0.0274	-0.0461

1/ Coefficiant of Variation = 100*(Standard Deviation of Average Daily Delivery/Average Daily Delivery).

2/ Simple average change between triennial years.

3/ Percentage point change from 2000 to 2012.

3/ Sum of contributions does not equal the weighted average change due to shifts between categories. See section II. Data and Methodology for an explanation of Contribution.

Table 4: Ratio of Butterfat to Protein Tests by Region

Region	2000	2003	2006	2009	2010	2011	2012	Average Change 1/	Change 2/	Contribution 4/
Western WA	1.2084	1.1970	1.2045	1.1967	1.1913	1.2067	1.2204	0.0030	0.0120	-0.1718
Central WA	1.1950	1.2050	1.1957	1.1832	1.1780	1.1756	1.1881	-0.0017	-0.0069	0.1001
Eastern WA 4/	1.1820	1.1886	1.2017	1.1754	1.1715	1.1646	1.1708	-0.0028	-0.0112	0.0392
Western OR 5/	1.2171	1.2310	1.2315	1.2170	1.2158	1.2311	1.2284	0.0028	0.0113	-0.0784
Central/Eastern OR	1.2517	1.2350	1.1820	1.1609	1.1611	1.1622	1.1796	-0.0180	-0.0721	0.1057

1/ Simple percentage point change from 2000 to 2012. Does not add to weighted average change due to different weightings of tests between regions/years.

2/ Simple average change between triennial years.

3/ Sum of contributions does not equal the weighted average change due to shifts between categories. See section II. Data and Methodology for an explanation of Contribution.

4/ Includes Nothern Idaho.

5/ Includes Northern California.

Note: Coloration is based on Microsoft Excel's Color Scale Conditional Formatting and serves merely to highlight relative test levels/contributions.