ADJUSTING FLUID MILK SALES DATA FOR CALENDAR COMPOSITION

One of the more important statistics used to assess the current dairy situation is the trend in the sales of fluid milk products. Federal milk order statistics include a data series that measures fluid milk product sales. In-the-marketing-area (In-area) sales are dispositions (deliveries) of fluid milk products in consumer-type packages from fluid milk processing (bottling) plants to outlets that sell directly to consumers. More recently, in-area sales also include deliveries to food product distribution facilities. Fluid milk products include regular and flavored, whole and fat-reduced, milk products that are consumed as a beverage. In-area sales are reported monthly, and account for about 81 percent of total fluid milk product sales in the U.S.

Monthly sales figures reflect not only variation due to trend, but also variations due to seasonality, calendar composition, and randomness. The effect of seasonality is minimized by comparing data for the current year with the same month of the previous year. The adjustment process described in this article removes the variation due to calendar composition. As a result, sales data adjusted by this process can be used to measure the trend in sales of fluid milk products in the U.S.

Variation in monthly sales data due to calendar composition results because of daily variation in sales and because the number of the types of days-Sundays, Mondays, etc.- that occur in a particular month vary from year to year. For example, in 2002, January had five Tuesdays, Wednesdays, and Thursdays, whereas in 2001, January had five Mondays, Tuesdays, and Wednesdays. In comparing the two months, 2002 had one more Thursday and 2001 had one more Monday. Since there is daily variation in fluid milk dales data, sales in January 2002 can be expected to be different than sales in January 2001, because sales on Thursdays are different than sales on Mondays.

Therefore, the key to accounting for calendar composition variation in fluid milk sales lies in estimating day-to-day variation. A procedure called the 31-30 Day Difference Model was used. A data series of total fluid milk product sales in all Federal milk order marketing areas combined, covering the period January 1992 through December 2001, was analyzed. The first step in the process is to determine the proportion of total weekly sales that occurs on each day of the week. Table 1 shows these daily proportions. For example, sales on Friday account for 19 percent of total weekly sales. From these daily proportions a set of daily indexes is developed that measures how sales on a particular day compare to an average sales day. If sales on each day of the week were the same (average), then 14.29 percent of the weekly sales would occur on each day of the week (100 ÷ 7). The ratio of the actual daily proportion to the average daily proportion is the daily index. These indexes also are shown in Table 1. For example, sales on a Sunday are 23.83 percent of an average sales day, 3.40÷14.29=0.2383. (Unrounded figures are used in the actual computation.) Sales on a Monday are 126.16 percent of an average sales day, 18.02÷14.29. A month with an extra Sunday would have lower sales than a month with an extra Monday.

The next step is to develop a set of weights for each type of month. The type of month depends on how many days are in the month and on which day the month begins. Each type of month has at least 28 days that are the same--4 Sundays, 4 Mondays, 4 Tuesdays, etc. Therefore, we use a base value for each type of month of 28.0000. To this base value, the daily weights (indexes) for the different days are added to determine a total monthly weight for each type of month. For example, a 31-day month beginning on a Monday has five Mondays, Tuesdays, and Wednesdays. The total weight for this type of month would be 31.2993 the sum of 28.0000 + 1.2616 (Monday's weight) + 1.1389 (Tuesday's weight) + 0.8988 (Wednesday's weight). A 30-day month beginning on a Sunday has five Sundays and Mondays. The total weight for this type of month would be 29.4999 the sum of 28.0000 + 0.2383(Sunday's weight) + 1.2616 (Monday's weight).

The final step is to develop a set of adjustment factors for each type of month. To derive these factors, the sum of the daily weights for each type of month was divided by the base value for the month if all the sales days were average, the number of days in the month. For example, as was determined above, a 31-day month beginning on a Monday has a total weight of 31.2993 which, when divided by 31, yields an adjustment factor of 1.0097. The adjustment factor for a 30-day month beginning on a Sunday is 0.9833— 29.4999 divided by 30. These adjustment factors reflect how sales in a particular type of month compare to sales in a month in which all the days are average sales days. For example, since the adjustment factor for a 31-day month beginning on a Monday is 1.0097, sales during such a month are higher than during an average-sales-day month. Therefore, sales during such a month need to be adjusted downward before comparisons can be made on a comparable basis. Likewise, since the adjustment factor for a 30-day month beginning on a Sunday is 0.9833, sales during such a month are lower than during an average-sales-day month and have to be adjusted upward in order to make a comparable comparison. Monthly in-area sales are adjusted to a comparable basis by dividing the reported sales by the respective adjustment factor. The adjustment factors for each type of month are shown in Table 2. The factor for a non-leap-year February is 1.0000 as these months always have the same number of the various days of the week. Adjustment factors for 29-day Februarys can be computed, but these are not shown. The specific adjustment factors for 2001 through 2003 are shown in Table 3.

The 31-30 Day Difference Model also can be used to compute monthly seasonal indexes. The same 10-year data series of fluid milk sales was analyzed. The procedure first determines the proportion of annual sales that occur each month of the year, after adjusting the total monthly sales to a daily average basis. These monthly proportions are shown in Table 4. From these monthly proportions a set of monthly indexes is developed that measures how sales in a particular month compare to an average sales month. If sales in each month of the year were the same (average), then 8.33 percent of annual sales would occur in each month (100 ÷ 12). The ratio of the actual monthly proportion to the average monthly proportion is the index. These daily average seasonal indexes are shown in Table 4. For example, sales in January on a daily average basis are 103.09 percent of an average-sales-day month, 8.59÷8.33=1.0309. (Unrounded figures are used in the actual computation.) Sales in July on a daily average basis are 94.11 percent of an average-sales-day month, 7.84÷8.33. For some analysts, these daily average indexes

depict a truer picture of seasonality. However, since in-area sales are reported on a total monthly basis, not a daily average basis, the daily average indexes must be adjusted to reflect the number (but not the type) of days in the month. These total sales seasonal indexes also are shown on Table 4. In order to compare sales in two different months, January and July for example, it is necessary to divide the sales figures first by the respective seasonal index, and then by the appropriate calendar composition adjustment factor.

Table 1. – Daily Variation in Weekly In-Area Sales		
Day	Percent of Week 1/	Index 2/
Sunday	3.40	0.2383
Monday	18.02	1.2616
Tuesday	16.27	1.1389
Wednesday	12.84	0.8988
Thursday	14.70	1.0287
Friday	19.01	1.3308
Saturday	15.76	1.1029
Sum	100.00	7.0000

1/ Sales on the day as a proportion of total weekly sales.
2/ Ratio of actual daily proportion to average daily proportion (14.3%), using unrounded figures.

Table 2. – Factors for Adjusting In-Area Sales for Variation Due to Calendar Composition, by Type of Month 1/		
First Day Of Month	31-Day Month	30-Day Month
Sunday	0.9884	0.9833
Monday	1.0097	1.0133
Tuesday	1.0021	1.0013
Wednesday	1.0083	0.9976
Thursday	1.0149	1.0120
Friday	0.9894	1.0145
Saturday	0.9872	0.9780
Sum	7.0000	7.0000

1/ Factor indicates how sales in a type of month compare to sales in a month of average sales days – no daily variation. For example, sales in a 31-day month beginning on a Sunday are 98.84 percent of an average sales days month.

Table 3. – Factors for Adjusting In-Area Sales for Variation Due to Calendar Composition for Specified Months 1/			
Month	2001	2002	2003
January	1.0097	1.0021	1.0083
February	1.0000	1.0000	1.0000
March	1.0149	0.9894	0.9872
April	0.9833	1.0133	1.0013
May	1.0021	1.0083	1.0149
June	1.0145	0.9780	0.9833
July	0.9884	1.0097	1.0021
August	1.0083	1.0149	0.9894
September	0.9780	0.9833	1.0133
October	1.0097	1.0021	1.0083
November	1.0120	1.0145	0.9780
December	0.9872	0.9884	1.0097
Year 2/	1.0007	1.0004	0.9997

1/ Factors from Table 2 assigned to the specific month according to its type.
For example, January 2001 is a 31-day month beginning on a Monday.
2/ Based on daily index for first day of year. Computed as (364 + daily weight)/365.

Month	Percent of Year 1/	Index for:	
		Daily Average Sales 2/	Total Sales 3/
January	8.59	1.0309	1.0508
February	8.57	1.0283	0.9468
March	8.56	1.0273	1.0472
April	8.33	0.9995	0.9861
May	8.19	0.9826	1.0017
June	7.87	0.9439	0.9311
July	7.84	0.9411	0.9594
August	8.12	0.9739	0.9928
September	8.54	1.0253	1.0114
October	8.51	1.0209	1.0407
November	8.50	1.0205	1.0067
December	8.38	1.0058	1.0253
Year 2/	100.00	12.0000	12.0000

Table 4. – Seasonal Variation in Monthly In-Area Sales

1/ Sales in the month on a daily average basis as a proportion of annual sales on a daily average basis.

2/ Ratio of actual monthly proportion to average monthly proportion (8.33%), using unrounded figures.

3/ Daily average sales index adjusted for the number (but not the type) of days in the month.