AFBF FEDERAL MILK MARKETING ORDER WORKING GROUP
BACKGROUND ON CHICAGO MERCANTILE EXCHANGE DAIRY SPOT MARKETS
JUNE 2019

Issue:

The Chicago Mercantile Exchange has electronic spot markets for butter, cheddar cheese, nonfat dry milk and dry whey. These markets are not cash-settled but instead, are settled based on physical delivery, with the buyer taking possession or ownership of the product. While not directly linked to USDA's National Dairy Product Sales Report, CME settlement prices indirectly price all milk regulated on Federal Milk Marketing Orders. This background paper provides an overview of CME spot dairy markets, settlement procedures, price correlation, trading volume and volume of product physically traded as a proportion of U.S. dairy product and milk solids production.

Background:

Products Traded

There are five products physically traded on the CME dairy spot market. These include butter, cheddar cheese in 40-pound blocks and 500-pound barrels, nonfat dry milk and dry whey. Trading for these products occurs Monday to Friday at the following times. The quality attributes, age of the product and entities involved in the transaction are unknown.

Product	Trading Hours	Contract Size
Dry Whey	10:45 a.m. – 10:55 a.m.	41,000 – 45,000 lbs.
Cheddar Cheese	11:00 a.m. - 11:10 a.m.	40,000 – 44,000 lbs.
Butter	11:15 a.m. – 11:25 a.m.	40,000 – 43,000 lbs.
Nonfat Dry Milk	11:30 a.m. – 11:40 a.m.	41,000 – 45,000 lbs.

Price Settlement Procedures

The price settlement of the dairy spot markets is based on electronic trading activity. There are three tiers for determining the spot market settlement price based on whether the last trade price was within the bid-ask or if a trade occurred. These tiers result in nine potential spot market price paths and four potential settlement prices. CME Dairy Settlement Procedures offers the following:

- If the last trade price is within the bid-ask, i.e., the price a buyer will pay compared to the price a seller will accept, then:
    - The settlement price equals the last trade price
- If the last trade price is outside the bid-ask, then:
    - If the bid price is higher than the last trade price,
        - The settlement price equals the last bid price
    - If the ask price is lower than the last trade price,
        - The settlement price equals the last ask price

- If there are **no trades**, then:
    - If the prior-day settlement price is within the current bid-ask,
        - The settlement price equals the prior-day settlement price
    - If the prior-day settlement price is outside the bid-ask, then:
        - If the bid price is higher than the prior-day settlement price,
            - The settlement price equals the last bid price
        - If the ask price is lower than the prior-day settlement price,
            - The settlement price equals the last ask price
    - If there are no bid or ask prices
        - The settlement price equals the prior-day settlement price.

CME dairy spot market prices can change even when no transactions occur. The prevailing thought is that the latest bid or ask that is outside the bid-ask range is used as the prevailing market value for the product. If there are no bids or asks, or the prior-day settlement price is within the bid-ask range, then the settlement price equals the previous day's settlement price.

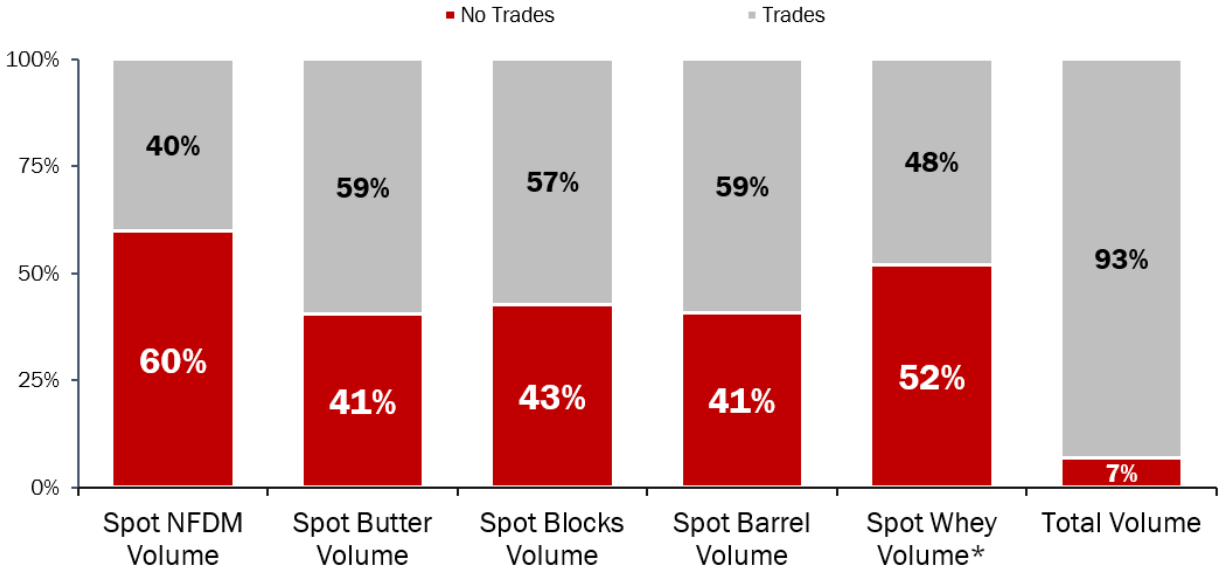
Spot Market Trading Volume

Since 2009 there have been nearly 26,000 dairy spot market transactions – with an average of nine trades per day. However, on many days there may be no trades. For example, since 2009, more than 1,500 trading days did not have a spot market transaction for nonfat dry milk – representing 60% of the trading days. Butter and cheddar cheese were not traded on more than 40% of the trading days, and there were more than 52% of trading days since dry whey was introduced in March 2018 during which there were no trades.

While a day may go by without a trade, spot market prices can still move higher or lower. In fact, on 15% to 21% of the days with no spot market transactions, CME spot prices moved, though not consistently in one direction or the other. In many cases, the price movements on days without transactions moved higher – indicating that the prior-day settlement price was outside the bid-ask and the bid price was higher than the prior-day settlement price.

Percentage of Days During Which Trading Does and Does Not Occur in CME Dairy Spot Markets

2009 to June 2019



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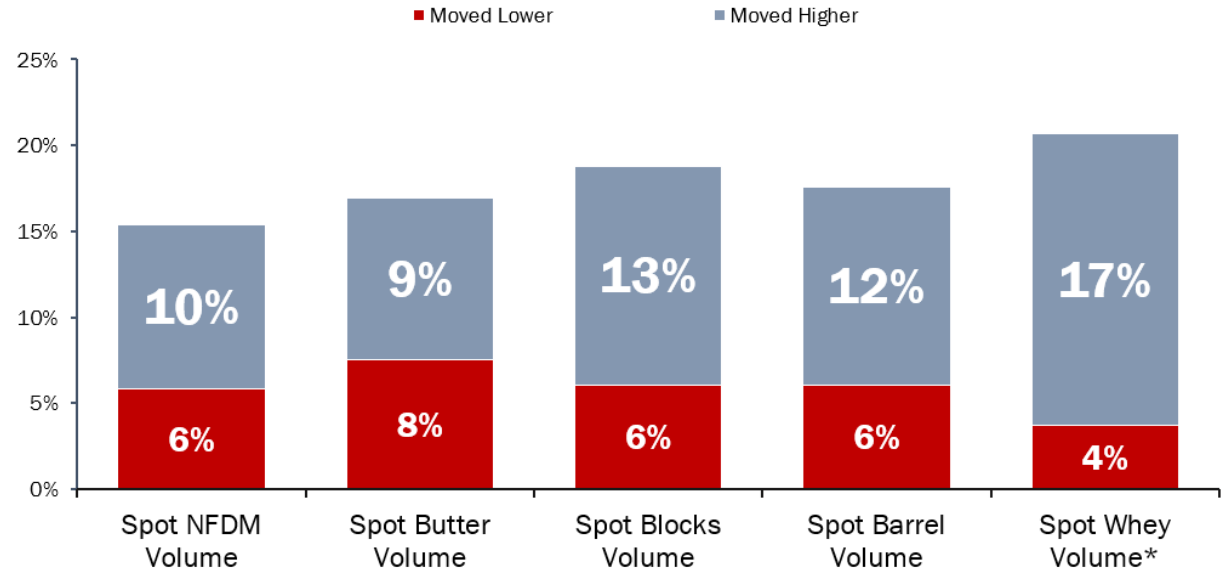
*Source: CME, Farm Bureau Analysis, *Dry Whey is March 2018 to June 2019*

Percentage of Days During Which No Trading Occurred and Price Changes by Direction of Movement

2009 to June 2019



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*Source: CME, Farm Bureau Analysis, *Dry Whey is March 2018 to June 2019*

Price Correlation with USDA Survey Prices

Reviewing the weekly average CME dairy spot market prices alongside USDA's weekly National Dairy Product Sales Report survey prices for cheddar, butter and dry milk powders reveals a high degree of correlation – at or above 95% – for butter, cheddar and nonfat dry milk. For dry whey, the correlation is 65%. A simple linear regression of USDA survey prices with lagged CME prices as conditioning information reveals statistically significant relationships. The regression coefficients and t-statistics are included below, the intercept is not included. This can be interpreted as:

*NDPSR Price = Intercept + CME_Coefficient_PriorWeek * CME_Price_PriorWeek + CME_Coefficient_Two Weeks Prior * CME_Price_TwoWeeksPrior*

Table. OLS Regression Coefficients and T-Statistics

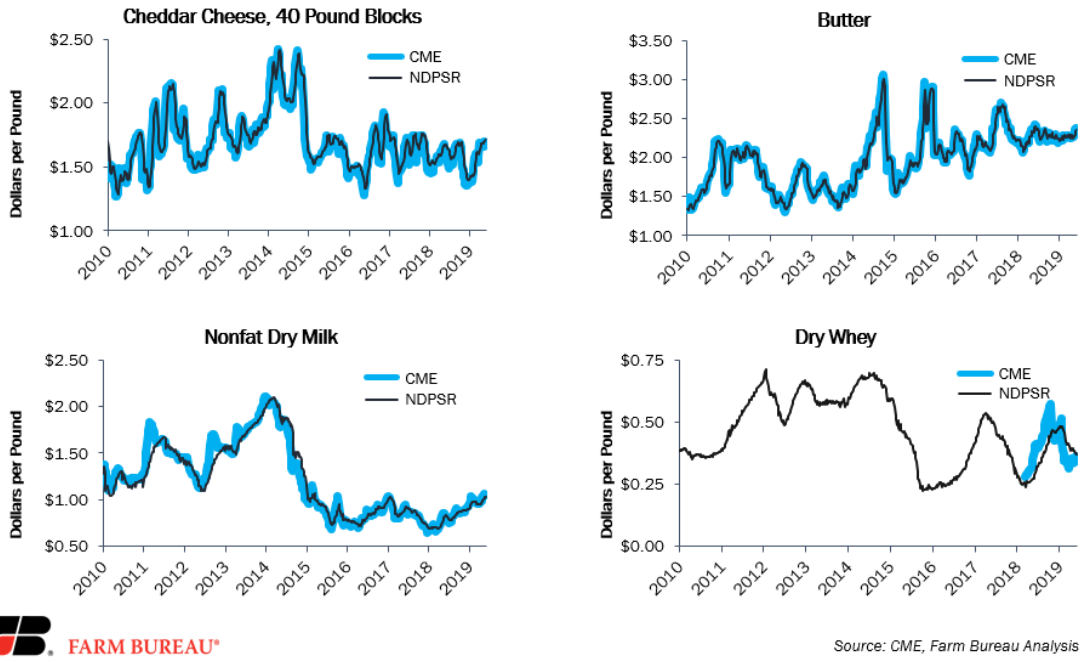
USDA Survey Price	CME (Prior Week)	CME (Two Weeks Prior)
Cheddar, 40-Pound Block*	0.2233 (14.47)	0.7792 (50.52)
Cheddar, 500-Pound Barrel*	0.4753 (39.42)	0.5500 (45.65)
Butter*	0.9567 (69.15)	0.0511 (3.69)
Nonfat Dry Milk**	0.4070 (12.31)	0.5323 (16.10)
Dry Whey***	-0.4949 (-1.62)	1.1168 (3.79)

*T-statistic included in parentheses. *Based on 2000-2019 data, **Based on 2010-2019 data, ***Based on 2018-2019 data*

As evidenced in the regression models and in the following figure, **USDA's survey prices for cheddar, butter, nonfat dry milk and dry whey are indirectly but strongly tied to prices discovered in the CME spot market**. This is not by USDA design. Rather, buyers and sellers choose to use the CME as the price discovery tool despite the limited number of market participants and low trading volume. *(Note: 500-pound barrel chart is not shown but resembles chart for 40-pound blocks.)*

CME Spot Prices and NDPSR Prices for Select Dairy Commodities

2010 to June 2019



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Source: CME, Farm Bureau Analysis

<u>CME Volume Relative to U.S. Milk Production</u>

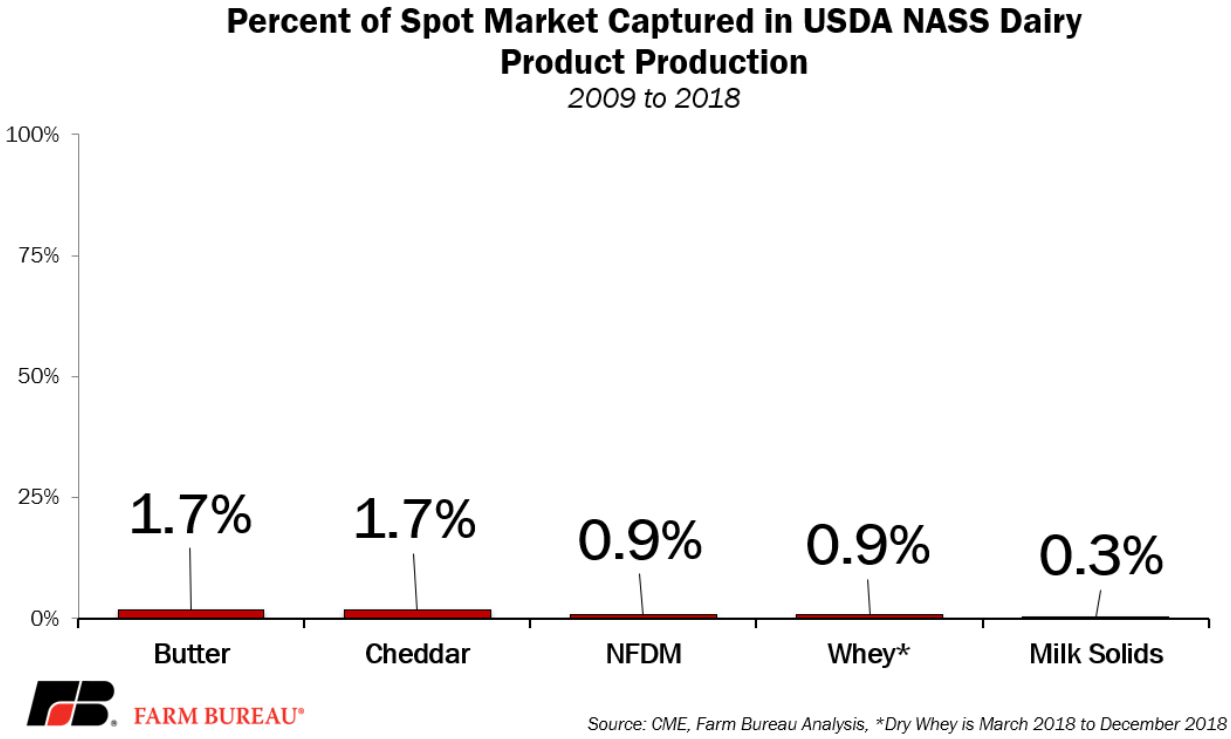
The previous section demonstrated that USDA survey prices, and thus Federal Milk Marketing Order pricing regulations, are strongly linked to prices discovered using the CME. To provide perspective on the volume of U.S. milk and dairy product production that is used for price discovery purposes, this section compares the CME spot market trading volume over the last decade to U.S. dairy product and milk solids production.

From 2009 to 2018 there were more than 7,200 loads of butter traded on the CME spot market. Based on the maximum contract size, these loads represent approximately 313 million pounds of butter. Over the same period, nearly 18 billion pounds of butter were produced in the U.S. Thus, less than 2% of butter production was traded on CME spot markets. Across cheddar blocks and barrels, approximately 573 million pounds of cheddar cheese was been traded on the CME from 2009 to 2018. Meanwhile, U.S. cheddar production totaled 33.5 billion pounds – indicating that 1.7% of U.S. cheddar production was traded on the CME. Similarly, less than 1% of nonfat dry milk was traded on the CME, and in 2018 0.94% of dry whey was traded on the CME.

Converting these dairy products to their milk solids equivalent indicates that approximately 785 million pounds of milk solids were traded on CME spot markets over the last decade. Compared to total solids production of 257 billion pounds, CME spot market activity represents 0.3% of total U.S. milk solids production.

The volume of products traded in CME spot markets is small relative to total milk and dairy product production in the U.S. While this spot market provides an opportunity for

buyers and sellers to transact, and aids in futures market liquidity, this small sampling is then intertwined into the regulated milk prices used in Federal Milk Marketing Orders -- serving as a reference point for 99.7% of milk and dairy products sold in the U.S.



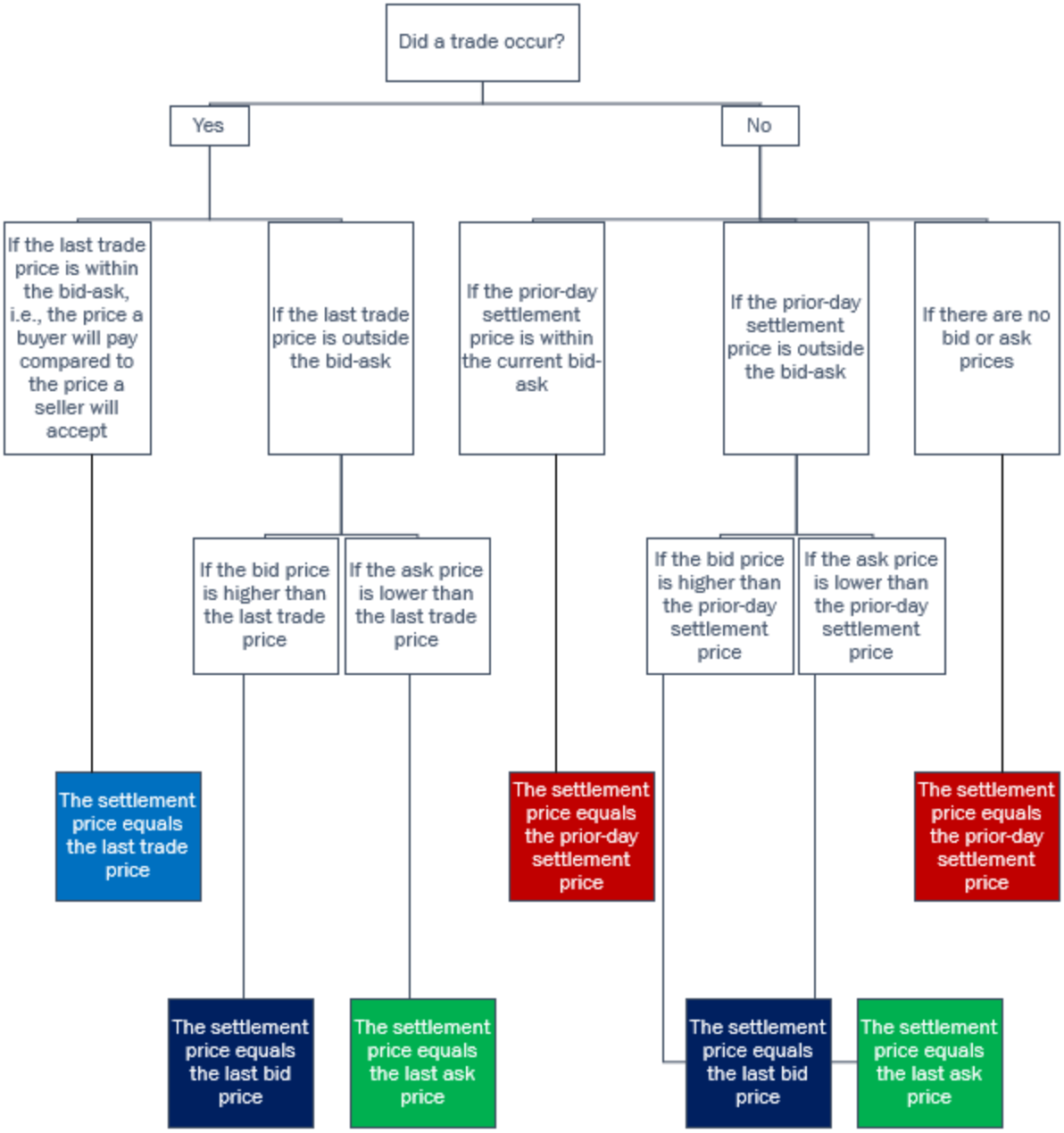
Current Farm Bureau Policy:

- Livestock producers should have access to competitive markets for price discovery that accurately determines the value of their products.

We support:

- Improving price discovery through mandatory daily electronic reporting of more common dairy products including reporting and auditing of prices and inventories. The number of plants being surveyed should be increased as well as the penalties for inaccurate dairy reporting.

CME Settlement Price Flowchart



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Source: CME, Farm Bureau Analysis