



Factors That Affect U.S. Farm-Gate Milk Prices

Prices for milk and dairy products are volatile and change on a weekly and monthly basis based on a number of supply and demand factors as well as government policies. Milk prices at the farm level are determined fundamentally by wholesale commodity prices for cheese, butter, nonfat dry milk, and dry whey in combination with federal milk marketing orders and interaction with the federal dairy price support program.

Milk Supply and Imports

Milk pricing begins with the supply of milk. USDA provides estimates of the number of milking cows and milk yield per cow for 23 major dairy producing states and for the United States. Cow numbers are determined by the number of live cattle imports, replacements, death loss, and slaughter. Generally, the number of cows on farms rises when milk prices increase relative to feed prices. The opposite is also true. There could be a 12- to 18-month lag between a change in milk prices and a change in cow numbers. Yield per cow is driven by seasonality, technology, and competition in the U.S. dairy industry, as well as milk and feed prices. Milk production normally grows 1.0 to 1.5 percent each year.

Milk consists of four major components: water (87.4 percent), butterfat (3.7 percent), protein (3.2 percent), and other dairy solids (5.7 percent). These components are purchased by dairy processors, who manufacture them into various dairy products. Processors may buy

raw milk from farmers and dairy ingredients (e.g., cream, dry whey, nonfat dry milk) from established wholesale markets in order to manufacture dairy products such as yogurt, cheese, and ice cream.

Imports also affect the supply of milk and dairy products. The United States imports processed dairy products that in some cases are ready for retail sales (e.g., specialty cheeses) and in other cases are bulk products (e.g., butter oil and milk protein concentrates) that are used in the processing of other dairy and nondairy food products (e.g., processed cheese and sport shakes). These imported bulk products sometimes compete directly with domestically produced dairy components and finished dairy products.

Dairy Product Processing

The supply of milk components from domestic and imported sources are used to manufacture various dairy products, which require alternative levels of dairy components. For example, butter consists of 80.5 percent butterfat, 0.6 percent protein, and 16.5 percent moisture, whereas cheddar cheese consists of 33.0 percent butterfat, 24.9 percent protein, and 37.0 percent moisture. The manufacture of some dairy products results in by-products that are manufactured into other products. For example, raw milk is used to bottle milk. However, because most fluid milk products contain less than 3.7 percent butterfat, additional cream left over from the bottling process can be used to manufacture butter, ice cream,

etc. Finally, most dairy manufacturing plants use raw milk in combination with some processed dairy products (e.g., bulk condensed milk, cream, nonfat dry milk, dry whey) as well as nondairy products to produce finished dairy products (e.g., yogurt, ice cream, cheese).

Milk components are first allocated to the production of fresh dairy products such as beverage milk, yogurt, ice cream, cottage cheese, and frozen desserts. Processors of these products pay dairy producers higher prices for their components under federal milk marketing orders (e.g., Class I and II prices under federal orders). Milk is then allocated to cheese production (Class III under federal orders). Major cheese categories in the United States are American, Italian, processed, and other specialty cheeses. Finally, residual milk components are then allocated to butter, nonfat dry milk, whole milk, and dry whey (Class IV under federal orders). If the milk supply in a particular year is reduced, this is reflected in reduced production of Class IV products. On the other hand, excess milk production normally results in growth in the production of Class IV products such as butter and nonfat dry milk.

Demand for Processed Dairy Products

Demand can be measured for specific dairy products such as butter, cheese, nonfat dry milk, dry whey, and fluid milk, and for an equivalent amount of milk that is represented by these products.¹ In addition, one can measure the supply and demand for

Table 1. U.S. Supply and demand for protein, 1997–2002 (metric tons).

	1997	1998	1999	2000	2001	2002
Marketings	2,260,420	2,272,954	2,350,869	2,420,828	2,392,428	2,456,482
% Change in Marketings		0.6%	3.4%	3.0%	-1.2%	2.7%
Beginning Commercial Stocks	69,239	74,222	71,238	98,550	106,146	96,920
Imports	148,938	174,208	190,968	209,234	188,829	196,072
Processing/Transportation Losses	22,921	23,098	23,905	24,653	24,292	24,932
Total Supply	2,455,676	2,498,285	2,589,171	2,703,959	2,663,111	2,724,543
Ending Commercial Stocks	74,222	71,238	98,550	106,146	96,920	102,020
Price Support Purchases	6,764	16,110	38,860	93,411	57,938	110,727
Commercial & DEIP Exports	73,608	82,320	97,804	89,062	99,170	90,333
Commercial Disappearance	2,301,082	2,328,617	2,353,958	2,415,339	2,409,083	2,421,463
% Change Commercial Disappearance	NA	1.2%	1.1%	2.6%	-0.3%	0.5%

Table 2. Commercial disappearance for milk and selected dairy products.

Item	Jan–Mar 2003	Jan–Mar 2004	Percent change
	(Million Pounds)		(%)
Milk (milk-equivalent, milkfat basis)	41,437	41,966	0.1
Butter	309.9	287.3	-8.4
American cheese	895.1	927.4	2.5
Other cheese	1,248.5	1,345.4	6.6
Nonfat dry milk	161.9	322.5	97.2
Fluid milk products	13,977.9	13,984.0	-1.1

Source: USDA, DAIRY MARKET NEWS, vol. 71, report 21, May 24–28, 2004.

various milk components. An example of the supply and demand for protein is provided in Table 1.

USDA provides a specific measure of demand for key dairy products with an estimate called “commercial disappearance.” This is a proxy for demand since it is a residual calculation. Stated another way, commercial disappearance represents what is left over after accounting for marketing, imports, change in inventory, government removals, and exports. USDA calculates this monthly for fluid milk, butter, American cheese, other cheese, and nonfat dry milk (Table 2). Unfortunately, USDA does not separate out commercial exports from this figure.² USDA also provides monthly measures of supply and demand for all these same

products (except fluid milk). Thus, one can form an opinion on “market fundamentals” by analyzing the supply and demand conditions for various dairy products. In other words, the market may raise or lower the price of cheese based on current and expected changes in supply and demand.

1. Called a “milk-equivalent conversion.” These conversions exist on a butterfat, nonfat solids, and total solids basis.

2. USDA does separate out government export programs such as the Dairy Export Incentive Program. Thus, commercial disappearance reflects both domestic consumption and commercial exports.

3. Block cheese is sold in 40-pound blocks and is used for cut and wrap sales, whereas barrel cheese is sold in 500-pound barrels for use in making processed cheese.

Wholesale and Retail Dairy Product Prices

A major wholesale market for dairy products in the United States resides at the Chicago Mercantile Exchange. Block and barrel cheese³ is traded daily, and Grade AA butter is traded three times a week. While cash transactions for these important dairy commodities represent only a small fraction of actual sales (just 1 to 6 percent), most wholesale transactions for cheese and butter in the rest of the United States are quoted in terms of a premium or discount relative to Chicago. In addition, cream is sold in the United States at a multiple over the butter price. The size of this multiple depends on market conditions. There are also wholesale markets for many other cheese

products (processed, Swiss, Monterey, etc.) and dried dairy products (nonfat dry milk, whole milk, dry whey, etc.) that are published weekly in USDA's *Dairy Market News* report.⁴

Wholesale prices for cheese, butter, and most dried dairy products are determined by market supply and demand factors. Wholesale prices rise when supply is short relative to demand. On the other hand, prices fall when supply grows and/or demand falls. That said, it is not always immediately clear why wholesale dairy products rise and fall in a given week or month. For example, block cheese prices rose above \$2 per pound in the spring of 2004. An objective assessment of monthly stocks-to-use or production-to-use ratios for American cheese could not justify this rapid rise in cheese prices—this is because some of the changes in market prices are based in part on speculation or expectations of future events. In this case the market was concerned that the “future” supply of American cheese would be limited.

There is a limit to how far wholesale prices for dairy commodities can fall in the United States. The Dairy Price Support Program (DPSP) uses a floor price for cheese, butter, and nonfat dry milk. The government stands ready to purchase unlimited quantities of these dairy commodities at fixed prices. Currently, the floor prices are \$1.1314 per pound for block cheese, \$1.1014 per pound for barrel cheese, \$1.05 per pound for bulk butter, and \$0.80 per pound for nonfortified nonfat dry milk. Wholesale market prices are normally well above support price levels. For example, cheese prices are rarely at or below support levels (Figure 1). The exception in recent years has been nonfat dry milk. Western wholesale prices for nonfat dry milk have been very close to support levels and the government has been purchasing substantial quantities of surplus product.

Figure 1. Cheese prices: market vs. support.

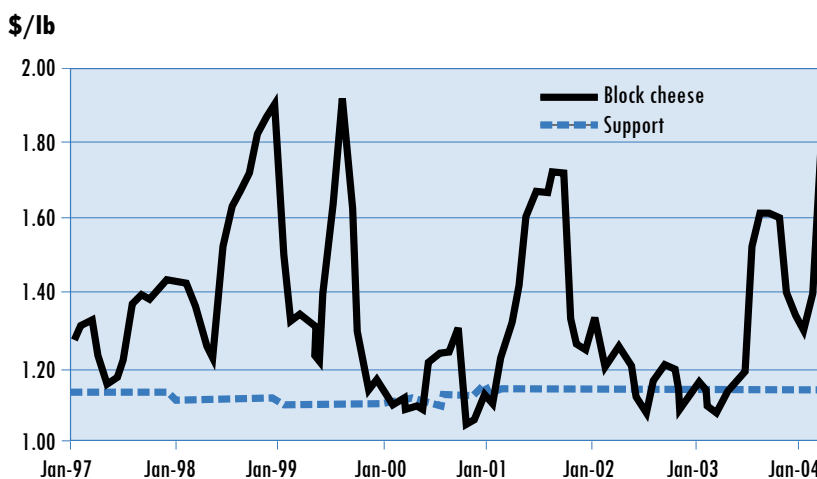
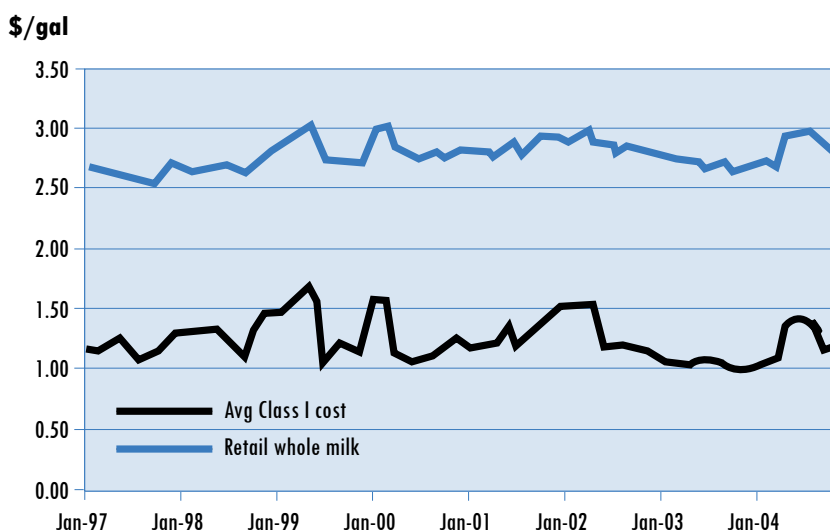


Figure 2. Retail and wholesale fluid milk prices.



As stated earlier, farm-gate milk prices and even wholesale prices for select dairy commodities are influenced to some extent by government programs, but are predominately determined via market supply and demand forces. The prices processors charge retailers and the retail prices of milk and dairy products

generally face very little government regulation.⁵ Thus, the market place sets the so called farm-to-retail price margin. For some dairy commodities, the farm price drives the retail price (e.g., butter and fluid milk). Retail fluid milk prices (Figure 2), for example, tend to rise and fall with farm prices (the Class I cost). Delays may be present, and retail prices are often less volatile than farm prices, but there is a relationship. In other cases, there is very little relationship between farm and retail prices (e.g., cheese and ice cream). Thus, in most cases, we rely on the marketplace in the United

4. Source: <http://www.ams.usda.gov/dairy/mncs/weekly.htm>.

5. There are exceptions. Some states such as Pennsylvania have milk control laws that set minimum wholesale and retail prices for fluid milk.

States to determine the mark-up from farm to retail prices rather than via government intervention.

Federal Order and Farm-Gate Milk Prices

Federal milk marketing orders (FMMO) are government programs that set minimum prices for what processors should pay dairy farmers for their milk. They regulate milk prices in set geographic regions of the country. Currently there are 10 federal orders that regulate about 85 percent of the nation's milk supply. Federal orders do not directly affect prices for dairy commodities and do not set maximum prices for milk.⁶

The market administrator, who works for USDA and manages one or more federal orders, sets milk prices on a monthly basis. Federal orders use classified pricing to set four different prices for raw milk depending on its use. Class I prices are for fluid milk; Class II is for spoonable dairy products such as yogurt, ice cream, and cottage cheese; Class III is for hard cheese production; and Class IV is for milk used to manufacture butter, nonfat dry milk, and other dried dairy products. The market administrator also requires all processors regulated by the order to report their sales. This information is used to determine how farmers' milk is used each month. The market administrator then "pools" or "blends" the four classified prices based on market sales to determine the federal order blend price. This forms the basis of the farm-gate milk price.

For example, the market administrator for the Northeast Federal Order 1 announced a blend price for the month of April 2004 of \$17.28 (Table 3). The price was a weighted average of four class prices where the weights were based on actual sales of milk in the Northeast order. These class prices change each month and are based on formulas

Table 3. Pool price announcement for the Northeast marketing area, April 2004.

Federal Order Class	Percent	Pounds (million)	Minimum Class Price (\$/cwt)
Class I	48.5	892.3	16.89
Class II	19.8	365.3	15.21
Class III	19.6	361.3	19.66
Class IV	12.1	221.9	14.57
Total producer milk Blend price	100.0	1,840.8	17.28

that are linked to the value of milk components (butterfat, protein, other dairy solids). The values of these components are then determined from formulas based on the wholesale values of cheese, butter, nonfat dry milk, and dry whey.⁷ Stated another way, the wholesale values of key dairy commodities directly determine the federal order class prices, and hence, farm-gate milk prices.

An example of the calculation of federal order prices is provided in Table 4 for the Northeast Federal Order. For the month of April 2004, USDA announced monthly average wholesale prices for butter, nonfat dry milk, cheese, and dry whey. They also announced component prices for butterfat, protein, and other dairy solids. These components were determined via economic formulas based on yields and processing costs. These components then determined the minimum class prices. The class prices are also announced on a butterfat and skim solids basis. That's because processors actually pay farmers for their milk this way.

6. Processors can pay above the federal order minimums if market conditions warrant it (called over-order premiums).

7. The federal milk marketing orders do not use the wholesale prices announced by the Chicago Mercantile Exchange. Instead they use a national weekly survey conducted by USDA's National Agricultural Statistics Service (NASS).

The federal order blend price forms the basis of what dairy farmers receive on their milk check. The blend price is announced for a specific county and is then adjusted to the plant where farmers deliver their milk. For example, the blend price for the Northeast order is announced for Suffolk County (Boston). A farmer in Lancaster County, Pennsylvania, will then have his milk price reduced by \$0.35 per hundredweight. This adjustment is called a "location differential." Next, premiums are often added to the adjusted blend price to reflect market conditions as well as quality and volume incentives. In Pennsylvania, dairy producers also receive an over-order premium mandated by the Pennsylvania Milk Marketing Board. Finally, deductions are made from the milk check to reflect cooperative deductions, marketing fees, advertising, and milk hauling costs.

Market Interactions

The U.S. dairy industry is dynamic and changes with market conditions. Thus, farmers, processors, retailers, and consumers face prices that rise and fall with these changing market conditions, which are complex since one impact can ripple throughout the U.S. dairy industry.

Farmers may experience low milk prices if the milk supply grows ahead of market demand. This occurred in 2002 when the U.S. milk supply grew 2.7 percent ahead of 2001. As a result,

dairy commodity prices and hence farm-gate milk prices fell to very low levels. The market sent dairy farmers price signals to cut back on milk production. It took an entire year of low milk prices before farmers began to reduce their cow numbers and slow the rate of growth in milk production per cow. As a result, the milk supply grew just 0.3 percent in 2003. Milk prices then began to rise. Cow numbers, however, continued to fall throughout 2003. Consequently, 2004 began with a herd size that was 1.7 percent below a year ago. In addition, the market became concerned about reduced levels of milk production per cow. As a result, dairy commodity prices were bid up in the spring of 2004, particularly for butter and cheese. This raised retail prices for fluid milk, ice cream, cheese, etc., during 2004. Thus, consumers faced higher prices and, in some cases, reduced consumption.

The United States dairy industry is now sensitive to outside factors that can affect the milk supply, product production, or consumption. These impacts will be felt not only at the farm level, but also at the processing and retail level because the entire dairy industry is interconnected. A wet spring in California may reduce national butter production, which will impact what a family in New England would pay for butter used to bake holiday cookies. A milk production shortage in the European Union could raise global prices for butter, cheese, and nonfat dry milk. That, in turn, could cause greater United States exports and higher domestic prices.

Conclusion

Prices for milk and dairy products are driven mainly by changing market conditions and less by government intervention. Farmers, processors, retailers, and consumers should expect to continue to see volatile milk and dairy product prices in the future. Milk prices begin with the supply

Table 4. Announcement of class and component prices for federal milk marketing orders, April 2004.

Prices	Dollars	Units
Class I price @ 3.5% butterfat	16.89	per hundredweight
Class II price @ 3.5% butterfat	15.21	per hundredweight
Class II Butterfat price	2.5083	per pound
Class II Skim price	6.66	per hundredweight
Class III price @ 3.5% butterfat	19.66	per hundredweight
Class III Skim price	11.30	per hundredweight
Class IV price @ 3.5% butterfat	14.57	per hundredweight
Class IV Skim price	6.03	per hundredweight
Component Prices:		
Butterfat price	2.5013	per pound
Protein price	3.4465	per pound
Other solids price	0.1042	per pound
Monthly Product Price Averages:		
Butter	2.1994	per pound
Nonfat dry milk	0.8171	per pound
Cheese	2.0520	per pound
Dry whey	0.2602	per pound

Source: Northeast Federal Milk Marketing Order, www.fmmone.com.

of milk and the allocation of these milk components to the production of fresh and storable dairy products. The interaction of the production of these products with market demand determines wholesale prices for cheese, butter, nonfat dry milk, and dry whey. These wholesale prices then determine what processors pay farmers for milk used to make various dairy products. These costs also influence what consumers pay for various dairy products.

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