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A banner for the Agricultural Outlook Forum. It features a dark green top section with the USDA logo and name. Below this is a light orange section with the event title and subtitle. On the left, a yellow curved shape contains the text "USDA's 93rd Annual".

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Situation and Outlook for the U.S. Dairy Industry

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The Dairy Interagency Commodity Estimates Committee

USDA short-term forecasts and long-term projections discussed in this report were produced by the Dairy Interagency Commodity Estimates Committee (ICEC). The Dairy ICEC is chaired by a Senior Agricultural Economist of the World Agricultural Outlook Board (WAOB), which is part of the USDA Office of the Chief Economist. The committee includes members from four USDA agencies: Agricultural Marketing Service (AMS), Economic Research Service (ERS), Foreign Agricultural Service (FAS), and Farm Service Agency (FSA).

The short-term forecasts discussed in this report were produced in February of this year and appear in the *World Agricultural Supply and Demand Estimates* (WASDE, published February 9) report published by WAOB and the February 15 *Livestock, Dairy, and Poultry Outlook* (LDP Outlook, published February 15) report published by ERS. Historical numbers in this report reflect recent revisions by USDA National Agricultural Statistics Service (NASS) in its February *Milk Production* report, subsequent to the most recent WASDE and LDP Outlook reports. *USDA Long-term Projections to 2026* were published in February of this year. However, these projections reflect information available as of early November 2016.

USDA's Milk Equivalent Estimates

To account for aggregate supply and use of milk in all products, USDA estimates the equivalent amount of milk associated with stocks, imports, and exports of dairy products on both a milk-fat basis and a skim-solids basis. To understand USDA supply and use data, its short-term forecasts, and its long-term projections for the dairy industry, a basic understanding of milk-equivalent accounting is helpful.

Milk is made up of water, milk fat, and skim solids (protein, lactose, ash, and trace elements). Dairy processors separate and reassemble these milk components to produce a wide array of dairy products. USDA uses conversion factors for milk fat and skim solids of dairy products for its two milk-equivalent accounting measures. For example, the milk fat in 1 pound of butter is about equal to the milk fat of about 22 pounds of milk (a little more or less depending on the milk-fat content of the milk and butter), so the conversion factor for butter is about 22 on a milk-fat basis. Since butter has trace amounts of skim solids, 1 pound of butter is equivalent to about 0.1 pounds of milk on a skim-solids basis. This contrasts with nonfat dry milk, which has a conversion factor of about 12 on a skim-solids basis but only about 0.2 on a milk-fat basis.

The 2016 Dairy Situation in Historical Context

The dairy situation in 2016 was eventful. U.S. prices for milk and dairy products were generally lower than the previous two years, largely due to global supply and use factors. Since the mid-2000s, trade has increasingly played a larger role in the U.S. dairy industry. While the industry has generally benefited from an upward trend in exports, it faces increased risks from global shocks. However, an increase in domestic demand, especially for dairy products with a high milk-fat content, has served to mitigate risks from abroad.

Milk production

U.S. milk production was a record 212.4 billion pounds in 2016, an increase of 1.6 percent over 2015 (adjusted for leap year). From 1990 to 2003, milk production grew at a compound annual rate (CAGR) of 1.1 percent. Since then the CAGR has been 1.7 percent, as milk production has expanded to meet growing export demand.

Milk cows in 2016 averaged 9.328 million head, the highest average since 1996. Milk cows followed a downward trend through 2004, but the trend has been upward since then, with variations along the way. However, changes in milk-cow numbers have been relatively small in recent years. Most of the increase in milk production has come from improved yields. Daily milk per cow reached a record of 62.2 pounds per head in 2016, an increase of 1.4 percent over 2015.

While U.S. milk production in 2016 was higher than 2015, for California, the largest milk-producing State, it was 1.3 percent lower (adjusted for leap year). However, the situation changed toward the end of the year, when fourth-quarter California milk production was 0.9 percent higher than a year earlier. Attenuation of the drought likely played a role in the milk-production increase.

U.S. milk production has consistently been above the previous year each month since December 2013, and it averaged 2.5 percent above the previous year in the fourth quarter of 2016. This contrasts with milk production of the leading dairy export competitors, the European Union (EU) and New Zealand. In 2015, EU milk production ran below previous year levels until April 2015, when milk supply quotas were discontinued. The EU milk supply ran above the previous year every month until falling below the previous year in June 2016 and the following months. For New Zealand, 2016 milk production ran about even with the previous year until the last quarter, when it fell below the previous year as producers reduced the herd in response to low milk prices and unfavorable weather affected yields.

Relatively low feed prices have contributed to the growth of U.S. milk production in recent years. In 2016, the calendar-year average prices for corn, alfalfa hay, and soybean meal were \$3.48 per bushel, \$139 per short ton, and \$328 per short ton, respectively. This compares with peak calendar-year average prices for corn and alfalfa hay of \$6.67 per bushel and \$206 per short ton, respectively, in 2012, and the peak price for soybean meal of \$479 per short ton in 2014. In

2016, the milk-feed ratio was 2.13 in the first quarter, fell to 1.85 in the second quarter, and then rose to 2.26 and 2.48 in the third and fourth quarters, respectively.¹

Domestic use

For many years, domestic use has grown more on a milk-fat basis than a skim-solids basis. For 2014 through 2016, domestic use on a milk-fat basis grew at an increasing rate. Domestic use in 2016 was robust, especially on a milk-fat basis. In 2016, domestic use on a milk-fat basis was 208.4 billion pounds, 5.9 billion pounds higher than 2015, the largest year-over-year volume increase in the data series (which begins with 1995 data). The percentage increase for the year was 2.9 percent.² On a skim-solids basis, domestic use was 178.3 billion pounds in 2016, a 1.6 percent increase over 2015.

Demand for products with high milk-fat content has increased for at least three reasons:

- Butterfat is perceived as healthier than trans fat after a 2013 announcement by the U.S. Food and Drug Administration (FDA) that trans fat is no longer “generally regarded as safe.” Trans fat, also known as partially hydrogenated oil, is used in some baked goods, snacks, fried food, doughs, creamers, and margarines. FDA has taken steps to remove it from the U.S. market over a 3-year period.
- Several studies have indicated possible health benefits of butterfat or lower risks of consuming butterfat than previously perceived.
- Major media outlets have reported widely on risks of consuming trans fat as well as possible health benefits and less perceived risk of consuming butterfat.³

Exports

In every year from 2003 to 2014, with the exception of 2009, the value of dairy commercial exports increased from the previous year. The rise in dairy exports can be attributed to the rise in dairy demand of developing countries and also policies of the United States, its trading partners, and its competitors allowing more trade openness. For the United States, long-term export growth has been much greater on a skim-solids basis than a milk-fat basis. These trends have complemented domestic demand, of which the opposite is the case.

However, in 2015, U.S. dairy exports fell by about 30 percent by value, for several reasons:

- Dairy product demand weakened for several major importers, especially China.
- Since August 2014, Russia has banned imports of most dairy products from the United States, the EU, Canada, Australia, and Norway. The United States exports only small

¹ The milk-feed price ratio, as reported by NASS, is the pounds of 16-percent mixed dairy feed equal in value to 1 pound of whole milk. Since feed costs are a large proportion of total milk production costs, analysts often use the ratio as an indicator for changes in milk production. The modeled feed uses 51 percent corn, 8 percent soybeans, and 41 percent alfalfa hay.

² On a percentage basis, the year-over-year increase was higher in 1999, 3.4 percent.

³ U.S. Dietary Guidelines, published by the U.S. Department of Health and Human Services and USDA, encourage consumption of “fat-free or low-fat dairy, including milk, yogurt, cheese, and/or fortified soy beverages.”

quantities of dairy products to Russia, but the ban has caused the EU to export to alternative markets in competition with the United States. Global dairy prices fell, in part, due to Russia's reduction of dairy imports and recession in that country.

- U.S. exports became less attractive due to the strong value of the U.S. dollar relative to other currencies.
- The EU discontinued its milk supply quotas in April 2015. Milk production increased thereafter, boosting EU dairy exports in competition with the United States.

In 2016, as the U.S. became more competitive in global markets, commercial exports recovered to 9.2 billion pounds on a milk-fat basis and 38.9 billion pounds on a skim-solids basis. Notably, milk-fat basis exports for the fourth quarter were 38 percent above the fourth quarter of 2015, with much of the increase to Canada. As of August 1, Canada allowed temporary supplementary imports of butterfat products and cream (in addition to imports usually allowed under tariff-rate quotas)⁴ in order to alleviate shortages in that country. It is unknown as to how long the supplementary imports will continue to be allowed.

For both bases, 2016 exports were above 2015 but below record highs of 2014. While export quantities increased from 2015 to 2016, export prices fell. The total value of U.S. dairy exports declined from \$5.3 billion in 2015 to \$4.8 billion in 2016,⁵ as the decline in export prices more than offset the increase in export quantities.

Imports

In the mid-2000s, U.S. dairy imports were about 7 billion pounds on both the milk-fat and skim-solids bases. They declined thereafter but have risen each year since 2013 on both bases, reaching 2016 levels of 7.0 billion on a milk-fat basis and 6.5 billion pounds on a skim-solids basis.

Imports on a milk-fat basis were especially high in the first quarter of 2016. The high imports can be attributed to large differences between domestic and international prices. The U.S. domestic wholesale price for butter was substantially higher than export prices for Oceania and Europe from the second quarter of 2015 through the third quarter of 2016, with peak differences of \$1.49 and \$1.38 per pound, respectively, in November 2015.⁶ Strong domestic demand for butterfat products contributed to the wide price differences. Since the over-quota tariff rate for butter is \$0.70 per pound, it was economical for importers to pay the over-quota rate to import butter.

⁴ Most dairy products are subject to tariff rate quotas (TRQs). A TRQ is a two-tiered tariff where a lower (in-quota) tariff is charged on imports within a quota volume, while a higher (over-quota) tariff is charged on imports in excess of the quota volume.

⁵ Export values used in this report are Foreign Agricultural Trade of the United States (FATUS) standard aggregations used by USDA Economic Research Service.

⁶ While comparisons between domestic wholesale prices and foreign export prices are helpful, it is useful to realize differences in how the prices are collected and reported. The domestic prices discussed in this report are collected through a mandatory survey for products shipped and title transferred. Foreign export prices are collected through a voluntary program, and prices are reported for the week in which the buyer and seller agreed to the transaction; shipment may arrive in the same month or a following month. This may explain why imports often appear to respond to price differences several months later.

Stocks

As demand for dairy products has grown, dairy industry suppliers have apparently felt the need to hold more products in storage. Ending stocks for 2016 were 14.3 billion pounds on a milk-fat basis (1.0 billion higher than 2015) and 14.8 billion pounds on a skim-solids basis (0.9 billion higher than 2015). Through the year, butter stocks averaged about 30 percent over the previous year, and cheese stocks averaged about 9 percent over the previous year. NDM stocks, on the other hand, averaged about the same as the previous year. There were some notable events concerning stocks in 2016:

- In May 2016, total cheese stocks reached a then-record of 1.249 billion pounds, surpassing the previous record of 1.248 billion pounds set in September 1983. Stocks continued increasing for the next two months, peaking at 1.276 billion pounds in July. The situation in 2016, however, was much different from 1983, when the Milk Price Support Program was active and the Federal Government owned most of the stocks. In 2016, nearly all of the stocks were privately held.
- Butter ending stock levels fell by 67 million pounds from October to November, the largest 1-month fall since September 1993, a time when most butter stocks were owned by the U.S. Government. The decrease for November reflects robust domestic use and relatively strong exports. Even with the large fall, however, ending butter stocks were still above the previous year level.
- Although 2016 NDM stocks were about the same on average as 2016, levels throughout the year were not. In the fourth quarter of 2016, NDM stocks averaged about 15 percent higher than the previous year.

Prices

Annual average prices for cheese, NDM, and dry whey in 2016 were lower than 2015, with cheese falling from \$1.645 to \$1.605 per pound, NDM declining from \$0.902 to \$0.829, and dry whey falling from \$0.380 to \$0.288. However, with strong demand for butterfat products, the price of butter rose from \$2.067 to \$2.077 per pound. Prices for cheese, NDM, and dry whey were higher in the second half of the year than the first half. The price of butter rose in the third quarter but declined in the fourth quarter.

With lower annual cheese and whey prices, the Class III price fell from \$15.80 per hundredweight (cwt) in 2015 to \$14.87 in 2016. With the lower NDM price more than offsetting the higher butter price, the Class IV price fell from \$14.35 per cwt in 2015 to \$13.77 in 2016. The all-milk price fell from \$17.12 per cwt in 2015 to \$16.24 in 2016. During the year, the all-milk price declined to a low of \$14.77 per cwt in the second quarter and then rose in the second half, averaging \$17.67 in the fourth quarter.

Forecasts for 2017

Milk production typically responds to milk prices and prices of inputs with a lag. The increases in the milk-feed ratio in the third and fourth quarters of 2016 are leading indicators for an increase in milk production for the first part of 2017. Feed prices are expected to continue to be

relatively low, with 2016/17 forecasts for corn and soybean meal of \$3.10-\$3.70 per bushel and \$305-\$345 per short ton, respectively.⁷ Under these conditions, the milk cow forecast for 2017 is 9.370 million head, and increase from 9.328 million head in 2016. The milk-per-cow forecast is 23,195 pounds, 2.1 percent higher than 2016, adjusted for leap year. The milk production forecast is 217.4 billion pounds, 2.6 percent higher than 2016, adjusted for leap year.

Growth of world milk production is expected to be less than for the United States. In December report by USDA Foreign Agricultural Service, the milk production forecast for the top five exporters combined is 1 percent, with no growth expected for the EU and 1-percent growth expected for New Zealand.

With an improving economy, domestic commercial use is expected to continue to strengthen in 2017. The forecast on a milk-fat basis is 214.7 billion pounds, 3.0 percent higher than 2016. If realized, this would be the fourth consecutive year that commercial use increased at an increasing rate on a milk-fat basis. On a skim-solids basis, the 2017 forecast for commercial use is 183.2 billion pounds, a 2.7 percent increase from 2016.

With expected tightness in milk supplies of major competitors and expected strength of global demand for NDM and dry whey products in 2017, exports on a skim-solids basis are expected to grow to 40.1 billion pounds, an increase of 1.2 billion pounds over 2016. On the other hand, exports on a milk-fat basis are expected to decline as butter and cheese prices become less competitive due to strength of domestic demand on a milk-fat basis. The forecast for exports on a milk-fat basis is 8.3 billion pounds, 0.9 billion less than 2016. With tight global supplies and expected growth of U.S. milk production, imports for 2017 are expected to decline to 6.6 billion pounds on a milk-fat basis (0.4 billion less than 2016) and 6.2 billion pounds on a skim-solids basis (0.3 billion less than 2016).

With an expected shift in domestic demand on both bases and higher exports on a skim-solids basis, prices for all major dairy products are expected to rise in 2017. However, relatively high beginning stocks at the start of the year and the expected rise in milk production will likely limit upward price movements. Price forecasts for butter, cheese, NDM, and dry whey are \$2.045-\$2.145, \$1.660-\$1.730, \$0.990-\$1.050, and \$0.455-\$0.485 per pound, respectively. Dairy product prices translate into Class III and IV milk price forecasts of \$16.45-\$17.15 and \$15.10-\$15.90 per cwt, respectively. The all-milk price forecast is \$17.70-\$18.40 per cwt, an increase from \$16.24 in 2016.

A Few Words About USDA Long-Term Projections⁸

From 2017 to 2026, milk per cow is expected to increase at a compound annual growth rate (CAGR) of 1.9 percent, reaching 27,585 pounds per cow in 2026. The expected growth (slightly

⁷ The marketing year begins September 1 for corn and October 1 for soybean meal.

⁸ USDA long-term projections make up a conditional, long-run scenario about what would be expected to happen under a continuation of current farm legislation and other specific assumptions. Critical long-term assumptions are made for U.S. and international macroeconomic conditions, U.S. and foreign agricultural and trade policies, and growth rates of agricultural productivity in the United States and abroad. The projections assume normal weather and no domestic or external shocks.

higher than 1.7 CAGR from 1990 to 2016) is due to relatively low expected feed prices and increasing efficiencies as dairy farms continue to consolidate and gain economies of scale. Low feed prices are also expected to contribute to an expansion of the herd, reaching 9.46 million head in 2022. However, as feed prices rise and milk per cow continues to increase, the herd is projected to gradually decline to 9.42 million head by 2026. These milk-cow changes are relatively small, with the peak in 2022 only 1.3 percent higher than 2016.

As incomes rise in developing countries, global demand for dairy products is expected to become more important for the U.S. dairy industry. In the long run, commercial exports are expected to increase, reaching 4.9 percent and 21.0 percent of milk production on milk-fat and skim-solids bases, respectively. This compares with 4.3 percent and 18.3 percent of production, respectively, in 2016.

The nominal all-milk price is projected to rise through the period, reaching \$19.65 per cwt in 2026.⁹ However, the real all-milk price (adjusted for inflation) is expected to decline over the period. It is typical for agricultural prices to decline in real terms as producers become more efficient, finding ways to produce more at lower real input prices.

⁹ Expectations for U.S. dairy prices can change significantly in only a few months. When long-term projections were determined in November 2016, the all-milk price forecast for 2017 was \$16.75 per cwt, significantly lower than \$17.70- \$18.40 per cwt forecast in the latest WASDE report.