Documentation for the USDA, Economic Research Service Annual U.S. Dairy Sector Econometric Model

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What Is the Issue?

This report provides documentation for the Annual U.S. Dairy Sector Model used by the USDA, Economic Research Service (ERS). Using econometric estimation, this dynamic model provides projections for supply, demand, and prices for U.S. milk and dairy products over a 10-year period. The model provides support for U.S. dairy projections published in the *USDA Agricultural Projections* report each year. The model is also used to analyze changes in market conditions and the impacts of changes in various Federal Government policies on the dairy sector.

The USDA, ERS Annual U.S. Dairy Sector Model is a comprehensive depiction of the dairy sector market, including the supply of milk; the allocation of milk fat and skim solids (also called nonfat solids) used in dairy products; various Federal Government policy variables; consumer demand quantities; imports and exports; stocks; and prices of milk and dairy products.

Dairy projections in the *USDA Agricultural Projections* report (also referred to as "baseline projections") are determined each year through econometric work and judgment of the USDA Dairy Interagency Commodity Estimates Committee (Dairy ICEC). The Dairy ICEC includes representatives from four USDA agencies: Economic Research Service; Agricultural Marketing Service; Foreign Agricultural Service; and the Farm Production and Conservation Business Center. The chairperson for the Dairy ICEC is from the USDA, World Agricultural Outlook Board. While the Annual U.S. Dairy Sector Model assists the Dairy ICEC in its deliberations for the baseline projections, model results can be adjusted during the process based on committee judgement. The final baseline model results each year represent the consensus judgment of the committee.

This Technical Bulletin provides an in-depth discussion of how the model is specified, estimated, and calibrated in order to:

- provide transparency concerning much of the econometric work associated with USDA baseline projections for the dairy sector,

- explain how the model is used in combination with judgment of the USDA Dairy Interagency Commodity Estimates Committee, and
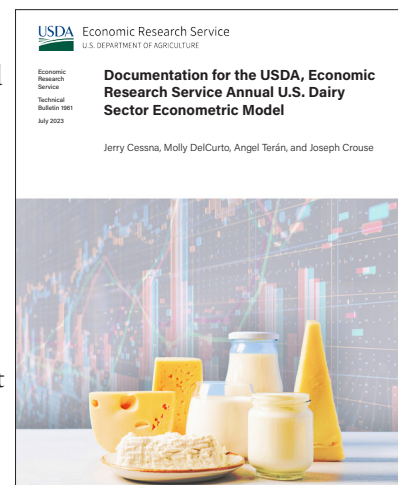
- explain how the model is used for scenario analyses concerning impacts of market conditions or various Federal Government policies on the U.S. dairy sector.

What Did the Study Find?

As stated in the *USDA Agricultural Projections* to 2031 report, "USDA's long-term agricultural projections…are a departmental consensus on a conditional long-run scenario for the agricultural sector. These projections provide a starting point for discussion of alternative outcomes for the sector." The Annual U.S. Dairy Sector Model, as calibrated to the baseline projections, is a tool to analyze alternative projected outcomes for the dairy sector due to impacts of changes in market conditions or impacts of changes to various Federal Government policies. Macroeconomic assumptions, feed prices, foreign export prices for dairy products, various Federal Government policy parameters, and other types of variables can be altered to analyze changes of supply, demand, and price variables for the dairy sector. The scenario model projections resulting from the altered inputs can be compared to the baseline projections in order to estimate impacts of the changes. An example is provided to demonstrate how the model can be used to analyze the effects of a change in feed prices on the dairy sector.

While scenario analyses from the model would be of interest to agricultural economists, policy makers, and private decision makers, the parameters used in the model would also be of interest. Prices and income are key signals of economic decision making. Prices are determined by the interaction of supply and demand, reflecting the willingness of producers to supply goods and consumers to buy these goods. Income changes affect the relative demand for these same goods. Key measures of producers' and consumers' responsiveness to changes in prices and income are price elasticities and income elasticities, respectively. Price and income elasticity estimates are provided in this report for many of the supply and demand variables included in the model.

The USDA, ERS Dairy Sector Model indicates that milk supply is very inelastic with respect to price changes. For the number of milk cows and average milk per cow, estimated elasticities for a 1-year lag of the milk-feed ratio are 0.031 and 0.016, respectively. Price and income demand elasticities for all dairy products included in the model are estimated to be inelastic, which is typical for food products. Price elasticities range from –0.035 for fluid milk to –0.868 for aggregated Class II products other than frozen products (mostly soft manufactured products such as yogurt, cottage cheese, sour cream, etc., that are in the Class II category of the Federal Milk Marketing Order system). Staple products, such as fluid milk, would be expected to be very price inelastic. Demand for products that are considered less essential, or luxury goods, are not as price inelastic. Some Class II products may fall in this category. Income elasticities estimates range from 0.069 for fluid milk to 0.604 for butter.

How Was the Study Conducted?

Historical data from various sources are used in the model. Data are drawn from USDA's Economic Research Service (ERS), National Agricultural Statistics Service (NASS), Agricultural Marketing Service (AMS), and Foreign Agricultural Service (FAS). The main data sources outside of USDA include the U.S. Department of Labor, Bureau of Labor Statistics (BLS) and the U.S. Department of Commerce, Bureau of the Census and Bureau of Economic Analysis. The model includes equations related to demand for dairy products; milk components of dairy products (milk fat and skim solids); manufacturing allocation of milk and milk components; imports and exports; stocks of dairy products; various Federal Government policies; and prices of milk and dairy products. Model equations include regressions, estimates based on conversion factors for milk components, and identities (straightforward calculations that are always true, such as milk production = number of milk cows x milk per cow). Regression statistics provided in this Technical Bulletin are used to assess how well regression equations reflect historical data relationships.