United States
Department
of Agriculture

Economic
Research
Service

Economic
Research
Report
Number 28

# U.S. Dairy at a Global Crossroads

**Don Blayney, Mark Gehlhar, Chris Hilda Bolling, Keithly Jones, Suchada Langley, Mary Anne Normile, and Agapi Somwaru**

## Visit Our Website To Learn More!

Want to learn more about U.S. and international dairy markets? Visit our website at **www.ers.usda.gov.**

You can also find additional information about ERS publications, databases, and other products at our website.

## National Agricultural Library Cataloging Record:

U.S. dairy at a global crossroads.
(Economic research report (United States. Dept. of Agriculture. Economic Research Service) ; no.28)

1. Dairy products industry—United States.
2. International trade.
3. Competition—United States.
4. Agricultural price supports—United States.
5. Dairy products industry—United States—Foreign ownership.
I. Blayney, Don P.
II. United States. Dept. of Agriculture. Economic Research Service.
III. Title.

HD9275.U62

Cover photo: Fred Gale

United States Department of Agriculture

Economic Research Report Number 28

November 2006

A Report from the Economic Research Service

www.ers.usda.gov

# U.S. Dairy at a Global Crossroads

**Don Blayney, Mark Gehlhar, Chris Hilda Bolling, Keithly Jones, Suchada Langley, Mary Anne Normile, and Agapi Somwaru**

## Abstract

Current dynamics in world dairy markets and the potential for global and domestic trade policy reform are bringing the U.S. dairy sector to a new crossroads as it faces competitive forces from outside its borders. Those forces—demand for new products by consumers in industrialized countries, changes in technology, rapid economic growth in emerging developing countries, particularly in Asia, and the increasing role of multinational firms in domestic and global dairy markets—are leading to increased dairy consumption, more opportunities for dairy product trade, and foreign direct investment benefiting both U.S. consumers and producers. As global demand for milk and new dairy products expands, the roles of policies that support prices are diminishing, while the roles of flexibility and innovation aimed at improving competitiveness are growing.

**Keywords:** International dairy markets, dairy trade, dairy policy, tariffs, production quotas, foreign direct investment, cheese, butter, dry milk powders

## Acknowledgments

Appreciation is extended to Neil Conklin, Mary Bohman, Barry Krissoff, and Janet Perry (USDA, ERS) for their support of the project and review comments. The authors extend thanks for review comments to Andrew Novakovic (Cornell University), Allan Rae (Massey University), Ronald Knutson (Texas A&M University), Alejandro Reca (Rabobank), Art Coffey (USDA, FAS), Milton Madison (USDA, FSA), and Howard McDowell (USDA, AMS). Finally, special thanks are extended to John Weber and Wynnice Pointer-Napper (USDA, ERS) for editorial and design assistance.

## Special Acknowledgment

This report represents one of the last professional contributions of Chris Bolling, who passed away in April 2006. Chris was an agricultural economist with USDA, ERS. She will be remembered by her colleagues at ERS and in the agricultural economics profession for her work in the area of foreign direct investment in agriculture, the Brazilian agriculture sector, and the economics of the processed food sector.

# Contents

# Summary

Most dairy sectors worldwide, including the U.S. sector, have been cast as heavily protected with limited exposure to global competition. However, current dynamics in world dairy markets and the potential for global and domestic trade policy reform are bringing the U.S. dairy sector to a new crossroads as it faces competitive forces from outside its borders. Those forces—demand for new products by consumers in industrialized countries, changes in technology, rapid economic growth in emerging developing countries, particularly in Asia, and the increasing role of multinational firms in domestic and global dairy markets—are leading to increased dairy consumption, more opportunities for dairy product trade, and foreign direct investment benefiting both U.S. consumers and producers. As global demand for milk and new dairy products expands, the roles of policies that support prices are diminishing, while the roles of flexibility and innovation aimed at improving competitiveness are growing.

## What Is the Issue?

Government intervention designed decades ago for improving dairy market performance has evolved into a means of producer support and protection from foreign competition. Yet, the benefits of government support can be modest and, in the long run, can distort market signals and discourage producers from pursuing new opportunities. The changing characteristics of world dairy markets have implications for the competitiveness of U.S. and international dairy industries and the role of policies in a global context. Understanding how the U.S. dairy sector might respond to liberalization of global dairy trade policies given the dynamics of current market forces will aid in assessing future domestic and international trade policy reforms.

## What Did the Report Find?

In response to changing global markets, the U.S. dairy industry is positioning itself to compete worldwide through innovation, expansion, and consolidation of firms and dairy businesses. Competition worldwide has given rise to increasing dairy consumption. In high-income countries, per capita consumption and population growth have subsided and demand for dairy products is growing at about 2 percent per year, driven primarily by consumption of higher value-added dairy products rather than volume increases. In many low-income countries, dairy consumption is growing at more than 10 percent per year; in China, for example, consumption is expanding at 15 percent per year.

As a sign of the worldwide dairy industry's vibrancy, dairy product launches more than doubled from 2000 to 2004, compared with the previous 5 years. New markets have developed for dairy ingredients such as milk proteins and lactose (milk sugar) used in both dairy and nondairy products. Global competitiveness is also fueled by new uses for milk-based ingredients, rising demand for cheese variety (including brands), an increase in niche product markets, and increased shelf-lives for products.

Globalization has tended to emphasize the strength of multinational dairy firms. As international dairy companies recognize the prospects for demand growth around the world, they are repositioning themselves to produce and sell milk and milk products from multiple locations. Foreign investors find the United States, with its large domestic market, particularly attractive for this purpose. Foreign companies such as Nestlé, Unilever, Bongrain SA, and the Fonterra Co-op Group now have a significant presence in the U.S. market.

The three dominant dairy trading areas today, as in the past, are the European Union (EU), Australia, and New Zealand. Australia and New Zealand, both with low-cost milk production and industries actively involved in international marketing, are prominent suppliers to the Asian markets for cheese and dry milk powders. The EU focuses on nearby traditional markets and North America, mainly exporting premium cheese. Product differentiation and consumer preferences play major roles in shaping global dairy product demand and trade flows. For example, all high-income countries import EU cheese. The largest dairy trade flow worldwide is cheese from the EU to the United States, even though milk production costs in the EU are higher than in the United States.

Dairy policies still influence the flow of products globally. For individual countries, providing an adequate supply of milk to satisfy domestic market needs is often the first priority. Thus, domestic dairy policies and programs are generally mechanisms to promote milk production, but in some cases they promote surplus production above domestic needs. Those surpluses are available for export and, in some countries, such as in the EU, Canada, and the United States, they have been subsidized. Additionally, almost all countries have trade policies in place that impede dairy imports.

Based on two independent simulation models, global liberalization of dairy policies would lead to increases in world market prices and the value of dairy product trade. For the United States, the effect would reduce dairy sector production by less than 2 percent. However, these results do not reflect recent globalization of the industry—new products, growing demand in emerging developing countries such as China and India, technological innovation, and the increasing role of multinational firms in domestic and global dairy markets. If the U.S. dairy sector continues to make gains in efficiency as it has in recent years, particularly with an open trading system, U.S. dairy producers and manufacturers could benefit from trade liberalization. Accordingly, U.S. consumers and producers would benefit from greater access to markets and higher international prices accompanying trade liberalization.

## How Was the Study Conducted?

The study was conducted in two parts. First, we performed a comprehensive analysis of changing global dairy markets. International data sources were used to examine patterns in dairy consumption, production, trade, foreign direct investments and evolving firm-level partnerships. Second, we used two formal trade models to measure the impacts of hypothetical dairy trade and domestic policy reforms. The first model, the Partial Equilibrium Agri-

culture Trade Simulator, explicitly captures the effects of interactions with nondairy agricultural sectors. The second model, the University of Wisconsin World Dairy Model, characterizes milk and dairy products in considerable detail and incorporates detailed specifications of dairy trade and domestic policies.

# U.S. Dairy at a Global Crossroads

Don Blayney, Mark Gehlhar, Chris Hilda Bolling, Keithly Jones, Suchada Langley, Mary Anne Normile, and Agapi Somwaru

## Introduction

In the early 1900s, dairy markets suffered from chronic imbalances in milk supplies and demands and had limited means for fresh product storage and long-distance transportation. This situation presented few marketing opportunities for dairy products beyond local sales of milk or butter. The associated price fluctuations from supply and demand imbalances made it difficult for dairy farmers to gauge long-term demand and link that growth to projected expansion. As a result, government intervention was deemed necessary because, left alone, dairy markets often failed both farmers and consumers. Governments used various mechanisms to smooth out the imbalances, such as production quotas and direct government purchases of surplus products. Today, advancements in technology and supply chain management have helped resolve many of the marketing issues that plagued the dairy industry in the past. For example, farm milk can now be transported hundreds of miles then processed and packaged into a variety of fresh or storable products that can be shipped to overseas markets.

Over the decades, government intervention historically designed for improving domestic market performance has evolved into producer support and protection from foreign competition. Yet, the benefits of government support can be modest and, in the long run, can distort market signals and discourage producers from pursuing new opportunities. An earlier study by USDA's Economic Research Service (ERS) found that the measurable effect of U.S. dairy programs on producer returns over the past 20 years increased the farm price by only 1 percent and had a limited impact on the financial viability of dairy farms. That study focused primarily on U.S. producers and on domestic policy. This study addresses the economic dynamics of global dairy markets, the effects of international dairy policies, and the implications for the competitiveness of U.S. and international dairy industry. Understanding how the U.S. dairy sector is changing in response to global market forces will help assess future U.S. domestic and international trade policy reform.

# Characteristics of Milk Products and Emerging Consumer Trends

International dairy commerce cannot be viewed as a global commodity market, such as that for oil or steel, where a country's supply of the commodity can satisfy demands anywhere in the world. Instead, the global dairy market comprises many interrelated dairy product markets that vary in geographic scope from narrow to global depending on the product. As the management focus of the dairy industry becomes more global, with national and multinational companies competing in nearly every region, many product markets are also becoming more global. Still, consumers of milk and dairy products across regions exhibit widely varying preferences for taste, convenience, nutrition, wholesomeness, and packaging.

Dairy products range from fairly standardized goods, such as milk, butter, and nonfat dry milk powder, to multivariety, multiflavored products, such as specialty cheeses, fermented drinks, and milk protein fractions used in food and beverage items. Some dairy product markets are local or national, while others are global (table 1). Products such as fresh milk, yogurt, and cheese are intended for direct consumption. Dairy products are also consumed indirectly as ingredients in other foods, such as pizza, snack bars, and bakery products. Nonfood uses range from nutriceuticals to industrial applications.

## Consumer Preferences and Differences in Per Capita Consumption

Variations in consumer demand for milk-based products around the globe differentiate localized markets when products are not traded globally or regionally. Variations in consumer preferences reflect economic status, culinary practices, and eating habits of different households. Income levels and the availability and cost of milk are key factors behind differences in dairy product consumption throughout the world (fig. 1). For example, high transportation costs and local preferences limit the international market for fermented milk drinks and yogurts.

Per capita consumption of fluid milk is growing rapidly in many middle-income countries, particularly in Latin America. Per capita milk consumption in Mexico now exceeds that in Japan (fig. 2), but consumption of dairy products in Latin America remains less than half of that in the United States and Western European countries. Dairy products in general, including dry milk powders, remain luxury goods for many consumers in low- and some middle-income countries.

Major differences in consumption patterns for dairy products can exist even within a country or region for a variety of reasons, including ethnic and cultural factors. This is particularly true in Europe where, for example, Finland has a noticeably higher proportion of per capita liquid milk consumption to per capita cheese consumption. France and Greece have a higher proportion of consumption of soft-type cheeses than the rest of the EU. Although it has grown steadily over the last three decades, per capita consumption of cheese in the United States remains lower than that in the EU.

Table 1

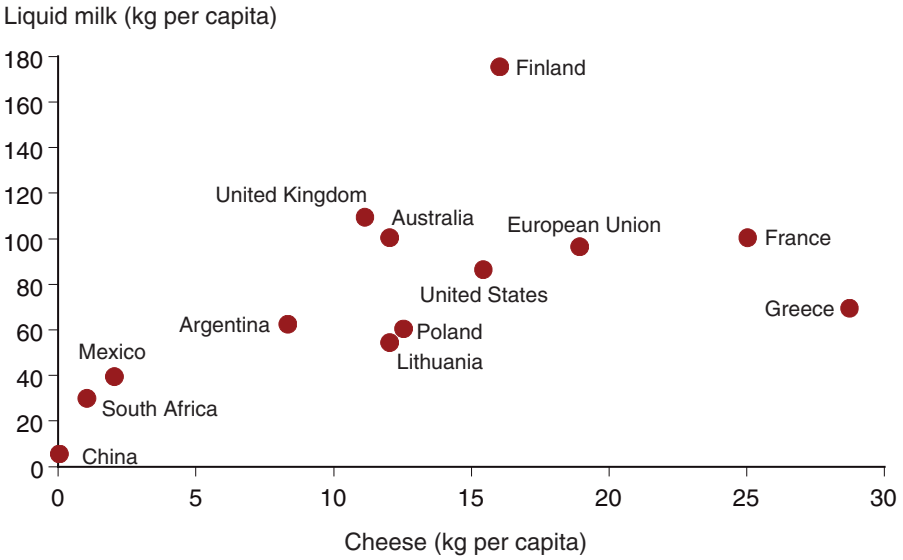
**Dairy products and their characteristics**

| General category | Specific products | Geographic market | Consumption/primary use | Quality attributes |
|---|---|---|---|---|
| Fluid milk | Fresh whole milk<br>UHT milk | Local or national<br>(rarely traded)<br>Regional | Direct consumption | Freshness<br>Shelf stability |
| Fresh milk products | Cultured milk<br>Yogurt | National or regional | Direct consumption | Freshness |
| Ice cream | Artisanal / bulk | National or regional | | Flavor/texture |
| Milk powders | Whole milk powders<br>Nonfat dry milk | Global (heavily traded) | Direct consumption<br>Food or feed ingredient | Reconstituted milk flavor<br>Shelf stability |
| Butter fats | Cream | National or regional<br>(small trade) | Direct consumption<br>or ingredient | Shelf stability<br>Freshness |
| | Butter<br>Butter oil | Global (heavily traded) | | |
| | | National or regional | Direct consumption | |
| Nonfat component | Milk protein concentrates<br>Whey proteins<br>Lactose<br>Casein | Global | Food ingredient<br>Pharmaceutical use | Functionality |
| Cheese | Fresh cheese<br>Processed cheese<br>Natural aged cheese | National or regional<br>(traded among<br>high-income countries) | Direct consumption | Freshness<br>Shelf stability<br>Flavor/aroma/texture |

Source: USDA, Economic Research Service.

Figure 1

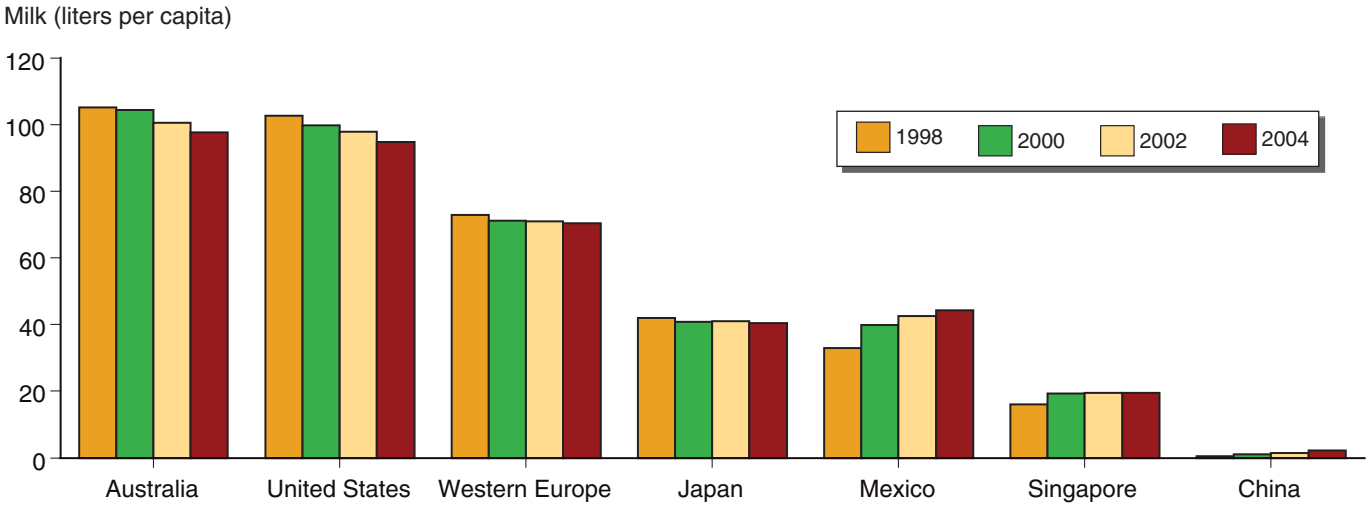
**Per capita consumption of liquid milk and cheese**




Source: Prepared by USDA, Economic Research Service using data from International Dairy Federation.

Figure 2

**Per capita consumption of milk declining in high-income countries while growing in developing countries**




Source: Prepared by USDA, Economic Research Service using data from Euromonitor International.

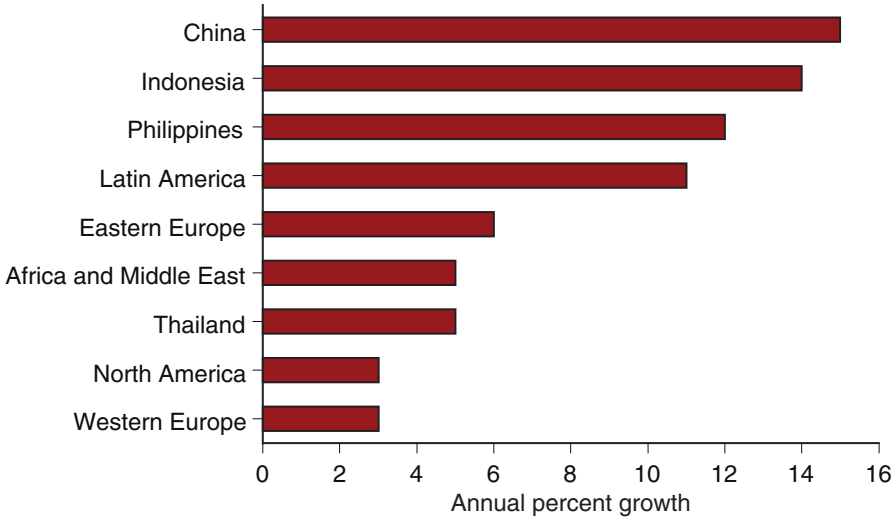
Retail dairy purchases are growing at widely different rates around the world in response to rising incomes and expanding urban populations. Mass media promotions and new forms of retail channels are also driving growth in countries where dairy products are only beginning to reach consumers (Fuller et al., 2005). In China, for example, dairy product consumption is growing at 15 percent per year. Supermarkets in China are helping to effect this increase by providing consumers access to expanded product selections and brands (Hu et al., 2004). The Chinese government is also facilitating the change by encouraging milk consumption in schools as a means to improve the diets of children.

In many other emerging markets of developing countries, retail growth in dairy markets is averaging more than 10 percent per year (fig. 3). In high-income countries where growth in per capita consumption and population have leveled off, demand for dairy products is still rising about 2 percent per year, driven primarily by consumption of higher value-added products rather than volume increases. Rapid growth in demand in middle-income developing countries will help boost dairy trade.

Although higher incomes generally lead to higher overall consumption of dairy products, the same cannot be said of consumption of individual products. For example, in several high-income countries, including the United States, consumption of cheese is increasing but consumption of fluid milk is decreasing. Per capita consumption of yogurt is also relatively high in high-income countries, such as Japan and Western Europe, and demand growth is unabated (fig. 4). However, unlike markets for dry milk powders or butter, the global market for yogurt is highly fragmented by country or region so as to meet specific consumer demands for taste or nutritional attributes.

Figure 3

**Average annual retail growth in dairy products, 1998-2004**

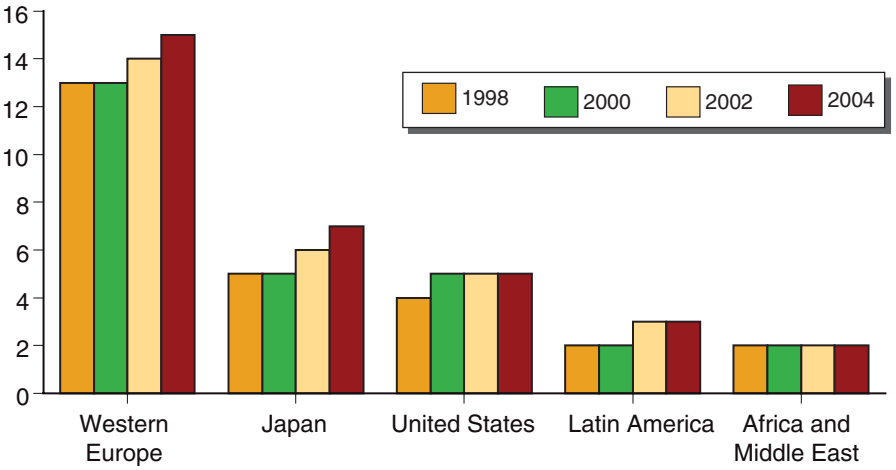



Source: Prepared by USDA, Economic Research Service using data from Euromonitor International.

Figure 4

**Per capita consumption of yogurt is rising faster in high-income regions**

Kg per capita




Source: Prepared by USDA, Economic Research Service using data from Euromonitor International.

## New Dairy Products and Targeting Consumer Segments

Protected industries are generally thought to have less incentive to invest in product innovation and technologies. Dairy industries, despite the protection of trade barriers, do not fit that mold as evidenced by the number of new product launches. To remain competitive, firms in the dairy industry must constantly entice and retain new consumers as food preferences change. Rising demand for nondairy substitutes—products made from grains, soy, rice, nuts, and oils and fats that can be seen as substitutes for dairy-based

products—is one force sparking the drive to retain market share. New dairy products worldwide more than doubled in number between 1995-99 and 2000-04 (fig. 5).

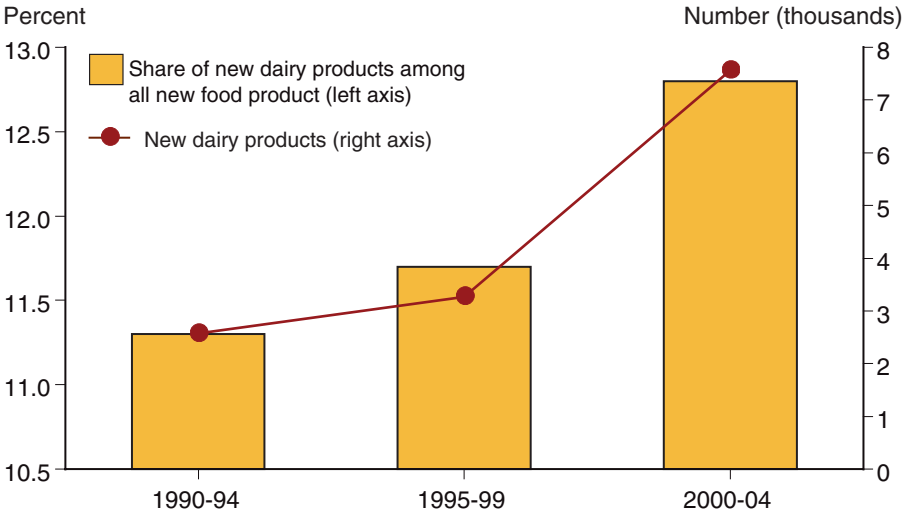
Dairy product marketing by multinational firms, such as Nestlé (Switzerland), Arla Foods (Denmark-Sweden), Danone (France), Lactalis (France), Unilever (Netherlands-U.K.), and Kraft Foods (U.S.), increasingly acknowledges regional preferences and demographic factors to reach specific consumers. For example, Nestlé launched a yogurt in Germany for babies, while Kraft launched the Manchego type of processed cheese in the United States to attract Hispanic consumers (app. table 1).

Foreign direct investment (FDI) in domestic dairy industries provides consumers with access to goods produced by global firms. FDI in the U.S. market includes Nestlé's and Unilever's stakes in the ice cream industry, French involvement in the yogurt and cheese markets, and other European brands, such as Président cheese made in Wisconsin and California. Fonterra Co-op Group (Fonterra), a New Zealand dairy firm, exports U.S. milk powders worldwide. Fonterra partners with other dairy companies in Australia, South America, and South Africa, enabling it to meet dairy demand in those countries with local milk supplies.

Marketing strategies for dairy products also emphasize the functionality of certain products to attract consumers. Milk for drinking is becoming a differentiated product tailored to specific consumer tastes and preferences. Innovative manufacturers are capitalizing on the growing consumer awareness of the role that specific components of dairy foods play in human vitality. This strategy has led firms to introduce such products as probiotic milks, yogurts, and fermented dairy drinks having health benefits deriving from "good" bacteria. Firms are also launching multiflavored milk drinks as a way to attract new consumers, especially young people.

Figure 5

**New dairy product introductions increasing at faster pace than all new food products**




Source: Prepared by USDA, Economic Research Service using data from Datamonitor Productscan.

## Technology-Driven Ingredients

The growing awareness of the many roles of specific milk components is helping to boost demand for those components as ingredients. The dairy industry is developing technologies to economically and efficiently extract and process these components of milk. Within the dairy ingredient complex—which includes fat, sugar (lactose), and proteins—proteins are the targets of much of the research and development (see box "Milk Proteins: Economic Significance and Uses"). The growth in new markets for milk proteins exemplifies the transformation of milk from a commodity to a value-added product tailored to meet specific consumer requirements.

Milk proteins are a major part of functional food product formulations, and their use is expected to grow (Gloy, 2004). The outlook for milk protein markets is promising given current demand trends among both food processors and consumers for protein ingredient specificity. For processors and manufacturers, the confirmed functionality of ingredients, not perceived or intangible values, determines market values. Dairy-based ingredients have the potential to evolve into truly global products traded in a world market, and pricing is likely to become highly competitive as this market matures.

### Milk Proteins: Economic Significance and Uses

The rapid rise in the milk proteins market is the result of growth in demand from food processors. Processors require specialized ingredients for processed cheese, yogurt, bakery products, and nutritional foods, such as high-protein sports drinks and energy bars. In the United States, imports of milk protein concentrates (MPC) have been encouraged in part by the higher price of nonfat dry milk (NFDM), which is supported by the domestic price support program. The U.S. International Trade Commission (ITC) found that the higher support price for NFDM contributed to a higher return to NFDM than to MPC. The ITC concluded that the current U.S. milk price support program created a disincentive to manufacture MPC in the United States.

Milk proteins were not considered a significant trade issue during the General Agreement on Tariffs and Trade in the 1990s because the product was not commercially viable in international markets. Since the mid-1960s, almost all casein or MPC-related products supplied to manufacturers in the United States have been imported. U.S. and Canadian milk producers are increasingly concerned about this trend, since MPC trade appears to circumvent WTO agreements (Bailey, 2003). MPCs may eventually threaten dairy support programs and lead to lower producer prices.

Although detailed data are limited, trade in whey products (dry whey, modified whey products, and whey protein concentrate) shows substantial growth. These byproducts of cheese production can offer almost all of the nutrition of skim milk powder at a very low price. The emergence of this market has caused prices of whey protein concentrate to become a floor for international prices of skim milk powder. Importers can readily shift from whey products to skim milk powder as the price falls.

*Continued on page 8*

Continued from page 7

## What Are Milk Proteins?

Milk proteins consist of a casein-type protein (fat soluble) and a whey protein (water soluble), a byproduct of cheesemaking. In the United States, commercial production of milk proteins has been almost entirely of whey proteins because the casein-type protein is fully used in the production of natural cheese. Within these two broad types, bovine milk contains 10 different milk proteins types differentiated by their unique amino acid profiles, each having different commercial applications and functional attributes but all being of generally high food quality.

## How Are Milk Proteins Manufactured?

Milk proteins are manufactured using ultra-filtration, a membrane separation technology that removes water, some lactose, and minerals from milk. Repeated passes through an ultra-filtration membrane alter the milk solids composition, increasing the protein percentage and reducing the percentage of lactose and other solids in the final product. MPC with protein content less than 70 percent is commonly used in frozen deserts, bakery, and confectionery products. Lower protein MPC is also the form most commonly used in standardizing cheese milk. The most common use of MPC with protein 70 percent or greater is in sports and nutrition drinks. These higher protein forms of MPC are not typically used in cheesemaking because of the higher cost. NFDM can be used instead of MPC in most applications, but its suitability varies across products. NFDM, which contains lactose as well as milk proteins, does not substitute well in products where a more concentrated milk protein is required. MPC can be easily formulated to meet specific product requirements in the rapidly growing sports/nutritional beverage and food market. Use of nonfat dry milk in these applications would require modification to elevate protein content and lower lactose content, likely through reconstitution and ultrafiltration of NFDM.

## How Are They Regulated?

Regulations on the use of MPC vary by country. In the United States, MPC may not be used for cheeses with the U.S. Food and Drug Administration (FDA) standard of identity. However, some dairy manufactures have made changes to accommodate MPC use in nonstandardized cheeses. Kraft Foods Inc. changed the product description on its American Singles from “Pasteurized Process Cheese Food,” which has the FDA standard of identity, to “Pasteurized Prepared Cheese Product,” which does not. MPC is listed as an ingredient in Kraft American Singles. Dannon is now using MPC as a substitute in its low-calorie yogurts.

Of the whey protein types, lactoferrin has the widest range of bioactive properties and is used in health supplements and nutrition formulation, and as an antimicrobial agent used to inhibit against foodborne pathogens. In 2003, FDA and USDA approved the use of lactoferrin as a meat preservative.

# World Dairy Production and Trade Trends

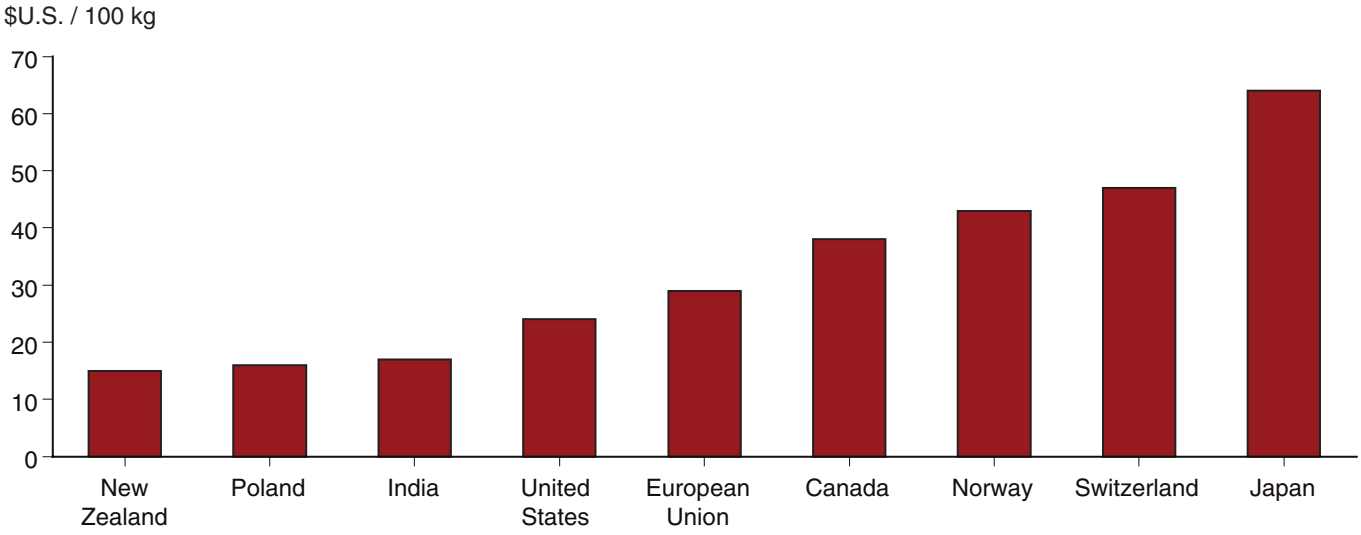
The share of global milk production entering world trade is low, at 7 percent, compared with shares of other farm commodities, such as wheat, coffee, soybeans, or bananas at 30 to 40 percent. Improved refrigeration and transportation technologies have made dairy trade more practicable than in earlier years, though high costs are still a constraint. Almost every country produces milk for local consumption, but production costs vary substantially due to such factors as labor costs, animal genetics, onfarm technology, and the availability of forages and water for livestock. Countries with a dairy surplus tend to be those with relatively abundant, low-cost milk inputs for milk production and comparatively small populations, such as New Zealand, the lowest cost major producer of milk in the world (fig. 6). Japan, Norway, and Switzerland are high-cost milk-producing countries largely due to their lack of land for growing dairy feeds. Poland, with an abundance of forage lands and low wages, provides the most ideal conditions for milk production among all European countries. Canada and the EU lie between the two cost extremes, as does the United States, where the changing structure of the dairy industry may lead to even lower average production costs.

## Major Trade Flows in Global Dairy

Dairy-exporting countries are few relative to the number of dairy-importing countries (fig. 7). The three dominant dairy-supplying areas today, as in the past, are the EU, Australia, and New Zealand. Australia and New Zealand, both with low-cost milk production and industries actively involved in international marketing, are prominent suppliers to the Asian markets for cheese and dry milk powders. The EU focuses on nearby traditional markets and trans-Atlantic trade with North America, mainly for cheese.

Figure 6

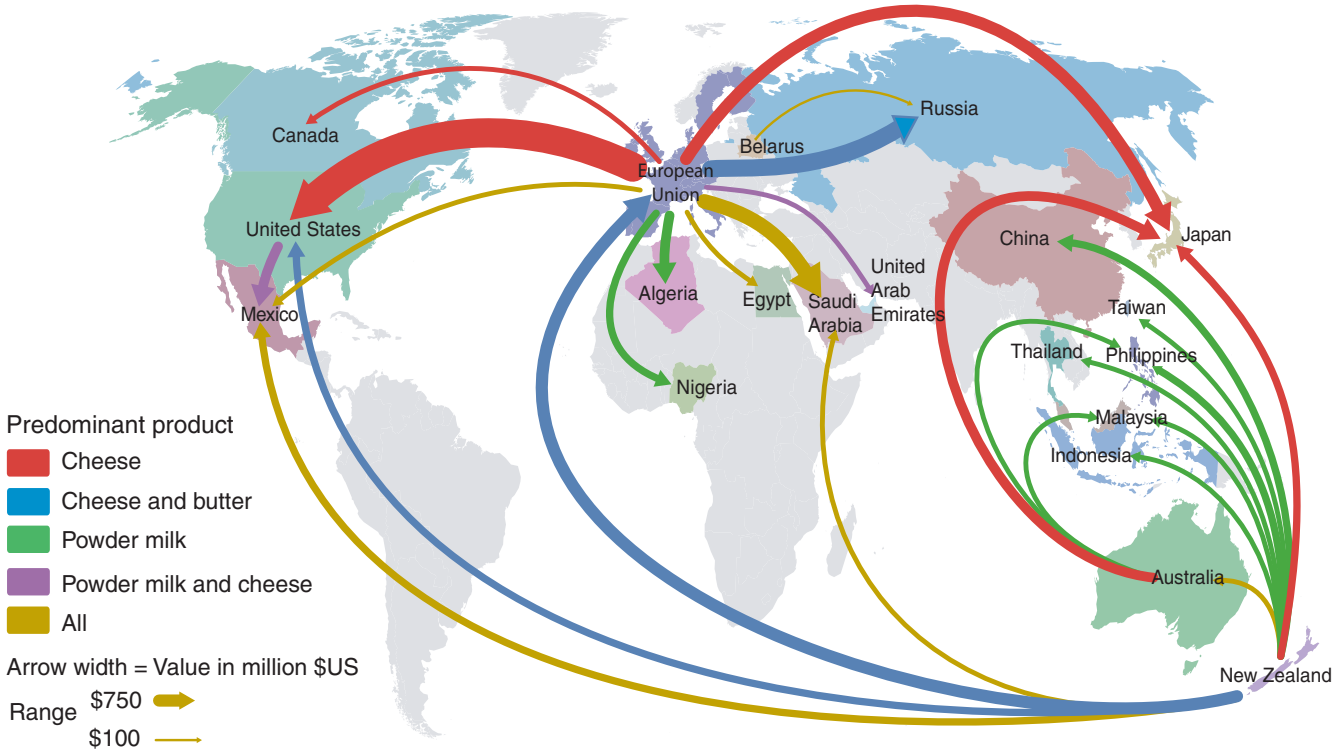
**Producer cost estimates of milk production at farm level, 2003**




Source: Prepared by USDA, Economic Research Service using data from International Dairy Federation.

Figure 7

**Major global trade flows of dairy products in 2004**




Source: Prepared by USDA, Economic Research Service using data from United Nations COMTRADE.

One would expect traded dairy products to flow from low-cost production regions to higher cost regions. However, product differentiation and consumer preferences play major roles in shaping dairy product demand and trade flows. All high-income countries, including major dairy producers like New Zealand, import EU cheese. The largest dairy trade flow worldwide is cheese from the EU to the United States, even though milk production costs in the EU are higher than in the United States. Consumer preferences for differentiated products provide suppliers incentives to make such generally higher priced products available even in markets where lower cost alternatives exist.

## Shifts in the Direction of Trade Driven by Growth in Demand

Although international trade in dairy products has been viewed as a secondary market to dispose of surplus commodities, this impression is changing. The growth and direction of global dairy trade depend more on the gaps between domestic milk production and dairy product demand in particular countries and the rate at which that gap is growing. Rapid growth in milk-deficit countries is forcing exporting countries to reassess international market opportunities.

Whey products and milk protein concentrates are widely traded, but because they are relatively newer markets, the quantities traded are not as large as those of other dairy products. Dry milk powders are high in demand, particularly in tropical countries, for both commercial and home reconstitution into beverage milks—important products for feeding children. At one time,

large centralized plants undertook commercial reconstitution using skim milk powder alone, recombined with anhydrous milkfat, or combined with vegetable oil. Increasingly, commercial reconstitution has been decentralized and adapted to use whole milk powder. This shift was facilitated by whole milk powder's greater flexibility for reconstitution, less costly packaging that maintains acceptable flavor, and the lack of any price premium between nonfat and whole milk powders.

The growing demand for milk in developing countries has affected trade patterns. For example, in 1980, the EU was the single largest importer of New Zealand dairy products, accounting for 30 percent of the country's exports; by 2004, that share had declined to 8 percent. Over the period, exports to the EU remained nearly unchanged, while exports to China and other developing countries spiked (fig. 8). In many of the countries triggering New Zealand's shift in dairy trade, the storyline is the same: demand for milk is outstripping the capacity of producers and processors to manufacture and transport finished products to fast-growing urban populations

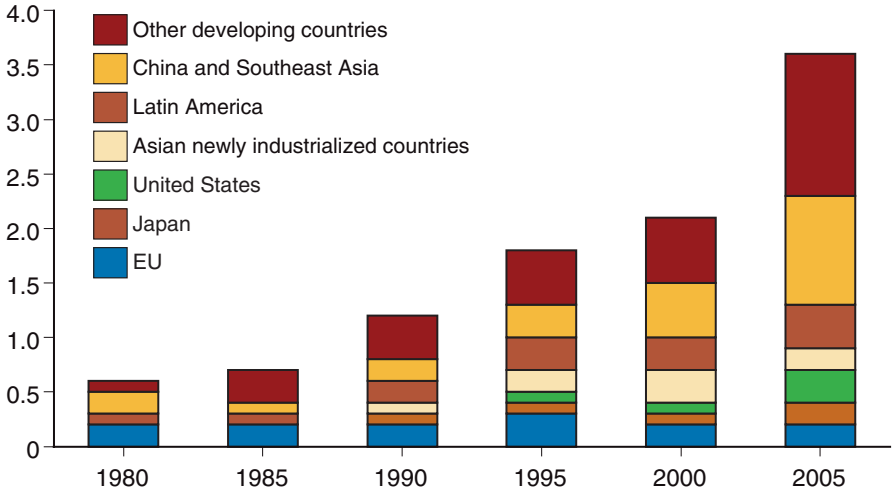
In some countries, per capita consumption of milk is rising but is still extremely low, compared with the rest of the world. In China, milk production has risen but not at a rate sufficient to meet demand where it is needed the most. The lack of coordination between milk producers and dairy processors in China remains a problem. As in other dairy-resource-scarce countries, the mismatch between domestic supplies and demand fuels increases in imports.

In the previous two decades, the EU was the dominant supplier of dairy products worldwide. Quotas and environmental restrictions, however, have limited the EU's dairy production; moreover, its dairy manufacturing sector has tended to focus on specialty cheeses exported and sold at premium prices. Australia and New Zealand now control a growing share of world trade in dairy products. This transformation in the ranks of top suppliers has also affected global trade flows.

Figure 8

**Developing countries driving exports of New Zealand dairy products**

U.S. dollars (billions)




Source: Prepared by USDA, Economic Research Service using data from Statistics New Zealand.

# Globalization of the Dairy Industry: Firms, Foreign Direct Investment, and Partnerships

A major challenge for participants in global dairy markets is responding to changing local market conditions while competing for reliable supplies of raw milk, dairy products, and, increasingly, dairy-based ingredients. For example, coordinating the supply of fluid milk and whole milk powders for fast-growing retail markets in China and Brazil requires considerable management expertise, technology, and financial resources. Global linkages among dairy markets are formed not only by trade flows but also by the formation of management and financial linkages by dairy companies across regions. Multinational dairy companies are playing a growing role, with FDI and international partnerships linking milk producers and consumers in countries around the world.

Strategies are evolving that change the nature of competitiveness in dairy markets. Strategic alliances, foreign partnerships, and FDI give companies flexibility in specific regional markets. A major benefit of having international operations is reduced revenue risk from regional economic fluctuations and product price volatility. Multinationals also benefit from the ability to achieve economies of scale in terms of production, distribution, and marketing. At the same time, multinational firms must be flexible in adapting brands to suit local tastes and crafting sensible strategic alliances combined with effective local market research.

## Attractiveness of U.S. Dairy Market

Three characteristics of the U.S. dairy industry attract foreign investment, alliances, and partnerships: (1) the sheer size of the market and the dynamism of U.S. consumer demand; (2) the absence of supply controls for raw milk production; and (3) liberal foreign investment policies in the United States, compared with other high-income markets.

The U.S. consumer market for dairy products is one of the strongest in the world, with high per capita income, freezers and refrigerators in most households, and a broad range of cultures that enjoy a variety of dairy products. The absence of production quotas also attracts investments in the U.S. dairy sector. At the same time, the long-term competitiveness of the U.S. dairy industry may be enhanced by investments from abroad—investments that have been steadily growing over the past two decades. In 2000, large foreign-owned proprietary firms had U.S. sales of $6.4 billion, accounting for about 3 percent of U.S. dairy sales. By 2003, the stock of foreign direct investment to the U.S. dairy industry amounted to $2 billion. Foreign companies now own $4.6 billion of assets in the U.S. dairy industry. Foreign firms have a significant presence in various "less-tradable" product markets, such as ice cream (Unilever), and yogurt (Danone and Sodiaal).

Some of the most prominent global dairy manufacturers include Nestlé (Switzerland), Kraft Foods (U.S.), Dean Foods (U.S.), Groupe Danone (France), Parmalat (Italy), Sodiaal and Bongrain SA (both France), and

Fonterra (New Zealand) (table 2). Each firm, regardless of its presence in particular countries or markets, possesses a different level of expertise in consumer marketing and branded products, research and development, milk processing and dairy product manufacturing, international trade, and milk production and distribution. Because they differ in specialization and locations, these firms can mutually benefit from partnering.

## New Zealand's Involvement in U.S. Dairy and Global Partnerships

New Zealand is a formidable competitor in global dairy markets. Fonterra, its leading dairy firm and the world's largest dairy product exporter with sales in 140 countries, has strengthened itself by forming a global network of partnerships (fig. 9). A primary rationale for such partnerships is to develop stable and secure supplies of milk, dairy products, and dairy-based ingredients using suppliers in other countries. Manufacturers wishing to use dairy ingredients to develop new products are likely to remain loyal to a supplier when they know customized ingredients are stable and readily available, regardless of where they, the customer, are located.

In the United States, Fonterra entered into a 50/50 limited partnership, called DairiConcepts, with Dairy Farmers of America (DFA), the largest U.S. producer-owned dairy cooperative, to provide products, including milk protein concentrates. DFA members expect this relationship to ultimately lead to increased demand for their milk. In addition, Fonterra has an agreement with Dairy America to be the major exporter of its nonfat dry milk and receives a commission on sales of the product. Dairy America is an association of seven U.S. producer-owned dairy cooperatives that markets 100 percent of the milk powder produced by the member cooperatives: Dairy Farmers of America, California Dairies, Land O' Lakes, AgriMark, United Dairymen of Arizona, O-At-KA Milk producers, and Maryland and Virginia Milk Producers. Dairy America's arrangement with Fonterra combines

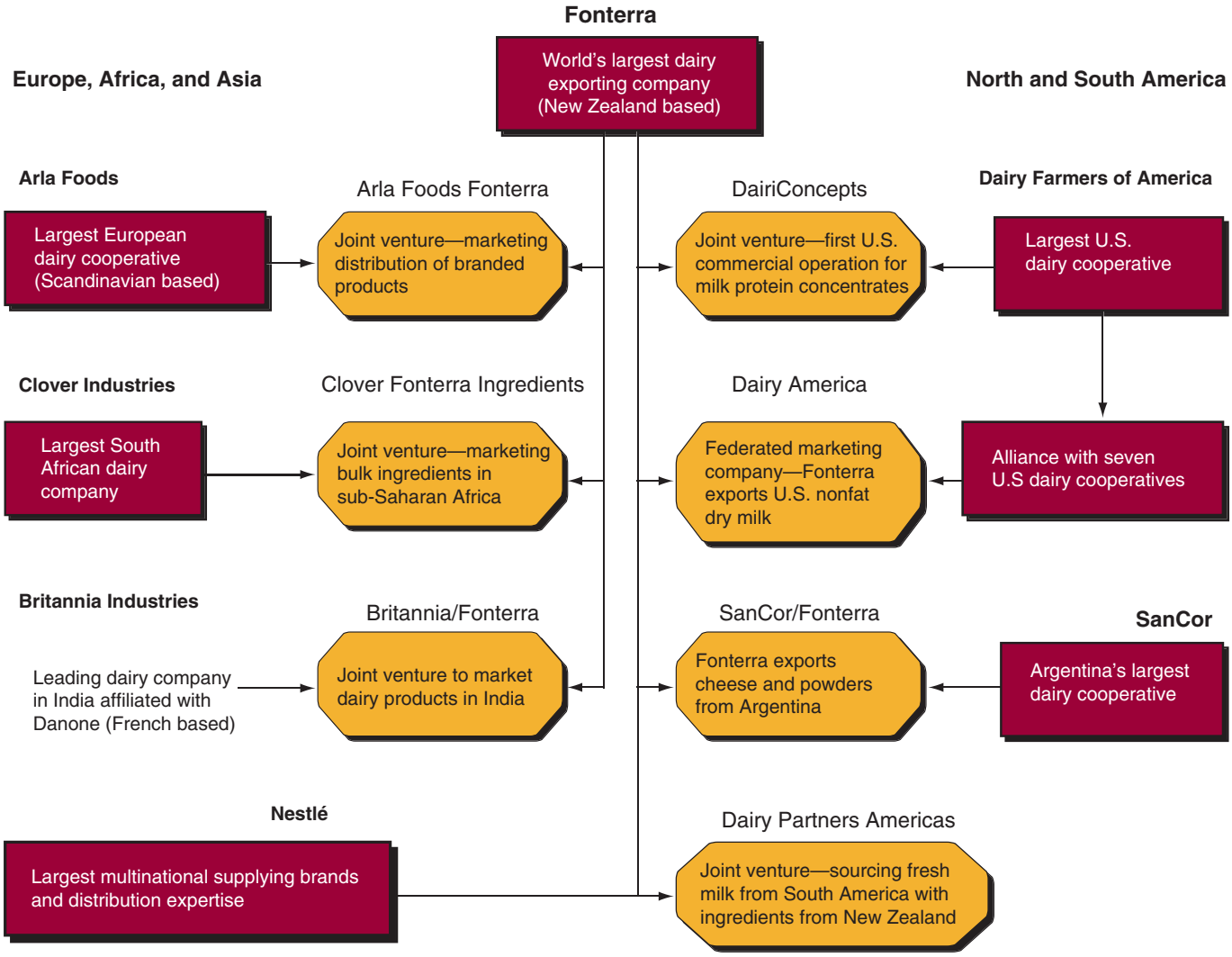
Table 2
**Global dairy market leaders, 2004**

| Company | Country | Sales | Geographic presence |
|---|---|---|---|
| | | *U.S. dollars (billions)* | |
| Nestlé | Switzerland | 17.5 | Global |
| Dean Foods | United States | 7.6 | U.S. |
| Danone (Dannon) | France | 7.4 | Global |
| Dairy Farmers of America | United States | 7.3 | U.S. |
| Fonterra | New Zealand | 7.3 | Global |
| Arla Foods | Denmark/Sweden | 6.7 | Europe/Middle East |
| Lactalis | France | 6.5 | Europe/North America/Middle East |
| Unilever | Netherlands/United Kingdom | 6.2 | Global |
| Kraft Foods | United States | 5.5 | Global |
| Parmalat | Italy | 5.3 | Global |
| Royal Friesland Foods | Netherlands | 5.3 | Europe/Asia/Latin America |
| Bongrain | France | 4.8 | Global |
| Meiji Dairies | Japan | 4.2 | East Asia |
| Campina | Netherlands | 4.1 | Europe, East Asia, South America |
| Morinaga Milk | Japan | 4.0 | East Asia |

Source: Prepared by USDA, Economic Research Service using data from Euromonitor International.

Figure 9

**Global networks arising from partnerships among major dairy companies**




Source: Prepared by USDA, Economic Research Service.

Fonterra's marketing services and a stable supply of U.S. nonfat dry milk, which benefits milk producers in both New Zealand and the United States. Similarly, Fonterra signed an agreement in 2004 with Argentina's largest dairy cooperative, SanCor, to export milk powders and cheese.

Although New Zealand historically accounts for a significant share of nonfat dry milk in world trade, Fonterra is increasingly emphasizing production and exports of whole milk powders to improve overall returns to New Zealand milk producers. By entering into agreements in other dairy-producing countries, Fonterra can effectively coordinate shipments of nonfat dry milk to international markets, potentially lessening price volatility and improving returns to New Zealand milk producers, actions that would be more difficult without such partnerships. In recent years when New Zealand had shortfalls in milk production, Fonterra has been able to tap the U.S. market for nonfat dry milk to supply many East Asian markets.

Expansion to new markets is a principal motivation behind many of Fonterra's recent alliances and partnerships. Fonterra established a joint venture with Britannia Industries to gain further access to the emerging dairy market in India. This joint venture combines Fonterra's production expertise and marketing acumen with Britannia's knowledge of the region and distribution network. In addition to forming alliances with small local companies, Fonterra and other large firms target international expansion through large-scale strategic alliances between multinational partners. In many cases, large firms in partnerships benefit mutually through symbiotic advantages stemming from each other's inherent capabilities and specialization. Those relationships, however, are country or market specific; that is, firms that enter partnerships in one market can, at the same time, be rivals elsewhere. For example, Fonterra and Nestlé, rivals in other markets, formally established a 50/50 alliance—Dairy Partners Americas—to establish joint dairy ventures in Latin American markets, initially including Argentina, Brazil, Paraguay, Uruguay, and Venezuela. The joint venture companies in each country benefit from the partners' logistical and marketing resources.

## European Investment in U.S. Dairy

Nestlé has been active in the United States for nearly a century but has only recently moved into U.S. dairy products through recent purchases of well-known domestic dairy companies, such as Dreyers. Nestlé also formed a joint venture, Ice Cream Partners, a General Mills subsidiary, which includes such popular brands as Haagen-Dazs and Drum Stick. Nestlé and Unilever, an Anglo-Dutch company, together account for 30 percent of the U.S. supermarket sales of ice cream. The U.S. dairy industry benefits from the presence of these global marketing giants through their expertise in meeting the demands of consumers as well as their purchases of U.S. milk and its components.

Several French dairy firms have a significant and growing presence in the U.S. market. Fromageries Bel produces Kaukauna, a cold pack (Cheddar) cheese produced for the U.S. market. Sodiaal is a French cooperative that previously made investments in U.S. butter processing plants, and Yoplait yogurt is one of the cooperative's premier brands in the U.S. market. Bongrain has a strong presence in aseptic food products in North America through a partnership with the Land O' Lakes Dairy Group, supplying cheese sauces, beverages, and puddings. Bongrain also sells a wide variety of dairy products in the United States, such as ice cream, fluid milk, natural and processed cheese, powered milk, and yogurt.

# The Interface Between Domestic Dairy Policies and Dairy Trade

For dairy industries in individual countries, the first priority is to provide an adequate supply of milk to satisfy domestic market needs, first the fluid market, and then manufactured product markets. Domestic dairy policies and programs are generally mechanisms to promote milk production in a country, but in some cases around the world they have promoted surplus production above domestic needs. Those surpluses are available for export but may also impede imports—for which they are termed trade distorting. By explicitly including agricultural trade and domestic agricultural support policies in its negotiations, the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) opened the door for several contentious debates during trade talks that often centered on domestic dairy policies and programs. As evidenced by these discussions, firms interested in greater international market participation may benefit from an assessment of the effects of domestic dairy policies and programs as they interface with dairy trade policies.

As the global dairy industry continues to evolve, it is important to determine those countries for which the interface between international dairy trade and domestic dairy policy is an issue. Table 3 shows the top five countries or areas of the world for production, consumption, imports, and exports of butter, cheese, nonfat dry milk, and whole milk powder. Almost all countries have tariffs or tariff-rate quota (TRQ) systems in place and at least two countries have both. The bottom line in the table identifies four countries with significant institutional structures, other than tariffs and TRQs, in place to provide domestic dairy industry support: the EU, Canada, Japan, and the United States.

## Dairy-Trading Nations With Significant Domestic Support

With the exception of the EU, the four countries/regions where significant domestic support for dairy is prevalent are not dominant players in international dairy product markets. The focus here is to provide a general descriptive outline of the key elements of current policy and programs; historical information for each area can be found in other detailed sources. The details of many domestic dairy programs can be daunting and are available from the governmental agencies charged with their implementation and operation. References are cited for each country in the following sections.

### *The European Union (EU)*

EU agricultural policy is embodied in the Common Agricultural Policy (CAP). Reforms of the CAP in 2003 significantly moved the EU toward using decoupled direct payments (called single farm payments) to support agriculture. The fundamental dairy policy components of the current CAP include a milk production quota and intervention programs for butter and nonfat dry milk. The reforms called for reduction of both the butter and the nonfat dry milk intervention prices. The 25-percent reduction for butter prices is to be spread over 4

Table 3
**Dairy trade and domestic dairy policy/programs, 2004**

| | Top five nations in each category | | | | |
|---|---|---|---|---|---|
| **Milk production** | European Union | United States | India | Russia | Brazil |
| **Dairy products:** | | | | | |
| **Production** | | | | | |
| Butter | European Union | United States | New Zealand | Russia | Ukraine |
| Cheese | European Union | United States | Australia | Brazil | Russia |
| Nonfat dry milk | European Union | United States | New Zealand | India | Australia |
| Whole milk powder | European Union | China | New Zealand | Brazil | Argentina |
| **Consumption** | | | | | |
| Butter | European Union | United States | Russia | Ukraine | Mexico |
| Cheese | European Union | United States | Russia | Egypt | Canada |
| Nonfat dry milk | European Union | United States | Mexico | India | Japan |
| Whole milk powder | China | Brazil | European Union | Venezuela | Russia |
| **Exports** | | | | | |
| Butter | New Zealand | European Union | Australia | Ukraine | Canada |
| Cheese | European Union | New Zealand | Australia | Ukraine | United States |
| Nonfat dry milk | New Zealand | European Union | United States | Australia | Ukraine |
| Whole milk powder | New Zealand | European Union | Australia | Argentina | Philippines |
| **Imports** | | | | | |
| Butter | Russia | European Union | Algeria | Mexico | Canada |
| Cheese | United States/Japan | Russia | European Union | Mexico | Australia |
| Nonfat dry milk | Mexico | Indonesia | Philippines | Thailand | China |
| Whole milk powder | China | Venezuela | Malaysia | Mexico/Philippines | Thailand |
| **Domestic policy "coverage"** | European Union | United States | Canada | Japan | |

Source: Prepared by USDA, Economic Research Service using data from USDA, Foreign Agricultural Service.

years—a 7-percent reduction per year in 2005-07 and a 4-percent reduction in 2008. For nonfat dry milk, the price reductions are uniform at 5 percent per year from 2004 to 2006, reductions that actually did occur. A limit has been established for annual intervention purchases of 30,000 tons of butter by 2008, starting from 70,000 tons in 2004 and reduced by 10,000 tons annually. The EU will make direct payments, which may be coupled to milk production or not, to cover lost revenues due to price reductions. Member states may make additional payments from a national budget provided by the EU. In 2008, dairy payments will be incorporated into the (noncommodity-specific) single farm payment (Kelch and Normile, 2004).

The EU today is much different from that of 3 or 4 years ago and is far removed from the original six-member Economic Community of 1967. In May 2004, eight Central and Eastern European countries (Poland, Hungary, Czech Republic, Slovakia, Slovenia, Estonia, Latvia, and Lithuania), Malta, and Cyprus joined the EU-15 to form the EU-25 (Cochrane, 2004). With the addition of the 10 new member states, the EU increased its population by nearly 30 percent and its arable land by nearly 40 percent. Other countries are also scheduled for membership, including Romania and Bulgaria in 2007. The ongoing changes in the EU will result in its having a larger presence in global agricultural markets, but whether it will be an importing or exporting area for various products is to be determined.

### *Canada*

Canadian dairy policy rests first and foremost on the supply management system implemented in the mid-1970s. All current programs are designed with this system as the backdrop. Both the Federal and the Provincial Governments are involved in regulating milk markets.

Canada's domestic production and marketing controls are intended to match milk supplies, classified as industrial or fluid, with estimated demand at an administered price. The national production target for industrial milk, called the market sharing quota, is allocated to provinces largely based on historical shares. An annual fluid milk quota is determined in each province. The quotas are assigned in each province by marketing boards. The dairy quotas are tradable and have become a valuable asset for producers. The administered industrial milk and fluid milk prices are based on cost-of-production estimates and other market information.

Canada has several other programs in place that address seasonality, domestic dairy product innovation, the marketing of dairy ingredients, and the provision of milk components through a special use permit for use in manufactured products. A revenue pooling system in place since 1996 serves as a means for revenues from all milk sales, fluid and industrial, adjusted by several factors, to be used to establish blend prices for producers. Canada also employs a purchase program for butter and skim milk powder that establishes reference (support) prices for milk used in manufactured products.

Canada implemented several TRQs for dairy products under the terms of the World Trade Organization (WTO) in 1994, the primary TRQ being for butter. Approximately two-thirds of the butter TRQ is allocated to New Zealand (Canadian Dairy Commission, 2005).

### *Japan*

Dairy policies in Japan emphasize self-sufficiency in milk and dairy product production through milk supply controls and direct producer income support. There are two milk markets—one for drinking milk and one for manufacturing milk. The quantity of fluid milk is set by a national board of designated milk producers and allocated to regional members who voluntarily accept their quota and face penalties if they exceed it. Manufacturing milk constitutes about 40 percent of total production (Bull and Roberts, 2001) and is subject to a formal quota system, except for milk to be used for cheese production. Quota participation is voluntary, and those who participate receive direct payments for milk produced within their quota and no payment for milk produced over their quota. The direct payment system replaced a deficiency payment system in 2001. Japan initiated an income stabilization program for milk producers in 2001 to reduce the effects of dairy product price declines. The Agriculture and Livestock Industries Corporation, a state trade enterprise, is authorized to stabilize dairy product prices by market intervention and stockpiling when necessary (Obara, Dyck, and Stout, 2005).

### *United States*

U.S. milk producers have received government support since the 1930s. Current domestic programs include milk price support, the Federal milk marketing order system, and direct payments under the Milk Income Loss Contract (MILC) program. Dairy policies and programs have been modified to meet changing economic relationships over time, but underlying general objectives remain the same: ensure the orderly marketing of an adequate supply of fresh wholesome milk to meet consumer demands at reasonable prices and provide adequate returns to milk producers (Manchester and Blayney, 2001).

WTO commitments in 1994 had immediate implications for the U.S. dairy industry. Legislation in 1996 addressed meeting the WTO commitments and proposed fundamental changes in domestic dairy policies and programs that, if implemented, would reduce trade-distorting support. The Dairy Export Incentive Program (DEIP), a program for subsidizing certain dairy product exports, was limited by WTO commitments, and the end of the price support program was proposed. Milk price support never actually ended. It was revived in its more traditional "permanent" form in 2002, and a direct payment program for milk producers, MILC, was authorized with payments first made in 2003. The DEIP was continued still subject to the reduced levels agreed to under the WTO.

## Dairy-Trading Nations With Little Domestic Support

Most of the remaining countries that appear as major dairy product exporters or importers have few or no domestic dairy policies or programs (see table 3). Australia and New Zealand are long-time international dairy market participants. New Zealand has not had significant agricultural support of any kind since the mid-1980s. The Australian dairy industry generally has been more protected, but efforts to tie its agricultural industries to international markets have led to domestic dairy policy changes—the most recent in 2000 when fluid milk market pricing was reformed.

Countries such as Brazil and Argentina are relatively new participants in international dairy-market exporting, and their long-term prospects are unknown. However, they are clearly recognized as potential key suppliers and have relatively unregulated domestic industries. Other importing and exporting relationships seem to be based on regional proximity and possibly former political ties.

Domestic dairy policies and programs in key trading areas or nations are still a significant determinant of global dairy product flows. Dairy industry representatives in the United States emphasize three major concerns in statements regarding international dairy trade: (1) market access (including administration of border measures), (2) export subsidies, and (3) change in existing domestic dairy support programs. Milk producers, processors, product manufacturers, and dairy marketing firms in other countries have generally expressed the same concern—but to different degrees. Assessments of dairy trade liberalization often posit complete elimination of domestic policies and programs, dairy border measures, and export subsidies.

# Dairy Policy Changes and the U.S. Dairy Sector

The continued commitment of the United States to WTO agricultural trade objectives, including reduced domestic support for agriculture and freer trade, leads to the question: What do changes in dairy trade and domestic dairy policies and programs worldwide mean for the U.S. dairy sector? We employed two empirical agricultural trade models to derive estimates of the effects of liberalization on the domestic dairy sector. The first model, the Partial Equilibrium Agriculture Trade Simulator (PEATSim), is a partial equilibrium commodity trade model with detailed crop and livestock sectors that captures interactions among dairy and nondairy sectors. The second model, the University of Wisconsin World Dairy Model (UWWDM), is a spatial model of only dairy sectors.[1]

[1]Further details on both models are included in appendix B.

All economic models are stylized representations based on theoretical assumptions and observed relationships that can not embody all of the economic complexities that might exist. The trade models used in this study fit that mold—they do not capture all of the realities of modern food markets. We noted some of these realities earlier: the strategies of international dairy companies and their decisions to invest in foreign markets providing economic returns to shareholders and farmers and the supplies and demands for many different types of nontraditional milk products. Attempts to include these types of relationships in modeling efforts are in their infancy. Nevertheless, the existing models can be used to estimate the effects of trade liberalization on dairy industries with given technologies and market structures (including policies and programs).

PEATSim and UWWDM focus on trade in butter, cheese, and dry milk powders. The UWWDM includes additional detailed product and policy representation for countries in the UWWDM framework. As part of the greater product detail, UWWDM includes milk component (fat, proteins, and skim solids) accounting as a step toward gaining more information about changing trade relationships related to ingredients. The two models are not connected—they represent two different ways of looking at dairy trade relationships and the potential effects of liberalized domestic dairy policies and dairy trade policies. The use of the two different models provides greater validation of the assessments of likely effects on key dairy industry and trade variables under alternative policy scenarios.

## Dairy Policy and Modeling Issues

Domestic dairy support instruments include intervention prices and other forms of price support, direct producer payments, and production and marketing quotas. Market access or border restrictions include tariffs and TRQs. Export subsidies for dairy products are important for some countries as are domestic consumer subsidies as a means of disposing of surplus dairy products or increasing dairy product demand.

Tariffs on dairy products are well above the overall average agricultural tariff level and are among the highest of all commodities. Gibson et al. (2001) calculated an average agricultural tariff level of 62 percent, with

dairy tariffs averaging about 85 percent. The only product with a higher tariff was unmanufactured tobacco at 90 percent. Gibson et al. also found average over-quota tariffs for dairy products to be high at 128 percent, even though they were applied to only a few products. Countries with some of the highest over-quota tariffs on dairy products have relatively low in-quota tariffs. Japan had an in-quota dairy tariff of 10 percent but a 227-percent over-quota tariff; the corresponding U.S. rates were 12 and 43 percent. Import measures work in concert with domestic price support programs in many countries, while some countries rely solely on tariffs to protect their dairy sectors. Removal of import protection would likely have the most significant effect of all policy reform measures because it would affect the largest number of countries and would expose the domestic dairy markets of previously protected countries to competition from lower priced imports.

The United States, the EU, and Canada all support the price of milk and some dairy products. In these countries, multilateral liberalization would likely lead to reductions in domestic milk prices, either directly through disciplines on domestic support or in response to increased imports in a more liberal trading regime. However, increased world prices resulting from liberalization would offset some of the reductions in support. The EU and Canada limit milk output with milk production quotas, an action that reinforces other price support measures by limiting surplus production.

When all domestic and border measures are included, dairy programs account for a large share of dairy producers' revenue. In those countries for which this measure is calculated, the share of revenue provided by government programs ranges from 1 percent in New Zealand to 68 percent in Japan. How would dairy output in these countries respond to policy reforms that simultaneously reduced price support and import protection and lifted restrictions on production? Of the specific countries analyzed, the United States, the EU, and Canada currently have longstanding domestic programs for dairy products.

The model scenarios defined here eliminate the longstanding export subsidy programs of the United States, the EU, and Canada (table 4). These programs offer a means of supporting domestic milk prices by removing surplus milk, in the form of dairy products, from the domestic markets. Eliminating only export subsidies could put pressure on domestic market prices or lead to accumulation of large government stocks. On the other hand, extensive use of export subsidies depresses world market prices. Their elimination would be expected to raise world dairy market prices and thus mitigate negative price impacts on countries that had relied extensively on them. It is also assumed that both the EU and Canada would eliminate production quotas as the need to manage surplus production disappears with elimination of the other support programs.

The observed interactions among domestic and border policies highlight a commonly held view—border measures are essentially extensions of domestic dairy policies. To alter or eliminate one set without changing or eliminating the other could result in potentially adverse effects on government budgets.

Table 4
**Dairy policies eliminated in liberalization scenarios, by country and product**

| | Milk | Butter | Cheese | Nonfat dry milk | Whole dry milk | Other dairy products |
|---|---|---|---|---|---|---|
| United States | PS,PP | T,TQ,X,PS | T,TQ,X,PS | T,TQ,X,PS | T,TQ,X | |
| European Union | PS,Q | T,TQ,X,PS,C | T,TQ,X | T,TQ,X,PS | T,TQ,X | T,TQ,X |
| Japan | PP | T,TQ | T | T,TQ | | |
| Canada | PS,Q | T,TQ,X | T,TQ,X | T,TQ,X | T,TQ,X | T,TQ,X |
| Mexico | | T | T,TQ | T,TQ | T,TQ | |
| Brazil | | T | T | T | T | |
| Argentina | | T | T | T | T | |
| China | | | | T | T | |
| Australia | | T | T,TQ | T | T | |
| New Zealand | | T | T | T | T | |
| South Korea | | | T | T,TQ | | |
| Rest of world | | T | T | T | T | T |

T = Tariffs
TQ = Tariff rate quotas
X = Export subsidies
PS = Price support
PP = Producer payments
Q = Production/marketing quota
C = Consumer subsidies

Source: Prepared by USDA, Economic Research Service.

PEATSim and the UWWDM generate results for multiple countries and, in the case of PEATSim, multiple commodities. We focus on the effects on the U.S. dairy industry of liberalizing only dairy sector policies and programs in all countries. The effects on milk production and milk prices are key indicators of interest as is the trade position of the U.S. in a scenario reflecting full liberalization. Appendix tables contain selected results for the other countries or regions as defined in the two models.

## Impacts From the PEATSim Model

Based on the assumption that dairy policies and programs worldwide are eliminated, the PEATSim model results indicate the U.S. milk price falls just over 11 percent while milk production declines about 6 percent (app. tables 2-5). Production of butter, nonfat dry milk, whole dry milk, and other dairy products decline, but cheese output expands slightly. World prices of the traded products included in the model—butter, cheese, nonfat dry milk, and whole dry milk—all increase. The largest percentage increase is for butter, followed in descending order by cheese, whole dry milk, and nonfat dry milk. The United States maintains its trade position in most markets but slightly increases exports of nonfat dry milk. For more information on the PEATSim results, see Langley, Somwaru, and Normile (2006).

## Impacts From UWWMD

The UWWDM framework provides results over a medium term (5 years) presented relative to a base scenario for each year. Impacts on price and

production are greater in the early years but decline in later years due to adjustments in milk production and product markets. Globally, multilateral full liberalization of dairy trade policies results in lower domestic milk prices in distorted sectors, which benefits consumers at the expense of producers, increases milk production, and increases trade in dairy products (app. tables 6-8).

At the end of the simulation period, 2007, U.S. milk prices are about 4 percent lower than the projected baseline price, and production is down just under 2 percent. As noted in appendix B, these estimates are based on an assumption regarding the U.S. classified pricing system that may overestimate its effects. If so, they could be considered maximum estimates. In any case, the results are modest. U.S. exports fall while imports rise—implying a slightly larger net import position—but the changes in trade volume are small relative to the size of the U.S. dairy sector. The loss in exports is a result of reduced milk production and elimination of U.S. export subsidies, even with their low volume limits.

A key feature of the UWWDM framework is its total welfare measure component. This measure includes producer, consumer, and government costs and benefits associated with dairy policy and trade liberalization. The welfare analysis shows that the U.S. economy gains from multilateral dairy liberalization, about $800 million, as a result of lower consumer and government costs offsetting lost producer benefits. The gains would be less if estimated effects on prices and production are smaller. For more information on the results of the UWWDM framework, see Peng and Cox (2006).

## Why the Results Differ

The two models that generate the empirical estimates represent alternative modeling structures. The PEATSim model adapted for our analysis is a partial equilibrium, comparative static model while the UWWDM is a dynamic spatial model. Additionally, the models depend on a large number of "fixed" parameters, such as the supply and demand price elasticities for each country or region identified in the model. Differences in the underlying structures and parameters partly determine the different quantitative estimates.

The selection of the base period also affects the quantitative findings. If the base year selected is a year in which U.S. dairy prices are high, a period when underlying domestic policies and programs would not be expected to be having much effect, elimination of those policies and programs would not be expected to have large impacts. The opposite is true for low dairy price base years. The PEATSim model is based on 2001, a period of relatively higher milk prices than 2002, the base for UWWDM.

Percentage changes are simple summary statistics, but the base year issue is of some importance. A large percentage change applied to a high price may generate the same magnitude as a small percentage change applied to a low price. It is the consistency of the directions and interpretations of the effects that are key elements for evaluating the usefulness of the two models. Estimated sizes of effects are always subject to arguments—this is a facet of all empirical economic modeling.

# U.S. Dairy Competing in a New Decade

In either a domestic or a global sense, the U.S. dairy industry is coming under greater pressure to compete more aggressively for a share of the consumer's food budget and for resources to keep the industry moving forward. Competition in the food industry is marked by offerings to consumers of an ever-expanding array of products, including high-quality, nutritious, nondairy substitutes. To remain competitive, the U.S. dairy industry is faced with assessing and responding to changing supply and demand trends. Efficient farm-level milk production and use of that milk in high-demand products are keys to providing both producers and investors adequate returns on their investments. Ensuring the development of well-coordinated supply chains will also help dairy firms and producers compete in a global industry.

The operational structures of modern dairy firms and global supply chains are becoming a new source of competitive advantage for the U.S. dairy industry. Multinational firms are investing and partnering in the U.S. market because of its sheer size, the dynamism of U.S. consumer demand, the steady and reliable supply of raw milk, and foreign investment policies considered to be more liberal than those in other high-income markets. In the U.S. market, multinationals can take advantage of economies of scale in terms of production distribution and marketing. When companies have greater flexibility to procure inputs and sell outputs in a more liberal trading environment, returns to milk producers are improved.

Companies adjust their production and marketing strategies because of market conditions and policy environment. Dairy policies can either facilitate changes or prove to be a bottleneck as the dairy industry adapts to a changing environment.

On a global basis, dairy product demand and the dynamics of international trade are changing—milk supply is becoming more constrained in some parts of the world and less so in other regions. This alone requires international dairy companies to reposition themselves in global markets. New Zealand, where the dairy industry is not protected through domestic support, is a leader in responding to changes in global demand and developing new foreign markets and the production, processing, and marketing mechanisms to reach them. As long-term growth is less certain due to domestic resource constraints, the industry has responded by procuring dairy inputs elsewhere. Other lower cost milk-producing countries, such as the United States, are benefiting in this environment. If subsidized exports from countries with heavily protected dairy industries and import barriers were reduced further, the U.S. dairy sector may benefit even more. Moreover, the role and extent of U.S. dairy policy is less clear today than in the past. The efforts of U.S. milk suppliers, processors, and product marketers to improve competitiveness depends more on innovation, flexibility, and investment than on policy support.

# References


Abbott, Philip, and B. Adair Morse. "Tariff Rate Quota Implementation and Administration by Developing Countries," *Agricultural and Resource Economics Review*, Volume 29/1, April 2000.

Abler, David, and David Blandford. "Dairy and Milk Supply Equations for WTO Model," *ERS Penn State Trade Modeling Project—Model Documentation*, June 6, 2000, *http://trade.aers.psu.edu/ documentation.cfm*

Ackerman, Karen Z., and Praveen M. Dixit. *An Introduction to State Trading in Agriculture*, Agricultural Economic Report Number 783. U.S. Department of Agriculture, Economic Research Service, November 1999.

Australian Dairy Corporation. *Australian Dairy Industry in Focus*, 2004.

Bailey, K. "MPC Imports Have Implications for the Dairy Industry," *Feedstuff*, February 10, 2003.

Barichello, Richard S. "A Review of Tariff Rate Quota Administration in Canadian Agriculture," *Agricultural and Resource Economics Review*, Volume 29/1, April 2000.

Blandford, David. *A U.S. Perspective on the Current Round of Agricultural Trade Negotiations*, paper prepared for the course "European Agricultural Policy in Transformation," held at Wageningen University, the Netherlands, September 2001.

Blayney, Don P., and James J. Miller. *International Dairy Markets and the WTO,* Outlook Report Number LDP-M-74, U.S. Department of Agriculture, Economic Research Service, August 2000.

Blayney, Don P., and Richard Fallert. *The World Dairy Market—Government Intervention and Multilateral Policy Reform.* Staff Report Number AGES 9053, U.S. Department of Agriculture, Economic Research Service, August 1990.

Boughner, Devry S., Harry de Gorter, and Ian M. Sheldon. "The Economics of Two-Tier Tariff-Rate Import Quotas in Agriculture," *Agricultural and Resource Economics Review,* Volume 29/1, April 2000.

Bull, Tim, and Ivan Roberts. *Agricultural Trade Policies in Japan—The Need for Reform,* ABARE Research Report Number 01.5, Australian Bureau of Agricultural and Resource Economics, 2001.

Bureau, Jean-Christophe, and Stefan Tangermann. "Tariff-Rate Quotas in the EU," *Agricultural and Resource Economics Review*, Volume 29/1, April 2000.

Burfisher, Mary E. (ed.). *The Road Ahead: Agricultural Policy Reform in the WTO—Summary Report*, Agricultural Economic Report Number 797, U.S. Department of Agriculture, Economic Research Service, January 2001.

Burfisher, Mary E. (ed.) and others. *Agricultural Policy Reform in the WTO—The Road Ahead*, Agricultural Economic Report Number 802, U.S. Department of Agriculture, Economic Research Service, May 2001.

Canadian Dairy Commission. *Canadian Dairy Commission Annual Report 2004-2005*, www.cdc-gccl.gc.ca.

Choi, Jung-Sup, and Daniel A. Sumner. "Opening Markets While Maintaining Protection: Tariff Rate Quotas in Korea and Japan," *Agricultural and Resource Economics Review*, Volume 29/1, April 2000.

Cochrane, Nancy. "A Historic Enlargement: Ten Countries Prepare To Join the European Union," *Amber Waves*, Volume 2, Issue 2, April 2004, *www.ers.usda.gov/amberwaves/april04/featres/ahistoricenlargement.htm*

Cochrane, Nancy (coord.) and others. *Livestock Sectors in the Economies of Eastern Europe and the Former Soviet Union*, Agricultural Economic Report Number 798, U.S. Department of Agriculture, Economic Research Service, February 2002.

Datamonitor, Productscan Database. www.productscan.com

de Gorter, Harry, and Ian M. Sheldon. "Issues in the Administration of Tariff-Rate Quotas in the Agreement on Agriculture in the WTO: An Introduction," *Agricultural and Resource Economics Review*, Volume 29/1, April 2000.

Dobson William, and Andrew Wilcox. *How Leading International Dairy Companies Adjusted to Changes in World Markets*, Babcock Institute Discussion Paper Number 2002-4, Babcock Institute for International Dairy Research and Development, *http://babcock.cals.wisc.edu/downloads/dp/2002-4.en.pdf*

Euromonitor International. 2005 edition, *www.euromonitor.com*

European Commission, Directorate-General for Agriculture. *The Meat Sector in the European Union: Fact Sheet*, 2004, *http://europa.eu.int/comm/agriculture/publi/fact/meat/2004_en.pdf*

Fuller Frank, Jikun Huang, Hengyun Ma, and Scott Rozzelle. "The Rapid Rise of China's Dairy Sector: Factors Behind the Growth in Demand and Supply," Working Paper Number 05-WP 394, Iowa State University, Center for Agricultural and Rural Development, 2005, *www.card.iastate.edu/publications/DBS/PDFFiles/05Wp394.pdf*

Gale, Fred (ed.). *China's Food and Agriculture: Issues for the 21st Century*, Agriculture Information Bulletin Number 775, U.S. Department of Agriculture, Economic Research Service, April 2002.

Gibson, Paul, John Wainio, Daniel Whitley, and Mary Bohman. *Profiles of Tariffs in Global Agricultural Markets*, Agricultural Economic Report Number 796, U.S. Department of Agriculture, Economic Research Service, January 2001.

Gloy, Angela. "Milk Protein Fractions: Potential Market Utilization," *Dairy Policy and Innovation*, Proceedings of the 11th Annual Workshop for Dairy Economists and Policy Analysts, Washington, DC, April 2004.

Hu, D., Frank Fuller, and Tom Reardon. "The Impact of Rapid Development of Supermarkets on the Dairy Industry in China," *Chinese Rural Economy*, 7(Serial Number 235):12-18, 2004.

International Dairy Federation. *Bulletin of the International Dairy Federation*, Number 391, 2004.

Jones, Elizabeth, and Jaclyn Y. Shend (eds.). *Review of Agricultural Policies in Europe and the Former Soviet Union*, Agricultural Economic Report Number 733, U.S. Department of Agriculture, Economic Research Service, June 1996.

Kelch, David R. (coord.) and others. *The European Union's Common Agricultural Policy: Pressures for Change*, International Agriculture and Trade Report Number WRS-99-2, U.S. Department of Agriculture, Economic Research Service, 1999.

Kelch, David, and Mary Anne Normile. *CAP Reform of 2003-04*, Outlook Report Number WRS-04-07, U.S. Department of Agriculture, Economic Research Service, August 2004.

Langley, S., D. Blayney, J. Stout, A. Somwaru, M. Normile, J. Miller and R. Stillman. *Trade Liberalization in International Dairy Markets*, paper presented at the American Agricultural Economics Association Annual Meetings, Montreal, Canada, July 27-30, 2003.

Langley, Suchada, Agapi Somwaru, and Mary Anne Normile. *Trade Liberalization in International Dairy Markets: Estimated Impacts*, Economic Research Report Number 16, U.S. Department of Agriculture, Economic Research Service, February 2006.

Liefert, William, and Johan Swinnen. *Changes in Agricultural Markets in Transition Economies*, Agricultural Economic Report Number 808, U.S. Department of Agriculture, Economic Research Service, February 2002.

Manchester, Alden C., and Don P. Blayney. *Milk Pricing in the United States*, Agriculture Information Bulletin Number 761, U.S. Department of Agriculture, Economic Research Service, February 2001.

Meilke, Karle, and Sylvain Lariviere. *The Problems and Pitfalls in Modeling International Dairy Trade Liberalization*, Working Paper, March 1999.

Miller, James J. *Coping With a Changing World: The Outlook for Dairy*, paper presented at USDA Agricultural Outlook Forum, Arlington, Virginia, February 2002.

Miller, James, Keithly Jones, and Donald Blayney. *International Dairy Markets and Trade Reform*, paper presented at 6th Economic Research Service Ag. Issues Roundtable, Washington, DC, June 2001.

Normile, Mary Anne (coord.). *Agriculture in the WTO*, International Agriculture and Trade Report Number WRS-98-4, U.S. Department of Agriculture, Economic Research Service, December 1998.

Obara, Kakuyu, John Dyck, and Jim Stout. *Dairy Policies in Japan*, Outlook Report Number LDP-M-134-01, U.S. Department of Agriculture, Economic Research Service, August 2005.

Peng, Fingjun, and Tom Cox. *Impacts of Trade Liberalization on the U.S. Dairy Market*, Contractor and Cooperator Report Number 21, U.S. Department of Agriculture, Economic Research Service, August 2006.

Pettit, Robert. *Outlook for World Milk Powder Trade*, presented at USDA Agricultural Outlook Forum, Arlington, Virginia, February 2002.

Podbury, Troy, Ivan Roberts, Apelu Tielu, and Benjamin Buetre. *Agricultural Export Measures in WTO Negotiations*, ABARE Research Report Number 01.12, RIRDC Publication Number 01/134, Canberra, Australia, 2001.

Roberts, Ivan, Troy Podbury, and Mike Hinchy. *Reforming Domestic Agricultural Support Policies through the World Trade Organization*, ABARE Research Report Number 01.2, RIRDC Publication No. 01/07, Canberra, Australia. 2001.

Rude, James, and Jean-Philippe Gervais. Trade Liberalization in Supply Managed Sectors, CATRN Paper 2000-10, Canadian Agrifood Trade Research Network, 2000.

Shaw, Ian, and Graham Love. *Impacts of Liberalizing World Trade in Dairy Products*, ABARE Research Report Number 01.4, Australian Bureau of Agricultural and Resource Economics, 2001.

Simpson, James R. "Structural Adjustments May Influence Japanese Dairy Industry," *Feedstuff*, Volume 64, Number 16, 2002.

Skully, David. "U.S. TRQs for Peanuts, Sugar, and Tobacco: Historical Allocation and Nondiscrimination," *Agricultural and Resource Economics Review*, Volume 29/1, April 2000.

Skully, David. *Economics of Tariff-Rate Quota Administration*, Technical Bulletin Number 893, U.S. Department of Agriculture, Economic Research Report, April 2001.

Statistics New Zealand. 2005.

Stout, James, and David Abler. *ERS/Penn State Trade Model Documentation*, *http://trade.aers.psu.edu/pdf/ERS_Penn_State_Trade_Model_Documentation.pdf*, updated October 2004.

United Nations. COMTRADE Database, *http://unstats.un.org/unsd/comtrade*

U.S. Department of Agriculture. *Economic Effects of U.S. Dairy Policy and Alternative Approaches to Milk Pricing*, USDA report to Congress, July 2004, *www.usda.gov/documents/newsreleases/dairyreport1.pdf*

U.S. Department of Agriculture, Foreign Agricultural Service. *Dairy: World Markets and Trade Circular*, *www.fas.usda.gov/dlp/circular/2005/05-12Dairy/toc.htm*

Wainio, John. "Canada's Subsidized Dairy Exports: The Issue of WTO Compliance." *Agricultural Outlook*, AGO-283, August 2001.

Washington, Andrew, A., and Richard L. Kilmer. *The Derived Demand for Imported Cheese into Japan by Country*, paper presented at the 2001 IATRC Conference, Auckland, New Zealand, 2001.

Wei, Anning. *The Dairy Industry in China*, Food and Agricultural Research, Rabobank International, North East Asia Region, February 2000.

Wei, Anning. "WTO Shake-up for Chinese Dairy Industry," *AgWorld Vision*, Volume 2, Number 1, 2002.

World Trade Organization. "The World Market for Dairy Products, 1997," *International Dairy Agreement*, Third Annual Report, Geneva, Austria, 1997.

# Appendix A—World Production and Trade by Country and Product

Global milk production is largely from cows (84 percent), but a growing share of milk is produced from other animals, such as buffaloes, goats, and sheep. The quantity of milk produced by animals other than cows is not large, but cheese varieties produced from sheep and goats are traded internationally, and their overall share of production has increased slightly since 2000. From 2000 to 2004, total milk production grew about 6 percent, while cow's milk production grew somewhat less (app. tables 9-13). The countries that produce individual dairy products detailed in this section account for about 78 percent of total world milk production.

## *Butter*

The international butter market consists of two segments of roughly the same size: anhydrous milkfat (AMF) and solid butter. Demand for, and trade in, both products has varied greatly in response to economic conditions in recent years but has shown no clear-cut trends. Demand for AMF is found primarily in the relatively affluent countries of Asia and Latin America, which use it for commercial reconstitution of beverage milks and for such products as ice cream. World butter production has remained fairly steady since the implementation of the World Trade Organization's (WTO) Uruguay Round Agreement on Agriculture (URAA) during 1986-94, though lower than pre-URAA quantities.

The major butter importers are Russia, the Middle East and North Africa, and the EU (for fixed negotiated amounts from New Zealand). In 1985, Oceania (Australia and New Zealand) exported less than 25 percent of the world's butter; by 2000, the region accounted for nearly half of the world's recorded butter exports, with New Zealand shipping about two-thirds of that amount. Significant additional trade in butter occurs among countries of the former Soviet Union and Eastern Europe, but reliable data are unavailable. The EU is the only other large butter exporter, although its share is much smaller than it was before URAA implementation. The United States normally is not a significant participant in the international butter market.

## *Cheese*

World cheese production has grown by nearly 2 percent during the post-URAA period, with North America and Europe accounting for much of the growth in production and consumption. The international cheese market continues to grow steadily, but slowly, in response to economic growth in Latin America, Westernization of diets in Asia, and the spread of pizza consumption to every part of the world. Cheese consumption in Asia has more than doubled since 1990, but it is still quite low.

World cheese exports grew only about 1 percent annually from 1994 to 1999. Japan, the United States, the EU, and, sometimes, Russia are leading markets. The Middle East and North Africa are key markets, particularly for some cheese types. The EU remains the largest exporter of cheese, although

its exports have fallen because of the WTO export subsidy disciplines. All of Western Europe accounts for over half of world cheese exports, with most of the remainder coming from Oceania. With growing milk production, New Zealand and Australia boosted cheese production and exports substantially as decreasing European exports created trade opportunities.

### *Dry milk powders*

Most East and Southeast Asian countries import significant amounts of milk powders. The more populous countries in the Middle East and North Africa continue to be key markets, although import demand has not grown much. Many countries in Latin America import substantial quantities of milk powders. Relatively rapid population growth in the region has boosted demand, although economic crises have led to erratic growth in import demand.

Milk powder export supplies consist of about equal amounts of skim milk and whole milk powders. About four-fifths of milk powder exports come from the EU and Oceania. Lesser amounts come from Poland, Argentina, and (for skim milk powder) the United States. U.S. export sales of skim milk powder have been generally lower in the 2000s than during the early 1990s.

# Appendix B—Model Descriptions

## Partial Equilibrium Agriculture Trade Simulator (PEATSim)

The Partial Equilibrium Agriculture Trade Simulator (PEATSim) model (formerly known as the ERS-Penn State model) is an applied partial equilibrium, multiple-commodity, multiregion model of agricultural policy and trade (Abler et al., 2001; Stout and Abler, 2004). PEATSim is a gross-trade model that accounts for exports and imports of each commodity in every identified region but does not identify them by origin or destination. The model is dynamic in that it allows for adjustment over time in crop and livestock production, dairy processing, and oilseed crushing.

The model includes 12 countries or regions—the United States, the European Union (EU-15), Japan, Argentina, Australia, Brazil, Canada, China, Mexico, New Zealand, South Korea, and the rest of the world (ROW). It covers 35 commodities (rice, wheat, corn, other coarse grains, soybeans, sunseed, rapeseed, peanuts, other oilseeds, cotton, sugar, soybean oil and meal, sunseed oil and meal, rapeseed oil and meal, cottonseed oil and meal, peanut oil and meal, tropical oils, other oilseed oil, beef and veal, pork, poultry, raw milk, butter, cheese, nonfat dry milk, whole dry milk, fluid milk, and other dairy products).[1] Raw and fluid milk are included as nontraded commodities.

[1]Constraints on dairy product shares are imposed to preserve consistency of milk components.

The model is different from other partial equilibrium trade models in that it has explicitly incorporated a wide range of domestic and border policies in agriculture. The core set of policies for all countries includes specific and ad valorem import and export taxes or subsidies, tariff-rate quotas (TRQ), and producer and consumer subsidies. Other types of domestic policies and programs are also included. For example, the U.S. model includes government support purchase prices, tariffs and TRQs, and export subsidies for dairy products and Milk Income Loss Contract (MILC) payments. The Japan model includes tariffs and "markups," such as for rice, wheat, and sugar. Compensation schemes for Japan and South Korea that pay producers for declines in price relative to a reference price are also included. The EU model includes intervention prices (which entail government purchases and export subsidies), tariffs, compensatory payments, acreage set-asides, and base area bounds (which limit the area (acreage) of grains and oilseeds that qualifies for payments), and production quotas for raw milk and sugar.[2] Milk production quotas for Canada and the EU are included.

[2]The model does not include limits on countries' exports due to WTO export subsidy commitments.

Model parameters come from various sources, including the European Simulation Model (ESIM), ERS baseline model projections, the Food and Agricultural Policy Simulator (FAPSIM), the Organisation for Economic Co-operation (OECD) AGLINK model, and the SWOPSIM (Static World Policy Simulation) model. Adjustments and restrictions were imposed on elasticities to satisfy requirements of economic theory, such as symmetry and homogeneity. The model can be used for comparative static or dynamic analyses.

PEATSim is used here as a comparative static model incorporating an adjustment path to capture dynamic adjustments, except for capital—a quasi-fixed input that has no longrun equilibrium adjustment—and to provide medium-term results. The analysis captures the marginal effects of policy reforms across all countries. No productivity growth is taken into account. The analysis does not account for shifts in supply functions over time, reflecting cost-reducing technology adoption, nor the growth in demand driven by population and income. This point is crucial in interpreting the model results. For example, productivity growth, if incorporated into the analysis, could have shown that a country with a capital-intensive and technologically advanced dairy sector that is able to compete in a nonsupported and nonprotected environment (such as the United States) may do well under trade liberalization.

The base year for the PEATSim dairy data is 2001, adjusted for the 2002 farm bill and China's WTO accession in the base model solution. Base data for crops (area, yield, production, consumption, stocks, and trade) are from the 2000 crop year and are drawn from USDA and country sources, including the USDA production, supply, and demand (PS&D) database.[3] Tariffs and TRQs are from the Agricultural Market Access Database (AMAD)[4] and Gibson et al. (2001).

[3]Found at *www.fas.usda.gov/psd*

[4]Found at *www.amad.org*

The model is a reduced-form model with production, consumption, and other behavioral variables represented by constant elasticity functions. All countries in the model are represented with similar structure, with different parameters and values of variables in behavioral equations. For a net importing country, dairy imports (and other commodity imports) are a residual to equilibrate exports and imports. For a net exporting country, dairy exports (and other commodity exports) are a residual. For detailed information on the model structure, equations, sources, and methods, see Stout and Abler (2004).

## The University of Wisconsin World Dairy Model (2002)

The University of Wisconsin World Dairy Model (UWWDM) used for this analysis is an updated annualized version of a model developed to assess impacts of changes in international dairy trade relationships. The updated model contains updated supply and demand elasticities, explicit modeling of the EU CAP reforms starting in 2005, incorporation of Australia/New Zealand free trade, explicit US-Australia Free Trade Agreement information, and the United States MILC program, a target price deficiency payment introduced in 2002.

The model is a classic math-programming, spatial equilibrium model with additional structure to address a spatial equilibrium in hedonic (characteristic) space. This hedonic spatial equilibrium model incorporates 24 regions, 9 dairy products, and 4 milk components (fat, casein, whey protein, and lactose) using United Nations Food and Agriculture Organization (FAO) and OECD databases. All regions and markets are linked via transportation costs and trade policy distortions (export subsidies and/or import TRQs). Within- and over-quota tariffs, import quotas, and export subsidies are modeled using 2000

GATT/WTO commitments for all developed economies. Developing economies continue to open access to their dairy markets until 2005, as specified by the 1995 GATT/WTO agreement. The model provides a framework to analyze hypotheses concerning the effects of liberalizing dairy trade through modifying both trade and domestic dairy policies and programs.

The 24 regions in the model are re-aggregated to 5 major regions in the summary tables to provide better intuition as to the gainers and losers from additional world dairy sector liberalization:

- Developed economy, heavily protected dairy: EU-15, Japan, Other Western Europe;
- Developed economy, less heavily protected dairy: U.S. and Canada;
- Developed economy, competitive exporters: Oceania (Australia and New Zealand);
- Less developed economies, potentially competitive exporters: India, Other Eastern Europe, South America-South (Argentina, Uruguay and Chile), China and Mongolia, Poland, and South Africa Republic;
- Less developed economies, net importers: Former Soviet Union, South America-North (Brazil and Other South America), Other South Asia, Middle East, Rest of world, Mexico, North Africa, Central America & Caribbean, South/North Korea, South East Asia.

The UWWDM for this analysis uses the year 2002 as the base or reference point. The model is solved recursively (1 year at a time, with the previous year solution as the starting point for the following year, with regional GDP and population (World Bank data) driven commodity demands and 5-year moving average supply growth rates (from FAO data) from 2002 to 2007). The following policy simulations were assessed relative to the 2002 base model:

- Full dairy sector (full) liberalization: All trade and domestic support policies are removed starting in 2002 and simulated through 2007. The full liberalization combines two other scenarios: the free dairy trade (FDT) scenario and the no domestic support (NDS) scenario. The 2007 simulation results, summarized as changes from the base scenario for 2007 in appendix tables 6-8, provide quantitative estimates of the 2007 impacts of full dairy sector liberalization.
- Free dairy trade: The second scenario (FDT) considers the elimination of all trade distortions starting in 2000 through 2007. All export subsidies and import TRQs (quotas, within- and over-quota tariffs) are eliminated. Domestic support policies are maintained as in the base scenario. This should increase world trade, increase world market prices, and put considerable strain on several domestic support policies (intervention price program costs, in particular) in the protected dairy sectors.
- No domestic support: The third scenario (NDS) eliminates all domestic support starting in 2002 through 2007. These measures include intervention/support prices for the EU (SMP), Canada (butter and SMP), and the United States (butter, SMP, cheese) as well as other countries; elimination of classified pricing in the United States and Canada (modeled as a

price wedge/premium for residual (fluid, soft and frozen) products over manufactured products); and, production/marketing quotas in the EU and Canada. Modeling the classified pricing as defined can overstate its effect. A sensitivity analysis on changes in only the U.S. price wedge indicates that smaller effects do indeed appear when the wedge is reduced. Thus, the effects as originally modeled represent maximum impacts. Still, they are modest for the United States.

The 2007 simulation results for the FDT and NDS scenarios as described in this report, summarized as changes from the base scenario for 2007, are presented in Peng and Cox (2006). Several of the key results are noted here. As the base year (2002) saw large U.S. costs via its intervention/price support program (about $U.S. ~500M in SMP purchases) and target price/deficiency payment (MILC) program (about $U.S. 1.2B), domestic deregulation could have strong impacts on U.S. milk prices. Similarly, given the large levels of milk production quota rents in the EU and Canada (35 percent and 40 percent of the domestic milk prices, respectively), elimination of these policies sharply increases these countries' competitiveness (no milk production quota constraints at sharply reduced milk production costs) and, hence, sharply increases their milk production even while milk prices and revenues drop. Note, this will lower prices in the protected dairy economies, hence lower world dairy prices, but not necessarily provide additional access to competitive exports—unless over-quota tariffs become less prohibitive at these lower protected market prices. Additionally, increased milk production from the EU and Canada, potentially beyond their domestic consumption, will likely displace base level imports by these protected dairy sectors, and reduce potential export market growth opportunities for competitive exporters.

Appendix table 1

**Major new product launches in global dairy markets, 2003-04**

| Country/product market | Brand name | Company | Product description |
|---|---|---|---|
| **North America** | | | |
| U.S. / milk | Land O'Lakes Dairy Ease 100% Lactose Free Milk | Dean Foods (under license) | New national brand of lactose-free milk |
| U.S. / cheese | Kraft Singles Pasteurized Process Cheese – Manchego | Kraft Foods | Processed Hispanic cheese; individually wrapped slices |
| U.S. / cheese | Stella Freshly Shredded Cheese – 3 Cheese European Blend, Natural Swiss | Saputo Cheese | Shredded cheese in resealable plastic cups |
| U.S. / cheese | Kraft Shredded Whole Milk Cheese – Queso Quesadilla | Kraft Foods | New cheese variety |
| U.S. / yogurt | Dannon Frusion Smoothies Fruit 'n Yogurt Drink | Danone | Name change for Dannon Frusion, package redesign with new graphics |
| U.S. / yogurt | Dannon Light n' Fit Carb Control Yogurt | Danone | Reduced carbohydrate sub-brand |
| Canada / milk | Dairy Oh! | George Weston Ltd | Fortified milk |
| Mexico / yogurt | Uva (grapefruit) | Lala | Regular drinking yogurt |
| Mexico / yogurt | Activia | Danone | Probiotic yogurt |
| **Europe** | | | |
| France / cheese | Mini Babybel au Chèvre | Fromageries Bel | Unspreadable processed cheese; new goat cheese variant |
| France / fermented drinks | Actimel allégé en sucre | Danone | Low-fat variant with reduced sugar content |
| France / yogurt | Velouté Fruix | Danone | Fruited yogurt. New range with puréed fruit; six flavors |
| Germany / flavored drinks | Müllermilch Lin Chi | Molkerei Alois Müller | Limited edition flavored milk drinks (exotic and fruity) |
| Germany / yogurt | Alete Milch- und Fruchtminis | Nestlé Deutschland AG | Yogurt for babies |
| Germany / yogurt | Onken Wellness Joghurt | Onken GmbH | Four new 1.5%-fat yogurt varieties, including aloe vera |
| Germany / fermented drinks | Actimel Multifrucht | Danone | Multifruit flavored fermented dairy drinks |
| Italy / fermented drinks | Crema Actidrink | Müller | Sold in 100 ml bottles |
| Italy / yogurt | Danone Frutta Frullata | Danone | Fruit frappe yogurt |
| Netherlands / yogurt | Vifit Calcimel | Campina Melkunie | Flavored yogurt with calcium |
| Sweden / yogurt | Cultura | Arla Foods | Probiotic yogurt |
| U.K. / yogurt | Munch Bunch Drinky | Nestlé | Fortified drinking yogurt for children, aimed at the lunchbox market |
| U.K. / yogurt | Petit Filous | Yoplait | Child-oriented fromage frais product, with added calcium |
| **South America** | | | |
| Argentina / yogurt | Yogurisimo Stick | Danone Argentina SA | Yogurt on a stick |
| Argentina / cheese | Adler | Cabaña y Estancia Santa Rosa SA | Spreadable processed cheese, in small pack sizes |
| Brazil / fluid milk | Corpus Light | Danone | Fat-free long-life/UHT milk |
| Chile / flavored drinks | Bliss Fresh | Nestlé Chile SA | Flavored milk drink with fruit juice |
| Chile / flavored drinks | Leche Cultivada Descremada | Parmalat Chile SA | Nonfat sour milk drink |
| Colombia / fluid milk | Avena con Canela La Alquería ultrapasteurizada | Productos Naturales de Cajicá SA | Long-life/UHT RTD flavored milk drink with extra cinnamon |

*Continued—*

Appendix table 1

**Major new product launches in global dairy markets, 2003-04—Continued**

| Country/product market | Brand name | Company | Product description |
|---|---|---|---|
| **East Asia** | | | |
| China / flavored drinks | Bright Wheat | Shanghai Bright Diary Co Ltd | With added wheat and chocolate |
| China / milk | Bight Shu Shui Nai (Sleeping Milk) | Inner Mongolia Mengniu Group | Brand extension in fresh milk, claims to aid sleep |
| Hong Kong / flavored milk | High-Calcium DHA chocolate milk | Kowloon Dairy | Flavored milk (focused on children under 10 years old) |
| India / flavored drinks | Amul Chocolate Milk | Gujarat Co-op Milk Marketing Federation Ltd | Flavored milk launched in the South, aiming at regional market |
| India / yogurt | Amul Lassi | Gujarat Co-op Milk Marketing Federation Ltd | Drinking yogurt launched in West India, targeting a regional market |
| Indonesia / fluid milk | Mimi UHT milk | Ultrajaya Milk Industry | UHT milk targeting children, available in small sizes |
| Japan / yogurt | Genso Mango | Chichiyasu | Mango-flavored yogurt |
| Japan / yogurt | Meiji Probiotics Yogurt LG21 | Meiji Dairies Corp | Plain probiotic with reduced sugar |
| Taiwan / drinks milk | Kuang Chuan I Love Milk Beer Yeast High Calcium | Kuang Chuan Dairy Co Ltd | Flavored milk containing beer yeast, vitamin B complex, DNA and RNA |

Source: Prepared by USDA, Economic Research Service using data from Euromonitor International 2005.

Appendix table 2

**Changes in world market prices of dairy products**

| | Dairy reform only | All sectors liberalized |
|---|---|---|
| | *Percent change from base* | |
| Butter | 66.4 | 68.2 |
| Cheese | 50.2 | 54.3 |
| Nonfat Dry Milk (NFDM) | 13.2 | 14.2 |
| Whole Dry Milk (WDM) | 24.0 | 26.4 |

Source: USDA, Economic Research Service, simulated from PEATSim model.

Appendix table 3

**Changes in milk price and production with trade liberalization**

| | Dairy reform only | | All sectors liberalized | |
|---|---|---|---|---|
| | Milk price | Milk production | Milk price | Milk production |
| | *Percent* | | | |
| United States | -11.4 | -5.7 | -8.8 | -7.3 |
| EU | -9.4 | -3.2 | -6.6 | -4.3 |
| Japan | -7.4 | -1.8 | -7.4 | -3.1 |
| Canada | -11.5 | -2.9 | -8.5 | -3.4 |
| Mexico | 14.2 | 3.5 | 20.7 | 3.9 |
| Brazil | 4.2 | 1.1 | 8.6 | 0.7 |
| Argentina | 27.1 | 6.3 | 31.1 | 5.5 |
| China | 7.3 | 1.8 | 10.2 | 1.9 |
| Australia | 34.1 | 7.7 | 37.3 | 7.3 |
| New Zealand | 33.2 | 7.5 | 35.9 | 7.4 |
| South Korea | -47.6 | -14.8 | -46.1 | -14.9 |
| Rest of world | 9.2 | 2.3 | 8.4 | 2.8 |

Source: USDA, Economic Research Service, simulated from PEATSim model.

Appendix table 4

**Changes in dairy product export shares with dairy policy reform[1]**

| | Butter | | Nonfat dry milk | | Cheese | | Other dairy products | |
|---|---|---|---|---|---|---|---|---|
| Country | Base | Scenario | Base | Scenario | Base | Scenario | Base | Scenario |
| | | | | *Percent* | | | | |
| United States | 0.8 | 0.8 | 11.8 | 12.2 | 2.8 | 2.2 | | |
| EU | 16.6 | 2.1 | 23.3 | 17.5 | 54.1 | 54.2 | 28.3 | 48.5 |
| Japan | | | | | | | 2.8 | 9.8 |
| Canada | 1.7 | 2.0 | 3.4 | 3.4 | 1.9 | 1.7 | | |
| Mexico | | | | | | | | |
| Brazil | | | | | | | | |
| Argentina | 1.3 | 2.3 | 2.4 | 2.8 | 2.3 | 3.9 | 27.3 | 16.3 |
| China | | | | | | | | |
| Australia | 22.9 | 27.5 | 24.7 | 27.3 | 17.0 | 17.6 | 41.6 | 25.2 |
| New Zealand | 53.1 | 61.0 | 19.9 | 21.5 | 18.8 | 18.9 | | |
| South Korea | | | | | | | | |
| Rest of world | 3.6 | 4.3 | 14.6 | 15.2 | 3.1 | 1.4 | 0 | 0.1 |

[1] Changes in export shares of whole dry milk are insignificant.
Note: Blank cell indicates no significant share of commodity market.

Source: USDA, Economic Research Service, simulated from PEATSim model.

Appendix table 5

**Changes in dairy product export shares with all commodity liberalization[1]**

| | Butter | | Nonfat dry milk | | Cheese | | Other dairy products | |
|---|---|---|---|---|---|---|---|---|
| Country | Base | Scenario | Base | Scenario | Base | Scenario | Base | Scenario |
| | | | | *Percent* | | | | |
| United States | 0.8 | 0.9 | 11.9 | 12.4 | 2.8 | 2.2 | | |
| EU | 16.2 | 0.7 | 23.5 | 18.0 | 54.5 | 54.9 | 27.9 | 47.1 |
| Japan | | | | | | | 3.6 | 12.0 |
| Canada | 1.7 | 2.1 | 3.4 | 3.4 | 1.9 | 1.7 | | |
| Mexico | | | | | | | | |
| Brazil | | | | | | | | |
| Argentina | 1.2 | 2.0 | 2.2 | 2.4 | 2.1 | 3.4 | 27.0 | 15.6 |
| China | | | | | | | | |
| Australia | 23.0 | 27.7 | 24.6 | 27.1 | 16.9 | 17.5 | 41.4 | 24.8 |
| New Zealand | 53.5 | 62.3 | 19.7 | 21.1 | 18.8 | 18.9 | | |
| South Korea | | | | | | | | |
| Rest of world | 3.6 | 4.4 | 14.7 | 15.5 | 3.1 | 1.4 | 0.1 | 0.5 |

1/ Changes in export shares of whole dry milk are insignificant.
Note: Blank cell indicates no significant share of commodity market.

Source: USDA, Economic Research Service, simulated from PEATSim model.

Appendix table 6

**Effects on milk price and production from multilateral liberalization, 2007**

| Country | Milk price change | Milk production change |
|---|---|---|
| | *Percent* | |
| EU | -54.7 | 11.6 |
| Japan | -57.2 | -21.5 |
| United States | -4.1 | -1.8 |
| Canada | -51.7 | 8.8 |
| New Zealand | 24.5 | 8.1 |
| Australia | -3.5 | -1.3 |
| South America-South (Argentina) | 9.5 | 3.1 |

Source: USDA, Economic Research Service, from University of Wisconsin World Dairy Model.

Appendix table 7

**Effects on dairy trade of multilateral liberalization, 2007**

| Country/region | Exports | Imports |
|---|---|---|
| | *Percent change* | |
| EU | 24.8 | -100.0 |
| Japan | -- | 95.2 |
| Australia | -6.9 | -- |
| New Zealand | 30.3 | -- |
| Canada | -17.5 | -35.2 |
| United States | -5.9 | 62.9 |
| Mexico | -- | 16.0 |
| South America-North (Brazil) | -- | 134.9 |
| South America-South (Argentina) | 66.7 | -- |
| World | 18.6 | 18.6 |

-- = not available due to insufficient trade.

Source: USDA, Economic Research Service, from University of Wisconsin World Dairy Model.

Appendix table 8

**Welfare effects of multilateral liberalization, 2007**

| Country/region | Total welfare change |
|---|---|
| | *Percent change from base* |
| EU | -2.3 |
| Japan | 0.3 |
| Australia | 2.2 |
| New Zealand | 3.5 |
| Canada | 0.7 |
| United States | 0.8 |
| Mexico | 2.3 |
| South America-North (Brazil) | -0.9 |
| South America-South (Argentina) | 1.0 |

Source: USDA, Economic Research Service, from University of Wisconsin World Dairy Model.

Appendix table 9

**Milk production in selected countries and regions, 2004[1]**

| Country/Region | Cows milk production | Cows |
|---|---|---|
| | *1,000 metric tons* | *1,000 head* |
| **North America** | | |
| Canada | 7,885 | 1,057 |
| Mexico | 9,874 | 6,800 |
| United States | 77,477 | 9,010 |
| Subtotal | 95,236 | 16,867 |
| **South America** | | |
| Argentina | 9,250 | 2,000 |
| Brazil | 23,317 | 15,200 |
| Chile | | |
| Colombia | | |
| Peru | | 0 |
| Venezuela | | |
| Subtotal | 32,567 | 17,200 |
| **European Union (EU)** | | |
| EU-25 | 130,812 | 23,963 |
| **Eastern Europe** | | |
| Romania | 5,723 | 1,694 |
| **Former Soviet Union** | | |
| Russia | 32,000 | 11,200 |
| Ukraine | 13,787 | 4,313 |
| Subtotal | 45,787 | 15,513 |
| **North Africa** | | |
| Egypt | | |
| Algeria | | |
| Subtotal | | |
| **South Asia** | | |
| India | 37,500 | 37,000 |
| **Asia** | | |
| China | 22,606 | 5,466 |
| Indonesia | | |
| Japan | 8,329 | 936 |
| Korea | | |
| Malaysia | | |
| Philippines | | |
| Taiwan | | |
| Thailand | | |
| Subtotal | 30,935 | 6,402 |
| **Oceania** | | |
| Australia | 10,377 | 2,036 |
| New Zealand | 15,000 | 3,920 |
| Subtotal | 25,377 | 5,956 |
| **Total selected countries** | **403,937** | **124,595** |

[1]Source: Prepared by USDA, Economic Research Service using final estimates by USDA, Foreign Agriculture Service, December 2005.

Appendix table 10

**Whole dry milk production, consumption and trade data, 2004[1]**

| Country/Region | Production | Consumption | Imports | Exports | Ending stocks |
|---|---|---|---|---|---|
| | | | *1,000 metric tons* | | |
| **North America** | | | | | |
| Canada | 0 | 0 | 0 | 0 | 0 |
| Mexico | 0 | 35 | 35 | 0 | 0 |
| United States | 19 | 22 | 3 | 0 | 1 |
| Subtotal | 19 | 57 | 38 | 0 | 1 |
| **South America** | | | | | |
| Argentina | 260 | 86 | 1 | 177 | 25 |
| Brazil | 420 | 435 | 21 | 16 | 11 |
| Chile | 51 | 52 | 4 | 8 | 4 |
| Colombia | 0 | 0 | 0 | 0 | 0 |
| Peru | 0 | 0 | 0 | 0 | 0 |
| Venezuela | 0 | 0 | 0 | 0 | 0 |
| Subtotal | 731 | 573 | 26 | 201 | 40 |
| **European Union (EU)** | | | | | |
| EU-25 | 857 | 346 | 3 | 514 | 0 |
| **Eastern Europe** | | | | | |
| Romania | | | | | |
| **Former Soviet Union** | | | | | |
| Russia | 90 | 109 | 25 | 6 | 0 |
| Ukraine | 28 | 10 | 0 | 18 | 0 |
| Subtotal | 118 | 119 | 25 | 24 | 0 |
| **North Africa** | | | | | |
| Egypt | | | | | |
| Algeria | 0 | 140 | 161 | 0 | 30 |
| Subtotal | 0 | 140 | 161 | 0 | 30 |
| **South Asia** | | | | | |
| India | 0 | 0 | 0 | 0 | 0 |
| **Asia** | | | | | |
| China | 832 | 898 | 91 | 25 | 0 |
| Indonesia | 45 | 65 | 21 | 1 | 6 |
| Japan | 0 | 0 | 0 | 0 | 0 |
| Korea | 0 | 0 | 0 | 0 | 0 |
| Malaysia | 0 | 0 | 0 | 0 | 0 |
| Philippines | 0 | 17 | 45 | 28 | 0 |
| Taiwan | 6 | 36 | 30 | 0 | 0 |
| Thailand | 0 | 0 | 0 | 0 | 0 |
| Subtotal | 883 | 1,016 | 187 | 54 | 6 |
| **Oceania** | | | | | |
| Australia | 187 | 23 | 12 | 173 | 28 |
| New Zealand | 658 | 1 | 2 | 669 | 53 |
| Subtotal | 845 | 24 | 14 | 842 | 81 |
| **Total selected countries** | **3,453** | **2,275** | **454** | **1,635** | **158** |

[1]Source: Prepared by USDA, Economic Research Service using final estimates by USDA, Foreign Agriculture Service, December 2005.

Appendix table 11

**Nonfat dry milk production, consumption and trade data, 2004[1]**

| Country/Region | Production | Consumption | Imports | Exports | Ending stocks |
|---|---|---|---|---|---|
| | | | *1,000 metric tons* | | |
| **North America** | | | | | |
| Canada | 88 | 56 | 2 | 16 | 41 |
| Mexico | 170 | 338 | 168 | 0 | 25 |
| United States | 638 | 621 | 1 | 231 | 232 |
| Subtotal | 896 | 1,015 | 171 | 247 | 298 |
| **South America** | | | | | |
| Argentina | 35 | 19 | 0 | 18 | 4 |
| Brazil | 110 | 112 | 4 | 2 | 0 |
| Chile | 10 | 15 | 3 | 0 | 3 |
| Colombia | 8 | 8 | 0 | 0 | 0 |
| Peru | | 8 | 8 | 0 | 1 |
| Venezuela | | | | | |
| Subtotal | 163 | 162 | 15 | 20 | 8 |
| **European Union (EU)** | | | | | |
| EU-25 | 1,066 | 950 | 25 | 282 | 77 |
| **Eastern Europe** | | | | | |
| Romania | | | | | |
| **Former Soviet Union** | | | | | |
| Russia | 125 | 170 | 65 | 20 | 0 |
| Ukraine | 78 | 15 | 0 | 63 | 2 |
| Subtotal | 203 | 185 | 65 | 83 | 2 |
| **North Africa** | | | | | |
| Egypt | 24 | 24 | 0 | 0 | |
| Algeria | 0 | 90 | 90 | 0 | 10 |
| Subtotal | 0 | 114 | 114 | 0 | 10 |
| **South Asia** | | | | | |
| India | 235 | 231 | 15 | 10 | 14 |
| **Asia** | | | | | |
| China | 68 | 127 | 61 | 2 | 0 |
| Indonesia | 0 | 115 | 125 | 12 | 10 |
| Japan | 183 | 222 | 37 | 0 | 83 |
| Korea | 25 | 31 | 4 | 0 | 7 |
| Malaysia | 0 | 0 | 0 | 0 | 0 |
| Philippines | 0 | 104 | 120 | 16 | 2 |
| Taiwan | 0 | 17 | 17 | 0 | 0 |
| Thailand | 0 | 0 | 0 | 0 | 0 |
| Subtotal | 276 | 616 | 364 | 30 | 102 |
| **Oceania** | | | | | |
| Australia | 203 | 20 | 2 | 187 | 5 |
| New Zealand | 294 | 5 | 1 | 305 | 55 |
| Subtotal | 497 | 25 | 3 | 492 | 60 |
| **Total selected countries** | **3,336** | **3,298** | **772** | **1,164** | **571** |

[1] Source: Prepared by USDA, Economic Research Service using final estimates by USDA, Foreign Agriculture Service, December 2005.

Appendix table 12

**Cheese production, consumption and trade data, 2004[1]**

| Country/Region | Production | Consumption | Imports | Exports | Ending stocks |
|---|---|---|---|---|---|
| | | | *1,000 metric tons* | | |
| **North America** | | | | | |
| Canada | 305 | 319 | 24 | 10 | 59 |
| Mexico | 134 | 214 | 82 | 2 | 0 |
| United States | 4,026 | 4,189 | 209 | 61 | 322 |
| Subtotal | 4,465 | 4,722 | 315 | 73 | 381 |
| **South America** | | | | | |
| Argentina | 370 | 338 | 0 | 31 | 23 |
| Brazil | 470 | 468 | 4 | 6 | 0 |
| Chile | | | | | |
| Colombia | | | | | |
| Peru | | | | | |
| Venezuela | | | | | |
| Subtotal | 840 | 806 | 4 | 37 | 23 |
| **European Union (EU)** | | | | | |
| EU-25 | 6,430 | 6,021 | 106 | 515 | 0 |
| **Eastern Europe** | | | | | |
| Romania | 26 | 25 | 3 | 4 | 5 |
| **Former Soviet Union** | | | | | |
| Russia | 350 | 528 | 190 | 10 | 12 |
| Ukraine | 224 | 133 | 3 | 94 | 2 |
| Subtotal | 574 | 661 | 193 | 104 | 14 |
| **North Africa** | | | | | |
| Egypt | 455 | 459 | 9 | 5 | 0 |
| Algeria | | | | | |
| Subtotal | 455 | 459 | 9 | 5 | 0 |
| **South Asia** | | | | | |
| India | | | | | |
| **Asia** | | | | | |
| China | | | | | |
| Indonesia | | | | | |
| Japan | 35 | 254 | 219 | 0 | 15 |
| Korea | 24 | 65 | 41 | 0 | 2 |
| Malaysia | | | | | |
| Philippines | | | | | |
| Taiwan | | | | | |
| Thailand | | | | | |
| Subtotal | 59 | 319 | 260 | 0 | 17 |
| **Oceania** | | | | | |
| Australia | 389 | 230 | 49 | 212 | 51 |
| New Zealand | 308 | 28 | 2 | 289 | 29 |
| Subtotal | 697 | 258 | 51 | 501 | 80 |
| **Total selected countries** | **13,546** | **13,271** | **941** | **1,239** | **520** |

[1] Source: Prepared by USDA, Economic Research Service using final estimates by USDA, Foreign Agriculture Service, December 2005.

Appendix table 13

**Butter production, consumption and trade data, 2004[1]**

| Country/Region | Production | Consumption | Imports | Exports | Ending stocks |
|---|---|---|---|---|---|
| | | | *1,000 metric tons* | | |
| **North America** | | | | | |
| Canada | 86 | 96 | 28 | 17 | 14 |
| Mexico | 88 | 141 | 53 | 0 | 0 |
| United States | 567 | 615 | 23 | 0 | 20 |
| Subtotal | 741 | 852 | 104 | 17 | 34 |
| **South America** | | | | | |
| Argentina | | | | | |
| Brazil | 75 | 75 | 1 | 1 | 0 |
| Chile | | | | | |
| Colombia | | | | | |
| Peru | | | | | |
| Venezuela | | | | | |
| Subtotal | 75 | 75 | 1 | 1 | 0 |
| **European Union (EU)** | | | | | |
| EU-25 | 2,154 | 1,936 | 90 | 352 | 232 |
| **Eastern Europe** | | | | | |
| Romania | 9 | 12 | 3 | 0 | 0 |
| **Former Soviet Union** | | | | | |
| Russia | 270 | 437 | 170 | 5 | 15 |
| Ukraine | 138 | 103 | 0 | 42 | 5 |
| Subtotal | 408 | 540 | 170 | 47 | 20 |
| **North Africa** | | | | | |
| Egypt | 12 | 40 | 28 | 0 | 0 |
| Algeria | | 15 | 15 | 0 | 1 |
| Subtotal | 12 | 55 | 43 | 0 | 1 |
| **South Asia** | | | | | |
| India | 2,600 | 2,608 | 10 | 2 | 0 |
| **Asia** | | | | | |
| China | | | | | |
| Indonesia | | | | | |
| Japan | 80 | 88 | 7 | 0 | 23 |
| Korea | | | | | |
| Malaysia | | | | | |
| Philippines | | | | | |
| Taiwan | | 11 | 11 | 0 | 0 |
| Thailand | | | | | |
| Subtotal | 80 | 99 | 18 | 0 | 23 |
| **Oceania** | | | | | |
| Australia | 132 | 60 | 9 | 75 | 8 |
| New Zealand | 390 | 26 | | 374 | 21 |
| Subtotal | 522 | 86 | 9 | 449 | 29 |
| **Total selected countries** | **6,601** | **6,263** | **448** | **868** | **339** |

[1] Source: Prepared by USDA, Economic Research Service using final estimates by USDA, Foreign Agriculture Service, December 2005.