INTERNATIONAL AGRICULTURAL TRADE RESEARCH CONSORTIUM

Working Paper

Implications of WTO Tariff Reductions for EU and US Dairy Policy

Mirjana Pajic
David Blandford
Kenneth Bailey

March 2009
IATRC
Working Paper #09-1

International Agricultural
Trade Research Consortium

Implications of WTO Tariff Reductions for EU and US Dairy Policy

By Mirjana Pajić, David Blandford, and Kenneth Bailey*

Working Paper #09-1

*Mirjana Pajić is a former research assistant, and David Blandford and Kenneth Bailey are professors at Penn State University.

Correspondence regarding this paper should be addressed to the authors at:

Department of Agricultural Economics
& Rural Sociology
Penn State University
112D Armsby Building
University Park, PA
dblandford@psu.edu

March 2009
ISSN 1098-9210
Working Paper #09-1

Implications of WTO Tariff Reductions for EU and US Dairy Policy

Abstract

The objective of this study is to measure the impact of proposed Doha Round tariff reductions on the global dairy industry and dairy policy. We examine how proposed tariff reductions affect global trade and prices, and the implications for the European Union and the United States. Since international market conditions can vary, we examine the implications of liberalization under two sets of market conditions. The first corresponds to the year 2004 in which there was a global surplus of dairy products. In that year import protection ensured that U.S prices of dairy products were above world prices. The second corresponds to 2007, when dairy products globally were in short supply and U.S. domestic prices were at or below world prices. We show that proposed tariff reductions have different implications for dairy commodities depending on policy assumptions. For cheese and dry whole milk, tariff reductions reduce supplies and raise world prices due to reduced production in the EU. However, without a change in EU policies global butter prices would decline due an increase in EU supplies. Production shifts away from cheese into butter production, increasing the supply of butter on the world market. We conclude that with trade liberalization EU intervention prices or milk quotas would have to be reduced in order to counteract an increase in butter production and increased use of export restitution payments for that commodity.

Introduction

The Doha Round of World Trade Organization (WTO) negotiations began in 2001. It has been difficult to reach agreement because of the different interests of WTO members. The U.S. is seeking concessions from other countries on market access – reductions in tariffs and increases in tariff rate quotas (TRQs). The European Union (EU) and a range of other countries are resisting this. If the EU agrees to expanded market access it may have to change its price support policies for some important agricultural products (Huan-Niemi 2007)

The world dairy industry is one of the most heavily protected sectors (Meilke et al. 1999). A key issue in the current Doha Round is market access. Increasing market access by lowering tariffs has been predicted to increase trade volumes and raise world prices (Zhu, Cox, and Chavas, 1999; Langley et al. 2003). Countries may be required to expand TRQs and reduce over-quota tariffs. Reductions in bound tariffs and the creation of TRQ's under the Uruguay Round Agreement on Agriculture (URAA) provided some increase in market access for dairy products, but left many high tariffs in place. Reducing these high tariffs remains one of the main sticking points for agriculture in the Doha negotiations.

Liberalizing border protection in the EU would increase the competition faced by European dairy farmers and would put into the question the continuation of EU price support policies. Changes in world prices have historically had only a limited impact on domestic dairy production and consumption in the EU due to the protection provided by the Common Agricultural Policy. Production is controlled by quotas, although these are scheduled for elimination in 2014/15. Currently, when world prices are below intervention prices export subsidies are used to dispose of surplus production. If world prices rise above intervention prices export subsidies are eliminated and internal prices rise, as occurred in 2007. If import tariffs were reduced, the resulting increase in imports would place further pressure on the price support policy. In order to maintain internal prices, the EU would be forced to consider reducing production quotas or lower intervention prices in order to prevent the buildup of intervention stocks. It is for these reasons that the EU has resisted large reductions in tariffs in the Doha Round.

Trade liberalization under the Doha Round may also put pressure on the U.S. domestic support program for milk and dairy products. Historically, domestic prices for most dairy products have been higher than world prices and the U.S. market has been insulted from global markets by tariff and non-tariff barriers. In recent years, U.S. imports have increasingly been driven by the demand for milk components (milk fat, protein, and lactose) used in the domestic food processing industry. Tariff reductions may result in further substitution among domestic and international sources of components. On the other hand, if world market prices are high the U.S. could end up exporting dairy products instead of importing them.

The objective of this paper is to measure the impact of proposed Doha Round tariff reductions on the global dairy industry and their implications for policy. We focus on measuring changes in over-quota imports in response to alternative tariff reduction scenarios. This is accomplished by developing a framework for analyzing tariff reductions and measuring their impact on domestic and international prices, and trade volumes. We use annual static equilibrium models of the U.S. and global dairy industry that explicitly reflect the tariff structure of dairy commodities. These models were developed as part of an M.S. thesis (Pajić 2008). We use the linked models to assess how lower tariffs will affect dairy policy in the U.S. and EU.

Market Access under the WTO

In May 2008 a revised draft of agricultural modalities was distributed by the chair of the WTO committee on agriculture prior to further negotiations in Geneva in July (WTO 2008). This document proposed tiered formulas for tariff reductions. For developed countries the proposed average tariff reductions are 48-73 percent and for developing countries they are 32-48.6 percent. It has not been possible to reach a final agreement on the modalities, although some further changes have been incorporated since the breakdown of negotiations at the end of July 2008.

The objective of this study is to examine the impact of tariff reduction scenarios on the global dairy market including developed and developing countries. We do this by developing a framework for analyzing the impact of the May 2008 formula for tariff reductions on the U.S. and global dairy industry. We refer to this scenario as “the tariff reduction scenario.”

The proposed formula for developed countries uses the narrowest tiers and the highest reduction percentages. The first tariff tier is 0-20 percent with a tariff cut of between 48-52 percent; the second tier is 20-50 percent with a reduction of 55-60 percent. The third tier is 50-75 percent with a cut of between 62-65 percent. Finally, the fourth tier is for tariffs greater than 75 with a reduction of between 66-73 percent.[1] The proposal for developed countries provides the largest reduction percentages across the tariff profile. For developing countries the formula has wider tiers and lower tariff reduction percentages. The developing country first tier is 0-30 percent with a tariff cut of 32-24.6 percent. The second tier is 30-80 percent with a tariff cut of 36.6-40 percent. The third tier is 80-130 percent and tariff cuts of 41.3-43.3 percent. Finally, the fourth tier is for tariffs higher than 130 percent with a cut of 44-48.6 percent.[2]

Based on these tiered formulas new product *ad valorem* equivalent tariffs (AVEs) were estimated. First, we arranged countries into developed, developing, and recently acceded members (RAMs). Second, we ranked existing product-based AVEs and determined the tier to which they belonged. Finally, the proposed reduction percentages were applied to these product-based AVEs.

Methodology

During the past decade a number of models have been used to examine dairy trade liberalization. The qualitative results of the studies are similar. They suggest that international trade liberalization will result in lower global supplies of milk and dairy products, higher world prices, and a higher value of dairy trade. The effect of trade liberalization on individual countries depends on the existing level of protection. Countries with moderate to high levels of support and protection such as the United States, EU, and Canada, may experience an increase in imports and reduction in production, but this will depend on conditions in world markets. In contrast, countries such as New Zealand and Australia, with low levels of protection and production costs, will benefit from higher prices and expanded export opportunities.

The global model developed in this study is based on a static equilibrium excess supply and demand trade model. It reflects supply, demand, market clearing conditions, and import prices and tariffs as follows:

Major Exporters:

Eq. 1 $$ES_j^i(P^i) = PRD_j^i + IMP_j^i - EST_j^i - CON_j^i$$

Major Importers:

Eq. 2 $$ED_j^i(IP^i) = EST_j^i + CON_j^i - PRD_j^i - IMP_j^i$$

Market Clearing Conditions:

Eq. 3 $$\sum_{i,j} ES_j^i = \sum_{i,j} ED_j^i$$

---

[1] In this paper we use average tariff reductions for developed countries as follows: 1st tier 50%, 2nd tier 57.5%, 3rd tier 63.5%, and 4th tier 69.5%

[2] For developing countries we use average tariff reductions as follows: 1st tier 33.3%, 2nd tier 38.3%, 3rd tier 42.3%, and the 4th tier 46.3%

Tariffs and Import Prices:

Eq. 4 $$IP_j^i = P_j^i + T_j^i$$

where ES denotes excess supply, ED is excess demand, PRD is production, IMP is imports, EST is ending stocks, CON is domestic consumption, P is the world price, IP is the import price, T is the tariff and i and j denote commodity and country, respectively.

The model was constructed using elasticities taken from other studies. The major sources were the PEATSIM model developed at Penn State and the Economic Research Service of USDA, and the FAPRI global dairy model. Our model involves twelve countries chosen for their significance in global dairy trade plus a residual for the rest of the world. Countries are arranged into two groups, importers or exporters, based on historical trade patterns, although this does not affect the results since the model solves for net trade for each country. The model is calibrated for two years: 2004 and 2007, and contains dairy products that are traded globally: butter, cheese, nonfat dry milk, and whole dry milk. It solves for equilibrium world dairy commodity prices.

A separate but linked model was developed for the United States that solves simultaneously for four wholesale dairy commodity prices: butter, cheese, nonfat dry milk, and dry whey (corresponding to data collected by the National Agricultural Statistics Service). The purpose of this model is to analyze the implications of trade liberalization for the United States in greater detail. Prices of U.S. dairy products are affected mainly by variations in internal supply and demand, due to the insulating effects of U.S. dairy policies. In the rest of the world, prices are assumed to be determined largely on the basis of global supply and demand, but are influence by U.S. exports and imports. Our model reflects the current state of global milk pricing in which U.S. prices and world prices are separate but related. This differs from most previous models that assume a single global price that is transmitted to the U.S. market.

Both models solve simultaneously for dairy commodity prices. In the U.S. model we solve for wholesale prices of cheese, butter, nonfat dry milk and dry whey. In the rest of the world model we solve for the world prices of butter, skim milk powder (nonfat dry milk powder in the U.S.), cheese, and whole milk. Results from the U.S. dairy industry model are integrated into the global dairy trade model. Both models are connected via trade equations that reflect U.S. imports and exports.

The U.S. dairy model differs from the framework used for the rest of the world in another important respect. It uses a component-based methodology to account for the production of processed products on the basis of their protein, milk fat, and other dairy solids content. This type of accounting allows us to allocate components in the supply of milk to fluid milk, ice cream (frozen products), soft manufactured products, and hard manufactured products. It provides an improved method for determining the production of processed dairy products and allows us to reflect more accurately the impact of the Federal Milk Marketing Order (FMMO) system on fluid and manufactured dairy products. In the FMMO, Class I milk relates to fluid use, Class II to soft manufacturing products, Class III is cheese, and Class IV is for butter and nonfat dry milk. The Federal

Order system meets the demand for fluid milk first, and then allocates the remaining milk to manufacturing uses. Dairy product manufacturing and trade in the United States is increasingly driven by the demand for components, rather than products *per se*, so this type of component-based model allows for an improved representation of how the U.S. dairy market actually functions (Tellioglu et al. 2007).

The global dairy trade model is constructed to analyze the impact of alternative tariff reduction scenarios. It is a gross dairy trade model that accounts for total imports and total exports of each of the four commodities in each country. Exports or imports by each country are derived from an excess supply or demand function with respect to the rest of the world. Aggregate exports equal aggregate imports in order to clear global markets. Through this, the world price for each product is linked to domestic prices and affects production, consumption, and net trade.

The main dairy policies for each country are included in the model. Trade policy instruments include specific and *ad valorem* tariffs, and TRQs. These are reflected through a common specification applied to all countries. In addition, the model includes important policy measures that apply to certain countries, such as Canada and the EU.[3] In the EU these additional measures include specific fixed tariffs in dollars per metric ton, exchange rates, milk production quotas, and intervention prices for butter and nonfat dry milk. In Canada, the additional measure is the milk production quota. All the country models include farm-to-retail markups to reflect the difference between producer and consumer prices for cheese, butter, nonfat dry milk and whole dry milk. Since it is difficult to obtain such data on a country-by-country basis, we applied the farm-to-retail mark up derived from U.S. data (in percentage terms) to all other countries.

Tariffs are based on data for 2000 or the most recent year available. The model uses applied tariffs rather than bound tariffs under the WTO Uruguay Round Agreement. Apart from the U.S., modeling the EU was more complicated than the rest of the countries in the model. This is because of the need to reflect the Common Agricultural Policy. The EU employs high import tariffs to keep domestic prices above world prices, milk production quotas to limit production, intervention prices to set minimum prices for butter and nonfat dry milk, and export subsidies to dispose of surplus products. These policies are in place to protect the domestic market for dairy products and each instrument is required to maintain market balance. With high domestic prices production will rise, requiring budgetary expenditures for export subsidies.

One of the key aspects of EU policy is the use of intervention prices for butter and nonfat dry milk. The EU uses intervention purchases to absorb surplus manufacturing milk components. Products acquired are exported using subsidies. In the model, import prices for cheese, butter, nonfat dry milk, and whole dry milk are represented by the world price plus the over-quota tariff. Export prices for the four dairy products are set equal to world prices. Processor and consumer prices for cheese and butter are modeled in the same way as for other importers, while the prices for butter and nonfat dry milk are

[3] The model uses an aggregate for the EU25. Data for the two most recent members (Bulgaria and Rumania) were not available.

set equal to intervention prices. Supply and demand for the four processed dairy products are modeled in the same manner as in any other country. We do not explicitly reflect other domestic subsidies in the model.

The import demand equations for processed dairy products are constant-elasticity functions in own import prices. Actual quota imports are compared to the TRQs for the four products. The data on TRQs were taken from Food and Agricultural Research Institute (FAPRI) database. FAPRI provides an historical database on production, consumption, trade, prices, as well as quota information for individual dairy countries. Finally, in order to clear the markets, export identities are specified as production plus imports minus domestic consumption.

Tiered Formula for Agricultural Tariff Cuts

In 2004, the WTO produced a document, called the Framework Agreement, to guide negotiations for a final agricultural agreement. The document reflects agreement that all members must make substantial improvements in market access for all products. In May 2008 a revised draft of the agricultural modalities was presented (WTO 2008). This document offers incorporate the progress made in the negotiating process to that point. One of the changes introduced was a modified tiered formula for tariff reductions. A summary of the tariff reduction formula is given in Table 1.

We used this tiered formula for agricultural tariff reduction to conduct our trade liberalization scenarios. New product *ad valorem* equivalents (AVEs) were estimated. To do this countries were grouped into developed, developing, and RAM developing (recently acceded WTO member) categories. Product-based AVEs were ranked to determine the tier to which they belonged. The reduction percentages in Table 1 were applied to generate new product-based AVEs. Since Russia is not a WTO member we applied the constant *ad valorem* over-quota tariff applicable in 2004. We subtracted 7.5 percent from the tariff reduction profile for China since it is considered a RAM developing country. The product AVEs derived from these calculations are given in Table 2.

Baselines and Scenarios

We examined two scenarios under two baselines. The baselines were designed to reflect two alternative market conditions. The first baseline is for 2004 and illustrates the "traditional" U.S. market situation in which domestic dairy prices are higher than world prices. The second baseline was for 2007 when U.S. domestic prices were below world prices. There was strong global demand for dairy products in 2007 generated by rising incomes, primarily in Asia and the Middle East. The strong demand confronted limited global supplies and world dairy prices increased. In addition, Australia experienced a drought and its dairy exports declined. Tight world supply, coupled with strong world demand, plus the added effect of depreciation of the U.S. dollar meant that the U.S. had a competitive advantage in exports.

The two baselines were used in the analysis of two policy scenarios: a tariff reduction scenario and an EU policy scenario. Our initial focus is on the tariff reduction scenario in the May 2008 draft modalities. We used the model under the two baselines to examine the impact of tariff reductions on global supply and demand for dairy commodities. The second scenario not only includes the tariff reductions, but policy response in the EU. A key issue is how the EU would respond to significant tariff reductions, and how this response would affect global supply and demand.

The following summarizes the baselines and scenarios used in this study:

Baselines:

- Traditional Global Surplus (2004)
- New Global Shortage (2007)

Scenarios:

- Tariff Reduction Scenario
- Tariff Reduction Scenario with EU Policy Response.

Results

The results of the Tariff Reduction Scenario for the 2004 and 2007 baselines are analyzed first. The 2004 baseline, reflecting traditional global supply and demand conditions, is presented in Tables 3-6. The results for 2007 were broadly similar and are discussed below.

Tariff Reduction Scenario

The impact of the tariff reduction scenario on the United States dairy market is not dramatic. This is because current dairy trade protection in the U.S. is not as rigid as in Europe and Canada. The required reduction in tariffs causes an initial decline in import prices for butter, nonfat dry milk, and whole milk powder under market conditions applying in both 2004 and 2007. Generally speaking, the cuts in tariffs reduce import prices and increase import demand. The cheese import price, however, shows a slight increase in both years even though over-quota tariffs fall 58-70 percent relative to the baseline. This is because the reduction in tariffs is offset by an increase in the world price. The same is true for whole dry milk. The change in imports created by tariff reductions creates a new supply/demand balance with a higher equilibrium global price.

Generally speaking, changes in global supply and demand for cheese and dry whole milk follow a similar pattern. On the supply side a major reduction in the EU import tariff causes a decline in the domestic price of cheese. With fixed support prices for butter and nonfat dry milk, the economics of milk allocation result in a substantial shift from cheese to butter and nonfat dry milk production. As a result, the EU changes from being a major net exporter of cheese to self sufficiency. That shift causes a sizeable increase in the global price of cheese, up roughly 28 percent from the 2004 baseline. The rise in world prices, which offsets the effect of the lower import tariff, result in a reduction in imports by major countries. China and Russia, for example, reduce their imports significantly in the face of increased world prices.

The results are substantially different for butter and nonfat dry milk. The reallocation of milk away from cheese to butter/nonfat production causes significant growth in exports. Total excess supply of butter rises 19 percent relative to the baseline in 2004. This large growth in supply reduces the world price of butter by 6 percent. The lower tariff and lower world price result in an increase in global excess demand of 34 percent relative to the 2004 baseline. These results are again due to a substantial reallocation of milk created by the significant reduction in the EU internal cheese price relative to fixed EU intervention prices for butter and nonfat dry milk.

Differences in results between 2004 and 2007 are due to the fact that the starting point for global prices of cheese, butter, nonfat dry milk, and whole dry milk is higher in 2007 than in 2004. As noted above, this is due to reduced global supply and strong demand. Another major difference was the volume of butter traded in 2007, which was half that in 2004. Under 2007 conditions the decline in global butter prices is much lower than under the conditions applying in 2004. With tariff reductions, global cheese and butter prices move in opposite directions – the cheese price increases whereas the butter price decreases. This is due to the reallocation of milk away from cheese to butter production in the EU. As a major global player, changes in the EU market have a significant impact on world prices under this scenario. Note, however, we assume that EU butter and nonfat dry milk intervention prices and the milk production quota are unchanged. Given the strong reduction in the domestic price for cheese compared to a fixed butter price, such assumptions may not be realistic. Strong growth in EU butter and nonfat exports would require increased use of export subsidies, which are limited under WTO agreements.

EU Policy Response Scenarios

Because of the importance of the policy assumptions for the EU, we examined a second scenario in which both intervention prices and the milk production quota are reduced. This causes the domestic price of butter to fall to world market levels, thus preventing the need for export subsidies. Also, the lower domestic butter price prevents a reallocation of milk from cheese to butter production.

In our model the EU intervention price affects the relationship between world and domestic prices. The EU is the only country (apart from the United States) in which price-support purchases for butter and nonfat dry milk occur. All intervention prices in 2004 were higher than world prices, and this also applied to butter in 2007. The world price of nonfat dry milk in 2007 was slightly higher than the intervention price and this increases the internal EU price.

As part of our alternative EU scenario we reduced the milk production quota in the EU by 3 percent in both years. We reduced the butter intervention price by 50 percent in 2004 and 25 percent in 2007 and the intervention price for nonfat dry milk by 10 percent in 2004. We did not change that price in 2007 because it was already higher than the world price. Lower intervention prices coupled with a lower milk production quota caused a decrease in processor prices for butter and nonfat dry milk. This is because we define the producer price as equal to the higher of the defined intervention price or the world price. The butter producer price falls by 29 percent to $2,796 per metric ton in 2004. This significant drop in the EU butter price causes a decline in EU exports of 92 percent in 2004 relative to the baseline. Under the 2007 conditions EU butter exports fall by 58 percent relative to the baseline. Other EU dairy exports also decline. Under the 2004 conditions cheese exports fall by 64 percent, skim milk powder exports by 92 percent, and whole milk powder exports by 35 percent. As a result the need for EU export subsidies is reduced significantly.

The impact of adjustments in EU policy is dramatic. Global excess supply in 2004 declines 249 thousand metric tons and demand falls by 238 thousand metric tons. Under this scenario, global butter prices in 2004 actually increased by 15 percent to $2,076 per metric ton. The same result occurs in 2007 except that the increase to $3,000 per metric ton is smaller in percentage terms (5 percent) due to higher base prices. These results are opposite to those in the earlier no-policy-change scenario.

Although a reduction in the milk quota helps to improve market balance in the EU in response to trade liberalization, it is unlikely to be a realistic option. As indicated earlier, the EU is on a path to eliminate quotas by 2014/15. Studies indicate that a gradual phasing out of the quota will result in an increase in the milk supply. A "soft landing" approach, in which the quota is increased by 1-2 percent per year is estimated to result in an increase in the milk supply of roughly 5 percent, and a fall in the milk price of roughly 3 percent by 2015 in comparison to 2008 (Commission of the European Communities, Réquillart).

To examine the implications of this for our analysis, we replaced the EU quota by a supply function. We used the FAPRI supply elasticity of 0.35 and solved for the intercept at the current quota level. We assumed that an expansion of the quota would result in a reduction in the marginal cost of production as milk prices drop and production moves to more efficient areas of the EU. We re-solved our model until we obtained a 5 percent growth in the milk supply. This not only mirrors the EU Commission results, but also implies a reduction in the marginal cost of production. In addition, we reduced intervention prices by 40 percent in order to avoid surplus production and the need to use export subsidies.

The results of the revised EU scenario are similar to the results implied from previous trade liberalization studies. A reduction in tariffs under the 2004 baseline results in lower domestic prices, greater domestic demand, and higher world prices. For the EU, the expansion and eventual elimination of the quota and a reduction in intervention prices results in a more market-oriented dairy industry. Milk production expands, production of cheese increases relative to butter and skim milk powder, and domestic consumption grows. Exports of cheese expand significantly (up 19 percent), whereas exports of butter, skim milk power, and whole milk powder fall by 49, 39, and 15 percent, respectively. Freeing up the quota and reducing intervention prices creates an opportunity for the EU to meet growing internal and export demand without the use of export subsidies. The results under 2007 conditions are similar except that exports of butter and nonfat dry milk, including cheese exports, grow to meet growing world demand despite the fact that world prices for butter and skim milk powder are lower by 5 and 6 percent, respectively.

Summary and Conclusions

The objective of this paper is to measure the impact of proposed Doha Round tariff reductions on the U.S. and global dairy industry, with a particular focus on the EU and US. We examine how proposed tariff reductions under the Doha Round affect the global pattern of trade and world prices under market conditions applying in two years – 2004 and 2007. We used the May 2008 draft WTO modalities as a point of reference and analyzed their impact on the global dairy economy. In particular we are interested in how a reduction in the U.S. and world tariff profiles for dairy products might alter the pattern of dairy trade.

A unique aspect of this study is that it employs two dairy trade models: one model for the U.S. market and one for the world. The U.S. dairy trade model uses a component-based methodology to account for the production of processed dairy products on the basis of protein, milk fat, and other dairy solids. This approach allows us to determine the supply of components from raw milk and to allocate them to fluid milk, ice cream (frozen products), soft and hard manufacturing. The approach provides an improved method of analyzing changes in the production of processed dairy products. We focus on two different but realistic sets of market conditions. The first is for the year 2004. In that year U.S prices of dairy products were above world prices. The second is for 2007 when U.S. domestic prices were below world prices due to tight domestic supplies, strong global demand, and exchange rate changes. In that year the U.S. had a competitive advantage in exports.

We find that under the tariff reduction scenario, global cheese and butter prices change, but in opposite directions. One would expect that lower import tariffs would cause a reduction in supply and an increase in world prices. However, the butter price is found to fall due to the reallocation of milk components away from cheese to butter production following a drop in domestic cheese prices relative to butter/nonfat dry milk prices. This depresses global butter prices. Also, a decline in global excess supply of cheese due to reduced cheese production in the EU exceeds the decline in excess demand, causing an increase in world cheese prices.

The reallocation of milk from cheese to butter production in the EU is due to the fact that EU cheese prices are supported by high tariffs, whereas EU butter and nonfat dry milk are supported by intervention prices. When tariffs are cut, cheese prices fall. Without offsetting adjustments in butter/nonfat dry milk prices there is a substitution away from cheese production towards butter and nonfat dry milk production. The end result is much higher production of butter and nonfat dry milk. This would likely not be acceptable under WTO rules since it would require much higher levels of export subsidies on butter and nonfat dry milk exports. Consequently, a scenario was analyzed in which reductions in intervention prices and a reduction in the milk quota is used to bring the EU market into balance. The result is that internal butter and nonfat dry milk prices fall to global price levels, avoiding the need for export subsidies. In addition, the quota prevents surplus production. With this scenario there is a rise in the global price of butter which is similar to results found in other studies. A final scenario was developed in which the EU quota on milk is eliminated and intervention prices are cut significantly. This is a more likely policy scenario given that EU quotas are to be eliminated by 2015. Under such a scenario the EU is free to react to changing world market conditions.

As is the case with every model, there are several limitations to the one developed in this study. First, we assume commodity homogeneity for all dairy products (e.g., all types of cheese are included in our cheese category). Second, we only provide specific treatment of quota versus over-quota trade for TRQs for selected countries, namely the U.S. and EU, as data were readily available and these are large countries. Third, we only use component accounting for processed dairy products for the U.S. The method would need to be expanded to other major producing countries if this approach is to be applied more generally. Fourth, under our alternative scenarios, we assume that EU intervention prices and U.S. support prices are fixed. This is a particularly strong assumption for the EU since a drop in domestic cheese prices relative to a fixed butter intervention price causes a major shift in the allocation of milk. In the alternative scenarios, we lowered the intervention price, and that caused a decline in the domestic price of butter. The drop in domestic price would prevent the reallocation of milk from cheese to butter production.

Despite the limitations of our analysis, it is clear that tariff reductions could create challenges for dairy policy in the EU since they would require reductions in internal rates of support. The EU would have to follow through with the gradual elimination of milk quotas and reduce internal support prices in order to avoid the challenge of having to deal with surplus dairy products. The traditional avenue for disposing of such surpluses on world markets would be unavailable if agreement is finally reached in the Doha Round and export subsidies were eliminated.

References

Commission of the European Communities. (2008). "Impact Assessment." Commission Staff Working Document accompanying the proposal for council regulation on modifications to the common agricultural policy. SEC(2008) 1885, Brussels, May 5, 2008.

Cox, T. L., J. R. Coleman, J. P. Chavas, and Y. Zhu. (1999). "An Economic Analysis of the Effects on World Dairy Sector of Extending Uruguay Round Agreement to 2005." *Canadian Journal of Agricultural Economics,* 47: 169-183.

Doha Round Negotiations Market Access Proposals. (2005). WTO Doha Round: Agricultural Negotiating Proposals, CRS Report for Congress,Washington, DC..

Huan-Niemi, Ellen. (2007). Market Access under the WTO: Identifying Sensitive Agricultural Products in the EU. Agrifood Research Finland, Working Paper 146, Helsinki. URL: http://www.mtt.fi/mtts/pdf/mtts146.pdf
Fallert, Richard F. (1973). "Accounting for Butterfat and Nonfat Milk Solids in the Dairy Industry." Economic Research Service, USDA. Proceedings of Workshop on Systems Analysis in the Dairy Industry. April 24-25. Herndon, VA.

Food and Agricultural Policy Research Institute (FAPRI), The U.S. and World Agricultural Outlook, URL: http://www.fapri.iastate.edu/. Data accessed March 2008.

Grant, J. H., T. W. Hertel, and T. F. Rutherford (2006). "Extending General Equilibrium to the Tariff Line" U.S. Dairy in the Doha Development Agenda." American Agricultural Economics Association Annual Meeting, Long Beach, CA, July 23-26, 2006.

Harry De Gorter and D. S. Boughner. (1999). "U.S. Policy and the Agreement on Agriculture in the WTO." *Canadian Journal of Agricultural Economics,* 47:31-42.

Hanrahan C., and R. Schnepf. (2005). CRS Report for Congress, WTO Doha Round: Agricultural Negotiations Proposals, Washington, DC.

Jesse, Ed. (2003). "U.S. Imports of Concentrated Milk Proteins: What We Know and Don't Know?" Department of Agricultural and Applied Economics, University of Wisconsin, Marketing and Policy Briefing Paper, Paper No. 80

Langley, S., A. Somwaru, and M. A. Normile. (2006). *"Trade Liberalization in International Dairy Markets: Estimated Impacts."* Washington DC: U.S. Department of Agriculture, Economic Research Report No. 16.

Langley, S., D. Blayney, J. Stout, A. Somwaru, M.A. Normile, J. Miller, and R. Stillman. (2003). "A Trade Liberalization in International Dairy Markets." USDA, Economic Research Service. Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30.

Meilke, K., S. Lariviére, and C. Martin. (2001). "Trade Liberalization in the Dairy Sector: An Overview." *The Estey Centre Journal of International Law and Trade Policy,* 1: 118-145.

Pajić, Mirjana. (2008). "The Impact of Tariff Reduction and Global Demand Growth on the U.S. Dairy Industy. M.S. Thesis, Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University.

Partial Equilibrium Agriculture Trade Simulator Model. (2007). Department of Agricultural Economics and Rural Sociology, Penn State University. URL: http://trade.aers.psu.edu/documentation.cfm

Réquillart, Vincent. (2008). "Economic analysis of the effects of the expiry of the EU milk quota system." Institut D'Economie Industrielle, Toulouse.

Stewart, Terence P. (1999). *The GATT Uruguay Round: A Negotiating History (1986-1994).* The Hague: Kluwer Law International.

Stout, J. and D. Abler. (2003). "ERS/Penn State Trade Model Documentation." Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University. URL: http://trade.aers.psu.edu/pdf/ERS_Penn_State_Trade_Model_Documentation.pdf

Tellioglu, I, K. Bailey and D. Blandford. (2007). "Implicit Tariffs on Imported Dairy Product Components in the United States." *The Estey Centre Journal of International Law and Trade Policy*. 8: 83-101.

USDA, Commodity Analysis Division, Agricultural Stabilization and Conservation Service. (1991). "Methodology of Calculating the Milk Equivalent, Total Solids Basis, of CCC Purchases of Surplus Dairy Products and of Imports of Dairy Products." April 1.

United States International Trade Commission. (2004). "Conditions of Competition for Milk Protein Products in the U.S. Market". Investigation No. 332-453. Publication 3692 U.S. Department of Agriculture, Agricultural Research Service. 2005. USDA National Nutrient Database for Standard Reference, Release 18. Nutrient Data Laboratory Home Page, http://www.ars.usda.gov/ba/bhnrc/ndl.

World Trade Organization (WTO). (2006). Schedule of tariffs and concessions by WTO members. available at: http://www.wto.org/english/tratop_e/schedules_e/goods_schedules_e.htm.

World Trade Organization (WTO). (2008). "Revised Draft Modalities for Agriculture." Committee on Agriculture Special Session. TN/AG/W/4/Rev.2, May 19. URL: http://www.wto.org/english/tratop_e/agric_e/agchairtxt_may08_e.pdf

Zhu, Yong, T. L. Cox, and J. P. Chavas. (1999). “An Economic Analysis of the Effects of the Uruguay Round Agreement and Full Trade Liberalization on the World Dairy Trade Sector.” *Canadian Journal of Agricultural Economics*, 47: 187-200.

Table 1. Tariff Reduction Formula for Developed and Developing Countries

Developed Countries			Developing Countries	
Tier	Tiers %	Reduction %	Tiers %	Reduction %
1st	0 <= 20	50.0	0 <= 30	37.5
2nd	> 20 <= 50	57	> 30 <= 80	42.8
3rd	> 50 <= 75	64	> 80 <= 130	48.0
4th	> 75	73	> 130	54.8

Source: Revised Draft Modalities for Agriculture, May 19, 2008, WTO, Committee on Agriculture Special Session.

Table 2. Average Tariffs, Ad Valorem Equivalent (AVE percents), Baselines and calculated Tariff Reductions for Tariff Reduction Formula in 2004

	Baseline AVE 2004	Model AVE 2004	Computed AVE's	Tiered Formulas
India (developing)				
Butter	40	40		24.68
Cheese	40	40		24.68
NFDM	60	60		37.02
WMP				
Mexico (developing)				
Butter	37.5	37.5		23.1
Cheese	125.1	125.1		72.2
NFDM	40	40		24.7
WMP	37.5	37.5		23.1
Russia (not a WTO member)				
Butter	20	20		20.0
Cheese	15	15		15.0
NFDM	10	10		10.0
WMP	10	10		10.0
New Zealand (developed)				
Butter	6.4	6.4		3.2
Cheese	12.8	12.8		6.4
NFDM	12.8	12.8		6.4
WMP	7.5	7.5		3.8
Canada (developed)				
Butter	298.7	298.7		91.1
Cheese	245.6	245.6		74.9
NFDM	201.6	201.6		61.5
WMP	243.4	243.4		74.2
Argentina (developing)				
Butter	16	16		10.7
Cheese	16	16		10.7
NFDM	16	16		10.7
WMP	16	16		10.7

Table 2. – continued

	Baseline AVE 2004	Model AVE 2004	Computed AVE's	Tiered Formulas
Brazil (developing)				
Butter				
Cheese	16	16		10.7
NFDM	16	16		10.7
WMP	16	16		10.7
China (RAM developing)				
Butter	18.9	18.9		14.0
Cheese	12.0	12.0		8.9
NFDM	11.7	11.7		8.7
WMP	13.3	13.3		9.9
EU ($/mt) (developed)				
Butter	2,359	2,359	131.1	719.4
Cheese cheddar	2,079	2,079	79.6	634.0
NFDM	1,478	1,478	73.2	539.4
WMP	1,742	1,742	86.0	531.2
USA ($/mt) (developed)				
Butter	1,541	1,541	85.7	470.0
Cheese	1,620	1,620	62.0	591.4
NFDM	865	865	42.8	367.6
WMP	1,092	1,092	53.9	398.6
Ukraine (RAM developing)				
Butter	50	50		34.9
Cheese	25	25		18.6
NFDM	30	30		22.3
WMP	30	30		22.3
Australia (developed)				
Butter				
Cheese	25.8	25.8		11.0
NFDM				

Source: FAPRI Database for all countries except for the U.S. Cheese Tariff Schedule of the United States (2007) for the data on over-quota average tariffs $/kg. The data on over-quota butter, NFDM, and WMP avg tariffs ($/kg) were taken from Pajić (2008). World prices of cheese, butter, NFDM, and WMP were taken from the Penn State/ERS model database.

Table 3. Global Cheese Excess Supply, Excess Demand, and Price in 2004

	Units	Baseline	Model	Change	% Change
CHEESE		2004	2004	2004	2004
Excess Supply:	kmt				
U.S.		59	59	0	0
EU		516	-41	-557	R
Canada		8	-9	-17	R
Australia		217	259	42	19
New Zealand		293	398	105	36
Argentina		29	130	101	349
Ukraine		91	121	30	33
Total		**1,213**	***1,102***	**-111**	**-9**
Excess Demand:	kmt				
U.S.		214	216	2	1
Canada		22	22	0	0
EU		106	110	4	4
Australia		50	46	-4	-8
Brazil		5	5	0	0
China		24	2	-22	-93
Mexico		80	90	10	13
Russia		178	108	-70	-39
Total		**679**	***600***	**-80**	**-12**
ROW	kmt				
Model		**533**	***502***	**-31**	**-6**
World Price	$/mt	**2,612**	***3,331***	**718.7**	**28**

R = switches from net exporter to net importer

Table 4. Global Butter Excess Supply, Excess Demand, and Price in 2004

	Units	Baseline	Model	Change	% Change
BUTTER		2004	2004	2004	2004
Excess Supply:	kmt				
U.S.		8	10	2	19
EU		310	540	230	74
Canada		18	10	-8	-44
Australia		85	72	-13	-15
New Zealand		381	346	-35	-9
Argentina		3	-4	-7	R
Ukraine		35	34	-1	-2
Brazil		6	-1	-7	R
Total		**846**	***1,007***	**160**	**18.9%**
Excess Demand:	kmt				
U.S.		104	123	19	18
Canada		21	21	0	0
EU		93	111	18	19
Australia		9	9	0	2
China		13	16	3	22
Mexico		53	58	5	9
Russia		167	174	7	4
India		5	108	104	2309
Total		**464**	***620***	**156**	**33**
ROW	kmt				
Model		**382**	***386***	**4**	**1**
World Price	$/mt	**1,799**	***1,693***	**-105.5**	**-6**

R = switches from net exporter to net importer

Table 5. Global Nonfat Dry Milk (NFDM) Excess Supply, Excess Demand, and Price in 2004

	Units	Baseline	Model	Change	% Change
NFDM		2004	2004	2004	2004
Excess Supply:	kmt				
U.S.		206	198	-8	-4
EU		142	248	106	75
Canada		45	34	-11	-24
Australia		180	160	-20	-11
New Zealand		241	220	-21	-9
Argentina		18	5	-13	-75
Ukraine		63	62	-1	-1
Brazil		2	-11	-13	R
India		11	5	-6	-55
Total		**908**	***920***	**13**	**1**
Excess Demand:	kmt				
EU		26	26	0	0
Australia		2	2	0	0
Brazil		5	5	0	0
China		59	62	3	5
Mexico		145	150	6	4
Russia		45	46	1	4
Total		**282**	***291***	**10**	**3**
ROW	kmt				
Model		**626**	***629***	**3**	**1**
World Price	$/mt	**2,019**	***1,973***	**-46.6**	**-2**

R = switches from net exporter to net importer

Table 6. Global Whole Dry Milk Excess Supply, Excess Demand, and Price in 2004

	Units	Baseline	Model	Change	% Change
Whole Dry Milk		2004	2004	2004	2004
Excess Supply:	kmt				
EU		517	286	-231	-45
Australia		173	155	-18	-10
New Zealand		701	795	94	13
Argentina		160	180	20	12
Ukraine		18	20	2	12
Brazil		23	98	75	324
Total		**1,592**	***1,534***	**-58**	**-4**
Excess Demand:	kmt				
Australia		11	11	0	0
Brazil		20	20	0	0
China		68	39	-29	-43
Mexico		26	25	-1	-2
Russia		19	19	0	-1
Total		**144**	***114***	**-30**	**-21**
ROW	kmt				
Model		**1,448**	***1,419***	**-29**	**-2**
World Price	$/mt	**2,024**	***2,296***	**272.0**	**13**

Appendix A – Component Accounting Methodology

A unique aspect of the U.S. model used in this study is that it simulates dairy commodity production using a component accounting or mass balance approach based on the component content of milk and dairy products. One of the first studies to account for milk components was published by USDA in order to portray Commodity Credit Corporation (CCC) purchase of surplus dairy products and imports on a milk equivalent (ME), total solids basis (USDA 1991). This was a reporting requirement of the Food, Agriculture, Conservation and Trade Act of 1990. The methodology was to convert pounds of CCC purchases of butter, nonfat dry milk and cheese into equivalent amounts of milk on a milk fat, nonfat solids (or skim), and total solids basis (skim and milkfat). Both the milk fat and nonfat solids ME's were computed by using estimated "component representation factors" (CRF) which represent the amount of components in both milk and specific dairy products. These CRF's attempted to account for all milk solids in finished products, and for by-products not reflected in the finished product totals. The total solids ME was then estimated by weighting the ME milk fat total by 0.4 and the ME nonfat solids total by 0.6.

USDA's methodology for accounting for milk products purchased by the CCC continues to be used to approximate total use of dairy products on a ME basis. This is reported on both a ME milk fat and ME nonfat solids basis and used to develop supply and demand tables for milk. In essence, the methodology attempts to convert the milk components in finished dairy products into the equivalent amount of milk used to produce those components. But ME milk fat conversion presents one view of milk and ME nonfat solids presents another. And such approximations must make *ad hoc* assumptions regarding product yields, by-product production and surplus component use.

Fallert (1973) argued that any model of the U.S. dairy industry must consider both the milk fat and solid-not-fat (SNF) sides of the industry. To that end Fallert developed a methodology to determine the amount of milk fat and SNF utilized in the production of all dairy products reported each month by the National Agricultural Statistics Service. This approach was based on the milk fat and SNF content of milk, product yield coefficients, and some accounting assumptions for by-products, namely whey and buttermilk. He compared the milk fat and SNF in net milk sales (after accounting for on-farm use) to that used in domestic processing. This was a significant first step in direct component accounting. A major shortcoming of the approach, however, was that it did not account for imports and exports of dairy ingredients, although these were limited at the time. Another shortcoming was that the methodology focused on accounting for SNF. It would have been preferable to have separated protein from other dairy solids since the former has a much higher market value than the latter.

The methodology used in this paper to account for sources and uses of milk components (milk fat, protein, other dairy solids) employs the following steps:

1. Start with U.S. milk production
2. Compute the components in U.S. milk production
3. Evaluate the components in fluid, other fresh, and frozen desserts.

4. Subtract those components from the milk supply to determine the supply of manufacturing milk components.
5. Allocate the milk components first to cheese. Then subtract the components used in cheese from the supply of manufacturing milk.
6. Use the residual components to determine the production of butter and nonfat dry milk.

Milk components contained in milk production and in processed dairy products are accounted for using the following equation:

$$(1)\ C_k = \sum_i b_k^i * X^i * a^i,$$

$$s.t. \sum_k b_k^i = 1$$

where C_k is tons of component *k* (*mf*=milk fat, *pr*=protein, *os*=other dairy solids, and *m*=moisture) in finished dairy products, b_k^i is the percentage of component *k* in dairy product *i*, X^i is the amount of dairy product *i*, and a^i is the percentage of dairy solids in product X^i. For example, regular ice cream must contain at least 20 percent dairy solids. Thus one can assume that a is 0.20. The balance of ice cream is moisture and non-dairy solids (sweeteners, stabilizers, and flavors). The dairy solids portion of ice cream contains 18 percent protein (b_{pr}), 60 percent milk fat (b_{mf}), and 22 percent other dairy solids (b_{os}). The source of component levels in dairy products was USDA's nutrient database (2005).