# DAIRY TARIFF-QUOTA LIBERALIZATION: CONTRASTING BILATERAL AND MOST FAVORED NATION REFORM OPTIONS

JASON H. GRANT, THOMAS W. HERTEL, AND THOMAS F. RUTHERFORD

A highly disaggregated, "tariff line," source-differentiated, partial equilibrium model of U.S. specialty cheese imports is developed to investigate reform options for tariff-rate quotas (TRQs). A mixed-complementarity framework is used to represent bilateral and most favored nation (MFN) tariff quotas. The impacts of liberalizing U.S. specialty cheese imports via bilateral and MFN quota expansions, out-of-quota tariff cuts, and simultaneous liberalization scenarios are evaluated. We find that the path of liberalization is quite different, depending on the reform approach undertaken, particularly if the United States adopted an MFN quota administration mechanism for specialty cheese imports.

*Key words*: agricultural trade, mixed-complementarity problem, most favored nation, partial equilibrium, tariff-rate quotas.



Views on the applicability of quantitative trade policy models differ widely. Critics often point to the problem of policy aggregation. For example, Sumner (1993) argues that policy models are too aggregated and may be harmful to the policy debate. Meilke and de Gorter (1996) contend that quantitative analyses are "woefully inadequate" when trade policy negotiations intensify into sensitive product lines. Gardner (1993) claims that computable general equilibrium (CGE) models have not been illuminating because key elements of the proposals dealt with nonstandard policy instruments (i.e., tariff-rate quotas (TRQs)). Bureau and Salvatici (2003) note that differences in methods of aggregating protection is one of the main reasons why policy results are fundamentally different between models analyzing an almost identical set of liberalization scenarios.[1]

In this article, we illustrate a methodology to deal explicitly with the issue of policy aggregation, particularly when TRQs are present and administration procedures differ across countries and product varieties. More specifically, a highly disaggregated, export-differentiated, "tariff line" policy model calibrated to 2001 protection levels is developed as a mixed-complementarity problem (MCP) to investigate bilateral and multilateral TRQ reform options using the heavily protected U.S. specialty cheese import market as our case study.[2] The MCP framework (Rutherford 1995) enables us to trace out the entire path of TRQ liberalization as exporters move through different regimes. We focus on in- and out-of-quota imports, quota rents, composite imports, and import prices as TRQ liberalization progresses. This enables us to rank the effectiveness of four TRQ liberalization strategies.

TRQ liberalization in U.S. dairy is complex because there are two tariffs, a quota, three possible regimes, and a complex set of quota administration procedures. U.S. specialty cheese quota administration can be country specific, through designated quota

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[1] The authors concluded that "…almost all modeling efforts of agricultural trade liberalization and market access run into major difficulties (*due to aggregation*) that limit the scope and accuracy of their results" (p. 5, italics added).

[2] As noted by one reviewer, using 2001 as the baseline for dairy trade and protection is now somewhat outdated. However, when we began this work, this was the latest year for which complete data were available. We hope that future studies will build on this approach and update the data, as well as extending it to other products.

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licenses, or on an "any-country" (i.e., most favored nation (MFN)) basis across very disaggregate and heterogeneous tariff lines. Thus, effective analysis of TRQs requires manipulating them at the "tariff line."

Previous studies investigating the impact of TRQs typically focus on complete liberalization because of the difficulty in handling regime changes (Cox et al. 1999; Larivière and Meilke 1999; Elbehri et al. 2004; van der Messenbrugghe, Beghin, and Mitchell 2003; Langley, Samwaru, and Normile 2006). Moreover, TRQ administration methods that differ by country and variety at a very detailed product level are not amenable to aggregation for use in many quantitative policy models. As Stillman (1999) notes: "*It would be interesting to see an empirical application of dairy products limited by TRQs in the U.S.* to identify what level of quotas and tariffs are necessary to cause an increase in global trade" (p. 5, italics added). This study is the first of its kind to highlight the interaction between country-specific and MFN TRQ administration methods in a quantitative framework.[3]

## U.S. Dairy Trade and Protection

In 2001, U.S. dairy imports amounted to $1.5 billion dollars and accounted for the largest sectoral share of agricultural imports (Nicholson and Bishop 2004). The largest class of U.S. dairy imports in 2001 is cheese, which accounts for 59% of the total value of dairy imports at the HS4-digit level.[4] At the HS6-digit level, a sharper picture emerges. Over 50% of U.S. dairy imports by value are specialty cheeses (HS 040690).[5] Together, the European Union (EU), New Zealand, Australia, Argentina, and Canada supplied over 95% (90) of U.S. specialty cheese (total dairy) imports in 2001 with EU countries accounting for the largest share.

Figure 1 summarizes 2001 protection levels in U.S. dairy taken from the Market Access Maps data set (MAcMap) (Bouët et al. 2004). The length of the bar depicts the simple average applied tariff rate, which is composed of an ad valorem tariff and the ad valorem equivalent (AVE) of specific tariffs. The United States applies specific (ad valorem) tariffs on twenty-two (fifteen) out of twenty-four tariff lines. What is notable in figure 1 is that the United States has established TRQs on eighteen dairy product lines.

TRQs were introduced in the Uruguay Round (UR) as a compromise for countries seeking additional policy flexibility after the conversion of nontariff barriers into bound tariff equivalents (Abbott and Morse 2000; Boughner, de Gorter, and Sheldon 2000).[6] TRQs combine quantitative restrictions and tariffs. Exporters face a lower in-quota tariff when import demand is below the quota level (regime 1). When import demand is stronger but the out-of-quota tariff is prohibitive, the TRQ is similar to a de facto quota (regime 2). Quota rents can accrue to the importing or exporting country or both depending on the method of TRQ administration. When import demand is sufficiently strong, imports can occur in unlimited quantities but a much higher out-of-quota tariff applies on shipments above the quota level. However, imports up to the quota level face a much lower tariff rate. Thus, the problem is who gets the right to supply under the quota?

This has led to a complex web of quota administration methods in U.S. specialty cheese imports.[7] Specialty cheese imports that enter under the quota are subject to licensing requirements (IATRC 2001).[8] Prior to the UR, specialty cheese quotas were allocated primarily by designated (i.e., country-specific) licenses. After the UR, however, the United States introduced MFN, or "any-country" licenses for quota. The newly created MFN quota was a strategic choice because it helped increase its market access commitments agreed to during the UR. Thus, further MFN quota expansion may be an important part of future TRQ liberalization in U.S. dairy.

[3] There are other alternatives to deal with complex trade policies. Anderson and Neary (1996) showed how a complex vector of trade policy (tariffs and quotas) can be summarized in a single index, called the trade restrictiveness index (TRI). In practice, however, the TRI assumes that the quotas are strictly binding and ignores different administration methods. These are fatal flaws when it comes to TRQs.

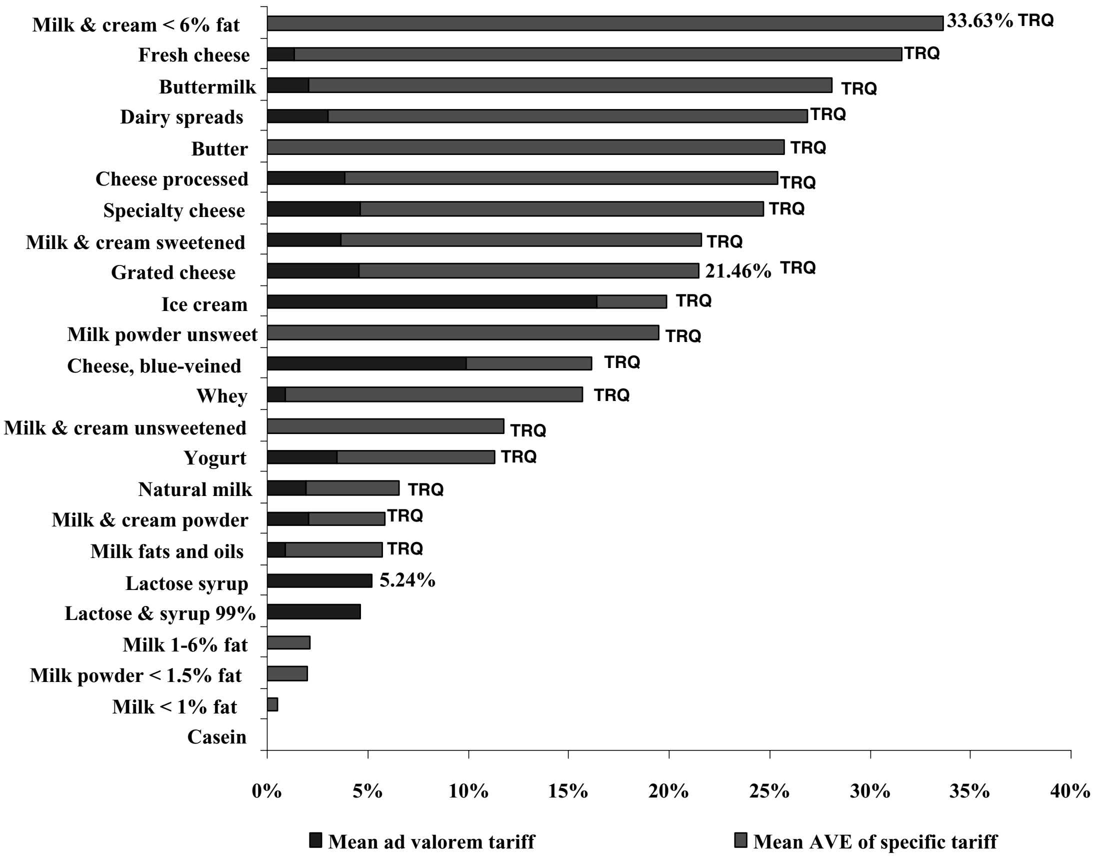
[4] HS refers to the Harmonized Commodity Description and Coding System. In total there are over 5,000 products at the HS6-digit level covering ninety-eight chapters. Dairy falls under chapter 04 and contains twenty-four HS6-digit product lines.

[5] Specialty cheese varieties that fall under HS 040690 are Bryndza, Cheddar, Colby, Edam, Gouda, Goya, Romano, Parmesan, Provolone, Sbrinz, Swiss, and other cheese substitutes.

[6] Forty-three WTO members have designated TRQs in their tariff schedules for a total of 1,427 individual quotas (Abbott and Morse 2000).

[7] For an exhaustive list of the possible TRQ administration methods, see Skully (1999).

[8] Licensing of tariff quotas is administered annually by the Foreign Agricultural Service (FAS) of the U. S. Department of Agriculture (FAS-USDA). U.S. tariff-quota licenses for dairy are: designated quota licenses, historical quota licenses, nonhistorical (lottery-based) licenses, first-come-first-served licenses, or any-country (MFN) licenses.




Source: CEPII's MAcMap database for 2001 (Bouët et al. 2004) and author's calculations.

**Figure 1. Import protection in the U.S. dairy market, 2001**

One of the contributions of this article is to identify some important interactions between existing country-designated quotas and newly created MFN (i.e., any-country) quota.

## The Subsector Dairy Model

Dairy products are differentiated by country of origin (Armington 1969). In what follows, $g$ denotes one of twenty-four HS6-digit dairy products; $d$ denotes final or intermediate demand segments; and $r$ and $s$ index source and destination regions, respectively.[9]

Subsector dairy products are produced using a constant elasticity of transformation (CET) function that permits dairy capacity to be shifted between twenty-four HS6-digit products:[10]

$$(1) \qquad Y_r = \left( \sum_g \left(\theta^Y_{g,r} P^Y_{g,r}\right)^{1+\gamma} \right)^{\frac{1}{1+\gamma}}$$

where $Y_r$ is the CET unit revenue function that determines the responsiveness of individual product supply to price, $\theta^Y_{g,r}$ is the CET share parameter, and $\gamma$ is the elasticity of transformation.

Market clearing ensures subsector output is sufficient to cover demand:

[9] Following the GTAPinGAMS model (Rutherford 2005), equilibrium conditions in the dairy model are based on a "dual" approach where zero profits and market clearing determine an equilibrium under perfect competition and constant returns to scale. The variables that define an equilibrium are activity levels and prices, which is different from standard equilibrium modeling because quantity variables are implicit in the model and calculated after a counterfactual scenario is run, but need not appear as explicit variables.

[10] We recognize that the CET functional form is an imperfect characterization of dairy supply because it assumes dairy capacity can be transformed among twenty-four HS6-digit products at a constant rate. However, dairy is a multiproduct industry that potentially produces all twenty-four HS6-digit products.

(2)

$$Y_r\left(\frac{P^Y_{g,r}}{P^Y_r}\right)^{\gamma} X^Y_{g,r} = \underbrace{\sum_d X^D_{g,d,r}\left(\frac{P^A_{g,d,r}}{P^Y_{g,r}}\frac{(1+\bar{t}^{AD}_{d,r})}{(1+t^{AD}_{d,r})}\right)^{\sigma}\left(\frac{P^A_{d,r}}{P^A_{g,d,r}}\right)^{\sigma} A_{d,r}}_{DOMESTIC} + \underbrace{\sum_s X^{EX}_{g,r,s}\left(\frac{P^M_{g,s}}{P^X_{g,r,s}}\right)^{\sigma_M} M_{g,s}}_{EXPORT}.$$

The expression on the left-hand side of (2) represents production activity, where $X^Y_{g,r}$ is the value of subsector output, and $P^Y_r$ is the CET unit revenue function at the industry (dairy sector) level. The first term on the right-hand side of (2) represents domestic demand activity ($X^D_{g,r}$). The variable $t^D_r(\bar{t}^D_r)$ is the (benchmark) tax rate on domestic goods and $\sigma$ is the elasticity of substitution between domestic goods. The second term is the activity level for export demand; $X^{EX}_{g,r,s}$ is the activity level of subsector bilateral trade, $M_{g,s}$ denotes subsector imports into region $s$, and $\sigma_M$ is the elasticity of substitution between imports.

We introduce several bilateral and one global MFN TRQ for specialty cheeses. Equilibrium in tariff-quota trade implies zero profits after appropriate distribution of quota rents. Following the MCP convention (Rutherford 1995), we use perp notation ($\perp$) to signify complementarity conditions. The zero-profit condition for in-quota trade ($X^{IQ}$) is

(3)

$$X^{IQ}_{SC,r,s} \geq 0 \perp P^X_{SC,r,s} - P^Y_{SC,r}T^{in}_{g,r,s} - q^{rent}_{g,r} \leq 0$$

where $T^{in}_{g,r,s}$ denotes the power of the in-quota trade cost between $r$ and $s$, including taxes/subsidies and transport margins. For $X^{IQ}_{SC,r,s} \geq 0$ to hold with strict *inequality*, $P^X_{SC,r,s} \leq P^Y_{SC,r}\ T^{in}_{g,r,s} + q^{rent}_{g,r}$ must hold with strict *equality*. Thus, the complementarity condition states that either $X^{IQ}_{SC,r,s}$ or $P^X_{SC,r,s} - P^Y_{SC,r}T^{in}_{g,r,s} - q^{rent}_{g,r}$ must equal zero such that $X^{IQ}_{SC,r,s}\ {}^*(\mathrm{P}^X_{SC,r,s} - P^Y_{SC,r}\ T^{in}_{g,r,s} - q^{rent}_{g,r}) = 0$. In the case of regime 2 (pure quota regime), quota rents ($q^{rent}_{g,r}$) precisely exhaust the difference between the domestic supply price in the source region ($P^Y_{SC,r}$) and the tariff-inclusive import price ($P^X_{SC,r,s}$) once in-quota imports hit the quota level. In other words, $q^{rent}_{g,r}$ is a slack variable that takes on value once $X^{IQ}_{SC,r,s}$ hits the quota level denoted $X^{UP}_{SC,r,s}$ which is country specific:

(4) $$q^{rent}_{g,r} \geq 0 \perp X^{IQ}_{SC,r,s} \leq X^{UP}_{SC,r,s}$$

where $q^{rent}_{g,r} > 0$ can only occur if $X^{IQ}_{SC,r,s} \leq X^{UP}_{SC,r,s}$ holds with strict equality. Quota rents are assumed to accrue to the source region ($r$).

Analogously, the zero-profit condition for out-of-quota trade is

(5) $$X^{OQ}_{SC,r,s} \geq 0 \perp P^X_{SC,r,s} - P^Y_{SC,r}T^{out}_{g,r,s} \leq 0$$

where positive out-of-quota trade $X^{OQ}_{SC,r,s} > 0$ implies that $P^X_{SC,r,s} \leq P^Y_{SC,r}\ T^{out}_{g,r,s}$ must hold with strict equality.

MFN (or any-country) quota licenses are reviewed and allocated by the Foreign Agricultural Service (FAS) of the U.S. Department of Agriculture (FAS-USDA) based on license applications that specify the product type and quality standards. To implement this in the model, we assume MFN quota is auctioned to the highest bidder. In equilibrium, the highest bids will come from those exporters supplying the highest valued cheeses, and are currently out-of-quota.[11] These countries can bid an amount slightly lower than their bilateral out-of-quota tariff and still garner additional revenue, since they do not have to pay the out-of-quota premium on the newly expanded MFN quota.

Since products in the model are differentiated by origin, we need to convert bilateral flows into a common unit in order to compute MFN quota fill. We do so by incorporating bilateral unit value of products. Specifically, we sum the value of all bilateral (i.e., country-specific) quotas, and divide each one by the appropriate exporter unit value:

(6) $$X^{MFN}_{SC,r,s} = \sum_r \frac{X^Q_{SC,r,s}}{UV_{SC,r}}$$

where $X^{MFN}_{SC,r,s}$ denotes the MFN quota activity level of bilateral trade between $r$ and $s$, $X^Q_{SC,r,s}$ is the value of country-specific quota level that is allocated to country $r$ by country

[11] In-quota exporters have no incentive to increase supply to a market where marginal cost is already equal to price, less the in-quota tariff.

$s$, and $UV_{SC,r}$ is the unit-value price of specialty cheese in region $r$. In the benchmark (2001) data, we assume that $X^{MFN}_{SC,r,s} = 0$ and then introduce MFN quota in increments of 5%. This assumption is not unrealistic since MFN quota currently accounts for 5% of total country-specific U.S. specialty cheese quotas.

Zero profits determine the equilibrium level of MFN quota trade:

$$(7) \quad X^{MFN}_{SC,r,s} \geq 0 \perp UV_{g,r}\left(P^{X}_{SC,r,s} - P^{Y}_{SC,r} T^{in}_{g,r,s}\right) \leq qrent^{MFN}_{g,s}$$

where $qrent^{MFN}_{g,s}$ denotes the value of MFN quota rents. Note how MFN quota rents are indexed over $s$ (i.e., the United States). A common MFN quota market implies the existence of a single quota price. For $X^{MFN}_{SC,r,s} \geq 0$ to hold with strict inequality, the difference between the destination price ($P^{X}_{SC,r,s}$) and marginal costs inclusive of the in-quota tariff ($P^{Y}_{SC,r} T^{in}_{g,r,s}$) scaled by the unit values ($UV_{g,r}$) must equal the MFN quota rent available (which we assume is collected by the U.S. government).

All tariff-quota activities must satisfy market clearing:

$$(8) \quad X^{IQ}_{SC,r,s} + X^{OQ}_{SC,r,s} + X^{MFN}_{SC,r,s} = X^{EX}_{SC,r,s}\left(\frac{P^{M}_{SC,r}}{P^{X}_{SC,r,s}}\right)^{\sigma_M}$$

where exports of specialty cheese ($SC$) can be delivered as in-quota trade ($X^{IQ}_{SC,r,s}$) including the case of regime 2, as out-of-quota trade ($X^{OQ}_{SC,r,s}$), or by bidding for quota in the MFN market ($X^{MFN}_{SC,r,s}$). Equation (8) determines the equilibrium product price ($P^{X}_{SC,r,s}$) in the destination (U.S.) market, which is source ($r$) and destination ($s$) specific.

The quantity of subsector imports must be sufficient to cover demand ($d$) in different markets (final or intermediate demand):

$$(9) \quad M_{g,i,r} X^{AM}_{g,i,r} = \sum_{d} X^{IM}_{g,d,r}\left(\frac{P^{A}_{g,d,r}(1+\bar{t}^{AM}_{d,r})}{P^{M}_{g,r}(1+t^{AM}_{d,r})}\right)^{\sigma_M} \times \left(\frac{P^{A}_{d,r}}{P^{A}_{g,d,r}}\right)^{\sigma} A_{d,r}$$

where $X^{AM}_{g,r}$ denotes aggregate expenditure on subsector imports, $X^{IM}_{g,d,r}$ denotes the activity level for import demand, and $t^{AM}_{d,r}$ is the tax rate on imports (with benchmark level $\bar{t}^{AM}_{d,r}$). The unit cost of subsector imports ($P^{M}_{g,r}$) is a share-weighted ($\theta^{M}_{g,s,r}$) CES function of the destination price ($P^{X}_{g,r,s}$):

$$(10) \quad P^{M}_{g,r} = \left(\sum_{g}\left(\theta^{M}_{g,s,r} P^{Xss}_{g,s,r}\right)^{1-\sigma_M}\right)^{\frac{1}{1-\sigma_M}}$$

where $\sigma_M$ is the elasticity of substitution between import sources ($r$). This composite price enters a higher level CES function that determines the Armington price index of domestic consumption ($P^{A}_{g,d,r}$) as a share-weighted composite of domestic ($\theta^{D}$) and imported ($\theta^{M}$) varieties governed by the import–domestic elasticity of substitution ($\sigma_{DM}$)[12]:

$$(11) \quad P^{A}_{g,d,r} = \left(\underbrace{\theta^{D}_{g,d,r}\left(\frac{P^{Y}_{g,r}(1+t^{AD}_{d,r})}{(1+\bar{t}^{AD}_{d,r})}\right)^{1-\sigma}}_{DOMESTIC} + \underbrace{(1-\theta^{D}_{g,d,r})\left(\frac{P^{M}_{g,r}(1+t^{AI}_{d,r})}{(1+\bar{t}^{AI}_{d,r})}\right)^{1-\sigma_{DM}}}_{IMPORTED}\right)^{\frac{1}{1-\sigma_{DM}}}.$$

In the final stage, subsector dairy products substitute for one another in a CES function that forms aggregate domestic dairy consumption:

$$(12) \quad A_{d,r} = \left(\sum_{g}\left(\theta^{D}_{g,d,r} P^{A}_{g,d,r}\right)^{1+\sigma}\right)^{\frac{1}{1-\sigma}}$$

where $\sigma$ is the elasticity of substitution between subsector dairy products in final consumption.

## Data and Model Parameters

In this section we discuss trade flow, protection, and domestic data sources as well as the key

[12] This is a critical feature of our approach because it implies that imports substitute for domestic products at the HS6-digit level. In Gohin and Laborde (2006), for example, the authors aggregate imports across HS6 categories before permitting them to substitute for domestic goods. This blunts the impact of heterogeneous tariffs at the HS6 level—effectively eliminating the variation observed in figure 1.

parameters of the model. This is followed by a discussion of TRQ fill ratios. To save on space, we frequently refer the reader to our technical appendix in Grant, Hertel, and Rutherford (2008).

### *Trade, Protection, and Domestic Data*

Trade flows and tariff rates at the HS6-digit level are taken from the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII) MAcMap data set for the year 2001 (Bouët et al. 2004).[13] Domestic use data at the HS6-digit level simply do not exist. However, in our technical appendix we develop a method to impute domestic demands based on target import intensity shares (Grant, Hertel, and Rutherford 2008). We recognize that this is an imperfect characterization of the dairy sector. However, competition among dairy products at the tariff line is essential to our approach. Until domestic data become available at this level of detail, our approach provides a reasonable starting point.

### *Model Parameters*

There are four parameters in the model: (*a*) the import–domestic elasticity of substitution ($\sigma_{DM}$), (*b*) the import–import elasticity of substitution ($\sigma_M$), (*c*) the elasticity of substitution in consumption ($\sigma$), and (*d*) the transformation elasticity ($\gamma$). When tariffs are reduced, $\sigma_{DM}$ will govern the extent to which imports displace domestic goods. Moreover, the ease with which consumers can substitute across imported cheeses depends on $\sigma_M$. The importance of these Armington elasticities is highlighted in McDaniel and Balistreri (2002), who show that Armington parameters drive the quantitative and even the qualitative results of trade reform.

Hertel et al. (2007) and Hummels (2001) use variation in trade and transport costs across source regions to estimate $\sigma_M$. Their estimate of $\sigma_M$ for all dairy products is 7.3. Using a similar methodology, we estimate values of $\sigma_M$ pertaining only to specialty cheese. More details on the econometric specification and results can be found in Grant (2007). Using variation in applied protection rates from MAcMap (Bouët et al. 2004) matched to trade flows in 2001, we find that the elasticity of substitution between all dairy products from different sources are moderately substitutable with $\sigma_M = 4.94$ and highly significant. However, the import–import substitution elasticity is almost twice as large when we restrict our attention to specialty cheese product lines. In this case, $\sigma_M = 8.11$ and is highly significant. This is the value we adopt in the model.

It is harder to estimate $\sigma_{DM}$ since this requires combining trade data with data on domestic utilization. Several industry-level estimates are available in the literature (see, e.g., Stern, Francis, and Schmacher 1976; Shiells, Stern, and Deardorff 1986; Reinert and Roland-Holst 1992; Shiells and Reinert 1993; and Gallaway, McDaniel, and Rivera 2003). In the United States, the National Agricultural Statistics Service of the USDA (NASS-USDA) provides domestic shipment and price data for some varieties of specialty cheese.[14] We follow Gallaway, McDaniel, and Rivera (2003) and estimate $\sigma_{DM}$ by regressing the first difference of the ratio of imports to domestic quantities on their relative price ratios using domestic shipments and aggregate import data from 1970 to 2005. The results (discussed in greater detail in Grant 2007) reveal that imported and domestic specialty cheese varieties in the United States are quite substitutable. The simple average import–domestic elasticity of substitution across all four varieties for which data are available is 3.38. This is the value we adopt in the model.

The final two parameters govern the aggregate responsiveness of supply and demand. Our results are much less sensitive to their values.[15] Because dairy products share the same input, fluid milk, we believe the transformation elasticity ($\gamma$) should be quite large, in absolute value, and set it equal to four. Thus, a permanent rise in the price of cheese, relative to butter, for example, would be accompanied by a significant increase in cheese supplies from the dairy industry. The other parameter required in the model is the elasticity of substitution in consumption ($\sigma$) across HS6-digit products. How responsive are consumers to price when choosing between cheese, fresh milk, and yogurt products? While this substitutability is surely larger than that between dairy products as a group and other food items,

[13] MAcMap is developed jointly by the International Trade Center in Geneva (ITC) and Paris-based CEPII (Bouët et al. 2004) and includes an exhaustive list of applied and bound ad valorem and specific tariffs, taking into account an extensive list of tariff preferences (www.cepii.com).

[14] Domestic quantity and price data for four specialty cheese varieties that are available with consistent time coverage are: aggregate cheese, American cheese, Cheddar cheese, and Swiss cheese.

[15] We have conducted considerable sensitivity analysis with respect to these values. The impacts of U.S. trade policy are robust to variation in these parameters (i.e., cutting by half and doubling their values).

we are inclined to believe this is not nearly as large, in absolute value, as the transformation elasticity, so we set it equal to 1.0, thereby fixing the share of the representative consumer's total dairy budget devoted to specialty cheeses (i.e., the effect of any price rise will be offset by a quantity decline).

### *U.S. Bilateral Tariff-Quota Data and Unit Values*

The technical appendix (Grant, Hertel, and Rutherford 2008) provides the details on our methodology for computing bilateral TRQ fill ratios. These ratios are as follows for the key exporters: Other South America: SAM = 2.10, Australia: AUS = 2.07, New Zealand: NZL = 1.49, Canada: CAN = 1.32, the EU15: EU = 1.21, Argentina: ARG = 1.16, and Rest of Europe: ROE = 0.88. Six exporting regions in our model are out-of-quota in 2001 with two of them (AUS and SAM) exporting more than twice their quota allocations (for a list of all countries and other sectors included in the model, see our technical appendix). Clearly these exporters have a lot at stake when it comes to liberalizing U.S.'s specialty cheese TRQs.

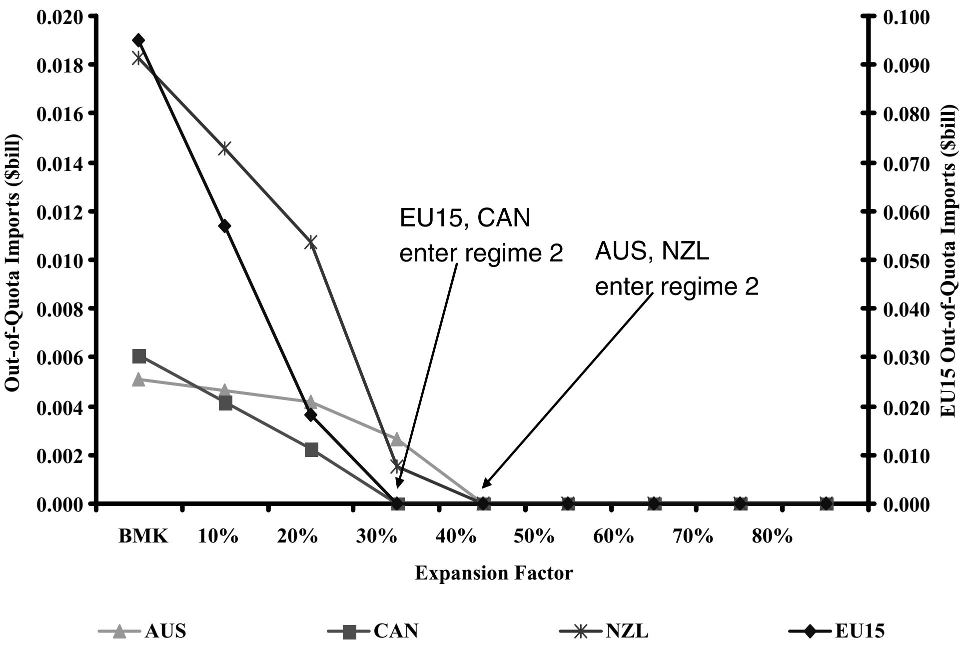
Bilateral unit values are a critical component of the bid prices an exporter can offer for MFN quota. We draw on the U.S. International Trade Commission's (USITC) Interactive Tariff and Trade database (dataweb.usitc.gov) to estimate unit values by exporter. The EU-15 supplies the highest valued specialty cheese. Normalizing on the EU-15 unit values, we have the following ranking: EU (1.0), CAN and ROE (0.9), NZL (0.8), AUS (0.7), ARG (0.6), and SAM (0.4).

## Results

Four specialty cheese liberalization experiments are performed: (*a*) expanding bilateral (i.e., country-designated) quotas, (*b*) cutting out-of-quota tariffs, (*c*) simultaneously expanding bilateral quotas and cutting out-of-quota tariffs, and (*d*) expanding newly created MFN quota. All experiments progressively liberalize TRQs until complete liberalization is achieved. Due to space limitations, we focus our discussion on bilateral and MFN quota expansions. However, we conclude by ranking all four TRQ liberalization options in terms of improving market access.

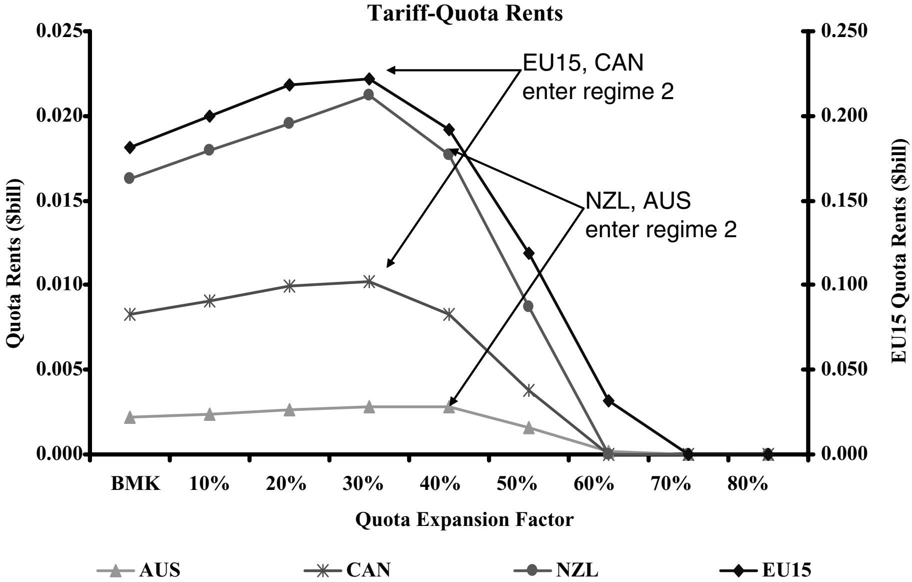
### *Bilateral Quota Expansion*

Figure 2 reports the path of out-of-quota imports for NZL, CAN, AUS, and the EU15 members (other exporters are suppressed for ease of exposition). Quota expansions of less than 30% may not result in a significant




Note: BMK denotes the benchmark equilibrium. For scaling reasons, the EU15 imports are illustrated on the secondary vertical axis.

**Figure 2. Out-of-quota specialty cheese imports after bilateral quota expansion**




Note: BMK denotes the benchmark equilibrium. For scaling reasons, the EU15 quota rents are illustrated on the secondary vertical axis.

**Figure 3. Value of specialty cheese tariff-quota rents after bilateral quota expansions**

improvement in market access because many exporters of specialty cheese are substantially out-of-quota (regime 3). For the EU15 and CAN (AUS and NZL) to move out of regime 3, a 30% (40%) quota expansion is required. Until exporters move out of regime 3 and into regime 2, there is no price decline and hence no increase in imports.

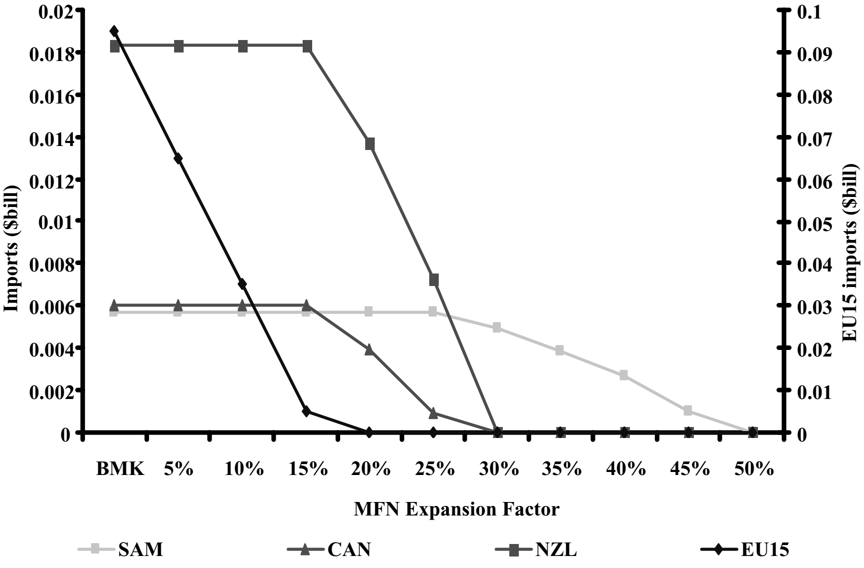
Figure 3 tracks the level of bilateral tariff-quota rents, assumed to accrue to the exporting country. Modest quota expansions (<30%) actually increase rents, since the United States is swapping out-of-quota tariff-laden imports for in-quota tariff-laden imports. This shifts tariff revenues (by the difference between the in- and out-of-quota tariffs) from the United States to specialty cheese exporters in the form of increased quota rents. Quota expansions greater than 30% move the EU-15 and CAN into regime 2 where quota rents dissipate quickly. However, a 70% U.S. specialty cheese bilateral quota expansion is necessary for these four exporters to move into regime 1.

*MFN Quota Expansion*

In this scenario, we introduce and expand a global MFN quota for specialty cheese in increments of 5% of total bilateral quotas. We can gain substantial insight into the workings of this MFN scenario by simply plotting the behavior of bilateral out-of-quota exports for each increment of MFN TRQ expansion (figure 4). For illustrative purposes, AUS has been dropped from figure 4 and replaced with the South American Group (SAM) of countries whose unit value prices are much lower.

One of the key insights offered by our study is the fact that the EU-15 and CAN are likely to simply divert bilateral out-of-quota exports to the MFN quota market, initially. In other words, out-of-quota exporters exhibit a horizontal supply function as long as there are still out-of-quota bilateral exports to be diverted to the MFN market. At the margin, they are not earning any rents on these exports, so they can costlessly divert this trade from the bilateral to the MFN quota market until they eliminate their over-quota bilateral exports. This is an important insight offered by our paper.

Moreover, from the point of view of market access, the MFN scenario is an attractive TRQ liberalization option. In the bilateral quota expansion discussed above, the EU15 moved into regime 2 after a 30% quota expansion (figures 2 and 3). In the MFN scenario, the EU15 bilateral out-of-quota exports are simply redirected to the MFN market, and absorb




Note: BMK denotes the benchmark equilibrium (no MFN quota available). For scaling reasons, the EU15 imports are illustrated on the secondary vertical axis.

**Figure 4. Bilateral out-of-quota specialty cheese exports under an MFN quota expansion**

all of the MFN quota expansion. Therefore, the EU15 moves out of regime 3 in the bilateral market much earlier, after only a 15% expansion of MFN quota, or *half* the amount of quota expansion it took to get the EU15 into regime 2 in the bilateral quota expansion scenario.

Once the EU15 has exhausted the transfer of its bilateral over-quota exports to the MFN market, their price falls and NZL and CAN begin successfully bidding for MFN quota. Both countries enter the MFN market after a 15% MFN quota expansion. MFN quota liberalization moves NZL out of regime 3 in its bilateral quota market after just a 30% MFN expansion, whereas it took a 40% bilateral quota expansion in the previous bilateral quota expansion scenario.

### *Comparing TRQ Liberalization Strategies*

In table 1 all four liberalization scenarios are judged with respect to one another by comparing aggregate import volumes and delivered (after tariff) import price changes. This is facilitated by measuring each scenario's percentage change in imports and import prices with respect to *increments of liberalization* versus absolute quota expansions as depicted in the previous figures. It takes a 190% bilateral quota expansion to move all countries into regime 1 (which we define as 100% liberalization). Thus, 100% liberalization is equivalent to a 190% bilateral quota expansion. Or, each 10% liberalization increment in table 1 is equivalent to a 19% bilateral quota expansion.

Consistent with the findings above, expanding bilateral quotas does not generate substantial market access until out-of-quota exporting countries move out of regime 3. A 76% bilateral quota expansion (40% liberalization) decreased the composite import price by 7.19% and increased aggregate imports by 30%. However, just a 20% out-of-quota tariff cut could generate an increase in market access equivalent to a 76% bilateral quota expansion! Expanding quotas on an MFN basis by 10% and 20% produces modest liberalization results. Thereafter, liberalization accelerates quickly. A 40% MFN quota expansion actually generates a larger increase (decrease) in imports (price) than comparable out-of-quota tariff cuts. Remarkably, complete liberalization (equal to a 273% increase in imports or a 190% bilateral quota expansion) occurs after MFN quota is expanded by only 50% of the amount required for full liberalization under the bilateral expansion scenario.

**Table 1. Specialty Cheese TRQ Liberalization Options Compared**

| | Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) Quota Expansion[a] | | (2) Out-of-Quota Tariff Cut | | (3) Simultaneous Liberalization | | (4) MFN Quota Expansion | |
| Liberalization | Composite Imports (%) | Composite Import Price (%) | Composite Imports (%) | Composite Import Price (%) | Composite Imports (%) | Composite Import Price (%) | Composite Imports (%) | Composite Import Price (%) |
| 10% | 0.85 | −0.25 | 13.51 | −3.53 | 13.51 | −3.53 | 0.00 | 0.00 |
| 20% | 0.92 | −0.27 | 30.09 | −7.19 | 30.09 | −7.19 | 4.41 | −1.22 |
| 30% | 6.38 | −1.75 | 50.55 | −10.98 | 50.56 | −10.98 | 21.30 | −5.33 |
| 40% | 30.01 | −7.19 | 75.92 | −14.87 | 76.30 | −14.92 | 77.16 | −15.04 |
| 50% | 96.20 | −17.51 | 107.60 | −18.84 | 125.70 | −20.78 | 272.61 | −31.62 |
| 60% | 215.41 | −28.16 | 147.42 | −22.87 | 219.52 | −28.43 | 272.61 | −31.62 |
| 70% | 270.31 | −31.49 | 197.89 | −26.94 | 268.68 | −31.40 | 272.61 | −31.62 |
| 80% | 271.08 | −31.54 | 258.60 | −30.84 | 272.61 | −31.62 | 272.61 | −31.62 |
| 90% | 271.85 | −31.58 | 272.61 | −31.62 | 272.61 | −31.62 | 272.61 | −31.62 |
| 100% | 272.61 | −31.62 | 272.61 | −31.62 | 272.61 | −31.62 | 272.61 | −31.62 |

Note: All values are percentage changes from benchmark equilibrium.
[a] Quota expansion values reported (scenario 1) have been scaled to reflect a percentage of full liberalization (100%) versus an absolute quota expansion. In figure 3, bilateral quotas were expanded in 10% increments and we saw that after a 70% expansion, EU15, CAN, NZL, and AUS entered regime 1. However, to get all model countries into regime 1 required a 190% quota expansion. For example, 40% liberalization of bilateral quotas is equivalent to a 76% absolute bilateral quota expansion (190/100 × 40).

## Conclusion

This article develops a practical approach to the problem of trade policy aggregation. In particular, working at the HS6-digit tariff-line level permits us to evaluate alternative TRQ liberalization strategies with different administration methods: designated (country-specific) licenses, and MFN (any-country) licenses. In particular, we highlight for the first time the interaction between MFN quota expansions and existing bilateral quotas that dominate U.S. dairy imports at present.

We find that expanding bilateral quota levels on the order of 20–30% will benefit some exporting countries through higher quota rents but will not generate much in the way of increased market access. For small liberalization commitments (<40%), cutting out-of-quota tariffs is the most efficient method of improving market access. This result is consistent with de Gorter and Boughner (1999) and Elbehri et al. (2004). However, liberalizing TRQs by expanding a global MFN quota, which is allocated by a competitive auction, produced some important insights. First, liberalization occurs in a cascading fashion. Those countries with the highest bids drop into the MFN market first, followed by those countries with lower unit value of products. Since the EU15 exports the highest valued specialty cheeses in 2001, they are first in this cascade of liberalization.

Second, the MFN scenario produced some interesting interactions with bilateral quotas currently in place. MFN quota expansions initially have little impact because exporters simply redirect bilateral out-of-quota exports to the MFN market. However, once this transfer is complete for the highest unit value exporter (the EU in this case), further MFN expansion increases trade rapidly toward the free trade equilibrium (more than simply expanding existing bilateral quotas.) Of course, eliminating the bilateral quotas and replacing them with MFN quotas would offer a more immediate expansion of trade, but it would likely encounter significant resistance from current quota holders who would see their quota rents evaporate immediately upon implementation of such a policy.

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