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Technical Annex

Implicit Tariffs on Imported Dairy Product Components in the United States

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This document is the technical annex to the full paper "Implicit Tariffs on Imported Dairy Product Components in the United States" which is available separately.

The purpose of this annex is to present the methodology that was developed to compute component-level prices and tariffs. We begin with the general method and then present modifications that are necessary if the approach is to reflect market realities.

General Methodology

Using data on volumes and values of imported dairy products and their component characteristics, implicit values for milk components can be estimated as follows:

(1) $\mathrm{MFV}_j = \dfrac{\%MF_j}{\%TS_j} * \mathrm{P}_j$

(2) $\mathrm{PRV}_j = \dfrac{\%PR_j}{\%TS_j} * \mathrm{P}_j$

(3) $\mathrm{OSV}_j = \dfrac{\%OS_j}{\%TS_j} * \mathrm{P}_j$

(4) $\%\mathrm{TS}_j = \%\mathrm{MF}_j + \%\mathrm{PR}_j + \%\mathrm{OS}_j$ and

(5) $\mathrm{P}_j = \mathrm{MFV}_j + \mathrm{PRV}_j + \mathrm{OSV}_j$

where for the *jth* imported product MFV, PRV, and OSV are the implicit import values of milk fat, protein, and other solids, respectively; %MF, %PR, and %OS are the percentage contents of these components per unit of imported product; %TS is the percentage total solids content; and P is the "world price" of the product (estimated from per unit import value).

Implicit component prices can then be derived as follows:

(6) $\mathrm{P}_j^{MF} = \dfrac{MFV_j}{\%MF_j}$

(7) $\mathrm{P}_j^{PR} = \dfrac{PRV_j}{\%PR_j}$

(8) $\mathrm{P}_j^{OS} = \dfrac{OSV_j}{\%OS_j}$

where P^{MF}_j, P^{PR}_j, and P^{OS}_j are component prices for milk fat, protein, and other solids for dairy product j, respectively.

Component tariffs can be calculated by allocating specific tariffs on imported products using the ratio of the values of their components to world prices. Where *ad valorem* tariffs also apply, these can be converted to their specific tariff equivalent by multiplying the *ad valorem* tariff by the world price. The total specific tariff on a product is allocated to each component as follows:

(9) $\mathrm{FT}_j^{MF} = \dfrac{MFV_j}{P_j} * \mathrm{TT}_j$

(10) $\mathrm{FT}_j^{PR} = \dfrac{PRV_j}{P_j} * \mathrm{TT}_j$

$$(11)\ \mathrm{FT}_j^{OS} = \frac{OSV_j}{P_j} * \mathrm{TT}_j$$

where FT_j^{MF}, FT_j^{PR}, and FT_j^{OS} are the implicit specific tariffs on milk fat, protein, and other solids components contained in dairy product j, respectively, and TT j is the total tariff (expressed as a specific tariff) on product j. Finally, component AVEs can be computed by converting fixed component tariffs to their *ad valorem* equivalents as follows:

$$(12)\ \mathrm{AVE}_j^{MF} = \frac{FT_j^{MF}}{P_j}$$

$$(13)\ \mathrm{AVE}_j^{PR} = \frac{FT_j^{PR}}{P_j}$$

$$(14)\ \mathrm{AVE}_j^{OS} = \frac{FT_j^{OS}}{P_j}$$

$$(15)\ \mathrm{AVE}_j = \mathrm{AVE}_j^{MF} + \mathrm{AVE}_j^{PR} + \mathrm{AVE}_j^{OS}$$

where AVE_j^{MF}, AVE_j^{PR}, and AVE_j^{OS} are the *ad valorem* equivalent tariffs for milk fat, protein, and other solids components in dairy product j, respectively, and AVE *j* is the *ad valorem* equivalent tariff on dairy product j. Note that in equations 12 through 14, fixed component tariffs are expressed as percentages of the world prices for the dairy products from which they are derived.

Component AVEs should sum to the AVE for the finished or intermediate product (equation 15). But imported dairy products often face both specific and *ad valorem* tariffs. Specific tariffs for dairy products can be converted to *ad valorem* equivalents by dividing by the world price of the product. The total AVE can then be computed as

$$(16)\ \mathrm{TAVE}_j = \mathrm{AVE}_j + \frac{FT_j}{P_j}$$

where TAVE is the total AVE for dairy product *j*, AVE is the *ad valorem* tariff, and FT is the specific tariff. Calculating the total AVE makes it possible to compare the sum of the computed component AVEs to the total reported AVE for each dairy product. This provides a check on the validity of the estimates obtained.

Modifications to Reflect Market Realities

The approach presented above uses unit values for imported dairy products and their associated tariffs to derive component-level prices and tariffs. This works well

for dairy products like cheese, which is a finished good that contains milk fat and protein in relatively similar proportions. We assume a zero value for the moisture and a small amount for "other solids" in cheese, and the remaining value is assigned to protein and milk fat. Using equations 6 and 7, the derived component prices for protein and fat in cheese would be the same. But the approach is not valid for products such as dry whey or skim milk powder, which contain relatively small amounts of valuable protein and large amounts of lactose with little market value. If we were to apply our general methodology to such products, the implicit price of protein would be substantially underestimated and that for lactose would be grossly overvalued. Similarly, a problem arises in valuing the components of whole milk powder, which is basically skim milk powder with the addition of some milk fat. With efficiently functioning markets, the price of whole milk powder should only exceed that of skim milk powder by the additional value of that fat. At the component level, the market would dictate that the derived price of milk fat from whole milk powder cannot exceed that of milk fat in, say, butter. Thus we modify the methodology presented above by making a number of assumptions to permit its application in a real world context.

We begin by assuming a price for other solids (OS) for use in dried milk HF, dried milk LF, and protein and whey products. OS mainly consists of lactose and some minerals. The lactose contained in intermediate products such as skim milk powder or dry whey has little market value. These products are mainly traded for the more valuable protein and milk fat components. One might assume that OS has an implied market value of zero, but under the U.S. Federal Milk Marketing Orders it has a derived minimal value based on the market price of dry whey (AMS, 2006). We take the export value for dry whey and use the federal order formula to derive a component price for OS at the U.S. border. We then subtract this minimal OS value from the U.S. import price of skim milk powder, dry whey, etc., before deriving the other component prices. In this way we assume some value for OS but assign most of the value to protein and milk fat.

For dried milk LF products, we also assume a market price for the milk fat component, since these products have a very low milk fat percentage compared to the other components. We use a price derived from the U.S. import price of anhydrous milk fat. For example, for a product like whole milk powder, we first deduct the value of milk fat and OS using our assumed milk fat and OS prices, and then derive the component price for protein as the remaining value. Conversely, if the milk fat

percentage exceeds 10 percent, we use the assumed price of OS and derive component prices for milk fat and protein using our general model.

For dried milk HF products, we use the OS price computed earlier and then derive implicit prices for milk fat and protein. Equations 3 and 8 in the general model must be modified, since P_j^{OS} is known. OSV^j can be calculated by rearranging equation 8 as follows:

(17) $OSV_j = P_j^{OS} * \%OS_j$

$\%OS_j$ is then deducted from %TS *j* (equation 4) to determine the remaining percentage of milk fat and protein contents. Next, the result from equation 17 is deducted from the total value of the given dried milk HF product (TV *j* in equation 5) to determine the value of the remaining components. This requires altering equations 4 and 5 as follows:

(18) $\%TS'_j = \%TS_j - \%OS_j = \%MF_j + \%PR_j$

(19) $RV_j = P_j - OSV_j$

where RV_j is the remaining value in total solids. The remaining product value and remaining percentage content then replace P_j and $\%TS_j$ in equations 1 and 2, as the product now consists of milk fat and protein only. Milk fat and protein values are estimated and used with equations 6 and 7 to compute component prices for the dried milk HF product.

In the protein and whey group, milk fat levels are negligible. Thus, only protein values, prices, and AVEs are computed. As in the case of dried milk HF, we use the OS price computed earlier. This value is then deducted from the total world price to derive a value for protein. This protein value and the protein percentage are then used to calculate a protein price and tariff.

For the dried milk LF products, the OS price computed earlier and a market price of milk fat are used to derive a price for protein. The value for OS is computed using equation 17. Equations 1 and 6 in the general model must be modified, as milk fat and OS prices are now given. Since P_j^{MF} can be derived from the U.S. import price of anhydrous milk fat, equation 6 can be rearranged and MFV^j can be computed as follows:

(20) $MFV_j = P_j^{MF} * \%MF_j$

Finally, %MF *j* and %OS *j* are then deducted from %TS *j* (equation 4) to derive the remaining percentage protein content in the dried milk LF product. Milk fat and OS values are deducted from the total value of the dried milk LF product (TV *j* in

equation 5) to determine the remaining protein value. This requires altering equations 4 and 5. After computing a value for protein (PRV j) using these equations, a protein price can be estimated using equation 7.

In the milk fat group, all other components (i.e., protein and OS) are assumed to have zero value since these products contain insignificant amounts of these components. Therefore, the percentage total solids content is equal to the percentage milk fat content, and the milk fat price is equal to the U.S. import price of the product.

An Example of Applying the Methodology

To apply the approach described above, import data were obtained from the U.S. International Trade Commission's (USITC) Interactive Tariff and Trade Data Web and the 2005 U.S. Harmonized Tariff Schedule (HTS), also published by the USITC. Customs value (in thousand dollars), first unit of quantity (in kilograms), dutiable value (in thousand dollars), calculated duties (in thousand dollars), c.i.f. import value (in thousand dollars), and tariff value of dairy products were collected. Given the large amount of data involved, we selected the most recent year (2004) for which published data were available to perform our analysis. U.S. tariffs in that year incorporate the full reductions under the Uruguay Round Agreement.

We use the general model and assumptions for a modified whey product from the protein and whey group (HTS code 0404.10.11 subject to a TRQ) to illustrate how component prices and tariffs are computed. The world (unit import price) for the product was $1,472.73 per ton and the tariff was $191.45 per ton. The component content of the product is protein 12.9 percent, milk fat 1.1 percent, moisture 3.2 percent, and other solids 82.8 percent (Chandan, 1997).

The *ad valorem* equivalent tariff for whey is computed as follows:

$$(21)\ \mathrm{AVE}_W = \frac{FT_W^{PR}}{P_W} = \frac{191.45}{1{,}472.73} = 13 \text{ percent}$$

where AVE_W is the *ad valorem* equivalent tariff on whey, FT_W is the specific tariff on whey, and P_W is its world price.

The price for OS in 2004 is estimated to be $387.81 per ton using the methodology outlined in the Federal Milk Marketing Orders, which take the wholesale price of dry whey and subtract a manufacturing allowance that reflects processing costs (USDA, 2006). We use the dried whey U.S. export price (HTS Code: 0404.10.40.00), since the U.S. does not import much whey. A make allowance of $350 per metric ton is approximated by computing the U.S. make allowance as a percentage of the wholesale price of dry whey and then applying this percentage to the U.S.

export price of whey. Once the OS price is derived, one can use equation 17 to compute the OS value:

(22) $OSV_W = P_W^{OS} * \%OS_W = 387.81 * 0.828 = \$321.11$ per ton

where OSV_W is the OS value, P_W^{OS} is the assumed OS price, and $\%OS_W$ is the percentage OS content in the modified whey product. Next, using the unit import price for whey, the assumed market price for OS, and equation 19, the remaining component value is computed:

(23) $RV_W = P_W - OSV_W = PRV_W = 1{,}472.73 - 321.11 = \$1{,}151.62$

where RV_W is the remaining component value in whey. This is also equal to the protein value, since there are no other components with a market value in the product. Using equation 18, the residual component content is

(24) $\%TS'_W = \%TS_W - \%OS_W = \%PR_W = 95.7 - 82.8 = 12.9$ percent

where $\%TS_W$ is the percentage total solids content, and $\%PR_W$ is the percentage protein content. To perform the remaining calculations, $\%TS'_W$ (12.9 percent) replaces $\%PR_W$, and RV_W ($1,151.62) replaces PRV_W in equations 7 and 10, and the protein price for whey is computed as

(25) $P_W^{PR} = \frac{PRV_W}{\%PR_W} = \frac{RV_W}{\%TS'_W} = \frac{1{,}151.62}{0.129} = \$8{,}927.29$ per ton

where P_W^{PR} is the protein price in whey, and PRV_W is the protein value in whey. The fixed protein tariff for whey is computed using equation 10:

(26) $FT_W^{PR} = \frac{PRV_W}{P_W} * TT_W = \frac{RV_W}{P_W} * TT_W = \frac{1{,}151.62}{1{,}472.73} * 191.45 = \$149.33$ per ton

where FT_W^{PR} is the fixed tariff on protein in whey, and TT_W is the total tariff on whey. Finally, component *ad valorem* equivalent tariffs are computed:

(27) $AVE_W^{PR} = \frac{FT_W^{PR}}{P_W} = \frac{149.33}{1{,}472.73} = 10$ percent

where AVE_W^{PR} is the *ad valorem* equivalent tariff on protein in whey.