Estimation of the Protein Content of US Imports of Milk Protein Concentrates

K. W. Bailey

Department of Agricultural Economics and Rural Sociology
Pennsylvania State University, University Park 16802

ABSTRACT

Recent declines in milk prices in the United States have sparked renewed concern that imports of milk protein concentrates (MPC) are increasingly entering the United States with very low tariff rates and is having an adverse impact on the US dairy industry. Milk protein concentrates are used in the United States in many different products, including the starter culture of cheese, or in nonstandard cheeses such as baker's cheese, ricotta, Feta and Hispanic cheese, processed cheese foods, and nutritional products. One of the difficult aspects of trying to assess the impact of MPC imports on the US dairy industry is to quantify the protein content of these imports. The protein content of MPC imports typically ranges from 40 to 88%. The purpose of this study is to develop a methodology that can be used to estimate the protein content of MPC on a country by country basis. Such an estimate would not only provide information regarding the quantity of protein entering the United States, but would also provide a profile of low- and high-value MPC importers. This is critical for market analysis, since it is the lower valued MPC imports that more directly displaces US-produced skim milk powder.

(Key words: harmonized tariff schedule, milk protein concentrates, tariff rate quota)

Abbreviation key: CIF = cost, insurance, and freight, FOB = free on board, MPC = milk protein concentrates, NMPF = National Milk Producers Federation, HTS = harmonized tariff schedule, WTO = world trade organization.

INTRODUCTION

Recent declines in milk prices in the United States have sparked renewed concern that imports of milk protein concentrates (MPC) are increasingly entering the United States with very low tariff rates. The Na-

tional Milk Producers Federation (NMPF), a trade association representing US dairy cooperatives, has recently linked increasing imports of MPC and low US milk prices (NMPF, 2003). They are proposing new tariff rate quotes in order to stem the tide of imports of MPC as well as imports of casein and caseinates.

Milk protein concentrate is essentially a dairy protein that is either liquid or spray dried. Most imported MPC is made from skim milk that is ultra filtered in order to separate the milk (casein and whey) protein from lactose. The filtration process results in a final form that contains varying levels of protein depending on end product use. The resulting retentate is then spray dried. Some MPC imports are actually blends of casein and nonfat dry milk. The NMPF has petitioned the U.S. Customs Service classification of MPC to exclude blends of other dairy products such as skim milk powder, whey protein, and casein (Cheese Market News, 2003). Imports of skim milk powder by itself would face a tariff rate quota, but blended in MPC, it would face a relatively low tariff.

Milk protein concentrate is used in the United States in many different products, including the starter culture of cheese or in nonstandard cheeses such as baker's cheese, ricotta, and Feta and Hispanic cheese, as well as various processed cheese products. Those cheeses with a standard of identity from the US FDA, which includes most natural cheese produced in the United States, are not allowed to use MPC outside of the starter culture. Milk protein concentrate is also used in ice cream and nutritional drinks. It is a very functional product for food processing because it can vary the protein-to-lactose ratio, even the protein-to-fat ratio, of the processed product. Milk protein concentrate is preferred in cheese production over skim milk powder because it adds a desirable product—protein—and excludes the extra costs of removing lactose.

There are two major import classifications of milk proteins. These classifications are based on the harmonized tariff schedule of the United States (HTS), which was established under the World Trade Organization (WTO). One MPC classification is HTS Chapter 4 (HTS code 04049010), which is defined as a dried dairy product that is at least 40% protein. Chapter 4 MPC can be

Received May 15, 2003.

Accepted July 8, 2003.

Corresponding author: K. W. Bailey; e-mail: baileyk@psu.edu.

made to alternative protein specifications such as MPC 42, 56, 70, and 80% protein depending on end use (Jesse 2003). Another MPC classification is CN products under HTS Chapter 35. This would include Chapter 35 MPC (HTS code 35011010), a 90% protein version of MPC obtained by a precipitation process; casein (HTS code 35011050), which is a milk protein made by treating skim milk with acid or rennet; and caseinates (HTS code 35019060), which is derived from CN by dissolving it in an alkaline solution of sodium or calcium in order to make the product soluble in water.

Imports of Chapter 4 MPC rose 18.1% in 2002 from a year ago to 33,626 t. There is no tariff rate quota on imports of MPC, just a low tariff rate of \$3.70 per t in 2002. The lack of an import quota and a low tariff rate explains part of the reason why MPC imports have grown in recent years. An earlier study by this author concluded that MPC imports rose in those years when the world price of skim milk powder (a reflection of world protein prices) fell significantly below the US support price level (Bailey 2002). The Northern European price of skim milk powder fell from a high of \$2200/t in September 2000 to a low of \$1163/t in August 2002. That compared to a US support price of \$1984/t for most of 2002. (The purchase price of skim milk powder fell to \$1764 beginning in November 2002.) This gap between the US domestic support price and the low world price in 2002 made it attractive to import MPC into the United States. Increased imports of MPC then displaced domestic consumption of skim milk powder, resulting in increased government purchases under the dairy price support program.

One of the difficult aspects of trying to assess the impact of MPC imports on the US dairy industry is to quantify the protein content of these imports. Chapter 35 MPC derived from a precipitation process contains about 90% casein. United States Customs classifies Chapter 4 MPC, however, as a product with from 40 to 90% milk protein. Thus, some knowledge of the average protein content of imports is required in order to analyze the market implications. The purpose of this study is to develop a methodology to estimate the protein content of Chapter 4 MPC on a country by country basis. Such an estimate would not only provide information regarding the quantity of protein in MPC imports, but it would also provide a country by country profile of low- and high-value MPC importers. This is critical for market analysis since it is the lower valued MPC imports that more directly displaces U.S. produced skim milk powder. It is also the protein content in MPC imports that directly affects cheese production and hence cheese prices.

MATERIALS AND METHODS

The methodology used in this study is based on the assumption that protein has a market value in both an exporting and importing country. The base market value of protein at the border of the importing country along with the export value of the product can be used to approximate the protein content of the imports. In the United States, the base protein price would be the price of skim milk powder, which contains less than 40% protein. One can assume that the higher the export value of the product from a specific country in relation to this base protein price, the higher the protein content of the MPC imports. Of course, one should also take into consideration the cost of moving that product from one country to the next.

The relationship between market prices in the exporting and importing country can be conceptualized in the price transmission equation. This relationship has been studied in earlier studies by Tweeten; Johnson; and Bredahl, Meyers, and Collins. The price transmission equation is described below.

Start with the price of MPC in an exporting country, in this case New Zealand:

$$P_{NZ}^{MPC} = \beta_{NZ}^{PR} \times P_{NZ}^{PR}, \quad [1]$$

where P_{NZ}^{MPC} is the average price of MPC in New Zealand, β_{NZ}^{PR} is the average percent protein for MPC exports from New Zealand, and P_{NZ}^{PR} is the market value of pure protein in New Zealand.

The price transmission equation between an exporting country like New Zealand and the United States is expressed below:

$$P_{US}^{MPC} = P_{NZ}^{MPC} \times (1 + C) + T, \quad [2]$$

where P_{US}^{MPC} is the domestic price of MPC at the border of the United States, C reflects costs such as U.S. tariffs, transportation costs from the dock to a plant just inside the United States and other importing costs like warehousing, and T is the cost of insurance and freight from the exporting country to the United States. Like equation [1] above, the US price of MPC imports from New Zealand at the border can be expressed as a function of the US pure protein price as follows:

$$P_{US}^{MPC} = \beta_{NZ}^{PR} \times P_{US}^{PR}, \quad [3]$$

where P_{US}^{PR} is the market value of pure protein at the US border, and β_{NZ}^{PR} reflects the implied protein percent of imports from New Zealand.

Using equations [2] and [3], one can solve for β_{NZ}^{PR} as follows:

$$\beta_{NZ}^{PR} = (P_{NZ}^{MPC} \times (1 + C) + T) / P_{US}^{PR}. \quad [4]$$

To illustrate, we will compute the average protein content of MPC imports from New Zealand in 2002. The USDA Foreign Agricultural Service's trade database provides the cost, insurance, and ocean freight (**CIF**) value; the free on board (**FOB**) value; and quantity of MPC imports from New Zealand. The FOB price reflects the market value of the product at the dock of the exporting country and therefore does not include ocean freight or insurance. Imports of MPC from New Zealand in 2002 were 20,609.5 t. The CIF value was \$77.354 million, and the FOB value was \$75.172 million, both for 2002. Thus the CIF and FOB values for 2002 were \$3753 and \$3647 per tonne, respectively.

A discussion with an importing broker reveals the actual cost of importing dried protein products like MPC into the United States. Ocean freight costs are anywhere from \$100 to 200 per tonne, plus \$3 to 4 per tonne for insurance. Tariff costs for MPC imports in 2002 were \$3.70 per tonne. Other importing costs are customs fees and harbor maintenance, which equate to about 0.25% of the import value. The freight forwarder charges \$200 to \$250 per bill of lading, which could represent several containers each of which holds 20 t of product. Inland freight charges from port to plant are about \$750 per container. And warehouse charges at the port are \$200 per mo per container. Other charges to consider are financing costs, insurance for inland transit, and profits for the importer. Excluding ocean freight and insurance, all importing costs for MPC are typically no more than 5% of the import value.

For our example, assume that the cost of freight and insurance from New Zealand to the United States for MPC, referred to as T in equation [4] above, was \$106 per t in 2002. This is based on the difference between the CIF and FOB values published by USDA. Thus, the only variable missing from equation [4] is the market value of protein in the United States.

Most exporters of MPC to the US set prices in relation to the market value of protein in skim milk powder. Skim milk powder is readily traded in world markets and price information is publicly available. For food processors considering MPC or skim milk powder in cheese production, the value in skim milk powder is all in the protein, because they must remove any lactose later in the production process. Prices for MPC at higher levels of protein (i.e., 70 and 85%) can thus be set at a premium relative to the base value of protein in skim milk powder. For example, in a recent market outlook report from NZMP, the dairy ingredient marketing arm

of Fonterra Co-Operative Group Ltd., New Zealand, the market outlook for protein products in the United States for the 2003/2004 fiscal year was higher for those products that had a protein content that exceeded that of skim milk powder. After dividing by protein content, the market prices were \$4921 per tonne for skim milk powder (36.2% protein), \$5669 per tonne for MPC 70, and \$6453 per t for MPC 82 (NZMP 2003).

One can therefore compute the market value of protein on the West coast for 2002 (Source: USDA Dairy Market News, various editions). The West Coast price of skim milk powder in 2002 was \$1985.5 per tonne. Considering that this product contains 36.2% protein, that would imply a protein price of \$5485 per t (USDA-ARS 2002). Substituting this into equation [4] above would imply that 2002 imports of Chapter 4 MPC from New Zealand contained 71.7% protein.

RESULTS AND DISCUSSION

The next step is to gather the relevant data to compute estimates for equation [4] for all major MPC-importing countries.

Data on Chapter 4 MPC imports and FOB values are used next to estimate protein percents on a country-by-country basis. The source for this data is USDA's Foreign Agricultural Service's U.S. Trade Internet Service. To use this internet service, simply select the HTS code level 8 to 10 for imports. Then select World Total, enter the HTS code 04049010 for Chapter 4 MPC imports, select a time period, and then enter either quantity, value (FOB), or CIF value. The data for major importers and the rest of the world are provided in Table 1. The data reveals that some countries export significant quantities of MPC to the U.S. in some years, only to fall to very low levels in other years. Overall, imports of Chapter 4 MPC's increased 98% over the period 1997 to 2002.

The MPC import data is used next to compute the per unit FOB values. The FOB sales data from the US Trade Internet Service was divided by the MPC imports for each country. The results are in Table 2. The data shows a surprising amount of variability. For 2002, the FOB values average \$3409 per tonne for all countries and range from a high of \$5684 per tonne for Ireland and a low of \$1742 per tonne for Germany.

The CIF sales values were also available from the U.S. Trade Internet Service provided by USDA. The per-unit estimates of the CIF value (CIF sales divided by MPC import quantities) were estimated this way. The difference between the CIF per unit values and the FOB per unit values were assumed to be the cost of ocean freight and insurance. In those cases where the estimate fell below \$100, it was assumed there was not

Table 1. Chapter 4 milk protein concentrate imports, 1997 to 2002.¹

Country	1997	1998	1999	2000	2001	2002
Metric tonne						
Australia	1,141	2,246	4,967	6,936	2,154	2,564
Canada	1,016	1,957	3,420	2,234	0	169
Denmark	14	92	80	961	254	701
Ireland	3,922	7,305	9,775	6,917	1,650	1,903
Estonia	60	180	300	80	201	237
France	306	0	339	931	80	200
Germany	1,175	1,445	5,261	7,018	730	4,327
Hungary	168	395	416	1,267	1,280	730
India	0	0	0	0	34	255
Netherlands	26	912	4,560	5,443	0	1,259
New Zealand	7,831	11,243	14,601	19,352	21,192	20,610
Poland	519	2,720	875	59	624	660
Other	820	433	283	1,731	269	12
Total	16,998	28,929	44,877	52,928	28,469	33,626

¹Source: USDA, Foreign Agricultural Service, 2003.

sufficient volume of sales to provide a good estimate. Thus the estimate of T in equation [2] above was floored at \$100. In addition, the estimate for C was kept at 5.0%.

A market value for pure protein in the United States is approximated next by dividing the West Coast price of US skim milk powder by the average protein content in skim milk powder of 36.2%. The source of this data was the USDA Dairy Market News Annual Summary (USDA, AMS). The market value of protein in the US western border fell steadily from \$6490 per tonne in 1997 to \$5485 per tonne in 2002. This steady drop was due to the “butter-powder tilt” that lowered the support price for skim milk powder and raised it for butter.

The computations above were next substituted into equation [4] in order to estimate the protein content of annual average MPC imports from major importers.

The results are presented in Table 3. The results indicate that the average protein level in Chapter 4 MPC imports varied from a low of 48.3% in 1999 to a high of 67.3% in 2002. It is apparent from Tables 1 and 3 that lower-valued MPC imports from Canada and Europe increased significantly in 1999, lowering the average protein content of MPC imports. On the other hand, imports of MPC from Europe were reduced significantly by 2002 and were offset by slightly higher value MPC imports from New Zealand.

Discussions with MPC importers revealed that there is a practical limit to the range in the protein content of MPC imports. Milk protein concentrate imports must contain at least 40% protein to meet US Customs definition of Chapter 4 MPC. Although the maximum protein content for Chapter 4 MPC is 90%, it would be unusual to see MPC protein levels exceed 88%, because

Table 2. Per unit free on board value of Chapter 4 milk protein concentrates, 1997 to 2002.¹

Country	1997	1998	1999	2000	2001	2002
US Dollars per metric tonne						
Australia	2,736	3,585	2,789	3,190	3,693	3,707
Canada	2,588	2,512	2,267	2,267	NA	2,066
Denmark	3,071	2,976	1,706	1,970	3,051	3,406
Ireland	6,078	4,391	3,268	3,113	4,538	5,684
Estonia	2,383	2,117	1,923	2,013	2,522	2,384
France	3,624	NA	2,640	2,586	3,409	2,060
Germany	2,688	2,774	1,947	2,061	2,750	1,742
Hungary	6,526	6,754	4,120	3,663	2,782	3,586
India	NA	NA	NA	NA	4,647	4,525
Netherlands	3,448	1,981	1,741	1,999	NA	1,839
New Zealand	3,444	3,463	3,082	3,431	3,593	3,647
Poland	2,204	1,900	1,764	2,961	2,253	2,636
Other	3,027	1,954	2,303	2,092	2,894	3,967
Total	3,873	3,427	2,724	2,897	3,550	3,409

¹Source: USDA, Foreign Agricultural Service, 2003.

Table 3. Estimates of protein contents of milk protein concentrate imports, 1997 to 2002.

Country	1997	1998	1999	2000	2001	2002
	%					
Australia	47.3	61.1	49.9	57.1	68.0	72.8
Canada	43.4	42.5	40.3	40.5	NA	41.4
Denmark	51.9	50.5	32.2	36.6	56.1	68.1
Ireland	100.4	73.2	57.7	55.2	82.0	111.1
Estonia	40.1	36.6	34.7	36.1	46.7	47.5
France	61.0	NA	47.0	46.7	62.0	41.3
Germany	45.6	47.4	35.0	37.4	50.6	35.9
Hungary	108.6	113.2	72.0	64.6	51.3	74.4
India	NA	NA	NA	NA	84.2	88.5
Netherlands	57.6	33.9	31.3	35.9	NA	37.5
New Zealand	58.1	58.7	54.7	60.7	65.6	71.8
Poland	38.0	32.8	32.0	53.0	42.3	53.4
Other	51.6	33.5	40.9	39.5	56.7	77.8
Total	64.9	57.8	48.3	51.4	64.9	67.3
EU	86.0	65.6	45.6	43.5	70.6	55.8
Other Europe	53.9	43.0	43.0	62.7	48.2	61.3

the cost of extracting lactose from the retentate would exceed its benefit. Thus, the computations in Table 3 should have a range of 40 to 88% protein. Yet the data range for just 2002 is 36 to 111%. The logical conclusion is that countries like Germany that had an estimated protein content of 36% in 2002 have discounted their MPC imports relative to US prices. On the other hand, countries like Ireland with an estimated protein content in 2002 of 111% have set a premium on their higher value MPC imports. Thus the estimates for Table 3 should be limited to no more than 88% and no less than 40% in order to get a practical estimate of the protein content of MPC imports. One can assume that the difference is largely due to discounts and premiums in the FOB value.

CONCLUSIONS

Imports of MPC have increased significantly in recent years. These imports enter the US with very low tariffs and are outside the tariff rate quota system that was negotiated during the Uruguay round of the WTO. At the time, ultra filtration technology was not widely used to manufacture dairy products. Many US dairy farmers and cooperatives are demanding that imports be slowed by imposing a tariff rate quota and increased tariffs on MPC and casein imports (NMPF, 2003).

One of the first questions to be asked when debating new tariff legislation for MPC is: what economic damage has it caused? In other words, how has it impacted the US dairy industry including dairy farmers as well as processors? To address that question, one needs to know how much actual protein has been imported into the United States. One can make reasonable assumptions when analyzing Chapter 35 MPC, casein, and

caseinates, since the amount of protein in these imports falls within strict ranges. That is not the case, however, with imports of Chapter 4 MPC, which technically range from 40 to 90% protein. This becomes a critical issue when one considers that Chapter 4 MPC imports increased 97.8% over the period 1997 to 2002.

This study developed a methodology to quantify the average protein level of Chapter 4 MPC imports from major MPC importing countries. This methodology provides a quantitative measure of the tons of imported protein that is potentially displacing US-produced protein. The results indicate that the protein in MPC imports averaged 52% over the period 1997 to 2002. This has a number of implications. First, it identifies which countries are importing high protein vs. low protein MPC. From a policy perspective, one can assume that lower valued MPC imports more directly displaces US-produced skim milk powder. Alternatively, it can be argued that higher value MPC imports do not displace US-produced protein and in fact fill a new market niche. Second, it quantifies how much the average protein content of Chapter 4 MPC changes from one year to the next. Third, it suggests that some countries are receiving premiums and others discounts on MPC imports relative to the US price of skim milk powder.

The major weaknesses with this approach are: 1) the results are not robust when import levels for some countries fall to very low levels, and 2) there is no way to quantify the premiums and discounts offered on MPC sales. The first weakness is easy to address. One could throw out country data in years when trade is very small. Also, one can aggregate countries into regions. An example is provided in Table 3, where two regions were aggregated: the European Union and other Europe. Finally, it would be very useful if further research

were conducted to isolate and quantify both premiums and discounts. It would also be useful to know if there were any public subsidies that have been used to offset price discounting.

REFERENCES

- Bailey, K. W. 2002. Implications of dairy imports: the case of milk protein concentrates. *Agric. Res. Econ. Rev.* 31:248–259.
- Bredahl, M. E., W. H. Meyers, and K. J. Collins. 1979. The elasticity of foreign demand for U.S. agricultural products: the importance of the price transmission elasticity. *Am. J. Agric. Econ.* 61:58–63.
- Cheese Market News. 2003. FDA, Customs act on controversial matters of ultrafiltered milk, MPC. 23(10).
- Jesse, E. 2003. "U.S. imports of concentrated milk proteins: what we know and don't know?" Marketing and Policy Briefing Paper no. 80, Dept. Agr. Econ., Univ. Wisconsin, Madison.
- Johnson, P. R. 1977. The elasticity of foreign demand for U.S. agricultural products. *Am. J. Agric. Econ.* 59:735–736.
- National Milk Producers Federation. 2003. NMPF endorses legislation curtailing milk protein imports. Online. Available: <http://www.nmpf.org/news/index.cfm>.
- NZMP. 2003. Market Forecast 2003–2004. Lemoyne, Pennsylvania. March 21.
- Tweeten, L. 1975. Econometric models of the agricultural sector: discussion. *Am. J. Agric. Econ.* 57:181–184.
- USDA: Agricultural Marketing Service. 2003. Dairy market statistics; 2002 annual summary. Online. Available: <http://www.ams.usda.gov/dairy/mncs/summary.htm>.
- USDA: Agricultural Research Service, Nutrient Data Laboratory. 2002. USDA national nutrient database for standard reference. Release 15. Online. Available: <http://www.nal.usda.gov/fnic/food-comp/Data/SR15/sr15.html>.
- USDA: Foreign Agricultural Service. 2003. U.S. trade internet service. Online. Available: <http://www.fas.usda.gov/ustrade/>.