The MEASUREMENT OF WATER IN THE TARIFF FOR CANADIAN DAIRY PRODUCTS

by

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Abstract

Canadian dairy market has been highly protected by the Federal Government for several decades. The current situation is the over-quota tariffs of dairy products are extremely high. However, it is possible to anticipate that this high over-quota tariff will be reduced in the future WTO negotiations. This paper tries to answer by how much tariff can be cut and still maintain protection from imports for the domestic dairy industry. This is also equivalent to test how much water in the tariff (WIT) for dairy products. The time series dairy products wholesale prices data of Canada and the world are used in the calculations. The methodologies are introduced in this paper to estimate WIT for four dairy products including butter, skim milk powder, cheddar and fluid milk (2% fat). In addition, I define the potential WIT and measure that by using adjusted Canadian wholesale price (equaling US dairy processor's market margin plus Canadian farm milk cost). In addition, how much WIT and potential WIT in the coming decade (2008-2017) are forecasted according to the predicted prices. The results show that there are large amounts of water in the Canadian over-quota tariffs in the period of 1996-2017, they vary across dairy products and over time.

Finally, the policy recommendations have been made on the question of how much percent of the over-quota tariff can be reduced without increasing imports in the coming decade when the international prices are stochastic but their development trends are certain.

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CHAPTER 1

Introduction

Tariff rate quota (TRQ) has been regarded as a very useful and important trade policy to protect domestic agricultural and food industry by many countries. In total, there are 37 countries with scheduled 1,374 TRQs for agricultural commodities in the WTO Agreement (WTO, 1999). A TRQ is a two-part tariff. A lower in-quota tariff rate is applied to the fixed amount of imports allowed and a prohibitively high over-quota tariff rate is applied to any imports over that level. Compared with regular quota, TRQ is not regarded as quantitative restrictions because it does not limit imports quantities. [1] One may import as much as he can if he wants to pay over-quota tariff. However, if the over-quota tariff rate is prohibitively high, it yields the same imports volume as a traditional quota.

One important feature of Canada's dairy policy is its very high over-quota tariff rates. At present, these run between 201.5% and 313.5%, and they are important for several reasons. First, they attract attention from Canada's trading partners in trade negotiations, who see these tariffs as unusually high and the object of tariff reduction proposals for potential exporters to gain market access. Second, they generate a great deal of protection for the domestic dairy processors. Finally, they are necessary to maintain dairy farmers' income and stabilize the numbers of dairy farmers in Canada.

In 2001, World Trade Organization (WTO) launched negotiations to further reduce global agricultural trade barriers and improved access to global agricultural

[1] Any import excess quota limit is prohibited under regular quota system.

markets. These will result in cutting tariff rates, increasing import quotas and reducing non-tariff barriers. "*Canada can not walk away from the negotiations, which cover international trade in all goods and services. Moreover, successful negotiations will bring major benefits to Canada's grain, oilseed, beef and pork farmers, who depend upon export markets..... It is clear that Canada will have to open its market to the same extent as other developed countries.*" (Mike Gifford, 2005). It is possible to anticipate that Canada has to reduce the trade barriers on the dairy products imports in the future WTO negotiations. Canadian trade policy makers face a trade-off in the WTO negotiations between increasing more in the import quota and decreasing more on the over-quota tariff rate. The former would always have a negative effect because it would require a reduction in the domestic production quota (consumption roughly fixed and more imports mean less domestic production). The latter, however, would have no effect on domestic prices at all if the remaining tariff was higher enough to keep out import.[2]

Therefore, it is very important to know by how much can the over-quota tariffs be lowered and still keep imports out of Canadian market? This is the primary objective of this thesis, namely to measure the difference between the applied tariff rate and the nominal rate of protection. The latter is defined as 'water in the tariff' (WIT).[3] Applied

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[2] Rude and Gervais (2006) used Canadian chicken industry data to examine the results for liberalizing tariff-rate quotas when there is supply management control in the domestic market and the international prices are stochastic. They found that the consumers and processors gain more with lowering over-quota tariff than with increased import quotas. Their results can also be applied on the Canadian dairy industry because there are supply management and TRQ in the domestic dairy industry.

3 Here, I follow the definition of WIT defined by Martin and Wang (2004). They defined WIT as any gap between the applied tariff rate and the actual rate of protection. The only difference is that the nominal rate of protection, instead of actual rate of protection, is used in my definition. This is because the actual rate of protection can better describe potential WIT which is discussed in Chapter Four. There is disagreement over the definition of the term 'water in the tariff' in the literature. For example, Brockmeier, Kurzweil and Pelikan (2006) define WIT as the difference between bound and applied duties or effective protection.

tariff rate is the actual tariff rate in effect at the importing country's border. Nominal rate of protection is a rate describing the difference between domestic and landed foreign product's wholesale price.

Some may argue that since the world prices are stochastic, the big drop of the world price need more tariff protection. Therefore, WIT should exist when the world price is uncertain. To find how much percent of the over-quota tariff can be reduced on the condition of the uncertain world price is another objective of the thesis.

It is important for trade negotiators to know by how much tariffs can be reduced and still maintain protection from imports for the domestic industry. It is also important for government and the domestic industry to know how a given tariff reduction will actually affect the industry. If the tariff is 300 percent but 90 percentage points represent "water" (which means 210 percent of tariff rate is required to keep out import), then a tariff reduction of anything less than 30 percent of the total tariff rate will leave the industry largely unaffected (30%×300%=90%). In this hypothetical example, only larger (than 30%) tariff cuts will have the effect of lowering domestic prices and hence provide some economic harm to the domestic industry. Therefore, such information about the degree of water in Canadian dairy product tariffs is critically important for assessing the outcome of the Doha Development Round (DDA), assuming agreement is reached. Even if no agreement is reached, this information is important for planning future agricultural and trade policy, industry initiatives and competitiveness.

There are eight chapters in this thesis. The history of Canada dairy supply management and the background of Canadian dairy market are introduced in Chapter

Two. Chapter Three is the literature review. The theories and methodologies of how to measure WIT and potential WIT are discussed in chapter four. Chapter Five provides a description of which data are used in this thesis, where do the data come from and why I choose them. Chapter Six shows the calculation results of the measurement and contains detailed explanations of the results. How much WIT and potential WIT in the coming decade are forecasted in Chapter Seven. Finally, the last part of this paper presents the conclusion, the questions for future research and policy recommendations.

CHAPTER 2

Background to the Canadian Dairy Industry

2.1 Supply Management System

Canadian dairy industry is highly regulated and has been protected by the Federal Government for nearly 40 years. In the early 1970s, Canada adopted the system of supply management for industrial milk to deal with the unstable dairy markets. Three main elements of the supply management system are market sharing quota (MSQ), support price and import control.

2.1.1 Market Sharing Quota (MSQ)

Market Sharing Quota is the national milk production target for industrial milk in Canada. The Canadian Milk Supply Management Committee (CMSMC) directs the implementation of the National Milk Marketing Plan, setting national aggregate milk production quotas and distributing the national quota among provinces. CMSMC relies on the Canadian Dairy Commission (CDC) to forecast marketing and changes in demand in the setting of the national industrial milk quota (Barichello, 1998).

The Canadian Dairy Commission is a crown corporation which was established in 1966 with the mandate of coordinating federal and provincial dairy policies and creating a control mechanism for milk production, which would help stabilize revenues and avoid costly surpluses (CDC, 2005). As mentioned previously, CDC recommends to the CMSMC of how much milk should be produced in Canada to meet the expected demand.

In addition, the CDC also monitors the national demand of dairy products and recommends the necessary adjustments to the national production target.

Under the MSQ system, each province is given an amount of producing quota each year. Each province allocates its quota to dairy producers according to its own policies. Therefore, by MSQ, the total supply of dairy milk is firmly controlled by the Federal Government. Table 2.1 shows each provincial shares of MSQ in 2007.

Table 2.1: Provincial shares of MSQ (July 31, 2007)

Province	Butterfat (millions of kg)	Milk (million hl)	Percentage (%)
NFLD & Labrador	0.65	0.18	0.36
Prince Edward Island	3.07	0.85	1.72
Nova Scotia	1.98	0.55	1.11
New Brunswick	2.30	0.64	1.29
Quebec	80.87	22.47	45.29
Ontario	56.41	15.67	31.59
Manitoba	6.37	1.77	3.57
Saskatchewan	4.70	1.30	2.63
Alberta	11.60	3.22	6.50
British Columbia	10.61	2.95	5.94
TOTAL	178.56	49.60	100.0
Data source: The Canadian Dairy Commission annual report 06/07			

2.1.2 Support Price

The use of a support price is another government policy instrument to raise farm price and stabilize producer and processor revenues. "CDC annually reviews and establishes support prices for butter and skim milk powder (SMP) for the next year. Support prices are floor prices at which the CDC purchases or sells butter and skim milk powder within the framework of its various programs. Provincial milk marketing boards and agencies use these support prices as a reference to determine the farm milk price.

Processors, taking into account all the factors that affect their own production costs, then set the prices of dairy products. Finally, distributors and retailers decide how they will pass on any increases in the price of dairy products to consumers." (CDC, 2008). In practice, the support prices of butter and SMP are the lowest wholesale prices in Canada which can guarantee dairy processors the least profits. Table 2.2 lists the support price of butter and SMP from 2000 to 2007 in Canada.

Table 2.2: Butter and SMP support prices in Canada (CAD/kg)		
Year	Butter	Skim Milk Powder (SMP)
2007	6.8695	5.9212
2006	6.8695	5.8337
2005	6.8695	5.7282
2004	5.2968	5.3928
2003	6.1061	5.1966
2002	5.9011	4.9859
2001	5.7261	4.8394
2000	5.5407	4.6842
Data source: CDC		

2.1.3 Import Control

Canada was a signatory to the WTO Agreement on Agriculture which was concluded in December 1993. The Agreement obliged Canada to convert its existing agricultural quantitative import controls to a system of tariff rate quotas (TRQ). Under this TRQ system, imports are subject to lower "within access commitment" rates of duty up to a predetermined limit, while imports over this limit are subject to significantly higher "over access commitment" rates of duty (Canadian Dairy Industry Profile, 2005). Currently, the Canadian "with access commitment" rates range from 6.5% to 11% among dairy products and "over access commitment" rates run between 201.5% and 313.5%. In

addition, a minimum amount duty value is charged in case of an unnaturally lower international price. For instance, Federal Government regulates that the over-quota tariff for butter is 298.5% but not less than $4/KG. It means that the "ad valorem tariff" rate (298.5%) will not be applied when international butter price dropped below $1.34/KG. [4] Because, in this case, if the import duty is calculated by the "ad valorem tariff" rate, it would equal $3.99/KG (1.34×298.5%=3.99) which is smaller than $4/KG. Therefore, in this case, according the Canadian Federal Government Custom Tariff Regulation, the over-quota tariff for butter should be $4/KG in stead of $3.99/KG. Just that there is an ad valorem tariff, and a specific tariff, and the larger of the two applies.

The Export and Import Controls Bureau of the Department of Foreign Affairs and International Trade has been administered all Canada's TRQs since they came into effect in 1995. For most dairy products, Canadian private firms have held import quotas and the quota allocations are decided upon annually. The scheduled TRQ levels for a sample of dairy products are listed in Table 2.3 for 2004.

Table 2.3: Canadian scheduled TRQ for Some Dairy Products in 2004

Product	Scheduled TRQ (Ton)
Fluid milk	64,500
SMP	0
Butter	3,274
Cheese	20,411

Data source: Canadian Dairy Information Centre, CDIC

[4] An ad valorem tariff is levied as a fixed percentage of the value of good that is being imported.

2.2 Canadian Dairy Market under the Supply Management System

One result of the supply management system is the higher farm milk prices in Canada. On average, in the last 12 years, the price of Class 4a farm milk in Canada is 52.4% higher than the US.[5] Another result of the supply management system is the foreign competition is virtually eliminated from Canadian market. Because of prohibitively high over-quota tariff rate, foreign dairy products can not be imported into Canada without quota. Dairy products were mostly imported into Canada only within quota limits. In 2007, the over-quota imports only accounts for 0.71% of the total dairy products importation.[6] Finally, the overall effect of the supply management system on the dairy market is the wholesale prices of the dairy products in Canada are much higher than the other regions. Wholesale prices of dairy products are extremely distorted in Canada. In 2007, Canadian butter, SMP and cheddar wholesale prices are 145.21%, 41.1% and 168.28% higher than the US, respectively. Figure 2.1 and 2.2 show the difference in the wholesale prices of butter and SMP between Canada and other regions. In these two figures, both Canadian butter and SMP wholesale prices are much higher than the other regions.[7]

[5] Figure A.1 in Appendix I shows the comparison of the farm milk cost between Canada and US.
[6] Table A.1 in Appendix I lists the percentage of the over-quota import in Canada's total dairy products import in the period of 2004-2007.
[7] For difference in the wholesale prices of cheddar and fluid milk between Canada and other regions, see Figure A.2 and A.3 in Appendix I.

Figure 2.1: Canada, Oceania, EU and US butter wholesale prices

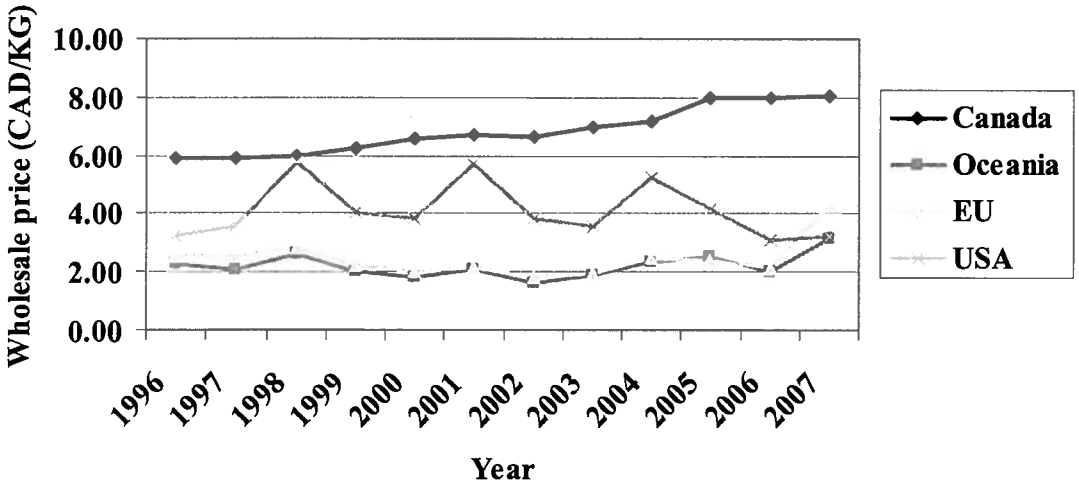
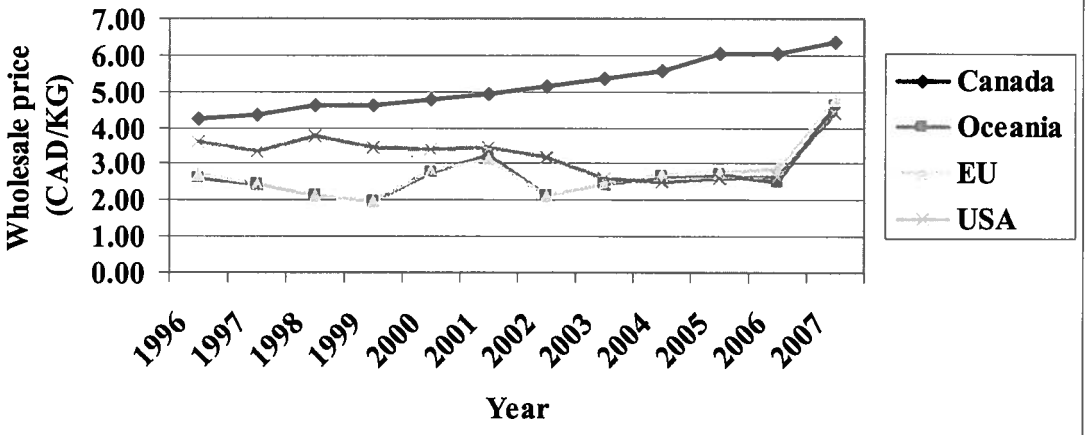


Figure 2.2: Canada, Oceania, EU and US SMP wholesale prices



In the last 40 years, the number of dairy processing plants has been largely reduced. In 1966, Canada had a total of 1,308 dairy processing plants. However, by 2006, this number was reduced considerably to about 450 dairy processing plants. While dairy products production has not decreased in the same period. There is an increased concentration trend in the dairy processing industry. In 1999, the top four dairy processors account for more than 45% of the total dairy processing industry output share.

Moreover, in 2007, the three largest processors in Canada, (Saputo, Agropur, Parmalat) processed approximately 70% of the milk produced in Canada (Agricultural and Agri-Food Canada, 2007).

Lack of foreign competition and increased concentration are often seen as an indicator of market power. Rude and Goddard (1995) found the evidence that the Canadian processing sector has some degree of market power. Cranfield (1995) concluded that oligopoly power exists in the Canadian dairy processing industry. Kevin Chen and Jeevika Weerahewa (1998) argued closing the border thus creates the opportunity for the Canadian dairy processing firms to exercise market power. [8]

By exercising the market power, Canadian dairy processors can charge higher prices on their products. This can be found in the comparison of the gross processing margin (GPM) between Canada and other countries. The gross processing margin (GPM) of the dairy product is the difference between the cost of farm milk to produce the final dairy product and the revenue of selling it. Figure 2.3 displays the Canada and US GPM of butter and SMP.[9] The GPM of cheddar and fluid milk in Canada and US are listed in Figure 2.4 and 2.5, respectively.[10] All of these three figures show that Canada always has much higher GPM in the four dairy products. In 2007, the GPM of butter and SMP, cheddar and fluid milk in Canada are 117.03%, 521.08% and 149.33% higher than the US, respectively.

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[8] It is beyond the scope of this paper to systematically measure how much market power in the Canadian dairy processing industry, but it is an area open for further consideration.

[9] Figure 2.3 shows the total GPM of 4.4kg butter and 8.9kg SMP with a hectoliter farm milk cost.

[10] Figure 2.4 shows the total GPM of 10.11kg cheddar and 6.8kg whey powder with a hectoliter farm milk cost. Figure 2.5 shows the total GPM of 96.4kg fluid milk (2% fat), 3.3kg butter and 0.33kg buttermilk powder with a hectoliter farm milk cost.

Figure 2.3: Canada and US gross processing margin of butter and SMP

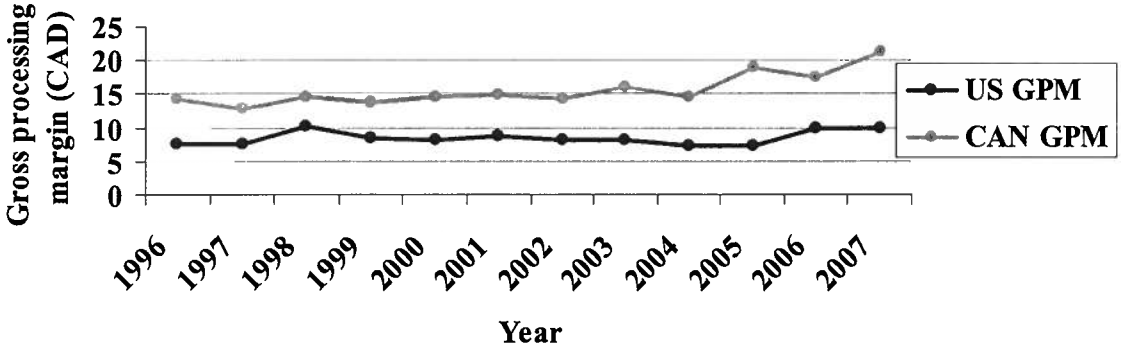


Figure 2.4: Canada and US gross processing margin of cheddar and its by-products

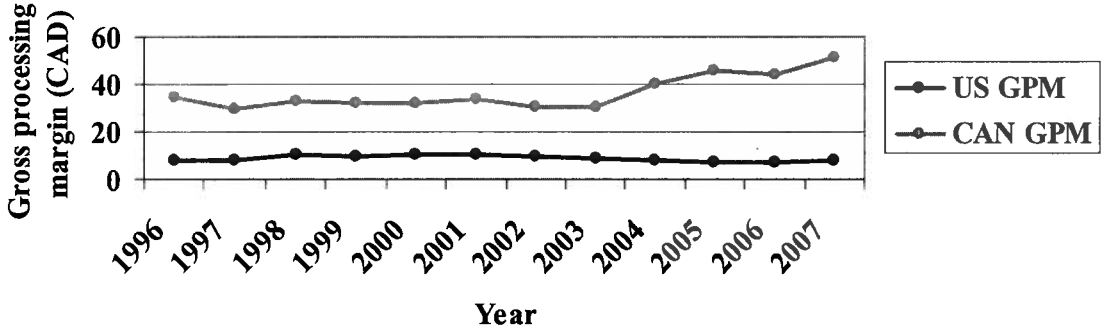
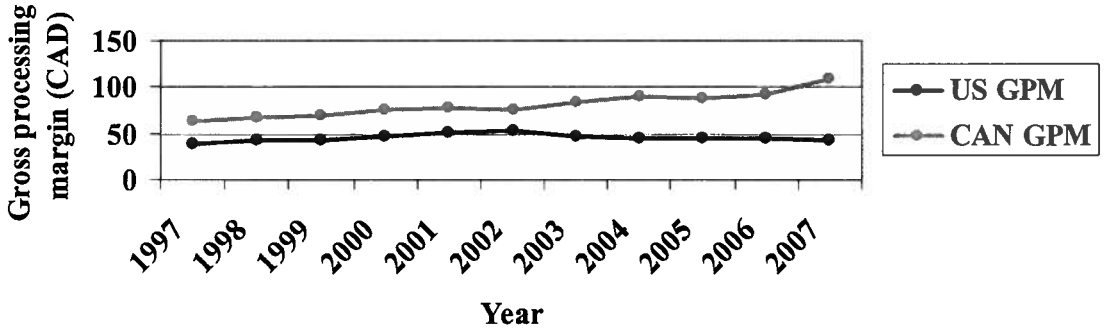


Figure 2.5: Canada and US gross processing margin of fluid milk and its by-products



Chapter 3

Literature Review

There has been no systematic empirical work in Canada to answer how much water is in the tariff. The extent of water almost certainly varies by dairy product. However, there is much debate about it. Even setting aside the argument from the dairy lobby that any tariff cuts would hurt the domestic industry, rather different levels of water are implied in Barichello, Cranfield and Meilke (2007). They argued that any fluid milk protection above 40 percent would represent water, or that tariffs could fall to 40 percent and there would be no effect on domestic fluid milk prices because imports would still be uneconomic at that tariff. For butter, however, Gifford suggested that a butter tariff of nearly 200 percent would be necessary to completely protect the Canadian butter market from imports. Partly this is due to lower international prices for butter (from non-US sources) than for fluid milk (from U.S. sources). But the difference is very striking because it implies a considerably less efficient butter processing industry in Canada as well as higher Canadian domestic farm milk prices, if Gifford's estimate is accurate. Merritt Cluff and David Vanzetti (2005) found that the average water in the tariff for Canadian butter is about 45 percent over the 2003-2004 periods. Clearly, this amount of water is less than Gifford's when the over-quota tariff for butter is 298.5%.

There has been some research on this question for other countries, or for cross-country studies of agricultural commodities. For example, Podbury and Roberts (2003) used data from some of the major importing countries to analyze the water in the tariff and they found that there is a great deal of unused water in most current tariffs for

agricultural commodities. But there are wide differences across countries and commodities in levels of water. For example, they find that butter and cheese have relatively low amounts of water in tariffs for importing countries. Brockmeier and Pelikan (March, 2006) estimated the effects of different magnitudes of tariff cuts for EU and showed high levels of water in the dairy import tariffs. Brockmeier, Kurzeil and Pelikan (June, 2006) extended their analysis to include developing countries and found that water in the tariff matters for both developing and developed countries.

Ramanovich and Hemme (2006) calculate WIT for the farm milk of six countries by using 2004 data. They concluded that there are 50% and 35% of WIT for the farm milk in Canada and in German, respectively. They did not find any WIT for the same kind of milk in US.

Ingco (1995) compared the difference between the Post Uruguay Round (UR) binging tariffs and the estimated tariffs equivalent of border measures in the Pre-UR and concluded that the tariffs which many countries have set in the Post-UR are significantly higher than the wedge between actual domestic and world market prices in the Pre-UR. Specifically, he found that US raised protection for sugar by 66 percent. While Canada increased protection for dairy product by more than 100%, and EU, with the biggest differentials in rice (207%) and milk (97.2%).

There are some theoretical researches on the TRQs. Herrmann, Kramb and Monnich (2001) examined the economic impact of the agricultural TRQs. They used the example of European banana regime to illustrate that the TRQs have the same economic effect as traditional quota, including redistributive effects.

Feldman (1993) developed political-economy models of the tariff setting process when the world price is stochastic. He found that the optimal tariff rate may involve redundant protection because world price uncertainty creates expected gains from redundant tariff protection even for the risk-neutral producers. This induces another question to the policy makers - how much percent of the over-quota tariff can be reduced when the world prices are stochastic? The answers to this question are recommended in Chapter Eight.

CHAPTER 4

Theory and Methodology

4.1 Method for Calculating Water in the Tariff (WIT)

It is necessary to know how much over-quota tariff is needed to keep out import before calculating WIT. This amount of tariff is also called nominal rate of protection, a rate describing the difference between domestic and foreign product's price. If the import tariff equals the nominal rate of protection, the domestic wholesale price would be equal to the duty paid foreign landed wholesale price (i.e. Domestic price = Foreign price in FOB value × Nominal rate of protection + Foreign price in CIF value).[11] By the definition of nominal rate of protection, it can be expressed by the following equation;

$$Tp = \frac{Pc - Pwc}{Pwb} \times 100\% \tag{4.1}$$

where Pc is the Canadian domestic wholesale price of any dairy product, Pwc is the landed foreign wholesale price (CIF value) of the same dairy product imported into Canada, Pwb is the FOB price of foreign dairy product and therefore Tp is the nominal rate of protection.[12] This can be seen as a measure of the apparent competitiveness of a country's product. The larger the (positive) difference between Pc and Pwb (or Pwc), the less competitive is the domestic country's production. Eq. 4.1 indicates the nominal rate

[11] In Canada, import duty is calculated on the FOB value of the goods. Hence, the landed duty paid foreign price equals foreign price (FOB value) × Import Tariff + Foreign price (CIF value). (For more information, please refer to the Customs D Memoranda, D13-3-1) By the definition of nominal rate of protection, the domestic wholesale price would be equal to the duty paid foreign landed wholesale price when the import tariff rate equals nominal rate of protection.

[12] Tp can be zero, positive or negative when Pc = Pw, Pc > Pw or Pc < Pw. Under free trade and when the domestic and traded goods are the same item, equality will hold.

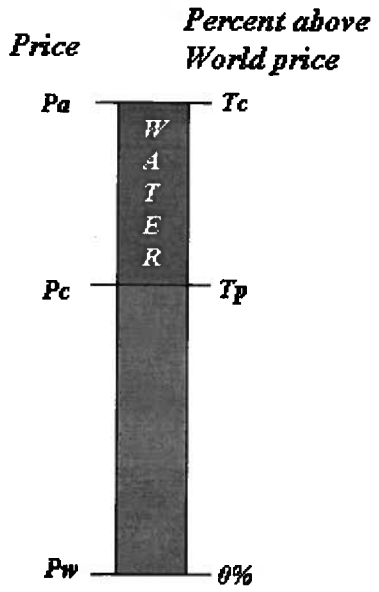
of protection as a difference between domestic and foreign product's price in a percentage term. Tp is also presented in Figure 4.1. The right hand side of the Figure shows Tp as the percentage of Canadian price above the world price.

As mentioned in Chapter One, WIT is defined as any gap between the applied tariff rate and the nominal rate of protection. Applied tariff rate is the actual tariff rate in effect at the importing country's border and has been predetermined by the Government. By the definition of the water in the tariff, it can be expressed by Eq. 4.2, which is

$$WIT = Tc - Tp \tag{4.2}$$

where WIT is water in the tariff, Tc is the Canadian over-quota tariff. Tc- Tp is the gap between applied tariff rate and nominal rate of protection and therefore, is the water in the tariff. WIT can be zero (Tc = Tp), positive (Tc > Tp) or negative (Tc<Tp). If Tc is greater than Tp, it means the import tariff is over charged and the water in the tariff exists. However, if Tc is smaller than Tp, it means the import tariff is too low to keep import out. Figure 4.1 shows a situation that the applied tariff rate exceeds the nominal rate of protection (Tc > Tp). WIT is presented by Tc-Tp, i.e. the area with blue color in Figure 4.1.

Figure 4.1: Applied tariff rate, nominal rate of protection and water in the tariff



Pa: The price of any paid foreign product. Pa = Pw * (1+Tc)
Pc: Canadian wholesale price. Pw: World wholesale price.
Tc: Canadian over quota tariff (Applied rate). Tp: Nominal rate of protection

4.2 Theory of Potential Water in the Tariff

As mentioned in Chapter Two, parts of the higher Canadian dairy products wholesale prices are due to the exercise of the market power by the dairy processors. Canadian dairy product wholesale price (Pc) can be expressed by Equation 4.3.

$$Pc = P_0 + \alpha \quad , \quad \alpha > 0 \tag{4.3}$$

where P_0 is the dairy product wholesale price without market power. It reflects a wholesale price in a perfect competitive market. α is the extra price the Canadian processors charged because of exercising market power. α is greater than zero which means the price with market power (Pc) is greater than the one without market power (P_0).

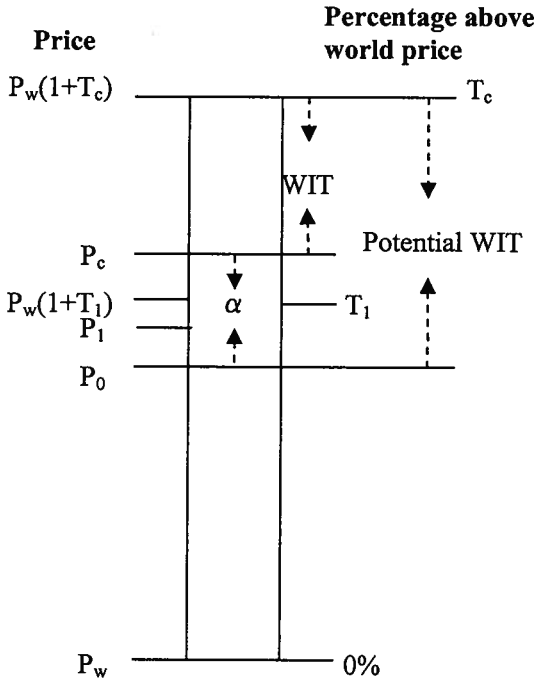
Theoretically, imports would increase if the tariff reduction exceeded the WIT. However, if processors exercise market power, there maybe still no imports even if the over-quota tariff reduction exceeds the WIT (which is calculated by using Canadian wholesale price in Eq. 4.2). Figure 4.2 shows a situation that the over-quota tariff was reduced from Tc to T_1, and $Tc-T_1 >$ WIT. In this case, the foreign dairy products could be imported into Canada because the duty paid foreign product price is less than the Canadian wholesale price, i.e. $Pw(1+T_1) < Pc$.[13] Canadian dairy processors face more foreign competition after the over-quota tariff reduced to T_1. However, by reducing their excess profit margin (α), the Canadian processors can lower their wholesale price to a level below $Pw(1+T_1)$, say at P_1 and still keep out imports (see Figure 4.2). P_1 can be expressed as $P_0 + [\alpha - (Pc-P_1)]$. At P_1, Canadian dairy processors still charge extra price although the amount is reduced from α to $[\alpha - (Pc-P_1)]$. Therefore, the amount of water in the tariff may be underestimated if it is only calculated by the Canadian wholesale price (Pc) when Canadian dairy processors have the market power.

When facing more foreign competition, Canadian processors can always lower their wholesale price by reducing α until there is no more excess profit being earned. In other word, P_0 is the lowest wholesale price of Canadian dairy product. There still exists water in the tariff for any duty paid foreign dairy product price higher than P_0. Since P_0 indicates a potential lower wholesale price, water in the tariff calculated by P_0 (instead of Pc) is named potential water in the tariff. If market power is exercised, P_0 is less than Pc, and potential WIT is greater than WIT.

[13] Pw is world wholesale price. $Pw(1+T_1)$ is the duty paid foreign product price after the over-quota tariff rate reduced from Tc to T_1. (Figure 4.2)

It is possible that dairy product wholesale prices could be reduced by lowering the farm milk price. However, I assume that this policy price is unadjusted due to changes in foreign competition. By contrast, processors could lower wholesale prices as a normal response to market competition, as long as they are not operating in a perfectly competitive environment.

Figure 4.2: Potential water in the tariff



4.3 Method for Calculating Potential Water in the Tariff

From previous discussion, P_0 must be estimated in order to calculate potential WIT. However, since the Canadian dairy market has been protected for 40 years, the Canadian dairy product wholesale prices data can not represent price without market power. Therefore, it is necessary to find a method to estimate a price very closed to P_0 by the data which are available in the market. This estimated price should also be feasible

and adjustable for Canadian dairy processors when they are facing more foreign competition. A method to estimate P_0 is developed starting from introducing gross processing margin (GPM).

As mentioned in Chapter Two, GPM of the dairy product is the difference between the cost of the farm milk to produce the final dairy product and the revenue of selling this final diary product. Therefore, the Canadian dairy product wholesale price can be expressed as the sum of the farm milk cost and GPM, which is;

$$Pc = FMc + GPMc \tag{4.4}$$

where, Pc is the wholesale price of a dairy product in Canada. FMc is the cost of farm milk and GPMc is the gross processing margin to produce this dairy product in Canada. The extra price (α) the Canadian dairy processors charged is included in GPMc. Similarly, the US dairy product wholesale price can be expressed by Equation 4.5.

$$Pu = FMu + GPMu \tag{4.5}$$

where, Pu is the wholesale price of a dairy product in US. FMu is the cost of farm milk and GPMu is the gross processing margin to produce this dairy product in US. Figure 2.3-2.5 in Chapter Two show that GPMu is much less than GPMc. In the period of 1997-2000, the difference of the average GPM for butter and SMP between Canada and US is 56.91%. But this difference rose to 119.81% in the period of 2005-2007 and there are the same trend on the difference of the average GPM for cheddar and fluid milk. To explain the increasing differences of GPM between the two countries, one should note that the technology of manufacturing dairy products is largely the same between Canada and the

US. Economies of scale could affect this difference but recent (last decade) mergers in the dairy processing factories in Canada have moved average plant sizes much closer to their US counterparts.[14] The fact that GPMc is a higher margin in Canada is mainly due to the existence of processor market power, while GPMu is likely to represent a more competitive processing margin due to the existence of the larger number of processors in the US market. (Here I assume the payment of higher farm milk prices does not increase any other processor cost.) Therefore, using the GPMu to replace the GPMc is a reasonable method to estimate P_0 in Eq. 4.3. In other words, P_0 is estimated as the sum of GPMu and FMc. The Canadian wholesale price estimated by this method is called the adjusted Canadian wholesale price which can be expressed by Equation 4.6.

$$Pac = FMc + GPMu = FMc + (Pu - FMu) \tag{4.6}$$

In Eq. 4.6, the adjusted Canadian wholesale price (Pac) equals the cost of farm milk in producing a unit dairy product in Canada (FMc) plus the processing margin to produce this dairy product in US (GPMu). As mentioned above, farm milk price is a policy variable in Canada and is assumed unadjusted.

There are always other by-products produced in manufacturing dairy products. SMP is a by-product of manufacturing butter; Whey is a by-product of producing cheddar cheese; Butter and buttermilk powder are by-products in making fluid milk. Therefore, in dairy processing industry, GPM is the aggregate processing margin of a final dairy product and its by-products which yields Equation 4.7.

[14] For example, Saputo is the largest dairy processor in Canada. But it is also the fifth largest dairy processor in the United States and the third largest in Argentina. (AAFC, 2005) Others like Agropur, Parmalat, Kroft are all the major dairy processors in North America.

$$GPM = P + \sum_{1}^{n} P_i \times Q_i - P_0 \times Q_0 \tag{4.7}$$

where GPM = the total processing margin of a final dairy product and its by-products,

P = the unit wholesale price of a dairy product,

Pi = the unit wholesale price of the i's by-product,

Qi = the quantity of the i's by-product in producing a unit dairy product,

P_0 = the unit wholesale price of farm milk and

Q_0 = the quantity of farm milk to produce a unit dairy product.

In Equation 4.7, $\sum P_i \times Q_i$ presents the total revenue of the by-products in manufacturing a unit dairy product. Therefore, the difference between the aggregate revenue of making a unit of dairy product ($P + \sum P_i \times Q_i$) and the farm milk cost ($P_0 \times Q_0$) is the total GPM of a final dairy product and its by-products. Move $P_0 \times Q_0$ to the left hand side of the Eq. 4.7, I get the total revenue (TR) of producing a unit dairy product which yields Equation 4.8;

$$GPM + P_0 \times Q_0 = P + \sum_{1}^{n} P_i \times Q_i = TR \tag{4.8}$$

The revenue share of the dairy product (RSD) equals its unit wholesale price divided by the total revenue of producing this dairy product which is expressed in Equation 4.9. Equation 4.10 shows the revenue share of the i's by-product (RSBi).

$$RSD = \frac{P}{P + \sum_{1}^{n} P_i \times Q_i} \qquad (4.9)$$

$$RSB_i = \frac{P_i \times Q_i}{P + \sum_{1}^{n} P_i \times Q_i} \qquad (4.10)$$

Assumption 1: The transformation technology in manufacturing dairy product across Canadian and US processors is same. Both Canadian and US processors can produce the same amount of dairy products and by-products with the same amount of farm milk. According to Assumption 1, I assume that, in both countries, a hectoliter of farm milk containing 3.6 Kg of fat and 3.2 Kg of protein can make (a) 4.4 Kg butter and 8.9 Kg SMP or (b) make 10.11 Kg cheddar cheese and 6.6 Kg whey powder or (c) 96.4 Kg 2% fluid milk, 3.3 Kg butter and 0.33 Kg buttermilk powder.[15]

Based on the assumptions and the Equations (Eq 4.1-4.8), the method of calculating adjusted Canadian wholesale price can be illustrated by Eq. 4.11 which is,

$$P_{ac} = (GPM_u + P_{0c} \times Q_{0c}) \times RSD_c \qquad (4.11)$$

where, Pac = the adjusted Canadian wholesale price,

GPMu = the US gross processing margin of the dairy product,

P_{0c} = the Canada's unit wholesale price of farm milk,

Q_{0c} = the quantity of farm milk to produce the unit dairy product and

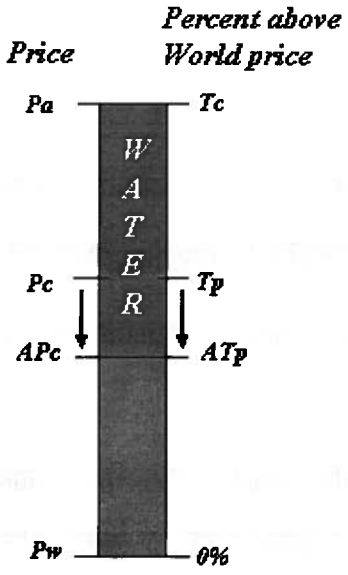
RSDc = the revenue share of the dairy product in Canada.

[15] The output yield function numbers are very standard in both Canada and US. For butter and SMP output yield function, I take reference on numbers from CDC 2006. The cheddar and fluid milk output yield functions are sourced from MSU - http://web1.msue.msu.edu/dairy/products.html#top. US weight unit, pound, is converted to KG by using Table A. 3 in Appendix 1.

Eq. 4.11 allows one to calculate the adjusted Canadian wholesale price by using the US processing margin. Replacing GPMc by GPMu, "GPMu + $P_{0c} \times Q_{0c}$"becomes the adjusted total revenue of producing a unit dairy product in Canada. Multiplying it by the revenue share of the dairy product in Canada, one gets the adjusted Canadian wholesale price.

Eq. 4.11 is the basic equation in this paper to calculate adjusted Canadian dairy products' wholesale prices. I first compute the GPM in US and Canada. And calculate RSD of dairy product in Canadian market. Then, replace Canada GPM by US margin and finally get the adjusted wholesale price in Canada by Eq. 4.11. Figure 4.3 shows a situation how does the amount of water changed in the tariff after adjusting the wholesale price to a lower lever.

Figure 4.3: Adjusted nominal rate of protection and potential water in the tariff



*Pa: The price of duty paid foreign product. Pa = Pw * (1+Tc)*
Pc: Canadian wholesale price. Pw: World wholesale price.
Tc: Canadian over quota tariff (Applied rate). Tp: Nominal rate of protection
APc: Adjusted Canadian wholesale price. ATp: Adjusted nominal rate of protection

4.4 Example of Calculating the Adjusted Wholesale Price

Table 4.1: Wholesale price of butter, SMP and farm milk in Canada and US				
2006 Wholesale Price	Butter (CAD/KG)	SMP (CAD/KG)	Farm milk (CAD/hl)	Transfer technology (The output of a hectoliter farm milk)
Canada	8.00	6.02	71.25	4.4 KG butter and 8.9 KG SMP
US	3.08	2.64	28.53	4.4 KG butter and 8.9 KG SMP

Substituting all the prices from Table 4.1 into Eq. 4.7 to calculate the GPM 4.4kg butter and 8.9kg SMP:

Canadian $GPM = 4.4 \times 8 + 8.9 \times 6.02 - 71.25 = 17.53\,\text{CAD}$

US $GPM = 4.4 \times 3.08 + 8.9 \times 2.64 - 28.53 = 8.52\,\text{CAD}$

Then, by substituting all the prices from Table 4.1 into Eq. 4.9 and 4.10 to calculate the revenue shares of 4.4kg butter and 8.9kg SMP in Canada:

Canadian Butter $RSD = \dfrac{4.4 \times 8}{4.4 \times 8 + 8.9 \times 6.02} = 39.65\%$

Canadian SMP $RSD = \dfrac{8.9 \times 6.02}{4.4 \times 8 + 8.9 \times 6.02} = 60.35\%$

Finally, one may calculate the adjusted wholesale price by substituting US GPM (8.52CAD), revenue shares of butter (39.65%) and SMP (60.35%) and farm milk cost (71.25 CAD/hl) into Eq. 4.11.[16]

Adjusted butter wholesale price

$$= (PM_u + P_{0c} \times Q_{0c}) \times RSD_c \div 4.4 = (8.52 + 71.25) \times 39.65\% \div 4.4 = 7.19 CAD / KG$$

[16] In this example, PM and RSD are for 4.4kg butter and 8.9kg SMP, Equation 4.9 has to divide 4.4 or 8.9 in order to get the unit wholesale price of butter and SMP.

Adjusted SMP wholesale price

$$= (PM_u + P_{0c} \times Q_{0c}) \times RSD_c \div 8.9 = (8.52 + 71.25) \times 60.35\% \div 8.9 = 5.41 CAD / KG$$

After this adjustment, the Canadian butter wholesale price is reduced from 8.00CAD/KG to 7.19CAD/KG. The SMP wholesale price also declines from 6.02 to 5.41CAD/KG.

CHAPTER 5

Data

As mentioned in Chapter Four, to calculate WIT and potential WIT, I need to know the world dairy products wholesale prices, Canadian dairy products wholesale prices, adjusted Canadian wholesale prices and Canada's over-quota tariff rates.

US, Oceania and Europe Union (EU) are the three major dairy products trade partners of Canada. In 2006, US, Oceania and EU account for 24.3%, 23.5% and 40.7% in the Canadian total dairy products importation, respectively. They are also the three biggest dairy products manufacturers and exporters in the world. In 2006, US, Oceania and EU share 92.86% of world butter exportation, 81.27% of world SMP and 88% of world cheese exportation (United States Department of Agricultural, 2006). Therefore, US, Oceania and EU wholesale prices are assumed to be the world wholesale prices for the Canadian dairy products market. [17] The time series data collected in this paper are in the periods of 1996-2007.

There are two kinds of world wholesale prices data available to collecting. One is the wholesale prices of US, Oceania and EU which were published in the world market. USDA published major dairy products wholesale prices of Oceania and EU yearly. In the US, many dairy products are trading at Chicago Commodity Exchange (CME). Therefore, US dairy products wholesale prices are collected from CME dairy products cash trading

[17] US, Oceania and EU wholesale prices are regarded as the world prices. Therefore, WIT is calculated by using US, Oceania and EU prices respectively. For example, WIT between Canada and US is calculated by US and Canadian wholesale price. Similarly, WIT between Canada and Oceania is computed by Canada and Oceania wholesale price.

prices. The other kind of world price is the world wholesale import price calculated by Canadian annul trade data (equals total import value divided by total import quantities).

Two kinds of Canadian domestic wholesale prices are used in the calculation. One is the wholesale price published by Agriculture and Agricultural Food Canada (AAFC) - the agriculture management and research organization of Canadian Government. WIT is calculated by this price. Another is the adjusted wholesale price, calculated by adding the US processing margin to the Canadian farm milk price. Potential WIT is calculated by this adjusted price.

In addition, Canada's farm milk price, the US farm milk price and dairy products' yield functions are three key factors in the calculation of Canadian and US dairy processing margins in Eq. 4.7. Hence, they are the variables in calculating the adjusted Canadian wholesale prices. The milk produced in Canada is sold to processors through a Harmonized Milk Classification System. Table 5.1 shows this milk classification system. The farm milk is classified into four groups in the US which are listed in Table 5.2. Assumption 1 has given the output yield functions for the dairy products.

Table 5.1: Canada Harmonized Milk Classification System	
Class	Products
1(a)	Fluid Milk and milk beverages
1(b)	All types of cream
1(c)	New 1(a) and 1(b) fluid products during an introductory period
1(d)	Fluid milk products in Yukon, NWT, Nunavut and cruise ships
2	All types of ice cream, ice cream mix and yogurt
3(a)	All cheeses other than those identified in Class 3(b)
3(b)	Cheddar and cheddar-type cheese
4(a)	Butter, butter oil and milk powder
4(b)	Concentrated milk
4(c)	New industrial products during an introductory period
4(d)	Inventories and losses
4(m)	Milk components for marginal markets
5(a)	Cheese used as ingredients for further processing
5(b)	Non-cheese dairy products used as ingredients for further processing
5(c)	Dairy products used as ingredients for the confectionery products
5(d)	Planned Exports
Source: CDC - http://www.cdc.ca/cdc/index_en.asp?caId=812&pgId=2182	

Table 5.2: US Milk classification	
Class	Products
I	Fluid Milk
II	Cream Products, Yogurt, Milk Shake Mix, Cottage & Ricotta Cheese
III	Cream cheese, spreadable cheeses and hard cheese
IV	Butter, any milk product in dry form

5.1 Butter and SMP Wholesale Prices Data

a. World butter and SMP wholesale prices published in the world commodity market or by Government Administration Organization

Both EU and Oceania butter and SMP wholesale prices used in this paper are published by USDA.[18] US butter and SMP wholesale prices used in this paper are the butter and SMP cash trading prices in CME. They are spot call prices in CME, prices of daily buy and sell transactions resulting in physical delivery of butter and SMP.

b. World butter and SMP wholesale prices calculated by Canada's annual trade data

US, Oceania and EU wholesale prices of butter and SMP calculated by Canadian trade data equal to the total import value divided by total import quantities. For instance, in 2006, Canada imports 6,810,601Kg and 17,067,565CAD of butter from Oceania in quantity and value, respectively. Therefore, Oceania butter wholesale price is 2.506CAD/KG (17067565/6810601 = 2.506). Canada's trade data are collected from Trader Analyser at Computing in the Humanities and Social Sciences (CHASS) under Harmonised System (HS) 10-digit code classification.

c. Canadian domestic wholesale prices of butter and SMP published by AAFC

The wholesale prices of dairy products are not published in Canada. However, AAFC publishes butter and SMP wholesale prices of Quebec twice a year (February and September). These AAFC published Quebec wholesale prices of butter and SMP are assumed to be the Canadian wholesale prices.[19]

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[18] The international wholesale prices published by USDA were estimated by their survey. The author provided the following responses when asked about the valuation of the data. "*The information that we collect is totally (100%) voluntary. No one needs to speak with us unless they desire to share information. The contacts that we speak with are a random sample of the industry and do not encompass the entire industry. We feel that the contacts we talk with are also provided information from our perspective. ... ... From this information, we prepare a written comment and generate a price series from the information gathered.*" - Mr. Steven Schneeberger, International Dairy Market News Reporter, USDA.

[19] Quebec is the biggest butter manufacturing province in Canada, in 2006, 40% of Canadian total butter production was made in Quebec.

d. Adjusted Canadian wholesale prices of butter and SMP

Adjusted Canadian wholesale prices of butter and SMP are calculated by adding US GPM to Canadian farm milk cost. Canada's farm milk price, US farm milk price and dairy products' yield functions are three variables in calculation Canadian and US dairy processing margins in Eq. 4.7. According to Table 5.1, the farm milk class 4(a) is the farm milk in manufacturing butter and SMP in Canada. While by US milk classification in Table 5.2, class IV milk is the farm milk of producing butter and SMP. AAFC publishes the Canadian farm milk wholesale prices for all the classes annually. The US class IV milk wholesale price used in this paper is the Federal milk order price and it is collect from USDA. According to assumption 1, a hectoliter of farm milk containing 3.6 Kg of fat and 3.2 Kg of protein can make 4.4 Kg butter and 8.9 Kg SMP.

5.2 Cheddar Wholesale Prices Data

a. World cheddar wholesale price published in world commodity market or by Government Administration Organization

Same as butter and SMP, USDA publishes Oceania Cheddar wholesale price bi-weekly and it is used in this paper. USDA does not publish EU cheddar wholesale price. And it is hard to find any EU cheddar wholesale price data in other publications.[20] However, according to the Canada-EU trade data, it can be found that Canada mainly imports cheddar from UK. UK account 77% of the total EU cheddar

[20] This maybe because it is hard to gather all the 27 EU countries' cheddar wholesale price data. Another reason is there are dozens of types of cheddar with different grades in each type in the EU market.

export to Canada in the period of 2004-2006.[21] In this paper, UK cheddar wholesale price is assumed to be EU wholesale price for the Canadian dairy market. The UK cheddar wholesale price used in this paper is the average wholesale price published by Eurostat and Milk Development Council (MDC) of UK. US cheddar wholesale price is collected from CME. It is the cheddar cash trading price in CME.

b. World cheddar wholesale price calculated by Canada's annual trade data

Oceania, EU and US cheddar wholesale prices calculated by Canada's trade data are equal to the total import value divided by total import quantity.

c. Canadian domestic wholesale price of cheddar published by AAFC

AAFC publishes cheddar wholesale price of Quebec twice a year (February and September). Quebec wholesale price of cheddar is regarded as Canadian wholesale price.[22]

d. Adjusted Canadian domestic wholesale price of cheddar

According to Table 5.1 and 5.2, farm milk Class 3(b) and Class III are the raw milk to produce cheddar in Canada and US, respectively. Class 3(b) milk price data is collected from AAFC. While the Class III farm milk price used in this paper is the US Federal milk order price of Class III and is obtained from USDA. It is assumed that hectoliter of farm milk containing 3.6 Kg of fat and 3.2 Kg of protein can make 10.11 Kg cheddar cheese and 6.6 Kg whey powder. Whey powder is the by-product in producing cheddar. In order to calculated GPM and RSD in Eq. 4.7, 4.9 and 4.10,

[21] Canada-EU trade data show that, in the last ten years, UK is the biggest cheddar exporter to Canada, accounting 70% in the total EU cheddar export to Canada.
[22] Quebec is the biggest cheddar manufacturing province in Canada, in 2006, 45% of Canadian total cheddar production is made in Quebec.

wholesale price of whey powder has to be obtained. In this paper, the Canadian wholesale price of whey powder is collected from AAFC. While US whey powder wholesale price is gathered from USDA.

5.3 Fluid milk Wholesale Prices Data

Canada mainly imports fluid milk from US (US account for 98% in the Canada total importation of fluid milk in the last five years).[23] Therefore, US fluid milk price is assumed to be the world price for Canadian fluid milk market. Oceania and EU fluid milk prices are not collected in this paper.

a. World fluid milk wholesale price published in world commodity market or by Government Administration Organization

USDA does not publish US fluid milk wholesale price. However, the US Government Accountability Office (GAO) did a survey from 2000 to 2004 and reported both the wholesale and retail price of fluid milk of fifteen major US cities. The average of GAO's wholesale price of fluid milk (with 2% fat) is assumed to be US fluid milk price. The rest of years' (1996-1999, 2005-2007) wholesale prices are computed by using US fluid milk producer price index (PPI).

b. World fluid milk wholesale price calculated by Canada's annual trade data

US fluid milk wholesale prices calculated by Canada's trade data equal to the total import value divided by total import quantity. However, these prices fluctuate hugely, especially in 2001 and 2002. In 2001, the total Canadian fluid milk (1-6% fat)

[23] Canada does not import fluid milk from Oceania and EU because it is hard to keep it fresh in the transportation between these from regions to Canada

import from US is 35CAD with the total amount 119.3 Kg. Similarly, this import number becomes 152 CAD and 249.6 Kg in 2002. The wholesale prices calculated by these two years' data are not representative. Therefore, US fluid milk wholesale price calculated by Canada's annual trade data are excluded in this paper.

c. Canadian domestic wholesale price of fluid milk published by AAFC

The Canadian fluid milk wholesale price equals the retail price minus retailing margin (the retailing margin is the difference between the wholesale and retail price). It is assumed that Canada and USA have the same fluid milk retailing margin.[24] And therefore, the Canadian fluid milk wholesale price equals Canadian retail price minus US fluid milk retailing margin. AAFC publishes retail price of fluid milk (2% fat) of thirteen Canadian cities from 2004 to 2007. The average prices of these thirteen cities' fluid milk retail prices are calculated and the other years' (1996-2003) retail prices are converted by using Canadian fluid milk retail price index. The US fluid milk retailing margin is calculated by subtracting GAO published fluid milk wholesale from the retail price.

d. Adjusted Canadian domestic wholesale price of fluid milk

AAFC published Class 1(a) milk price is the farm milk price to produce fluid milk in Canada. Federal milk order price of Class I milk is the farm milk price to make fluid milk in US. It is assumed that a hectoliter of farm milk containing 3.6 Kg of fat and 3.2 Kg of protein can make 96.4 Kg 1% fluid milk, 3.3 Kg butter and 0.33

[24] Here, I may over estimate Canadian fluid milk wholesale prices. US retailer's market margin may less than Canadian margin because of more competition and economy of scale in the US retail market.

Kg buttermilk powder. Butter and buttermilk powder are the by-products in producing fluid milk. In order to calculated GPM and RSD in Eq. 4.7, 4.9 and 4.10, wholesale prices of butter and buttermilk powder have to be obtained. Butter wholesale prices have been discussed in Section 5.1. And the Canadian wholesale prices of buttermilk powder are collected from AAFC. While US buttermilk powder wholesale prices are gathered from USDA.

Table 5.3 summarizes the source of the wholesale prices data for each dairy product in Canada, USA, Oceania and EU.

Table 5.3: Source of the wholesale price data for USA, EU, Oceania and Canada

	Wholesale price published in the world commodity market or by Governments				World prices calculated by Canada's Trade data
Dairy product	Canada	US	Oceania	EU	US, EU and Oceania
Butter	AAFC	CME	USDA	USDA	Trade Analyser
SMP	AAFC	CME	USDA	USDA	Trade Analyser
Cheddar	AAFC	CME	USDA	Eurostat & MCD	Trade Analyser
Fluid Milk	AAFC*	GAO	**	**	Trade Analyser
Farm milk	AAFC	USDA	***	***	Trade Analyser
Whey Powder	AAFC	USDA	***	***	Trade Analyser
Buttermilk Powder	AAFC	USDA	***	***	Trade Analyser

*: Canadian fluid milk wholesale price equals AAFC published retail price minus US retailing margin which is calculated by GAO wholesale and retail price.
**: US fluid milk wholesale price is assumed to be the world price for Canadian market. Therefore, Oceania and EU prices are not collected.
***: Farm milk, whey powder and buttermilk powder are to calculate the processing margin in US and Canada. Therefore, the prices of these products of Oceania and EU are not collected.

5.4 Transportation Cost

All the world wholesale prices discussed above are FOB prices. They should be converted into landed prices (CIF prices) in calculating WIT. However, Statistics Canada

only collects trade data based on FOB price. To my best knowledge, there is no agency collect trade data on CIF value.

Both CIF and FOB prices are available for the USA trade data in USDA. The difference between CIF and FOB prices represents the aggregate cost of all freight, insurance, and other charges (excluding U.S. import duties). The unit cost of freight and insurance of dairy products can be calculated by US trade data which equals (CIF Value – FOB Value)/quantity. For example, in 2007, 5,657,700Kg Oceania made butter were imported into US, which worth 11,972,187USD and 12,973,660USD in FOB and CIF value respectively. Therefore, the transportation and insurance cost from Oceania to US in 2007 is 0.18USD/KG which equals (12,973,660-11,972,187)/5,657,700. Hence, the transportation and insurance costs for dairy products from Oceania and EU to US during 1996 to 2007 are easily computed by the same method. These transportation and insurance costs are regarded as cost from Oceania and EU to Canada as well. In other word, it is assumed that the transportation and insurance costs are the same from Oceania (or EU) to US and Canada. I understand this may under estimate Canadian landed price because the transportation cost from Oceania and Europe to Canada may a little bit higher than to US. But the difference is quite small.[25]

[25] To the information I got from one of the biggest dairy products exporter in OCEANIA, freight moves from New Zealand to North America on the same routes, whether it is Canada or the US. Product coming to Canada can go directly into Vancouver (same rates as west coast USA) or Toronto and Montreal. In the case of Toronto and Montreal the shipping line sends the containers by rail from the port of Philadelphia to the two cities. The cost difference would be USD $25 per MT. or 2.5 cent/KG.

The transportation cost between US and Canada is measured by using Cornell Scholars equation in their paper base on the 1995 data.[26] This 1995 transportation cost value is converted to the rest of years' (1996-2007) value using U.S. Department of Labor, Bureau of Labor Statistics general freight trucking producer price index.

5.5 Canadian Over-Quota Tariff

From 1996 to 2000, Canada has decreasing over-quota tariffs because of the Uruguay Round Agreement. After 2000, Canada has relatively stable over-quota tariff rates which are listed in Table 5.4.

Table 5.4: Canadian Over-quota tariff rates, 1996-2008

Year	Butter	SMP	Cheddar	Fluid Milk
1996	333.80%	225.30%	274.50%	269.60%
1997	325.10%	219.40%	267.30%	262.60%
1998	316.00%	213.00%	260.00%	255.00%
1999	307.50%	207.00%	252.50%	248.00%
2000-2008	298.50%	201.50%	245.50%	241.00%

Source: WTO and Canada Border Services Agency

5.6 Interest Rate

In order to convert world wholesale prices into Canadian Dollars, Bank of Canada yearly USD/CAD, Pound/CAD, EURO/CAD and ECU/CAD exchange rates are used.

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[26] Pratt, et al. (1997) reported an equation to estimate the transportation cost between two US cities using 1995 data. In their model, the transportation cost is a function of the distance between two cities, the minimum gross vehicle weight encountered along the route from the two cities and the wage index of the producing location.

The distance between US and Canadian cities are the capitals of the major dairy trade partners between provinces and States. The major butter trade partners are Ontario-Minnesota, Quebec-New York and British Columbia- Washington State. While for SMP, Ontario-California, Ontario-Illinois and Quebec-Vermont are major SMP trade partners. The major cheddar trade partners are Ontario-Wisconsin, Ontario-New York and Quebec-New York. The major fluid milk trade partners are BC-Washington State, Ontario-New York and Quebec-Vermont. The distance between trade partner cities is calculated by great circle method. The minimum gross vehicle weight and wage index are the numbers reported in their paper.

The transportation cost for of the dairy product between US and Canada is the average transportation cost between the trade partners.

One limitation of this method is that I ignore the border effect in the transportation dairy product from US to Canada. Broker fee and other cross border charges are excluded in my calculation. Because of this reason, I may underestimate the transportation cost between US and Canada.

CHAPTER 6

Results

Substituting Eq. 4.1 into Eq. 4.2 from Chapter Four, the WIT can be expressed as,

$$WIT = Tc - Tp = Tc - \frac{Pc - Pwc}{Pwb} \times 100\% \qquad (6.1)$$

As mentioned previously, Tc has been predetermined through Canada's commitments as part of the Uruguay Round Agreement on Agriculture and therefore, Tc is an exogenous variable. It can be concluded from Eq. 6.1 that Pc has a negative relationship with WIT; while Pwb (or Pwc) has a positive effect on WIT.[27]

As discussed in Chapter Five, WIT and potential WIT calculations are made for four dairy products, they are; butter, SMP, cheddar and fluid milk. Two types of Canadian wholesale price are used in this paper in the period of 1996-2007, they are; the Canadian wholesale price (CW) published by AAFC and the adjusted Canadian wholesale price (ACW) which equals the US processing margin plus Canadian farm milk cost. Similarly, two kinds of world wholesale price are applied in the same period. One is the world wholesale price (WW) published in the world commodity markets or by government administration organizations; another is the world trade wholesale price (WT) calculated by Canadian trade data. Hence, there are four groups of wholesale price data set to calculate WIT and potential WIT which are CW and WW, ACW and WW, CW and WT, ACW and WT. Four outcomes of WIT and potential WIT are calculated for each dairy product by each group of wholesale price.

[27] See Appendix II for the proof of the relationship between Pwb (Pwc) and WIT.

Table 6.1 shows the calculation results of WIT and potential WIT for butter. The first three column of Table 6.1 Part A shows the results of WIT calculated by CW and the world wholesale price (WW) of Oceania, Euro and US, respectively. For instance, in 2007, the WIT for butter between Canada and Oceania is 148.51% which can be found in Column (I). Similarly, the WIT between Canada and US is 150.67% in the same year. Column IV lists the minimum WIT of the first three columns. It can be concluded from Eq. 6.1, the lower the world wholesale price, the less the WIT. Oceania has absolute advantage in producing butter. The Oceania butter wholesale price is always the lowest one in the world. This is also reflected by the minimum WIT in column IV. The average minimum WIT in this part is 96.85%. The lowest minimum WIT is 8.17% (in 2002). Table 6.1 Part B displays the potential WIT calculated by ACW and WW. Since ACW is less than CW, potential WIT in Part B is higher than the WIT in Part A. In 2007, the minimum potential WIT is 180.43% which is 29.76% higher than the minimum WIT in Part A. The lowest minimum potential WIT is 41.56% (2002).

Table 6.2 lists the results of measuring WIT for butter calculated by CW/ACW and WT. The average minimum WIT is 118.04% which is shown in the Part A column (IV). The lowest minimum WIT is 37.25% (2006). The average minimum potential WIT is 146.15% in Part B. The lowest minimum potential WIT is 69.62% (2006). It can be found that the lowest WIT in this table is mostly calculated by using Oceania wholesale price. This is consistent with the results that the Oceania has advantage in producing butter in Table 6.1. Comparing WIT in Table 6.1 and 6.2, Table 6.2 always has a higher WIT in 1996-2007 (except 2003). This is because WT is greater than WW in most years which means Canada's import butter wholesale price is higher than the world butter

wholesale price. A possible explanation is that WW used in this paper is for the butter with an average quality. While, the butter the Canada import is in a better quality with higher value. Import quota holders would like to import higher valued products to gain a relatively high profit from their quotas.

Table 6.3 lists the WIT for SMP calculated by CW/ACW and WW. The average minimum WIT and average potential minimum WIT for SMP is 110.75% and 129.37%, respectively. The lowest minimum WIT and potential WIT are 65.67% and 85.72% (in 2002), respectively. Oceania shows the advantage in producing SMP which is reflected by the column IV in both Part A and B. But after 2004, US SMP price has dropped to the same level as Oceania. Since then, because of the relatively lower transportation cost, US have been the major SMP supplier to the Canadian market. Table 6.4 displays WIT for SMP computed by CW/ACW and WT. The average minimum WIT and average potential minimum WIT for SMP is 101.23% and 120.80%, respectively. The lowest minimum WIT is 54.56%. The lowest minimum potential WIT is 76.44% (2006).

Table 6.5 shows the WIT for cheddar computed by CW/ACW and WW. The average minimum WIT and average potential minimum WIT for Cheddar is 65.25% and 147.45%, respectively. Table 6.6 shows the WIT for cheddar computed by CW/ACW and WT. The lowest minimum WIT and potential WIT are 77.59% and 150.78%, respectively. In addition, Table 6.6 always reports a higher WIT and potential WIT than Table 6.5 which means Canada's import cheddar wholesale price is higher than the world market cheddar wholesale price. A reasonable explanation is that there are many types of cheddar in the world market with difference grades and flavors in each type. Compared

with butter and SMP (relatively homogeneous products), cheddar is a relatively heterogeneous product. Higher valued cheddars are imported into Canada in order to fit for demands of different groups of consumers.

As mentioned above, butter and SMP are relatively homogeneous dairy products.[28] For the homogeneous products, the product with the lowest price will dominate the import market. Therefore, the columns list the minimum WIT in Table 6.1, 6.2, 6.3 and 6.4 are regarded as the final WIT for butter and SMP. For the heterogeneous product, like cheddar, different consumers have different preferences. Therefore, there are always demands for the different types of cheddars in different prices level. For this reason, the minimum WIT can only be regarded as the WIT for cheddar with the lowest price. Any TRQ reduction beyond the minimum WIT for cheddar can not affect the importation of other types. For this reason, the average WIT and potential WIT for cheddar among Canada and Oceania, EU and US are regarded as WIT for all types of cheddar in the mean level.

The average WIT for cheddar among Canada and Oceania, EU and US is listed in Table 6.5 Part A column V. While the average potential WIT for cheddar among Canada and Oceania, EU and US is listed Part B column V. The lowest average WIT and potential WIT for cheddar are 44.76% and 142.84%, respectively. The columns V in Table 6.6 report the average WIT and potential WIT calculated by WT.

Table 6.7 reports the final WIT for the fluid milk with 2% fat. The average WIT in Part A which is calculated by Canadian wholesale price and US wholesale price is

[28] There exist several types of butter. However, compared with cheese and cheddar, butter is regarded as a homogeneous product.

164.31%. The average potential WIT computed by adjusted Canadian wholesale price and US price is 207.84%. The lowest minimum WIT and potential WIT are 111.15% and 176.01% (2006), respectively. Fluid milk has the highest average WIT and potential among the four dairy products indicating that Canadian fluid milk wholesale price is much closer to the world price than other dairy products on the wholesale level.

Table 6.1: WIT and potential WIT for butter calculated by WW

Butter	(Part A) WIT: CW/WW				(Part B) Potential WIT: ACW/WW			
Year	(I) Oceania	(II) EU	(III) US	(IV) minimum	(I) Oceania	(II) EU	(III) US	(IV) minimum
1996	189.56%	218.36%	252.87%	189.56%	217.40%	243.87%	272.76%	217.40%
1997	156.60%	208.04%	259.52%	156.60%	179.12%	226.57%	272.88%	179.12%
1998	195.64%	213.71%	313.43%	195.64%	210.14%	226.95%	319.94%	210.14%
1999	105.65%	139.70%	253.33%	105.65%	129.37%	160.81%	265.12%	129.37%
2000	53.39%	85.09%	229.88%	53.39%	85.79%	114.16%	245.24%	85.79%
2001	83.82%	98.39%	281.49%	83.82%	110.32%	123.50%	291.07%	110.32%
2002	8.17%	44.16%	226.11%	8.17%	41.56%	74.32%	240.43%	41.56%
2003	39.49%	57.52%	202.59%	39.49%	76.57%	92.80%	222.33%	76.57%
2004	98.07%	114.40%	261.56%	98.07%	126.28%	141.10%	274.19%	126.28%
2005	95.78%	71.99%	206.40%	71.99%	136.51%	116.04%	231.83%	116.04%
2006	11.29%	40.43%	141.50%	11.29%	45.99%	72.60%	164.09%	45.99%
2007	148.51%	214.73%	150.67%	148.51%	180.43%	238.31%	181.80%	180.43%
Average	98.83%	125.54%	231.61%	96.85%	128.29%	152.59%	248.47%	126.58%

Note: CW = Canadian Wholesale price of butter published by AAFC
ACW = Adjusted Canadian wholesale price of butter
WW = World (OCEANIA, EU, US) wholesale price of butter published by USDA

Table 6.2: WIT and potential WIT for butter calculated by WT

Butter	(Part A) WIT: CW/WT				(Part B) Potential WIT: ACW/WT			
Year	(I) Oceania	(II) EU	(III) US	(IV) minimum	(I) Oceania	(II) EU	(III) US	(IV) minimum
1996	227.15%	214.46%	216.78%	214.46%	250.71%	240.44%	240.63%	240.44%
1997	196.10%	232.70%	229.21%	196.10%	215.31%	249.12%	245.02%	215.31%
1998	212.03%	230.58%	228.54%	212.03%	225.46%	242.72%	240.43%	225.46%
1999	165.32%	166.12%	197.54%	165.32%	184.36%	185.15%	213.60%	184.36%
2000	94.59%	117.36%	125.91%	94.59%	123.12%	143.44%	150.74%	123.12%
2001	122.31%	108.01%	124.91%	108.01%	145.56%	132.31%	147.31%	132.31%
2002	70.68%	98.85%	127.42%	70.68%	98.72%	124.37%	149.93%	98.72%
2003	37.63%	76.32%	198.32%	37.63%	74.90%	109.65%	218.49%	74.90%
2004	108.51%	134.28%	222.06%	108.51%	135.74%	159.10%	238.33%	135.74%
2005	98.90%	122.43%	213.43%	98.90%	139.21%	159.68%	237.93%	139.21%
2006	37.25%	91.33%	131.87%	37.25%	69.62%	118.93%	155.30%	69.62%
2007	73.01%	120.40%	168.24%	73.01%	114.58%	156.08%	197.16%	114.58%
Average	120.29%	142.74%	182.02%	118.04%	148.11%	168.41%	202.91%	146.15%

Note: CW = Canadian Wholesale price of butter published by AAFC
ACW = Adjusted Canadian wholesale price of butter
WT = World (OCEANIA, EU, US) butter wholesale price calculated by Canadian trade data

Table 6.3: WIT and potential WIT for SMP calculated by WW

SMP	(Part A) WIT: CW/WW				(Part B) Potential WIT: ACW/WW			
Year	(I) Oceania	(II) EU	(III) US	(IV) minimum	(I) Oceania	(II) EU	(III) US	(IV) minimum
1996	171.72%	173.87%	211.05%	171.72%	189.39%	190.91%	223.76%	189.39%
1997	148.34%	148.09%	192.25%	148.09%	162.65%	162.47%	202.63%	162.47%
1998	103.89%	114.94%	194.47%	103.89%	117.59%	128.41%	202.08%	117.59%
1999	79.01%	81.72%	175.47%	79.01%	96.86%	99.36%	185.65%	96.86%
2000	136.49%	137.41%	162.93%	136.49%	151.97%	152.77%	175.70%	151.97%
2001	153.40%	152.34%	163.20%	152.34%	165.77%	164.99%	174.66%	164.99%
2002	68.72%	65.67%	144.14%	65.67%	88.47%	85.72%	157.35%	85.72%
2003	87.69%	87.70%	101.13%	87.69%	109.62%	109.57%	121.52%	109.57%
2004	93.32%	98.66%	80.51%	80.51%	112.77%	117.64%	101.08%	101.08%
2005	81.74%	87.16%	74.95%	74.95%	111.09%	116.01%	105.21%	105.21%
2006	69.11%	95.15%	78.12%	69.11%	90.05%	113.56%	97.92%	90.05%
2007	167.08%	169.58%	159.56%	159.56%	184.21%	186.24%	177.52%	177.52%
Average	113.38%	117.69%	144.82%	110.75%	131.70%	135.64%	160.42%	129.37%

Note: CW = Canadian Wholesale price of SMP published by AAFC
ACW = Adjusted Canadian wholesale price of SMP
WW = World (OCEANIA, EU, US) wholesale price of SMP published by USDA

Table 6.4: WIT and potential WIT for SMP calculated by WT

SMP	(Part A) WIT: CW/WT				(Part B) Potential WIT: ACW/WT			
Year	(I) Oceania	(II) EU	(III) US	(IV) minimum	(I) Oceania	(II) EU	(III) US	(IV) minimum
1996	175.09%	128.88%	160.66%	128.88%	192.37%	150.97%	178.97%	150.97%
1997	172.55%	119.64%	131.58%	119.64%	184.84%	136.42%	146.91%	136.42%
1998	116.22%	187.58%	119.10%	116.22%	129.11%	196.11%	131.55%	129.11%
1999	101.96%	85.57%	84.08%	84.08%	118.01%	102.92%	101.34%	101.34%
2000	129.31%	133.77%	164.84%	129.31%	145.46%	149.47%	177.44%	145.46%
2001	144.73%	144.70%	158.25%	144.70%	157.83%	157.99%	170.12%	157.83%
2002	96.48%	71.50%	132.30%	71.50%	113.88%	91.05%	146.51%	91.05%
2003	72.56%	138.78%	100.19%	72.56%	96.04%	155.43%	120.68%	96.04%
2004	79.40%	n/a	90.70%	79.40%	100.16%	n/a	110.31%	100.16%
2005	73.37%	n/a	84.05%	73.37%	103.83%	n/a	113.09%	103.83%
2006	n/a	n/a	54.56%	54.56%	n/a	n/a	76.44%	76.44%
2007	n/a	n/a	140.58%	140.58%	n/a	n/a	160.93%	160.93%
	116.17%	126.30%	118.41%	101.23%	134.15%	142.54%	136.19%	120.80%

Note: CW = Canadian Wholesale price of SMP published by AAFC
ACW = Adjusted Canadian wholesale price of SMP
WT = World (OCEANIA, EU, US) SMP wholesale price calculated by Canadian trade data
n/a = Data are not available

Table 6.5: WIT and potential WIT for cheddar calculated by WW

Cheddar	(Part A) WIT: CW/WW					(Part B) Potential WIT: ACW/WW				
Year	(I) Oceania	(II) EU	(III) US	(IV) minimum	(V) average	(I) Oceania	(II) EU	(III) US	(IV) minimum	(V) average
1996	126.99%	267.89%	198.69%	126.99%	197.86%	206.26%	302.31%	253.57%	206.26%	254.05%
1997	117.36%	269.56%	177.74%	117.36%	188.22%	185.51%	296.50%	228.20%	185.51%	236.74%
1998	94.31%	266.11%	206.41%	94.31%	188.95%	166.69%	291.87%	247.27%	166.69%	235.28%
1999	52.15%	254.29%	178.42%	52.15%	161.62%	132.61%	280.70%	224.09%	132.61%	212.47%
2000	50.88%	221.83%	128.11%	50.88%	133.61%	126.93%	253.92%	183.18%	126.93%	188.01%
2001	98.37%	220.49%	173.12%	98.37%	163.99%	161.68%	252.76%	216.51%	161.68%	210.31%
2002	40.85%	220.11%	142.53%	40.85%	134.50%	111.95%	249.58%	188.99%	111.95%	183.51%
2003	30.16%	172.43%	135.98%	30.16%	112.86%	104.62%	213.60%	184.64%	104.62%	167.62%
2004	59.97%	179.75%	137.37%	59.97%	125.70%	148.52%	231.44%	201.07%	148.52%	193.68%
2005	39.24%	133.26%	77.13%	39.24%	83.21%	142.18%	204.88%	165.99%	142.18%	171.02%
2006	-1.92%	136.22%	-0.03%	-1.92%	44.76%	111.74%	205.10%	111.70%	111.70%	142.84%
2007	87.52%	155.56%	74.60%	74.60%	105.89%	180.13%	224.18%	170.81%	170.81%	191.70%
Average	66.32%	208.13%	135.84%	65.25%	136.76%	148.23%	250.57%	198.00%	147.45%	198.94%

Note: CW = Canadian Wholesale price of Cheddar published by AAFC
ACW = Adjusted Canadian wholesale price of cheddar
WW = World (OCEANIA, US) wholesale price of cheddar published by USDA, EU wholesale price is the average of UK wholesale price published by Eurostat and MDC

Table 6.6: WIT and potential WIT for cheddar calculated by WT

Cheddar	(Part A) WIT: CW/WT					(Part B) Potential WIT: ACW/WT				
Year	(I) Oceania	(II) EU	(III) US	(IV) minimum	(V) average	(I) Oceania	(II) EU	(III) US	(IV) minimum	(V) average
1996	172.19%	228.36%	232.15%	172.19%	210.90%	236.98%	275.54%	276.58%	236.98%	263.04%
1997	175.48%	211.73%	235.63%	175.48%	207.62%	227.79%	254.62%	270.68%	227.79%	251.03%
1998	150.27%	218.36%	243.17%	150.27%	203.94%	207.41%	257.22%	274.25%	207.41%	246.29%
1999	135.77%	240.39%	230.94%	135.77%	202.37%	193.82%	270.54%	262.83%	193.82%	242.40%
2000	115.70%	237.99%	208.70%	115.70%	187.46%	175.02%	265.89%	243.35%	175.02%	228.09%
2001	135.63%	238.03%	218.43%	135.63%	197.36%	189.39%	265.77%	250.41%	189.39%	235.19%
2002	145.14%	269.09%	225.63%	145.14%	213.29%	191.89%	287.05%	253.07%	191.89%	244.00%
2003	90.59%	265.53%	186.95%	90.59%	181.02%	150.78%	284.56%	223.77%	150.78%	219.70%
2004	77.59%	257.93%	202.49%	77.59%	179.34%	160.68%	285.23%	246.26%	160.68%	230.72%
2005	83.95%	249.31%	191.86%	83.95%	175.04%	171.86%	281.77%	242.74%	171.86%	232.12%
2006	229.17%	246.98%	183.54%	183.54%	219.89%	267.22%	279.40%	235.91%	235.91%	260.84%
2007	198.86%	241.61%	176.59%	176.59%	205.69%	251.50%	279.14%	236.57%	236.57%	255.74%
Average	142.53%	242.11%	211.34%	136.87%	198.66%	202.03%	273.89%	251.37%	198.18%	242.43%

Note: CW = Canadian Wholesale price of cheddar published by AAFC
ACW = Adjusted Canadian wholesale price of cheddar
WT = World (OCEANIA, EU, US) cheddar wholesale price calculated by Canadian trade data

Table 6.7: WIT and potential WIT for fluid milk (2% fat)		
Fluid milk	(Part A) WIT: CW/WW	(Part B) Potential WIT: ACW/WW
Year	(I) US	(II) US
1996	n/a	n/a
1997	189.68%	224.95%
1998	193.18%	222.95%
1999	195.15%	226.99%
2000	178.03%	211.14%
2001	190.45%	219.30%
2002	183.83%	208.78%
2003	155.93%	200.26%
2004	143.82%	198.94%
2005	140.17%	193.96%
2006	111.15%	176.01%
2007	126.02%	202.95%
Average	164.31%	207.84%

Note: CW = Canadian Wholesale price of fluid milk
ACW = Adjusted Canadian wholesale price of fluid milk
WW = US wholesale price of fluid milk
n/a = Data are not available

Chapter 7

Water in the Tariff Forecasting

It is important for the policy makers to know how much WIT for dairy products in the future. In this chapter, WIT and potential WIT are forecasted starting from forecasting world and Canadian dairy products wholesale prices.

7.1 Forecasting world dairy products wholesale prices

Oceania butter, SMP and Cheddar wholesale prices in the coming decade (2008-2017) were forecasted by the OECD-FAO in the Agricultural Outlook 2008-2017. OECD-FAO's predictions were based on the assumptions on the international market and Governments' policies. These OECD-FAO forecasting world wholesale prices are used in this paper.

7.2 Forecasting Canadian dairy products wholesale prices

Since Canadian dairy market is separated from the world under the supply management system, Canadian dairy products wholesale prices do not vary as the world prices. However, the real value of Canadian raw milk price and the real value of GPM of dairy products in Canada and US have shown relatively stable in the last twelve years.

Figure 7.1 show the real value of the raw milk price and GPM of butter in Canada and US. The real value of Canadian raw milk price has shown a flat upward sloping trend in the last twelve years. Assuming unchanged Canadian agricultural and trade policies on the farm milk over the period to 2017, the real value of Canadian raw milk price is

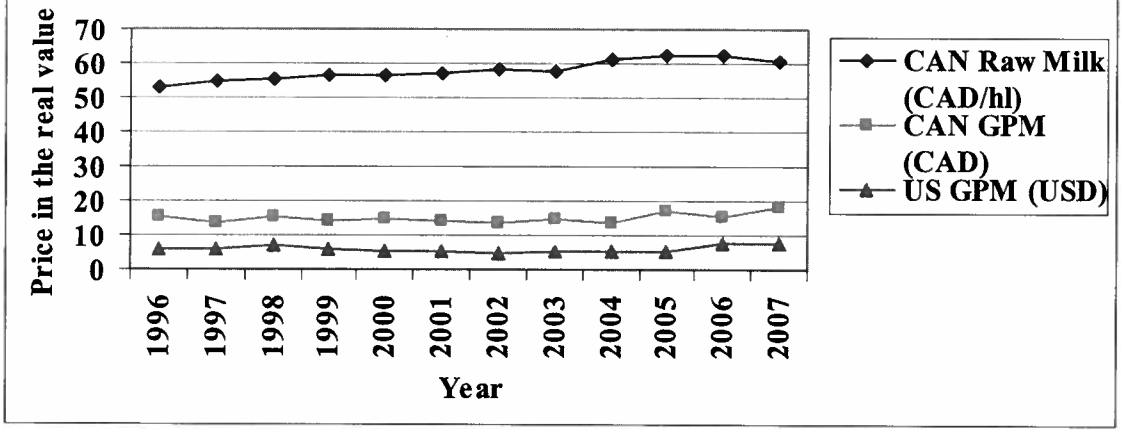
forecasted by regression the time series data.[29] Figure 7.1 also shows that the real value of Canadian GPM was stable in the period of 1996-2004, but kept on rising after 2004. This is mainly due to the increasing concentration level of Canadian dairy processors. Assume that the concentration level of Canadian dairy processing industry in the next decade is stable at the current level. Also assume that the real value of Canadian GPM in the coming decade follows the same developed trend as in the period of 1996-2004. Therefore, the real value of Canadian GPM in the next decade is predicted constant and at the same level as 2007. The real value of US GPM is also shown stable in the past decade in Fg 7.1. Assume that the real value of US GPM will keep this stable trend over the coming decade. Then the real value of US GPM in the next decade can be presented by the mean value of the GPM in the last twelve year.

Based on the previous assumptions, the real value of Canadian dairy products prices can be forecasted by the sum of the real value of Canadian raw milk prices and the Canadian GPM. While the real value of the adjusted Canadian dairy products wholesale prices are predicted as the sum of the real value of Canadian raw milk price and US GPM. All these real value prices are converted into the nominal term by using the OECD-FAO predicted Canadian inflation rate for the period 2008-2017 in their Agricultural Outlook report.

[29] First run linear regression on the time series data of Canadian raw milk wholesale prices in the period of 1996-2007 to find the time trend. Then use this regression result to forecast the prices over the period to 2017.

In order to split the dairy products and their by-products from the total revenue, the coming decade dairy products' revenue shares are assumed to be constant at the mean level of the revenue share in the past twelve years.[30]

Figure 7.1: The real value of Canadian raw milk price, Canada and US GPM of butter



7.3 Forecasting the exchange rate and transportation

The future exchange rate (CAD/USD) used in this chapter is the OECD-FAO predicted exchange rates in their Agricultural Outlook Report. The transportation cost between Oceania and Canada is assumed stable and constant at the same level as 2007.[31]

7.4 Canadian over-quota tariff rate

Assume the unchanged Canadian over-quota tariff rate over the period to 2017.

[30] The revenue share of butter, SMP and cheddar in the past decade were quite stable.
[31] Admittedly, there is an increasing trend of the international transportation cost because of the increased oil prices. I notice that I may underestimate the transport cost by assuming it is constant in the coming decade. Hence, I may underestimate the future WIT and Potential WIT in this Chapter.

Based on all the assumptions and substituting all the predicted prices data into Eq 6.1, WIT and potential WIT in the next decade are forecasted and the calculation results are listed in the Table 7.1.

The results show that there still exists huge WIT and potential WIT for butter, SMP and cheddar in the next decade. However, compared with the past decade, WIT and potential WIT in the period of 2008-2017 show relatively small variability. This is mainly because of the relatively stable future world prices which were predicted by OECD-FAO. In the period of 2008-17, the lowest WIT for butter, SMP and cheddar is 127.17%, 125.83% and 75.98% respectively. Similarly, the lowest potential WIT for butter, SMP and cheddar is 165.86%, 149.25% and 167.45% respectively.

Table 7.1 WIT and potential WIT between Canada and Oceania 2008-2017

Year	WIT			Year	Potential WIT		
	Butter	SMP	Cheddar		Butter	SMP	Cheddar
2008	173.39%	157.87%	124.80%	2008	207.01%	179.26%	203.13%
2009	162.29%	145.54%	108.33%	2009	197.20%	168.53%	191.85%
2010	138.31%	135.81%	84.17%	2010	176.32%	159.94%	175.45%
2011	127.17%	131.62%	76.07%	2011	166.31%	156.05%	169.39%
2012	127.23%	129.54%	75.98%	2012	165.86%	153.96%	168.56%
2013	128.94%	128.22%	76.55%	2013	166.85%	152.52%	168.16%
2014	132.67%	126.89%	77.99%	2014	169.59%	151.07%	168.36%
2015	135.47%	126.77%	78.77%	2015	171.53%	150.66%	168.13%
2016	136.05%	126.01%	79.68%	2016	171.58%	149.70%	168.01%
2017	137.29%	125.83%	79.92%	2017	172.22%	149.25%	167.45%

Chapter 8

Conclusion and Recommendations

This thesis uses theoretical and empirical analysis to answer one of the most sensitive questions - How much water is in the tariff of the Canadian dairy products? Based on the models discussed and the data presented, some important results are reported in this paper.

There are huge amount of WIT and potential WIT among the four dairy products. The extent of water varies by dairy products. The WIT is significantly increased to the potential level if it is calculated by using adjust Canadian wholesale price. This allows a potential deeply tariff cut without increasing imports.

In the period of 1996-2007, by using Canada and world wholesale price data, the average minimum WIT for butter, SMP, cheddar and fluid milk are 96.85%, 110.75%, 65.25% and 164.31%, respectively. In the period of 1996-2007, by using adjusted Canada and world wholesale price data, the average minimum potential WIT for butter, SMP, cheddar and fluid milk are 126.58%, 129.37%, 147.45% and 207.84%, respectively. The average minimum WIT and average potential minimum WIT calculated using Canadian trade data are still high for all four products.

The results also show that there still exists WIT and potential WIT for butter, SMP and cheddar in the next decade. The WIT and potential WIT fluctuate smoothly as compare to the past decade. Specially, in the period of 2008-17, the lowest WIT for butter, SMP and cheddar is 127.17%, 125.83% and 75.98% respectively. Similarly, the lowest

potential WIT for butter, SMP and cheddar is 165.86%, 149.25% and 167.45% respectively.

There are also some limitations in this thesis. The Canadian wholesale prices data used in this paper are the prices in the Quebec province. It would improve the measurement if by using the real Canada wholesale prices data in stead of only using Quebec province data. Another limitation is that when I calculate the adjusted Canadian wholesale price by adding US GPM to the Canada's raw milk price, I assume that the payment of higher farm milk prices does not increase any other processor cost. I may under estimate the adjusted Canadian wholesale prices if the higher part of the Canadian farm milk cost generate some processor cost. It is an area open for further consideration.

There are other interesting questions for future study. For example, there is considerable variability in the level of water by year. There are systematic influences on the level of water, with the primary candidates explaining its variability being the exchange rate and the world price of dairy products. Two questions that can be asked are, (a) how has the exchange rate affected water levels, and (b) how have world prices affected them? I plan to set up a simple simulation model to estimate how the exchange rate and world wholesale prices affect water in the tariff in future research.

8.1 Policy Recommendations:

As mentioned in Chapter One, it is important for trade negotiators to know by how much tariffs can be reduced and still maintain protection from imports for the domestic industry. It is also important for government policy makers to know how a

given tariff reduction will actually affect the industry. In addition, if it would affect the domestic industry, the distributional effects of the tariff reduction is also an interesting issue. The answers to these questions are discussed in this section and some policy recommendations are also made below.

(a) Distributional effect of the tariff reduction

Any tariff reduction smaller than the WIT will not increase any import and will not affect Canadian dairy processing industry. Domestic dairy products prices are not affected, either. There is no distributional effect when the tariff reduction is smaller than WIT.

Any tariff reduction beyond WIT but less than the potential WIT can always keep imports out, but it will lower the Canadian dairy products wholesale prices to a more competitive level and therefore, will affect the dairy processing industry. Lower Canadian dairy products wholesale prices will squeeze some amount of the extra profit out of the dairy processors, resulting in a reduced processor surplus. The new low prices will also induce more consumption on the dairy products. The processors will gain profit from selling more products, resulting in a positive processor surplus. The weight of these two different results will determine the overall effect of the new lower prices on the processors. Assuming the dairy products retailing margin is constant, the lower wholesale price means lower retail price. Consumers will benefit from the price reduction, resulting in a positive consumer surplus. The Federal Government will not gain any tariff revenue in this case because there are still no imports. The new lower wholesale price will also reduce the import quota price, resulting in a welfare lose for import quota holders. What's

more important is that the increased consumption (due to the new lower prices) will result in the increasing demand for farm milk. As assumed in Chapter Four, the farm milk price is a policy variable in Canada and is assumed changed. Therefore, the only way to meet the increased demand is to expand farm milk production, i.e. increased farm milk production quota. Finally, it will result in a positive milk farmer's (producer) surplus. Total social welfare will increase from the low wholesale prices (for the detailed explanation, please see Appendix III). Therefore, tariff reductions beyond WIT but less than potential WIT can always increase the social welfare without affecting any import. It is also can be concluded that the closer the tariff reduction to the potential WIT, the more social welfare gains for the Canada.

(b) The international dairy products wholesale prices maybe stochastic, but their trends are relatively clear in the coming decade

The future Canadian and world wholesale prices in Chapter Seven are forecasted based on the assumptions on the dairy markets and agricultural trade policies. Admittedly, any wrong assumptions will induce an inaccurate predicted wholesale price. For this reason, one may have questions surrounding the predicted wholesale prices and therefore, suspects the predicted WIT and potential WIT in Chapter Seven.[32] However, compared to the past decade, it is anticipated that the average world dairy products wholesale prices will increase substantially in the period of 2008-2017. The main reasons for this positive

[32] According to the predictions in Chapter Seven, any tariff reduction less than 127.17% for butter, 125.83% for SMP and 75.98% for cheddar will not affect Canadian dairy processing industry in the coming decade. And the tariff reduction for butter, SMP and cheddar lower than 165.86%, 149.25% and 167.45%, respectively, will not increase any import in the coming decade, but will lower the Canadian dairy products wholesale prices to a more competitive level and therefore, will increase the Canadian social welfare.

expect are the increasing demand from the emerging markets (such as India and China) and the fact that the EU will have to give up market share on the international market as consumption increases in the domestic EU (OECD-FAO, 2008). In addition, "*the OECD-FAO predictions are based on the assumption of continuation of current policies and do not take account of the prospective Doha Round results. The elimination of export subsidies and the expansion of market access for dairy products would only reinforce the positive outlook based on the underlying market fundamentals*" (Gifford and Dymond, 2008). Hence, the development trend of the world dairy products wholesale prices is quite clear even if their future exact values are uncertain. Therefore, it is predictable that the world dairy products wholesale prices in the coming decade will not drop hugely as compared to 2002 and 2006.[33] In other words, the probability that the WIT in the next decade will be less than or as low as in 2002 and 2006 is extremely low. In addition, even if this small probability event would happen in the future, Canada can still use special safeguard provisions on the dairy product to protect the domestic market.[34]

[33] In 2002 and 2006, the world dairy products wholesale prices dropped to the lowest points over the past decade, resulting the smallest WIT and potential WIT.

[34] Special Safeguard Provisions are restrictions on imports taken temporarily to deal with special circumstances such as a sudden surge in imports. Canada has reserved the right to use a combined total of 150 special safeguards on agricultural products including all four dairy products examined in this paper. (WTO, 2000)

(c) On the conditions of the stochastic international prices and their certain development trends, what percent of the over-quota tariff can be reduced without increasing imports in the coming decade?

When the international prices are stochastic, the predicted WIT and potential WIT in Chapter Seven can not answer the above question. However, as discussed in Section 8.1.2, it is clear that the international prices will not drop substantially as in 2002 and 2006. Therefore, I conclude that (1) any tariff reduction less than the lowest minimum WIT in the period of 1996-2007 (excluding 2002 and 2006) will not affect the domestic dairy processing industry in the coming decade. Specifically, a tariff reduction less than 39.49% for butter, 74.95% for SMP, 83.21% for cheddar and 126.02% for fluid milk will not affect Canadian dairy industry and will not increase imports, either; (2) any tariff reduction less than the lowest minimum potential WIT in the period of 1996-2007 (excluding 2002 and 2006) will not increasing any imports in the coming decade, but will lower the wholesale prices. Specifically, any tariff reduction less than 76.57% for butter, 96.86% for SMP, 167.62% for cheddar and 193.96% for fluid milk will not increase any import, but will lower Canadian wholesale prices. The new low wholesale prices will increase the Canadian social welfare. Especially, it will maximize the social welfare gain when the tariff reduction is equal to the potential WIT. Of course, Canada should still reserve the right to use special safeguard provisions on the dairy products in the case of future declines in world prices.

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Appendix I

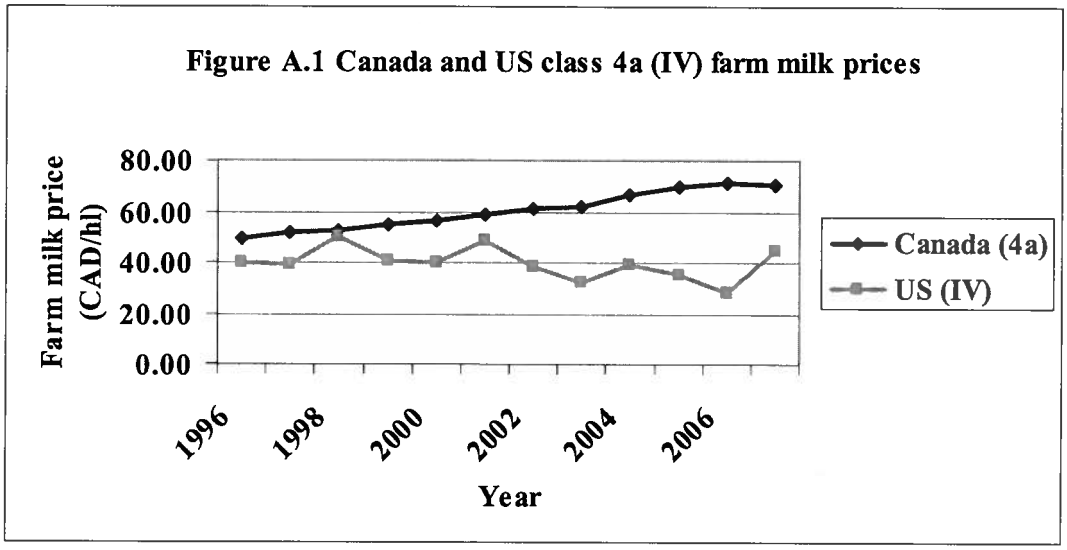
Figure A.1 Canada and US class 4a (IV) farm milk prices
Farm milk price (CAD/hl)
80.00
60.00
40.00
20.00
0.00
1996
1998
2000
2002
2004
2006
Year
Canada (4a)
US (IV)

Table A.1 Percentage of over quota import in the total Canadian dairy products import		
Year	Quantity	Value
2007	0.96%	0.71%
2006	1.60%	1.22%
2005	1.04%	0.97%
2004	0.73%	0.54%

Figure A.2: Canada, Oceania, EU and US cheddar wholesale prices

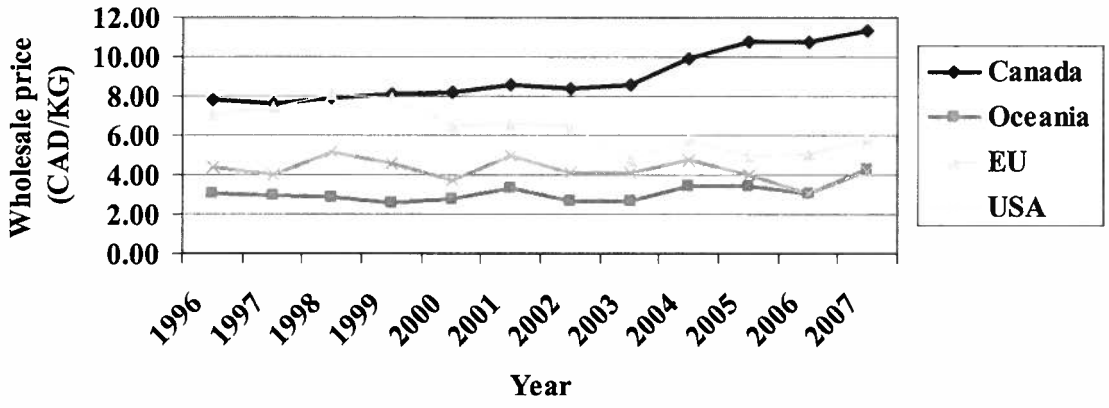

Figure A.3: Canada and US fluid milk (2% fat) wholesale prices

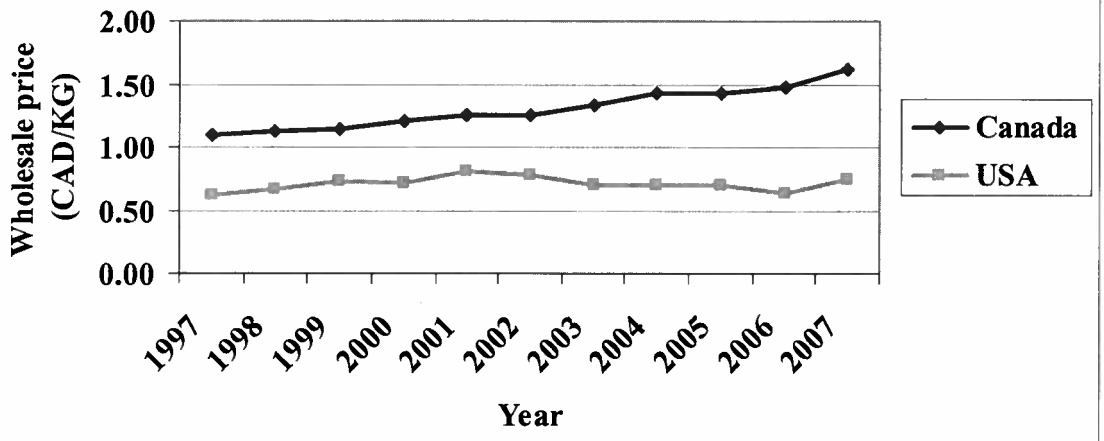

Table A.2 Per Capita consumption of dairy products in Canada				
Year	Fluid Milk (liters)	Butter (KG)	SMP (KG)	Cheddar (KG)
2006	83.39	2.83	2.42	4.14
2005	83.82	3.15	2.17	3.97
2004	85.50	3.45	1.92	3.78
2003	85.20	3.23	1.57	3.88
2002	85.53	3.29	1.47	3.77
2001	87.03	3.36	1.45	3.84
2000	88.21	3.10	1.14	3.91
1999	87.73	2.85	1.45	4.00
1998	88.77	2.89	1.15	3.85
1997	89.14	2.63	1.04	3.97
1996	90.05	2.87	1.28	3.76

Table A. 3 Metric-U.S. conversions
1 hectolitre = 100 liters
1 hectolitre = 26.42 gallons
1 hectolitre = 227.3 pounds
1 hectolitre = 2.273 cwts
1 liter = 1.033 kilograms
1 liter = 2.273 pounds
1 liter = 0.264 gallons
1 metric ton = 1000 kilograms
1 metric ton = 2205 pounds
1 kilogram = 2.205 pounds
1 pound = 0.454 kilograms
1 gallon = 8.621 pounds
1 gallon = 3.785 liters
Source: Kenneth W. Bailey, 2002

Appendix II

The proof of the relationship between Pwb (Pwc) and WIT

Proof:

Note: World wholesale price in CIF value (Pwc) equals the sum of world wholesale price in FOB value (Pwb) and the Transportation Cost (Tr). Assume Pc is greater than Tr which means that the Canadian domestic wholesale price is greater than the transportation cost.

Therefore, $Pwc = Pwb + Tr$ (A.1)

Or $Pwb = Pwc - Tr$ (A.2)

$$WIT = Tc - Tp = Tc - \frac{Pc - Pwc}{Pwb} \times 100\% \quad (6.1)$$

Substitute Eq. A.1 into Eq 6.1 to replace Pwc,

$$WIT = Tc - \frac{Pc - Pwb - Tr}{Pwb} \times 100\% = Tc - \frac{Pc - Tr}{Pwb} + 1 \quad (A.3)$$

Differentiate Eq A.3 w.r.t Pwb, I get

$$\partial WIT / \partial Pwb = \frac{Pc - Tr}{(Pwb)^2} \succ 0$$

Substitute Eq A.2 into Eq 6.1 to replace Pwb,

$$WIT = Tc - \frac{Pc - Pwc}{Pwc - Tr} \times 100\% \quad (A.4)$$

Differentiate Eq A.4 w.r.t Pwc, I get

$$\partial WIT / \partial Pwc = \frac{Pc - Tr}{(Pwc - Tr)^2} \succ 0$$

Therefore, both Pwc and Pwb have positive relationship with WIT.

Appendix III

Welfare analysis for the tariff reduction less than potential WIT

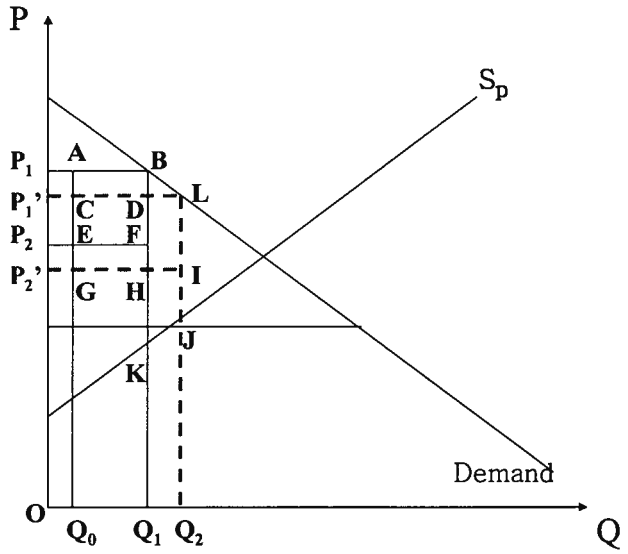

Figure A.4: Welfare analysis for the tariff reduction less than potential WIT

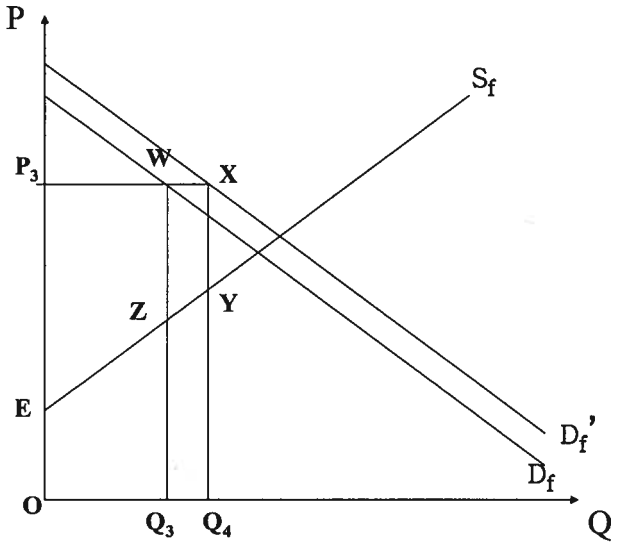

Figure A.5: Welfare analysis for dairy farmers after the tariff reduction

Figure A.4 analyzes the changes of the welfare after the tariff reduction beyond WIT but less than potential WIT. Sp is the supply curve of dairy processors. P_1 is the retail price of dairy product and P_2 is the Canada domestic wholesale price with the limit amount of import quota Q_0. Therefore, the domestic production is Q_1-Q_0. The difference between P_1 and P_2 is the retailing margin. Here, I assume the retail margin is constant.

As discussed in Chapter Four, the Canadian dairy processors will lower their price to math the new duty paid foreign price by reducing GPM. Their new low the retail and wholesale price are P_1' and P_2', respectively. The consumption also increased from Q_1 to Q_2 after the prices decreased, resulting in a positive consumer surplus (equals P_1BLP_1' in Figure A.4). Processor surplus is HIJK-EFGH. The new low prices also reduced the import quota price and therefore, the import quota holders will lose profit for the amount equals to P_1ACP_1'.

In Figure A.5, D_f and S_f are the demand and supply curves for farm milk, respectively. P_3 is farm milk price and Q_3 is farm milk production before tariff reduction. After the tariff reduction, the increased consumption (due to the new lower prices) will induce the increasing demand on the farm milk, shifting the demand curve to D_f'. As assumed in Chapter Four, the farm milk price is a policy variable in Canada and is assumed unadjusted. Therefore, the only way to meet the increased demand is to expand the farm milk production to Q_4. The dairy farmer (producer) surplus is WXYZ.

Therefore, the total welfare gain = consumer surplus + processor surplus + quota holders lost + dairy farmer surplus = P_1BLP_1' + HIJK-EFGH - P_1ACP_1' + WXYZ = BDL + HIJK + WXYZ. (in Figure A.4, ABCD=EFGH)