Evaluating Trade Developments in Dairy Products*

Keithly Jones**
(202) 694-5172
kjones@ers.usda.gov

and

Don P. Blayney**
(202) 694-5171
dblayney@ers.usda.gov

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**Keithly Jones and Don Blayney are economists with the Animal Products Branch, Markets and Trade Economics Division, Economic Research Service.

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Abstract

Non-parametric measures of pre- and post-URAA period trade openness for dairy products in key dairy product-trading countries are calculated. Import penetration and export performance are regressed on economic variables to gauge their influences on the two measures. Modest changes in trade openness are suggested but economic variables seemed most influential.

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Introduction

Agricultural trade was not addressed systematically under the General Agreement on Tariffs and Trade (GATT) until the Uruguay Round (UR) starting in 1986. Dairy products trade in many countries are already "liberalized" and are exempted from further liberalization under the Uruguay Round Agreement on Agriculture (URAA). International dairy markets have changed considerably since 1986, fueled by three linked factors. First, market forces have substantially changed dairy industries in major exporting and importing countries. Second, a number of countries have made major changes in, or seen the full effects of, domestic dairy policy changes made in the eighties. And lastly, the URAA has affected the international dairy markets through the implementation of tariff-rate quotas, and changes in subsidies for exports. These changes provide the context for future negotiations, if the current global trade talks resume.

International dairy trade proved to be a difficult issue to address during the UR because most of the dairy industries of the developed world enjoyed relatively high domestic support and strong protection from foreign competition. The UR of the GATT, concluded in December 1993, signed in April 1994, and with the final Act of the UR and the Marrakesh Agreement established the WTO. The WTO Agreement on Agriculture was implemented beginning January 1, 1995. The implementation of the agreement has changed the course of international dairy markets and the way future multilateral trade negotiations are likely to be handled. The objectives of trade liberalization under the WTO are to reduce trade and production distortions and expand market access. Ultimately, increased world import demand for dairy products coupled with higher and more stable world prices should result from trade liberalization.

The World Trade Organization (WTO) Agreement on Agriculture or informally known as the Uruguay Round Agreement on Agriculture (URAA) among researchers produced general rules that applied to all members and specific commitments made by individual member governments. For agriculture, the commitments generally took the form of tariff quotas, limits on export subsidies and efforts to reduce domestic support. Based on the schedules of concessions, limits for most countries involved doubling of tariff quotas over a 6-year period (1995-2000) and cutting tariffs and subsidies by half for the same period. For the fairly liberalized countries, these concessions meant little-to-no change in dairy support and protection policies.

Studies on world dairy trade liberalization are few. Shaw and Love (2001) used the OECD AGLINK model to examine the market effects of increased market access and reducing export subsidies for dairy products and found that the value of world dairy trade increased substantially. Relative to a 1999 baseline, the study showed that Australia, New Zealand and Argentina would increase their value of milk production by 7-9 percent under increased market access.

Langley et al., (2003) examined trade liberalization in international dairy markets using a partial equilibrium model that explicitly incorporated a wide range of domestic and border policies in agriculture. They found that liberalization of the dairy industry would result in lower supplies, higher world dairy prices, and higher value of trade. Non-subsidizing countries such as Australia, New Zealand and South American countries would benefit from liberalization with higher trade and higher value of production.

Diakosavvass (2001) studied the openness of OECD markets by providing an appraisal of the short-term implications of the URAA. Using a simple "before and after" approach, absolute and relative comparisons were made between various trade openness indicators in the six years preceding the URAA and in the first six years of its implementation. Indexes of trade openness, import penetration and export performance were calculated that showed modest changes in the openness of world markets.

Diakosavvas (2001) also emphasizes the difficulties associated with using such an approach for assessing changes in trade status. First, it is difficult to untangle effects of trade reform from other policy shifts, technological changes and business cycles. Second, pre-existing policies may have been changed, irrespective of the WTO commitments. Third, adjustments initiated due to the URAA are not instantaneous and the adjustment rate varies among products. Despite the difficulties, statistical evaluation of pre-and post-URAA period trade performance indicators for individual countries and products could suggest avenues for further attempts to assess the effects of trade liberalization. The objectives of this study are to explore aspects of trade openness related to dairy products in selected countries and to develop some sense of what the factors influencing trade developments for these countries might be.

Following Diakosavvas, four commonly used indicators for assessing the impacts of trade policy on dairy products are calculated:

- Trade openness is calculated as the average share of imports plus exports in output
- Import penetration ratios are defined as the ratio of imports to consumption
- Export performance is calculated as the ratio of agricultural exports to production

- Net trade performance is defined as the ratio of exports minus exports plus imports

Calculations were based on the 1987 to 2002 time period with the pre-URAA period defined as 1987 to1994 and the post-URAA period as 1995 to 2002. Unlike Diakosavvass (2001) who pooled his data for the OECD markets, we evaluate these indicators for each of 8 key dairy producing and product trading countries. The trade data for developing these indicators come from the U.S. Department of Commerce, U.S. Census Bureau; Foreign Trade Statistics.

Import penetration and export performance are two indicators that could be used to gauge the degree of the world's dairy product market openness. The development of world dairy products imports relative to the world's consumption and the worlds dairy products exports relative to world dairy products production could signal whether changes have taken place post-URAA. Figure 1 shows world dairy product import penetration since 1987. The indices of import penetration for both cheese and butter have trended upward since 1993 (prior to implementation of URAA) while the index for non-fat dry milk has trended downwards. The indices of dairy product export performance shown in Figure 2 have remained fairly flat for all three products.

Comparison of Pre-and Post-URAA Dairy Products Trade Performance

While trade performance indices provide a clear indication of the direction of movement over the period of study; they do not provide information on the heterogeneous nature of the pre- and post-URAA trade performance. Nonparametric statistical tests (Wilcoxon –Mann-Whitney ranked sum tests, Vander Waerden Scores, Median, Kolmogorov-Smirnov two-sample test, and the Savage tests) were used to compare the pre-and post-URAA trade performance for 3 dairy products (cheese, non fat dry milk powder, and butter) and 8 countries (Canada, Mexico, United

States, Argentina, Brazil, Japan, Australia and New Zealand) in the study. To address the question of heterogeneity across samples, we tested the hypothesis that the trade performance ranking from the pre and post URAA came from populations that have the same distributions, and similarly, the trade performance ranking of each dairy product came from populations with the same distributions. All of the nonparametric approaches mentioned above showed similar results. We show only results based on the Wilcoxon-Mann-Whitney statistic in table 1. The results of the other tests are available from the authors.

The two-sample Wilcoxon-Mann-Whitney rank-sum test statistic (Wilcoxon, 1945) is based on the assumption that two random samples, from two populations with unknown cumulative distribution functions, can be used to test the hypothesis of homogeneity of the two samples against the one-sided alternative hypothesis of heterogeneity of the two samples. Since the two populations are assumed to be identical under the null hypothesis, independent random samples from the two populations should be similar with similar location parameters. Jointly ranking the measurements from both samples from lowest to highest and then examining the sum of the ranks for each sample can then measure a comparison between the two samples.

Table 1 presents the Wilcoxon-Mann-Whitney rank "Z" statistics for the four trade performance indices of the three dairy products by country. The differences between the pre- and post-URAA trade performance indicators were found to be statistically significant in a "common" pattern for the same countries and products for the four performance indicators.

Cheese

Canada, the United States, and Australia showed statistically significant differences in cheese export performance, trade openness and net trade performance between the pre-and post–URAA periods. Cheese import penetration was significantly different in Mexico, Japan and Australia. Australia was the only country with statistically significant differences in both cheese export performance and import penetration.

Nonfat Dry Milk Powder

Nonfat dry milk powder showed the least changes in market openness in the post-URAA period. Australia is the only country that showed a statistically significant difference in export performance. However, Mexico, the United States, Argentina, Brazil and Japan showed significant differences in import penetration.

Butter

Like cheese, butter exhibited increases in market openness in Canada, the United States and Australia. Overall, New Zealand, though exhibiting significant a difference in export performance between the two time periods, there was very little change in market openness. This is expected since New Zealand is probably the most liberalized of the countries in this study.

Seemingly Unrelated Regression Analysis

The non-parametric analyses of pre-and post-URAA periods give some indication of the statistical differences in dairy product trade developments but they do not indicate what factors might influence them. In an attempt to identify influencing factors, the import penetration and

export performance measures for the selected countries are regressed on a number of exogenous variables using seemingly unrelated regression (SUR) estimation. The exogenous variables include each country's milk production, the dairy product prices, a number of macroeconomic related variables (real exchange rates, real gross domestic product, and population), and a dummy variable that represent the pre- and post URAA time periods. The SUR technique was used to estimate the combined import penetration and export performance for each country due to the apparent contemporaneous correlation of the disturbance terms between trade openness in the different countries. Thus, it is assumed that all the counties trade performances are linked by their disturbances and hence efficiency can be gained through a SURE model. This is logical, since trade involves the transfer of good among countries, one country's trade openness is expected to influence another country's trade openness. The data are from the FAPRI, U.S. and World Agricultural Outlook and the Economic Research Service Macroeconomic Database.

The estimated model is expressed as:

$$Y_{ijt} = b_0 + b_{1j} Y_{ijt\text{-}1} + \mathrm{B} Z_{ijt} + v_{ijt} D_{ij,t} + \varepsilon_{ij} \qquad \text{I=1, 2; j=1, 8, t=1,….,T}$$

Thus, the value of a trade indicator *i* for country *j* (Y_{ijt}) is assumed to be a linear function of Z_{ijt} exogenous variables and *D* is a dummy variable with 0 representing the pre-URAA period and 1 representing the post-URAA period. Assuming that movement toward liberalized trade is most likely a gradual process, the trade performance indicators follow a partial adjustment process. This helps to capture the long run impacts.

The results for the estimated equations are reported in tables 2, 3, and 4. The estimated coefficient on the lagged dependent variable for the trade openness indices gives an indication of the speed of adjustment to these trade openness measures. A small estimated coefficient implies a rapid adjustment, the larger the estimated coefficient the slower will be the rate of adjustment of these measures to changing trade, production, and other economic conditions. In most cases the speed of adjustment for all of the countries and all of the dairy products were less than two years. Only export performance of cheese for the United States (2.4 years) and import penetration of butter for Canada (4.7 years) suggest longer than two years for the indices to adjust to economic conditions. In general, Argentina, Brazil, and New Zealand had negative signs on most the lagged dependent variables of the trade performance indices. This is possibly because these countries have fairly liberalized dairy policies and variability in production is possibly driving the trade performance indicators.

Table 2 shows the import penetration and export performance models for cheese. On the import side, only Brazil and Japan dummy variable were statistically significant and the United States and Argentina had dummy variables with unexpected signs. On the import penetration index for cheese, most of the coefficients for Brazil and Japan and New Zealand were statistically significant. Overall, the exchange rate variable was statistically significant with the expected sign for most of the countries. On the export performance side, none of the dummy variables were statistically significant, and again, dummy variables for the United States and Argentina did not have the expected signs.

Table 3 shows the import penetration and export performance models for nonfat dry milk. The results show that milk production was the main variable impacting the import penetration of nonfat dry milk powder. Price and the macro-economic variables were not statistically significant in determining import penetration and export performance of nonfat dry milk powder and butter for most of the countries. The dummy variables also suggest that there was no statistically significant difference trade development since the URAA.

Table 4 shows the import penetration and export performance models for butter. The results were similar to that of nonfat dry milk powder with non-significance on the dummy variables.

Testing the Significance of Economic Variables

To test the null hypothesis that the economic variables were jointly equal to zero for each country equation, H_o: $z_{i2} = z_{i3} = z_{i4} = 0$, versus the alternative H_a: $z_{i2} = z_{i3} = z_{i4} \neq 0$; where z_{ij} are economic variables (=2,3,4). The equations were first estimated by SUR without any restrictions. Then, the equations were restricted with the assumption that the assumptions that the economic variables were jointly equal to zero. Testing the results of these restrictions determine whether or not the economic variables were significant in determining dairy product trade performance. If the economic variable estimators for any country significantly alter the variance covariance matrix of the errors, we reject H_o and conclude that at least one of the economic variables significantly influenced a country's trade performance. Table 5 shows the results of the test of significance of the economic variables. The economic variables were most influential in determining Argentina and Brazil's trade performance.

Conclusions

The URAA has changed the way future multilateral trade negotiations will likely be handled. The URAA (or WTO as it is now known) developed and implemented a framework to address barriers to and distortions of agricultural trade in terms of market access, domestic support, and export subsidies. The objectives of this study were to explore aspects of market access in selected countries and to examine the factors that might influence international dairy trade developments for these countries.

Four commonly used indicators for assessing the impacts of a country or a region's trade policy on dairy products were calculated for key dairy product producing and trading countries. A number of nonparametric two sample and efficiency tests (Wilcoxon –Mann-Whitney ranked sum tests, Vander Waerden Scores, Kolmogorov-Smirnov two-sample test, Siegel-Tukey test and the Savage tests) were used to compare the pre-and post-URAA trade performance for each dairy product (cheese, non fat dry milk powder, and butter) and each of the 8 countries (Canada, Mexico, United States, Argentina, Brazil, Japan, Australia and New Zealand) in the study.

The results show that of all the dairy products, nonfat dry milk powder showed less change in market openness in the post-URAA period. The major dairy producing countries, Canada, the United States, Australia showed statistically significant differences in cheese export performance, trade openness and net trade performance between the pre-and post–URAA periods.

When two of the major trade openness indicators, import penetration and export performance were regressed against price, a dummy variable representing pre- and post-URAA periods, and number of macro-economic variables for each country, the results show that the dummy variable was statistically insignificant in most cases, suggesting that either dairy product reform has not been statistically significantly different or that a rather large lag exists in the reforms that are associated with increased market access.

Overall, assessing trade policy effects requires more than one simple measure analysis. The analysis of openness based on the non-parametric approaches conflicted with that of the parametric approach. This is probably due to the small sample size that was available. Clearly, it may be more difficult to observe significant changes over a 7-year period using parametric measures. Although for non-parametric measures, the power of tests improves with the sample size, some, such as the Wilcoxon-Mann-Whitney test are fairly powerful for smaller sample sizes—N >12. It is therefore likely that significant changes can be more easily observed with non-parametric measures.

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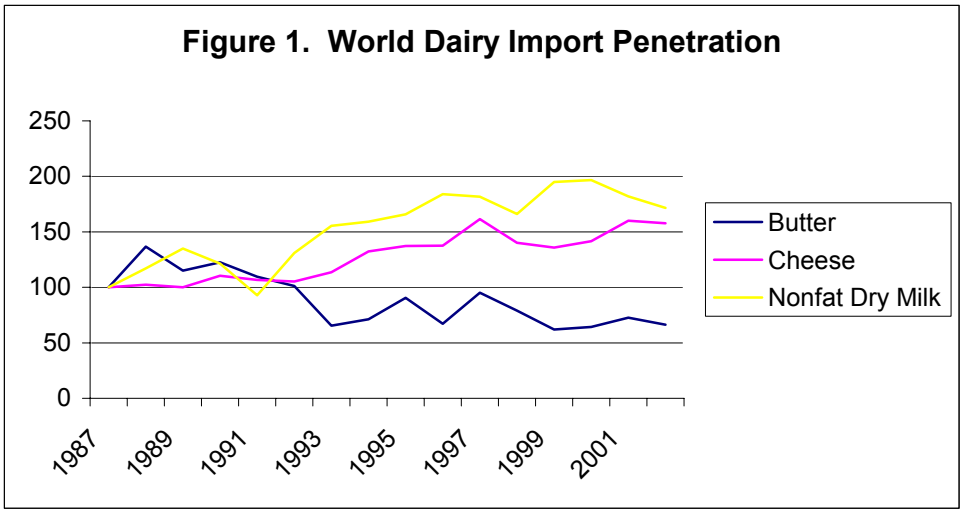
Figure 1. World Dairy Import Penetration
250
200
150
100
50
0
1987
1989
1991
1993
1995
1997
1999
2001
Butter
Cheese
Nonfat Dry Milk

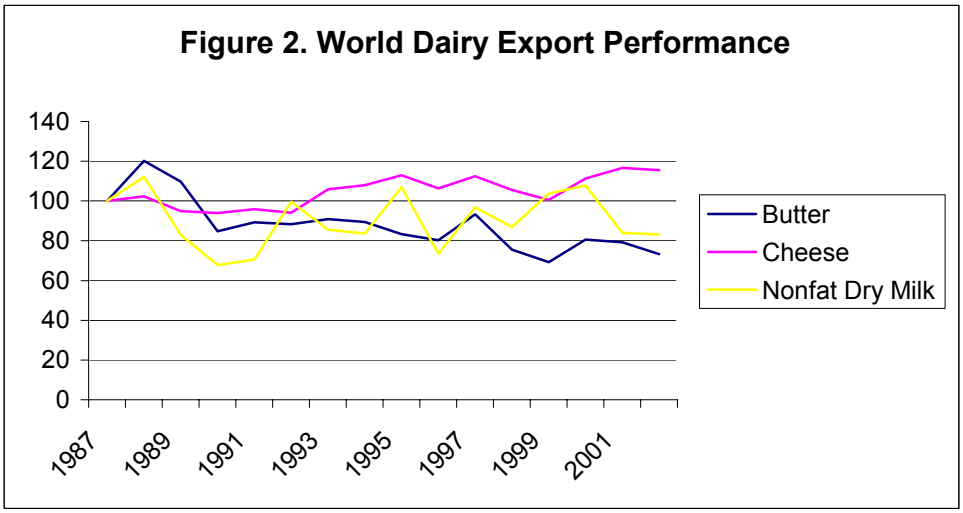
Figure 2. World Dairy Export Performance
140
120
100
80
60
40
20
0
1987
1989
1991
1993
1995
1997
1999
2001
Butter
Cheese
Nonfat Dry Milk

Table 1. Comparison of trade performance indicators for 8 major dairy product trading countries

	Export Performance			Import Penetration		
	Cheese	Nonfat Dry Milk Powder	Butter	Cheese	Nonfat Dry Milk Powder	Butter
Canada	+***	--	+**	--	--	***
Mexico	--	--	--	**	**	--
United States	+***	--	+***	--	**	***
Argentina	--	--	*	--	*	*
Brazil	*	--	--	--	--	--
Japan	--	--	--	**	**	***
Australia	+***	+***	+**	***	--	***
New Zealand	+***	--	--	***	--	--
	Trade Openness			**Net trade Performance**		
	Cheese	Nonfat Dry Milk Powder	Butter	Cheese	Nonfat Dry Milk Powder	Butter
Canada	***	--	**	***	--	***
Mexico	**	**	--	***	**	--
United States	***	--	***	--	--	**
Argentina	--	--	**	--	--	--
Brazil	--	--	--	--	--	--
Japan	***	**	*	**	**	***
Australia	***	***	***	***	***	***
New Zealand	***	--	--	***	--	--

***Significant at the 99 percent level
**Significant at the 95 percent level
*Significant at the 90 percent level
-- indicates not significant
[1]Pre-and post-URAA are compared for all countries in the two-sample test
+associated with the significance level signifies significantly greater in post-URRA

Table 3. Import Penetration and Export Performance of Cheese

Import Penetration (IP)	Canada	Mexico	United States	Argentina	Brazil	Japan	Australia	New Zealand
Intercept	0.161608	-0.91489	-0.00283	-0.03931	-1.72309	5.601236	-0.4471	1.588771
	(0.83)	(-1.42)	(-0.07)	(-0.36)	(-2.78)**	(2.46)**	(-1.33)	(2.64)**
(IP)t-1	0.142407	-0.00599	-0.58681	-0.39963	-0.94823	-0.04358	0.376001	-1.06601
	(0.77)	(-0.03)	(-1.29)	(-1.54)	(-4.04)***	(-0.31)	(1.43)	(-3.75)***
milk prodn	-7.73E-06	0.000013	2.78E-06	2.53E-06	-0.00009	-0.00014	-0.00002	0.000062
	(-0.95)	(0.54)	(1.77)	(0.76)	(-4.12)***	(-5.90)***	(-1.82)	(4.76)***
Price	0.013242	0.000018	1.50E-06	-8.69E-06	0.000235	0.000165	-0.00001	0.000182
	(2.27)*	(1.80)	(0.43)	(-0.21)	(1.72)	(2.05)*	(-1.43)	(2.82)**
real ex rate	-0.053	-0.02865	-	-0.00331	-0.22446	-1.96069	0.025146	-0.03267
	(-1.63)	(-2.23)*	-	(-0.18)	(-4.17)***	(-4.26)***	(0.68)	(-0.73)
real GDP	-0.0005	-0.00132	-0.00094	-0.00018	-0.00474	-0.00416	-0.00078	0.010214
	(-0.62)	(-0.65)	(-1.53)	(-0.43)	(-1.57)	(-1.35)	(-0.32)	(3.63)***
Population	-3.97E-06	0.000013	-4.54E-07	1.08E-06	0.000023	-0.00003	0.000042	-0.00064
	(-0.51)	(2.04)*	(-1.09)	(0.36)	(3.61)***	(-1.53)	(1.63)	(-3.06)**
Dummy	0.00405	0.061226	-0.001611	-0.008988	0.2598	0.05286	0.01007	0.03571
	(0.65)	(1.04)	(-0.42)	(-1.05)	(4.95)***	(2.17)*	(0.57)	(1.03)
System Weighted R-Square	0.97			Degrees of Freedom	57			

Export Performance (EP)	Canada	Mexico	United States	Argentina	Brazil	Japan	Australia	New Zealand
Intercept	-0.7715		-0.03575	-0.18593	-0.04043		1.972741	-2.16716
	(-1.14)		(-3.13)**	(-0.65)	(-1.8)		(1.53)	(-0.86)
(EP)t-1	0.156055		0.586483	0.4725	-0.22089		-0.68041	-0.66273
	(0.49)		(3.67)***	(2.01)*	(-0.78)		(-1.79)	(-2.44)**
milk prodn	0.000035		-8.64E-08	0.00001	-1.30E-06		0.000094	-0.00003
	(1.17)		(-0.23)	(1.17)	(-1.64)		(1.84)	(-0.59)
Price	-0.02221		-1.05E-06	0.000116	-0.00001		-0.00004	-0.00015
	(-1.14)		(-1.04)	(1.07)	(-3.08)***		(-0.86)	(-0.62)
real ex rate	-0.08819		-	-0.04064	0.00643		0.171186	-0.05958
	(-0.8)		-	(-0.84)	(-3.99)***		(1.15)	(-0.40)
real GDP	0.000504		-0.00002	-0.00018	-0.00009		0.008575	-0.00475
	(0.20)		(-0.1)	(-1.10)	(-0.88)		(0.92)	(0.42)
Population	0.000031		1.83E-07	-0.00115	4.10E-07		-0.00012	0.001136
	(1.18)		(2.06)*	(0.33)	(1.78)		(-1.23)	(-1.27)
Dummy	0.00947		-0.000358	-0.019358	0.00142		0.0821	-0.046531
	(0.46)		(-0.29)	(-0.83)	(0.99)		(1.3)	(-0.34)
System Weighted R-Square	0.91			Degrees of freedom	43			

t-values are in parentheses
***Significant at the 1 percent level
**Significant at the 5 percent level
*Significant at the 10 percent level

Table 3. Import Penetration and Export Performance of Nonfat Dry Milk Powder

Import Penetration (IP)	Canada	Mexico	United States	Argentina	Brazil	Japan	Australia	New Zealand
intercept	2.477966	0.36216	-0.03661	-3.7308	-1.26155	12.00428	1.181327	-
	(1.44)	(0.05)	(-1.04)	(-1.34)	(-0.44)	(2.43)*	(2.25)	-
(IP)t-1	0.370191	-0.59211	0.414197	0.007806	-0.33927	-0.38515	-0.67157	-
	(0.91)	(-2.48)**	(1.57)	(0.03)	(-2.16)*	(-1.47)	(-3.3)***	-
milk prodn	-0.0002	-0.00039	-1.84E-06	-0.00012	-0.00012	-7.02E-06	0.000041	-
	(-2.42)**	(-1.44)	(-1.93)	(-2.07)*	(-1.27)	(-0.12)	(2.05)	-
Price	0.050239	-0.00022	-5.55E-06	0.002605	-0.00036	0.000216	0.00005	-
	(0.35)	(-0.8)	(-1.49)	(1.33)	(-0.35)	(0.16)	(2.58)**	-
real ex rate	0.60812	0.071745	-	-0.67408	-0.31978	-1.14376	0.259369	-
	(2.13)	(0.43)	-	(-1.44)	(-1.65)	(-1.46)	(3.43)***	-
real GDP	-0.00481	-0.03646	0.000727	0.008328	0.000442	-0.00201	-0.00533	-
	(-0.62)	(-1.53)	(1.43)	(1.56)	(0.04)	(-0.24)	(-1.32)	-
Population	-0.00007	0.000038	6.74E-07	0.000135	0.000029	-0.00009	-0.00011	-
	(-0.78)	(0.6)	(2.49)**	(1.57)	(1.03)	(-2.53)	(-2.69)**	-
Dummy	-0.063425	-0.488987	-0.001987	-0.175253	0.29399	0.08083	0.03158	-
	(-0.83)	(-0.72)	(-0.62)	(-1.1)	(1.56)	(1.32)	(1.1)	-
System Weighted R-Square	0.895			Degrees of Freedom	50			

Export Performance (EP)	Canada	Mexico	United States	Argentina	Brazil	Japan	Australia	New Zealand
intercept	5.748888		0.520276	7.294073	-0.47311		-2.93943	-2.6233
	(1.18)		(0.32)	(2.55)**	(-0.47)		(-1.52)	(-0.76)
(EP)t-1	-1.07155		0.008182	0.150807	-0.90612		0.162231	-0.54896
	(-2.69)**		(0.03)	(0.85)	(-3.53)***		(0.46)	(-1.8)
milk prodn	-0.00038		-4.81E-06	0.000114	0.00004		-0.00006	-0.00003
	(-1.63)		(-0.12)	(1.69)	(1.22)		(-0.79)	(-0.39)
Price	-0.12995		-0.00006	-0.0034	0.000467		-0.00012	0.000906
	(-0.7)		(-0.31)	(-1.73)	(1.19)		(-1.81)	(1.15)
real ex rate	0.610907		-	0.789086	-0.08934		-0.52759	-0.26315
	(0.87)		-	(1.65)	(-1.17)		(-2.21)	(-1.16)
real GDP	-0.00651		0.035467	-0.01813	0.011456		-0.00976	-0.02974
	(-0.42)		(1.29)	(-2.29)**	(2.3)**		(-0.67)	(-1.94)
Population	-0.00004		1.61E-07	-0.00022	-2.49E-06		0.000283	0.001212
	(-0.24)		(0.01)	(-2.49)**	(-0.26)		(1.89)	(1.05)
Dummy	0.38655		-0.05035	0.29011	-0.244996		-0.025102	-0.196264
	(2.51)**		(-0.36)	(1.67)	(-3.19)***		(-0.25)	(-1.04)
System Weighted R-Square	0.83			Degrees of Freedom	43			

t-values are in parentheses
***Significant at the 1 percent level
**Significant at the 5 percent level
*Significant at the 10 percent level

Table 4. Import Penetration and Export Performance of Butter

Export Performance (EP)	Canada	Mexico	United States	Argentina	Brazil	Japan	Australia	New Zealand
Intercept	-1.83596		-0.2185	-2.40051	-0.32387		-0.64089	2.381301
	(-1.57)		(-0.37)	(-1.33)	(-1.73)		(-0.47)	(0.70)
(EP)t-1	0.293492		0.112778	0.279487	-0.39874		-0.29835	0.216631
	(1.1)		(0.35)	(1.07)	(-1.36)		(-1.16)	(0.75)
milk prodn	0.000043		-0.00002	-0.00004	-0.00001		7.84E-06	0.000057
	(0.66)		(-1.14)	(-1.09)	(-2.27)		(0.15)	(0.82)
Price	0.212266		-0.00007	0.00142	-0.00006		-0.00004	-0.00073
	(1.21)		(-1.79)	(2.03)*	(-1.05)		(-0.78)	(-1.29)
real ex rate	-0.16848		-	-0.55708	0.027672		0.150188	0.085827
	(-0.52)		-	(-2.06)*	(1.76)		(0.76)	(0.38)
real GDP	-0.00614		0.005903	-0.00709	-0.0011		0.0151	0.012764
	(-0.74)		(0.6)	(-1.95)	(-1.22)		(1.47)	(0.92)
Population	0.000015		6.71E-06	0.000078	3.50E-06		0.000066	-0.00053
	(0.28)		(1.24)	(1.43)	(2.01)*		(0.67)	(-0.46)
Dummy	0.022532		0.107883	0.026111	-0.01912		-0.01589	-0.00139
	(-0.41)		(-1.7)	(-0.28)	(1.52)		(0.19)	(0.01)
System Weighted R-Square	0.94			Degrees of Freedom	50			
Import Penetration (IP)	Canada	Mexico	United States	Argentina	Brazil	Japan	Australia	New Zealand
intercept	-1.3607	-4.5458	-0.39342	1.452361	-1.02689	-5.07413	-0.51778	
	(-0.94)	(-1.31)	(-3.7)***	(0.74)	(-0.93)	(-1.35)	(-0.92)	
(IP)t-1	0.785355	-0.06749	-0.26865	0.288835	-0.09019	-0.52362	-0.07157	
	(2.94)**	(-0.27)	(-1.82)	(1.42)	(-0.26)	(-3.8)***	(-0.27)	
milk prodn	0.000088	0.000039	-2.26E-06	2.39E-06	-0.00006	-0.00016	2.05E-06	
	(1.09)	(0.25)	(-0.95)	(0.06)	(-1.57)	(-3.57)***	(0.11)	
Price	-0.12638	0.000288	0.000019	-0.00076	-0.00011	0.001137	0.000017	
	(-0.49)	(2.51)**	(5.25)***	(-0.99)	(-0.34)	(3.9)	(0.91)	
real ex rate	-0.17031	-0.11887	-	0.347058	-0.04602	-0.85595	0.109122	
	(-0.38)	(-1.18)	-	(1.2)	(-0.48)	(-0.88)	(1.67)	
real GDP	-0.00874	0.006412	-0.00313	0.012295	0.0029	-0.00024	-0.00537	
	(-0.84)	(0.52)	(-2.8)**	(3.49)***	(0.49)	(-0.04)	(-1.4)	
Population	0.000059	0.000047	1.98E-06	-0.00004	0.000015	0.000043	0.000023	
	(0.87)	(1.36)	(2.77)**	(-0.7)	(1.33)	(1.45)	(0.6)	
Dummy	0.007326	0.360741	0.014961	-0.07646	-0.13014	0.041215	-0.03749	
	(-0.09)	(-1.05)	(-1.51)	(0.82)	(1.62)	(-0.87)	(1.19)	
System Weighted R-Square	0.90			Degrees of Freedom	43			

t-values are in parentheses
***Significant at the 1 percent level
**Significant at the 5 percent level
*Significant at the 10 percent level

Table 5. Tests of joint importance of economic variables (product prices, gross domestic product, real exchange rates) on dairy trade performance

	Import Penetration			**Export Performance**		
	Cheese	NFDM	Butter	Cheese	NFDM	Butter
Canada	7.62***	1.93	0.68	0.64	0.89	3.94**
Mexico	2.49*	1.28	2.92**	-	-	-
United States	1.93	1.85	19.14***	0.63	1.36	2.32
Argentina	1.51	6.93***	7.68***	4.23**	12.55***	3.79*
Brazil	12.37***	6.81***	2.08	6.36***	3.31**	3.03*
Japan	8.88***	0.93	8.51***	-	-	-
Australia	2.11	5.19***	3.25*	1.45	2.77*	2.01
New Zealand	9.65***	-	-	0.31	1.61	1.39

Tests of joint significance of economic variables (unrestricted SUR estimation compared with restrictions of economic estimators=0 in each equation)
F values are presented with ***=significance at the 1 percent level, **=significance at the 5 percent level, and *=Significant at the 10 percent level