PENNSTATE

Staff Paper #341 June 1, 2001

Impact of the Northeast Interstate Dairy Compact on Consumer Prices for Fluid Milk

By Kenneth W. Bailey

Department of Agricultural Economics and Rural Sociology
College of Agricultural Sciences
The Pennsylvania State University
Armsby Building
University Park, PA 16802-5600

Impact of the Northeast Interstate Dairy Compact on Consumer Prices for Fluid Milk

By Ken Bailey[1]
Penn State University

June 1, 2001

Introduction

The objective of the Northeast Interstate Dairy Compact (Northeast Compact) has been to assure the continued viability of dairy farming in the northeast, and to assure consumers of an adequate local supply of pure and wholesome milk (Dyer). The Northeast Compact affects milk pricing in six New England states. Despite socially appealing goals, the Northeast Compact has been mired in controversy since it was included in the 1996 Farm Bill.

There have been limited studies on the economics of dairy compacts. The Office of Management and Budget (OMB) completed a preliminary study on the economic impact of the Northeast Compact. Their study was limited to the first six months of the compact, July 1997-December 1997. Bailey (2000) examined the economic impact of multi-regional dairy compacts. And the University of Vermont developed a number of econometric models to examine the market implications of the Northeast Compact (Nicholson).

Proponents of the Northeast Compact assert that it will provide additional economic support to small northeast dairy farmers and have only limited impact on New England consumers. In fact, proponents argue that the Compact should reduce retail milk prices by stabilizing wholesale milk costs and thereby reducing the risk premium in the farm-to-retail margin (Federal Register). Opponents of the Northeast Compact, most notably the International Dairy Foods Association, a trade association representing dairy processors, assert it will cost New England consumers an additional $70 million a year for fluid milk and will depress fluid milk sales (IDFA, July 1997).

The economic implications of the Northeast Compact have taken on added importance in recent years. Pennsylvania and New York have petitioned Congress for inclusion in the Northeast Compact. In addition, a number of southern states have passed legislation in their statehouses in order to begin the process of creating a Southern Dairy Compact. Growing demands for regional dairy compacts could have national implications if such efforts affect interstate commerce for milk and dairy products.

The viability of the Northeast Compact was recently called into question when the Massachusetts Senate voted to remove the state from the Northeast Compact. In an editorial to the Boston Globe, columnist Jeff Jacoby wrote that Massachusetts consumers have spent an additional $45 million to date for milk due to the Northeast Compact. Only $6 million has been retained by Massachusetts dairy farmers, with the rest of the money flowing out of

[1] The author is an Associate Professor of Agricultural Economics at Penn State University. You may reach the author at (314) 863-8649 or via email: baileyk@psu.edu.

state. The Massachusetts Senate proposed to directly subsidize dairy farmers in lieu of participation in the Northeast Compact by allocating $3 million annually into a Dairy Farms Trust Fund (Marvin). The bill, which Governor Paul Cellucci promised to veto, never made it out of conference committee with the House.

One critical issue that has not yet been settled is the impact of the Northeast Compact on New England milk consumers. In a background paper on the Northeast Compact, IDFA claims that the Northeast Compact will create "a massive, regressive consumer tax." Linda Dyer, Chair of the Northeast Dairy Compact Commission, testified before Congress that retail milk prices in New England since implementation of the Northeast Compact have not increased significantly and are actually cheaper than in Madison, Wisconsin.

The objective of this paper is to analyze the impact of the Northeast Compact on retail fluid milk prices in New England. Class I costs for raw milk to processors (hereafter referred to as the farm price) and retail prices for fluid milk in New England will be analyzed before and after implementation of the Northeast Compact. An econometric model will be estimated in order to simulate the farm-to-retail price spread and to analyze the impact of the Northeast Compact on retail milk prices.

Literature

Lass et al. published a study on the impact of the Northeast Compact on New England retail milk prices (2001) based on the earlier study from the University of Vermont. The authors estimated an econometric model using data over the period January 1982 – June 1996. They used the model to simulate the impact of the Northeast Compact over the period July 1997 – June 1998. Since the Compact began July 1997, there was only 12 months of overlap with actual compact data.

Lass et al. used a standard farm-to-retail price transmission model based on earlier work by Kinnucan and Forker. They found that retail price responses to farm price changes were asymmetric with respect to rising versus falling farm prices. They used this model to simulate the impact of the compact on retail milk prices in Boston and Hartford. The authors found that a 12-month compact over-order premium of $1.40 per cwt, or 12 cents per gallon, increased retail milk price by 6.9 cents per gallon in Boston and 5.7 cents per gallon in Hartford. This implies that processors and/or retailers did not fully markup milk from cost and in fact absorbed part of the cost of the Compact over-order premium.

Cotterill and Franklin evaluated the impact of the Northeast Compact on retail milk prices and increased concentration for both processors and retailers. They found that "implementation of the Compact, a distinct non-market event with considerable signaling of price intentions, seems to have facilitated tacitly collusive pricing by processors and retailers." They concluded that $50 million of the $130 million increase in the milk bill paid by New England consumers at supermarkets over a three year period (from July 1997 through July 2000) is due to increased profits from supermarket retailers and dairy processors. Cotterill and Franklin also concluded that the Compact had no impact on retail milk prices since "there is absolutely no relationship between farm and retail prices."

There are numerous problems with the Cotterill and Franklin study. They used a rather unorthodox methodology to model the before and after impact of the Compact. This methodology has no basis in the literature. And, they note that the Compact raised $128.5 million between July 1997 and July 2000 and consumers in New England paid an additional $130 million for milk in supermarkets (only 40 percent of all milk sales in New England are through supermarkets). However, only $19 million of the $130 million in higher New England consumer retail milk prices through supermarkets was attributed to the Compact. Thus the question begs, how could the authors conclude there were excessive profits by processors and retailers when they also concluded that the full cost of the Compact was not passed on to consumers?

Clearly the literature is not decisive on this issue of the impact of the Compact on retail milk prices.

Background

Authority for the Northeast Compact was included in the Federal Agriculture Improvement and Reform Act, otherwise known as the 1996 Farm Bill. That legislation required the Secretary of Agriculture to find "a compelling public interest" before the compact was to be implemented. In addition, the Northeast Compact was to expire once federal order reform was implemented. That deadline has since been reauthorized twice. The Northeast Compact is currently scheduled to expire September 30, 2001.

The Northeast Compact required the creation of the Northeast Dairy Compact Commission (the commission) to administer the Compact. The commission establishes regulations through a notice and comment rulemaking procedure that includes producer referenda for adoption or amendment of the regulations. Once these regulations are in place, the commission establishes a fluid milk price (compact price) above the minimum Class I federal order price in the compact region.[2] The purpose of the compact price is to stabilize and enhance the fluid portion of a farmer's milk check. The Northeast Compact only affects prices for milk used for Class I purposes. Milk used for soft manufactured purposes (Class II), for manufacturing cheese (Class III), or for manufacturing butter and nonfat dry milk (Class IV) are not affected by the Northeast Compact. The difference between the compact price and the Class I price (called the compact obligation) is collected by the commission each month and is distributed back to compact farmers (net of certain deductions).

The compact price set by the commission is for all fluid milk sales in the compact region and essentially creates a "price floor" on Class I milk sales. The Northeast Dairy Compact Commission has maintained the compact price at $16.94 per cwt since July 1997. The commission took into consideration the cost of producing milk in setting this price.

The Northeast Compact and the Northeast Federal Milk Marketing Order have different roles, but do work together. The federal order establishes minimum class prices each month for fluid milk (Class I), and milk used for manufacturing (Class II is for soft

[2] Federal milk marketing orders require minimum prices to be set for milk used for different purposes. Milk used for fluid purposes is Class I milk and is set equal to the Class I mover plus a fixed location-specific fluid price differential. The current Class I differential for Boston is $3.25 per cwt.

products, Class III is for cheese, and Class IV is for butter and nonfat dry milk). The federal order also "blends" all four prices each month to establish the basis for the farm price of milk. The Northeast Compact establishes an "over-order premium" each for Class I milk only. This premium is in excess of the minimum announced Class I price for Boston and represents additional producer revenue on fluid sales only.

The compact over-order obligation is the monthly difference between the compact price and the federal order Class I price. The minimum class I price set by the Northeast federal order changes each month with market conditions. Thus the compact over-order obligation also changes each month. In fact, if markets are strong enough (e.g. 1998, 1999), the minimum federal Class I price could exceed the compact price. In that case, there would be no compact over-order obligation. Fluid milk processors that supply the compact region pay the compact over-order obligation to the Compact Commission and also pay the administrative cost of running the program.

Dairy farmers that supply milk to the compact region receive an economic benefit from the commission in the form of a compact producer price. It appears as a separate price on their milk check. The compact obligation is computed first and is multiplied by the pounds of Class I milk sales. This creates a pool of money called the compact over-order obligation value. Then, certain deductions are made:

- WIC reserve—equal to 3 percent of the compact over-order obligation value
- School milk reserve—equal to 1 percent of the compact over-order obligation value
- Court ordered escrows (when authorized by the courts)
- Potential CCC payments (when determined to be necessary)

Among these deductions are dollars set aside to reimburse the Women, Infants and Children (WIC) program and school milk programs. Also, if milk production in New England is rising at a rate faster than the national average, the Commission has from time to time held funds in reserve against potential obligations to the USDA Commodity Credit Corporation. The Commission keeps another reserve in its checking account and each month a formula is used to remove half the funds from the reserve and return that money to farmers, while additional funds are placed in this account to maintain a stable reserve of operating funds. Finally, various milk handlers have at times brought legal actions against the commission. The courts have ordered that these handlers make payments into court-ordered escrow accounts until the lawsuits have been settled.

After these deductions and adjustments are made, the total pool of compact dollars is divided by the total pounds of producer milk reported by handlers. Producer milk reflects the total pounds of milk marketed in the compact region. The result is the compact producer price.

The compact over-order obligation is the difference between the compact price and the Northeast federal order Class I price.[3] The compact producer price, the funds the farmers receive from the Compact Commission, can also be computed by weighting the compact over-order obligation by the Class I fluid milk utilization rate. The Class I volume,

[3] Prior to federal order reform (January 1, 2000), the appropriate Class I price was for the New England order number 1.

total pool volume, and the utilization rate for the compact region over the months July 1997 – April 2000 is presented in Table 1. On average, about 46 percent of all producer milk in the compact region has been used for fluid purposes.[4]

Farm and Retail Milk Prices in the Northeast

Farm and retail milk prices are compared in this study over two time periods: January 1994 – June 1997, and July 1997 – December 2000. The first time period reflects 42 months prior to the introduction of the Northeast Compact on July 1997 and is called the pre-Compact period. The latter period reflects 42 months after the Compact was initiated and is called the Compact period.

The relationship between the farm price of milk (the total Class I cost of milk to fluid milk processors) and retail milk prices in Boston over these two time periods is illustrated in Figure 1. The Class I cost of milk to processors is equal to the Class I price of milk announced by the Northeast federal market administrator, plus premiums collected by dairy cooperatives to offset marketing costs, and the over-order obligations required by the Northeast Compact. The cost for Class I milk is then compared to the retail price of milk in Boston.

Figure 1 illustrates that the farm-to-retail margin, equal to the retail milk price less the Class I cost of milk, changed after introduction of the Northeast Compact. The margin eroded slightly over time prior to the compact. After the introduction of the Compact, the Class I cost of milk was fairly stable, except for two price spikes in the Class I milk prices. The retail price of milk in Boston rose 20 cents per gallon in response to a 20 cent per gallon increase in the Class I cost of milk to processors after the Compact was introduced on July 1997. The farm-to-retail margin also appears to have widened during the Compact period. The data also indicates that the retail price of milk does appear to rise and fall with changes in the Class I cost of milk.

Further analysis of the farm-to-retail markup in Tables 2 and 3 indicates that the farm share of the retail price of milk did not change appreciably during the two time periods. The Boston market was analyzed in Table 2. The Class I cost of milk to processors rose 14.3 cents per gallon when comparing the pre-Compact and Compact periods. Of this amount, 11.3 cents per gallon was directly attributable to the Compact over-order obligation (Compact premium) and 3 cents per gallon was due to an increase in the minimum Class I price of milk announced by USDA.

The Northeast Compact created an average over-order obligation of $1.44 per cwt during the period July 1997 – December 2000. This reflects the additional dollars (on a cwt basis) that Class I processors were required to pay for milk due to the Compact and does not reflect what farmers actually received. Class I premiums that cooperatives paid to processors during this time period actually fell by 12 cents per cwt. This was likely due to the new

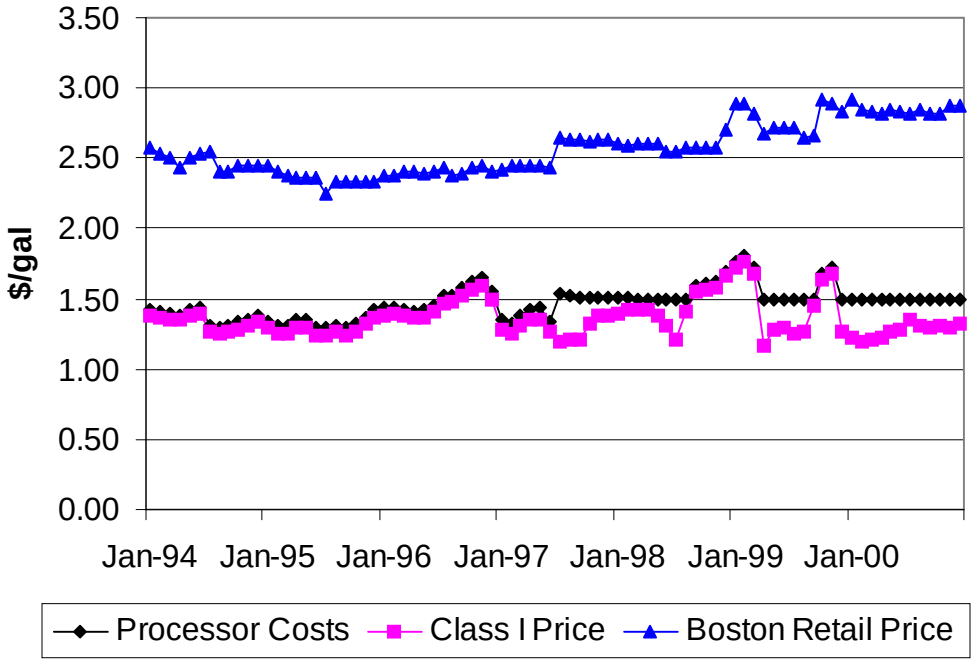
[4] Producer milk is defined as all milk sold into the compact region. Class I milk is a subset of producer milk and represents milk used solely for fluid purposes. The ratio of Class I milk to producer milk is defined as the Class I utilization rate. That rate is used by the Compact Commission to translate the fluid processors obligation (the compact over-order obligation) into a producer pay price.

Table 1. Compact Pool Volume and Utilization Rate by Month

Month	Class I Milk Volume	Total Pool Milk Volume	Utilization Rate	% Change from Year Ago in Class I Volume
	----------Lbs----------		%	%
1997				
Jul	245,001,960	531,000,726	46.1%	NA
Aug	251,670,411	532,180,093	47.3%	NA
Sept	256,358,041	503,917,650	50.9%	NA
Oct	270,552,780	517,345,975	52.3%	NA
Nov	249,814,033	498,023,775	50.2%	NA
Dec	264,936,547	535,146,037	49.5%	NA
1998				
Jan	267,187,950	544,161,724	49.1%	NA
Feb	234,897,947	508,104,687	46.2%	NA
Mar	262,944,181	561,242,392	46.9%	NA
Apr	248,291,753	541,755,424	45.8%	NA
May	252,572,087	580,786,219	43.5%	NA
June	243,091,584	552,127,107	44.0%	NA
July	248,178,437	567,929,595	43.7%	1.3%
Aug	246,196,943	551,257,123	44.7%	-2.2%
Sept	251,893,182	529,486,670	47.6%	-1.7%
Oct	271,577,387	544,309,299	49.9%	0.4%
Nov	248,153,426	527,299,972	47.1%	-0.7%
Dec	269,243,415	566,030,176	47.6%	1.6%
1999				
Jan	259,841,558	568,297,169	45.7%	-2.7%
Feb	233,805,230	528,208,431	44.3%	-0.5%
Mar	261,985,130	563,000,280	46.5%	-0.4%
Apr	252,135,199	568,505,303	44.4%	1.5%
May	252,285,179	598,956,471	42.1%	-0.1%
June	233,013,120	569,215,616	40.9%	-4.1%
July	247,855,745	564,319,166	43.9%	-0.1%
Aug	245,574,839	559,755,162	43.9%	-0.3%
Sept	256,083,868	530,408,722	48.3%	1.7%
Oct	254,832,612	545,866,478	46.7%	-6.2%
Nov	251,338,627	525,330,767	47.8%	1.3%
Dec	263,291,146	560,685,543	47.0%	-2.2%
2000				
Jan	256,492,334	567,734,438	45.2%	-1.3%
Feb	240,208,001	532,888,759	45.1%	2.7%
Mar	262,866,360	577,824,096	45.5%	0.3%
Apr	235,076,394	560,496,716	41.9%	-6.8%
Ave 7/97-4/00	**245,418,984**	**531,841,089**	**46.1%**	**-0.8%**

Source: Ken Becker, formerly Executive Director of the Northeast Interstate Dairy Compact Commission.

Figure 1. Fluid Milk Prices in Boston, Class I Cost to Retail, Dollars per Gallon



premiums created by the Compact. Therefore, the net effect of these two premiums was to raise the cost of milk to processors by $1.31 per cwt.

Note that the standard deviation for the Class I cost of milk to processors was nearly identical during the two time periods. This was surprising since the Compact was supposed to stabilize the Class I cost of milk. However, due to two rather large price spikes in the minimum Class I price of milk announced by USDA, the Class I cost of milk to processors was nearly as volatile during the Compact period as during the pre-Compact period.

The retail price of milk in Boston rose 30.5 cents per gallon during the Compact period when compared to the pre-Compact period. The standard deviation for the retail milk price in Boston was much less than that of the Class I cost of milk. And, the standard deviation for the retail milk price increased from 0.07 during the pre-Compact period to 0.12 in the Compact period. The objective of this study is to decompose the retail milk price increase and to isolate factors that caused the change.

In addition, the farm share of the retail milk price fell only slightly from 57.8 percent during the pre-Compact period to 56.6 percent during the Compact period. Since the farm share includes the compact over-order obligation and cooperative premiums, one could argue

Table 2. Analysis of the Farm to Retail Markup in Boston Before and After Introduction of the Northeast Interstate Dairy Compact

	Pre Compact[1]	Post Compact[2]	Change
Average Class I price ($/cwt):	15.633	15.984	0.351
Class I premiums ($/cwt):			
Coop	0.625	0.502	-0.123
Northeast Compact	0.000	1.435	1.435
total ($/cwt)	0.625	1.937	1.311
total ($/gal)	0.054	0.167	0.113
Cost of Class I milk to processors ($/gal):			
Class I price	1.344	1.375	0.030
Coop premiums	0.054	0.043	-0.011
Northeast Compact premiums	0.000	0.123	0.123
Total Class I cost	1.398	1.541	0.143
standard deviation	1.03	0.99	-0.05
Farm share of the retail price (%)	57.8%	56.6%	-1.2%
Farm-to-retail markup			
Percent (%)	72.9%	76.7%	3.8%
Dollars ($/gal)	1.02	1.18	0.162
standard deviation	0.10	0.13	0.02
average retail ($/gal):	2.418	2.723	**0.305**
Standard deviation	0.07	0.12	0.06

[1]January 1994 – June 1997.
[2] July 1997 – December 2000.

Table 3. Analysis of the Farm to Retail Markup in Hartford Before and After Introduction of the Northeast Interstate Dairy Compact

	Pre Compact[1]	Post Compact[2]	Change
average Class I price ($/cwt):	15.533	15.884	0.351
Class I premiums ($/cwt):			
Coop	0.625	0.502	-0.123
Northeast Compact	0.000	1.435	1.435
total ($/cwt)	0.625	1.937	1.311
total ($/gal)	0.054	0.167	0.113
Cost of Class I milk to processors ($/gal):			
Class I price	1.336	1.366	0.030
Coop premiums	0.054	0.043	-0.011
Northeast Compact premiums	0.000	0.123	0.123
Total Class I cost	1.390	1.533	0.143
standard deviation	1.03	0.99	-0.05
Farm share of the retail price (%)	57.0%	55.7%	-1.3%
farm-to-retail markup			
Percent (%)	75.4%	79.5%	4.1%
Dollars ($/gal)	1.05	1.22	0.171
standard deviation	0.08	0.11	0.03
average retail ($/gal):	2.437	2.751	**0.314**
standard deviation	0.04	0.11	0.07

[1]January 1994 – June 1997.
[2] July 1997 – December 2000.

that the farm share of milk did not decline significantly in the Compact period. The data results for the Hartford market (Table 2) are nearly identical to those of the Boston market.

Data and Model

Retail milk prices for Boston, Massachusetts, and Hartford, Connecticut were provided by USDA (the Federal Market Administrator for Northeast Order 1). This is the same price series used by Lass et al. USDA survey's monthly retail milk prices from the first and second largest food retailing chain store and the largest dairy or convenience store on one day between the 1st and 10th of the month, excluding Fridays and Weekends. The retail prices are reported as an average of these three prices. The retail price represents the most common brand of whole milk in either non-returnable plastic or paper containers.

It should be noted that this data series does have some limitations. First, it only reflects wholesale milk prices on just one day each month. And, it does not reflect prices for other kinds of milk (i.e. one percent or skim) or brands, nor does it reflect any specials or sales on milk. Finally, it does not reflect a broad survey of several retail outlets in New England.

Despite these limitations, however, the data for retail prices does adequately reflect the variation in retail milk prices relative to processor costs for raw milk. Retail milk prices are usually set once a month by grocery stores based in part on the minimum monthly Class I price announce by the USDA. These prices are always announced in advance. Second, retail prices for whole milk generally rise and fall with retail prices for other kinds of milk, although large rises in butterfat prices could alter the relationship between high fat and low fat milk prices. Third, a comparison between this dataset and the more comprehensive scanner data used by Cotterill and Franklin indicate a correlation coefficient of 0.92. Thus the USDA retail milk price data is deemed representative of retail milk prices in New England.

USDA also provided information on the Class I price of milk for Boston (zone 1) and Hartford (zone 5), as well as cooperative market over-order premiums. This price series for cooperative over-order premiums, often called a service charge, reflects what cooperatives charge fluid processors for marketing services in order to reflect their added costs to service the fluid market. It generally represents an announced price; additional credits are often issued to individual processors after the announced price depending on market conditions. Data for the additional credits, however, are not available.

Data on the compact price and compact over-order obligation were provided by USDA and is the same as that published by the Northeast Dairy Compact Commission.

A standard markup model was used in this analysis. It expresses the retail price of milk as equal to the cost of milk to processors (Class I milk) plus a farm-to-retail markup. The cost of milk to processors, expressed in dollars per hundredweight (cwt), is equal to the announced minimum federal order Class I price, the compact over-order obligation, and any cooperative over-order premiums.

The markup model is specified as follows:

$$(1) \qquad P_r = (P_{ClassI} + PR_{coop} + PR_{compact}) / 11.628 * (1 + MU)$$

$$(2) \qquad MU = f(\ PPI, \sigma\ )$$

where P_r is the retail price of milk in dollars per gallon, P_{ClassI} is the minimum Class I price of milk, PR_{coop} is the cooperative market over-order premium, $PR_{compact}$ is the compact over-order obligation, MU is the percent farm-to-retail markup, PPI is a vector or processing, distribution, and marketing costs, and σ is a risk variable that reflects volatility in the Class I cost of milk to processors. The percent farm-to-retail markup is the only variable to be derived in this study; all other variables were directly measured (i.e. retail milk prices and Class I costs for milk). Also, the percent farm-to-retail markup is the only variable to be estimated with an econometric model.

This model is a slight variation of the standard farm-to-retail model used by Heien et al., Kinnucan and Forker, and more recently by Lass et al. In fact, this model more closely follows the work of Brorsen et al. who endogenized the farm-to-retail marketing margins for the U.S. wheat industry by taking into consideration volatility in prices.

The farm-to-retail markup is derived by dividing the retail price of milk by the cost of milk to processors. Monthly data was used. This markup reflects processing costs, distribution costs, retail costs and profits. The markup is computed this way the fluid industry measures all margins, from processors to retailers, in relation to major costs. This is particularly true in retail, where all goods sold are marked up from cost. Retailers set markups and hence margins (the difference between the retail price and the cost of the good, divided by the retail price) based on goals, cost of the good, competition in the marketplace, and consumer reaction. Overall economic performance for processors is measured as gross operating margins, expressing major costs as a percent of the output price.

For example, Suiza, a major fluid milk processor, regularly discusses the results of operations as a percentage of net sales in their quarterly and annual reports (Suiza 2001). Retail grocery stores markup individual items from cost, then monitor economic performance after sales after calculating gross margins for individual items. For milk, the gross margin is equal to the difference between the retail price of milk and the cost of milk, divided by the retail price of milk.

Following Brorsen et al., the farm-to-retail markup in equation (2) above was estimated as a function of a vector of producer price indices to reflect processing, distribution, and retail costs. Producer price indices for electricity, oil, natural gas, and plastic packaging, as well as a labor index derived by Bureau of Labor Statistics data were provided by the Economic Research Service of USDA.[5] In addition, a risk variable σ was included in the model to test whether increased volatility in the Class I cost of milk had the effect of widening margins. The risk variable was defined as the squared difference between observations and the mean over the sample period for the Class I cost of milk.

[5] Source: Howard Elitzak, personal correspondance.

The results of the econometric specification are presented in Appendix A. They indicate that the risk variable was statistically insignificant. In other works, volatility in the Class I cost of milk did not have any appreciable impact on the size of the farm-to-retail margin over the historical period. A dummy variable that reflects a 1 when the Class I cost of milk rose and a 0 when it did not was found to be statistically significant with a negative coefficient. This implies that the farm-to-retail margin is squeezed whenever the cost of fluid milk to processors increases. This lends merit to the asymmetric price transmission models used by Kinnucan and Forker and Lass et al. The other variables that were found to be significant in the margin model were the PPI for oil and natural gas. The PPI for labor had a negative sign and was not statistically significant, but was kept none-the-less since it is a major cost of doing business.

Analysis and Results

Two monthly retail milk price models were estimated and then simulated over the compact period July 1997 – December 2000 (one for Boston, the other for Hartford) under alternative assumptions for the exogenous variables. The farm-to-retail markup model estimated in the appendix was used with the retail price identity in equation (1) to create the retail milk price models. The econometric markup model was "lined up" to the model baseline over the Compact period by adding the observed errors to the monthly model simulation results. Next, the retail milk price identity in equation (1) was created so that the simulated model was identical to the observed retail milk prices over the Compact period.

The objective of this simulation exercise was to decompose the average retail price increase during the Compact period relative to the pre-Compact period January 1994 – June 1997. This was done by changing the level of the exogenous variables over the Compact period, simulating the model, and comparing the results with the baseline data for the retail milk price. In fact, this was done for a number of variables, one at a time, including the Coop premiums and Compact over-order premiums, and the PPI indices. In this way, the model was used to explain why retail milk prices increased 30 cents per gallon in both Boston and Hartford during the compact period.

Three general scenarios were performed over the Compact period using the retail milk price simulation model:

Scenario 1: eliminate the dairy Compact over-order obligation over the Compact period July 1997 – December 2000
Scenario 2: use the 42-month average cooperative Class I over-order premium for the period January 1994 – June 1997 over the simulation period July 1997 – December 2000
Scenario 3: use the 42-month average index for each PPI index for the period January 1994 – June 1997 over the simulation period July 1997 – December 2000.

For example, the Compact over-order obligation was reduced to zero over the Compact period July 1997 – December 2000. This data was then entered into the monthly retail milk price simulation models for Boston and Hartford. The monthly results of this simulation exercise were then compared to the actual monthly baseline retail milk price series. This comparison shows the impact of the Compact on retail milk prices. Likewise, the growth in the PPI indices over the Compact period was replaced with the average PPI

over the pre-Compact period in order to isolate the impact of each PPI index on retail milk prices (actually, on the farm-to-retail markup). The results of these simulations for both Boston and Hartford are summarized in Table 4.

Table 4. Average Retail Milk Price Implications of Alternative Changes in the Retail Milk Simulation Model for Boston and Hartford

	Simulated levels for the exogenous variables	Boston	Hartford
		changes measured in dollars per gallon	
Scenario 1: no Compact premium	0, $/cwt	-0.224	-0.229
Scenario 2: rise in Coop over-order premiums to the pre-Compact period	$0.63, $/cwt	0.018	0.013
Scenario 3:			
PPI for oil over the pre-Compact period	612.48, index 100=1967	-0.012	-0.013
PPI for natural gas over the pre-Compact period	1139.16, index 100=1967	-0.085	-0.088
Other factors not explained by the model		-0.002	0.003
Total changes		-0.305	-0.314

Note: monthly changes in the simulation model relative to the historical baseline. The results are then averaged over the Compact period July 1997 – December 2000. The pre-compact period was January 1994 – June 1997.

The retail milk price in Boston averaged $2.42 per gallon over the period January 1994 – June 1997 and $2.72 per gallon over the period July 1997 – December 2000. In other words, the average retail milk price in Boston rose $0.305 per gallon during the Compact period. The Boston retail milk price model was simulated over the Compact period after the Compact over-order obligation was reduced to zero. A monthly comparison was then made between the model results and the baseline retail milk price series. The average difference over the Compact period was –22.4 cents per gallon. In other words, the results indicated that the Northeast Dairy Compact raised the retail milk price in Boston by an average 22.4 cents per gallon over the Compact period. Effectively, the Compact increased the Class I cost of milk to processors and retail milk prices rose after the markup margin was applied to a higher base cost for milk.

Cooperative over-order premiums, however, fell from an average 5.4 cents per gallon ($0.63/cwt) in the pre-Compact period to 4.3 cents per gallon ($0.50/cwt) in the Compact period. The retail milk price model for Boston was re-simulated with a cooperative over-order premium of 5.4 cents per gallon over the Compact period. In other words, it was assumed that cooperatives would raise their market service charges back to the pre-Compact levels if the Northeast Dairy Compact were eliminated. The average retail price impact of this change over the Compact period was to increase retail milk prices 1.8 cents per gallon. Thus the net impact of an elimination of the Compact was to lower retail milk prices by 20.7 cents per gallon. Said another way, after accounting for changes in cooperative over-order premiums, the net effect of the Compact was to raise retail milk prices 20.7 cents per gallon in Boston.

It should be mentioned that it is possible that cooperative over-order premiums in the absence of the Compact would have increased over the period July 1997 – December 2000 when compared to the pre-Compact period. Over-order premiums in the Mid-Atlantic and South, for example, have generally increased during this period. The impact of this change would be to moderate the impact of the Compact on retail milk prices. In other words, one could argue that this methodology may overstate the impact of the Compact on retail milk prices.

Processing, distribution and retailing costs increased over the Compact period when compared to the pre-Compact period. For example, the PPI for natural gas, a major energy cost to processors, increased an average 9.3 percent over the Compact period (Erba et al.). The PPI for oil, a major component of distribution costs, rose an average 14.5 percent over the Compact period. Finally, labor costs, which are represented throughout the marketing channel, rose 10.6 percent.

The farm-to-retail markup model estimated in this study indicates that higher costs for fuel effectively accounted for most of the increase in the margin over the Compact period. Simulation results for Boston indicate that the retail price of milk rose 1.2 cents and 8.5 cents per gallon during the Compact period due to higher costs for oil and natural gas, respectively. Labor costs were not simulated here since they had a negative coefficient. This coefficient indicates that higher labor costs were not successfully passed on to retail customers.

Similar results were found for Hartford retail milk prices (see Table 3). The Compact had the impact of raising retail milk prices by 21.5 cents per gallon in Hartford. The rest of the retail price increase in Hartford over the Compact period was due to higher fuel costs.

Implications and Concluding Comments

The objective of this study was to analyze the impact of the Northeast Compact on retail milk prices in New England. A simple markup model was estimated in order to isolate and explain the factors that resulted in changes in the farm-to-retail margin and the retail price of milk. This approach assumes that retail prices are marked up from costs, and that changes in the farm-to-retail margin are due to changes in processing, distribution and marketing costs. This model, while simplistic, reflects observed pricing strategies for processors and retailers in the U.S. dairy industry.

The weakness of this model, however, is that it does not allow for the possibility that changes in the Class I cost of milk may increase or decrease the farm-to-retail margin over a period of one or more months. This effect, however, was partially reflected in the model by the use of a dummy variable, which found that the farm-to-retail margin was squeezed whenever the Class I cost of milk increases. Said another way, the farm-to-retail margin remained unchanged whenever the Class I cost of milk fell, but was squeezed whenever the Class I cost of milk rose. Also, the objective of this study was to focus on the average changes in the retail milk prices over the entire Compact period, not a month-to-month change.

This study found that processors paid an average 14.3 cents per gallon more for milk over the Compact period when compared to the pre-Compact period. About 3 cents of this

increase was due to higher minimum Class I federal order prices. About 12.3 cents of this increase was due to the Compact over-order obligation. There was a credit of one cent to reflect reduced cooperative premiums. Thus the net impact of the Compact was to raise direct processor costs 11.3 cents per gallon.

This study concludes that the net effect of the Compact was to raise retail milk prices 20.7 cents per gallon in Boston and 21.5 cents per gallon in Hartford. A standard farm-to-retail margin was applied to all Class I costs for milk, including that of the Compact. This is a reasonable assumption since grocery stores may not be aware of how much of their invoice cost for packaged milk is due to the Compact and how much is due to other factors such as higher fuel and other processing costs.

Higher costs for labor, electricity, and fuel raise the possibility of increased margins from the farm to retail, and thus higher retail costs to consumers. Processors and retailers will attempt to pass on these higher costs to consumers, if the market will allow them to do so. Competition in some cases prevents this from happening. This study found that higher fuel costs contributed to an additional 10 cents per gallon increase in retail milk prices in Boston and Hartford during the Compact period. It is possible that some of the other higher costs, most notably those for labor and electricity, could be reflected in the coefficient for fuel costs. If that was the case, it would imply that these other costs would also be reflected in the 10-cent higher retail milk prices. This is a limitation of using econometrics to estimate models.

Thus retail milk prices rose 30.5 cents per gallon in Boston and 31.4 cents per gallon in Hartford over the Compact period July 1997 – December 2000 when compared to the pre-Compact period January 1994 – June 2000. Most of this increase, about 70 percent, was directly attributable to the Northeast Dairy Compact.

References

Bailey, Kenneth. 2000. "Evaluating the Economic Impacts of Regional Milk Pricing Authorities: The Case of Dairy Compacts." *Agricultural and Resource Economics Review*. 29/2(October 2000):280-219.

Brorsen, B. Wade, Jean-Paul Chavas, Warren R. Grant, and L. D. Schnake. "Marketing Margins and Price Uncertainty: The Case of the U.S. Wheat Market." *American Journal of Agricultural Economics* 67 (1985):521-528.

Cotterill, Ronald W. and Andrew W. Franklin. "The Public Interest and Private Economic Power: A Case Study of the Northeast Dairy Compact." Food Marketing Policy Center. Department of Agricultural and Resource Economics, University of Connecticut, Storrs. May 2, 2001.

Dyer, Linda Smith. Testimony on the Northeast Dairy Compact. Presented to the Committee on Agriculture, Nutrition and Forestry, United States Senate, February 9, 2000.

Erba, Eric M., Richard D. Aplin, and Mark W. Stephenson. "An Analysis of Processing and Distribution Productivity and Costs in 35 Fluid Milk Plants." Cornell Program on Dairy Markets and Policy. R.B. 97-03. February 1997.

Federal Register. "Proposed Rules." Vol. 62, No. 81, Monday, April 28, 1997, page 23049.

Heien, D. M. "Markup Pricing in a Dynamic Model of the Food Industry." *American Journal of Agricultural Economics* 62 (1980):10-18.

Jacoby, Jeff. "Our Sour Milk Policy." Editorial in the Boston Globe. June 29, 2000.

International Dairy Foods Association. Compact Activity May Hurt Milk Sales in New England. News Release, Washington, D.C. July 9, 1997.

Lass, Daniel, Mawunyo Adanu, and P. Geoffrey Allen. "Impacts of the Northeast Dairy Compact on New England Retail Prices." *Agricultural and Resource Economics Review* 30/1 (April 2001): 83-92.

Marvin, Jeanette. "Dairy Compact Sabotage." Farm Progress. July 2000.

Nicholson, Charles F. "The Northeast Interstate Dairy Compact: Milk Market Impacts." Agricultural Experiment Station Research Report No. 73, University of Vermont. March 2000.

Office of Management and Budget. "The Economic Effects of the Northeast Interstate Dairy Compact." A Study Required by Section 732 of the FY 1998 Agriculture Appropriations Act (PL 105-86). Washington, DC. February 1998.

Suiza Foods Corporation. 2000 Annual Report. Available online: http://media.corporate-ir.net/media_files/NYS/SZA/reports/suiza00.pdf . 2001.

Appendix A—Econometric Estimation Results for the Farm-to-retail Markup Model

Appendix Table 1. Maximum-likelihood coefficient estimates for two autoregressive linear models

Natural log of variables:	Model 1: Natural log of the retail price of milk ($/gal) in Boston, Massachusetts	Model 2: Natural log of the retail price of milk ($/gal) in Hartford, Connecticut
Intercept	-2.3345 (-0.59)	-4.0477 (-1.06)
PPI oil, 100=1967	0.2110 (2.24)	0.1740 (1.98)
PPI natural gas, 100=1967	0.8804 (1.86)	0.8373 (1.86)
PPI labor, 100=1967	-0.8974 (-1.25)	-0.5247 (-0.76)
DumBRise	-0.0598 (-3.59)	-0.0782 (-5.13)
AR1	-0.8184 (-12.22)	-0.8318 (-12.37)
Total R-square	0.7943	0.7941
Durbin-Watson	1.7963	1.6316
Number of observations	84	84

Note: DumBRise = 1 when the Class I cost of milk rose from the previous period, and 0 elsewhere. It was used as a proxy for asymmetric price transmission. Also, brackets below parameter estimates are t values.

The model specified in equation (2) estimated the percentage farm-to-retail markup as a function of a vector of producer price indices as well as a risk variable. The model was estimated over the time period January 1994 – December 2000. An autoregressive estimation procedure was used due to the presence of autocorrelation in the error terms. The risk variable was constructed by computing the squared error from the mean derived over the sample period. It did not prove to be statistically significant and was therefore dropped from the model specification. In addition, the PPI for electricity and plastic packaging was also dropped due to insignificant parameter estimates. These two variables were also highly correlated with other variables in the model specification. The PPI for labor was kept in the model, despite low t-values, because it represents a significant cost to processors and retailers. A negative coefficient suggests rising labor costs were not successfully passed on to consumers over the period of estimation.