Evaluating the Economic Impacts of Regional Milk Pricing Authorities: The Case of Dairy Compacts

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Congress consented to the creation of the Northeast Interstate Dairy Compact in the 1996 Federal Agriculture Improvement and Reform Act. Interest is now growing in expanding this compact and creating new multi-regional dairy compacts. Dairy compacts provide a floor for Class I fluid prices and thus stabilize and enhance farm milk prices in compact regions. This analysis indicates that multi-regional dairy compacts will result in clear economic tradeoffs between dairy farmers, processors, retailers, and consumers. While dairy farmers within the compact region may economically benefit from higher farm milk prices, processors, retailers and consumers in the compact region and dairy farmers outside the compact region will face economic losses.

The basic thrust of the 1996 Federal Agriculture Improvement and Reform Act (FAIR Act), the so-called "Freedom to Farm Bill," was to move agriculture towards freer markets and away from government regulation. Crop farmers were suddenly allowed to make their own planting decisions. Dairy farmers were no longer required to pay federal assessments, but in exchange, lost the dairy price support program.

Yet Congress also created authority for a new price support program for a select group of dairy farmers. Section 147 of the FAIR Act established the Northeast Interstate Dairy Compact (Northeast Compact) consisting of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. That legislation was specified in section 1(b), Senate Joint Resolution 28 of the 104th Congress, and was subject to a number of conditions (U.S. Senate).

Now there is interest in expanding the Northeast Compact to include other Northeast states, and in creating a new Southern Dairy Compact. Many states are losing dairy farms and rural economic activity. State and federal legislators in these states are looking to dairy compacts as a regulatory measure to provide additional support to their local dairy industry.

The objective of this article is to evaluate the intermediate-run economic impacts of forming regional dairy compacts. A national study will be conducted to evaluate the economic tradeoffs between dairy farmers, fluid milk consumers, processors, and retailers both in and outside of dairy compact regions.

Dairy Compacts

A dairy compact is an agreement among states to regulate the price of milk used for fluid purposes (called the Class I price in federal order language). Dairy compacts can work in conjunction with the federal milk marketing order system. Proceeds of the federal order system and that of dairy compacts, however, are separate. To manage the compact, a commission is formed which sets a compact price. That price creates a floor on the minimum wholesale cost of fluid milk that processors pay. It is likely set in excess of the federal minimum Class I price for fluid milk in the compact region. Since the federal minimum price fluctuates each month based on market conditions, the monthly difference between the compact price and the Class I price—called the compact premium—is variable and usually greater than zero. This difference is collected

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by the compact commission directly from fluid processors and disbursed to eligible farmers.

Interstate compacts are authorized under the Compact Clause (Article 1, Section 10, Clause 3) of the United States Constitution as follows:

> No State shall, without the Consent of Congress, lay any Duty of Tonnage, keep Troops, or Ships of War in time of Peace, enter into any Agreement or Compact with another State, or with a foreign Power, or engage in War, unless actually invaded, or in such imminent Danger as will not admit of delay.

The Northeast Compact is currently the only dairy compact in existence. 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. Wackernagel analyzed the "potential" impact of the Northeast Compact on Vermont dairy farmers. Outside these two studies, there has been no national study of the economic impact of regional dairy compacts.

Dairy Industry Model

To carry out the objective of this study, an intermediate-run regional economic simulation model of the U.S. dairy industry was developed. This model (Dairy Compact model) reflects the economics of federal and state milk marketing orders, and includes elasticities derived from the literature. The model was "calibrated" to a baseline reflecting regional supply, demand and prices. Then, a number of regional dairy compact (i.e. Northern, Mid-Atlantic, and Southeast) were imposed on the model. The model was then resolved. The difference between the baseline and the model simultions represent the economic impacts of regional dairy compacts.

Prior Dairy Models

The Dairy Compact model used in this study is based on a conventional model of discriminatory pricing. Kessel developed an early model of discriminatory pricing that reflected two markets: one for fluid milk, which faced a relatively inelastic market, and another for manufacturing milk, which faced a more elastic demand curve. Ippolito and Masson expanded this model and allowed federal regulators to set minimum classified prices in order to bring forth an adequate supply of milk to meet the needs of consumers.

More specifically, the Dairy Compact model is based on a conventional exogenous fluid differential model developed by Kaiser (1997), Liu et al. (1990, 1991), and Suzuki et al. (1993, 1997). This model reflects regulations of federal milk marketing order which set minimum Class I fluid milk prices equal to the minimum manufacturing price plus a local fluid differential. The combination of the relatively inelastic fluid demand curve and the relatively more elastic manufacturing demand curve forms a "kinked" demand curve. Manufacturing and fluid prices are then simultaneously determined. This method of discriminatory pricing will result in an enhanced market equilibrium milk price at the farm level.

The Dairy Compact model also reflects the pooling of federal order class prices for fluid milk and manufacturing uses. These are minimum prices set at 3.5% butterfat. The pooled price is called a "blend price." Farmers receive the blend price plus any over-order premiums. The latter reflects premiums in excess of federal minimum prices paid by processors to dairy cooperatives based on local market conditions.

Federal Order Reform

A major issue that could affect the results of this study is the choice of a model baseline. A major reform of federal milk marketing orders was approved by dairy farmers in a national referendum and was implemented January 1, 2000. This reform includes new class formulas and a permanent replacement to the Basic Formula Price (the manufacturing milk price), multiple component pricing, a reduction in the number of federal orders from 31 to 11, and new Class I fluid differentials that will reflect multiple basing points (see Bailey 1999, and Cox and Cropp). Thus, should milk regulations or the new federal order reforms be used in the baseline? This issue could have a significant impact on this analysis particularly since some local Class I differentials will change significantly. Also, some states will experience changes in fluid utilization rates due to the new boundaries of the revised orders (i.e. Southern Missouri).

Thus, in order to isolate the impact of dairy compacts and avoid any questions regarding the impact of federal order reform on this analysis, the baseline was constructed to reflect Secretary Glickman's federal order reform.

The Dairy Compact model used identities from the USDA's federal order reform regulations to specify component values for butterfat, protein, other solids and nonfat solids as a function of NASS survey prices for butter, cheese, nonfat dry milk and whey. The NASS survey prices were then

Table 1. Own Price Elasticities for Retail Fluid Milk

Fluid Milk	Maynard (1998)	Gould (1995)	FAPRI	AC Neilsen
Whole	−0.52 to −0.58	−0.803	−0.23	
Low fat:			−0.10	
2 percent	−0.33 to −0.72	−0.512		
1 percent	−0.54 to −0.74	−0.593		
Skim	−0.61 to −0.81	−0.593		
Fluid				−0.32 to −0.76

Note: see the bibliography for references.

linked in the model to Chicago Mercantile Exchange prices. The component values were used to specify class prices. The Class III (milk used for cheese) skim price is a function of the component values of protein and other solids. The Class IV (milk used for butter and nonfat dry milk) skim price is a function of the component value for nonfat solids. The Class II (milk used for soft manufactured products) skim price is equal to the Class IV skim price plus $0.70. The Class I skim mover (similar in effect to the BFP) is equal to the higher of the Class III or IV skim price. All prices are adjusted (to 3.5% butterfat) by the butterfat price, which in turn is a function of the Grade AA NASS butter price (see Bailey 1999 for more detail).

Review of Elasticities

The Dairy Compact model is conditioned on market elasticities of supply and demand. A thorough review of elasticities from previous studies was developed in order to provide input for the model parameters.

Maynard estimated a number of models that reflected price volatility in the demand for fluid milk. All estimated elasticities were negative and inelastic but were at levels five times that of prior estimates. Gould investigated factors affecting the demand for reduced fat milk. He used household panel data which included over 4,300 households who recorded fluid milk purchased for at-home consumption over a 12-month period. AC Nielsen estimated fluid milk elasticities using retail scanner data (Hall). This study, "DMI Milk Pricing Analysis," was conducted under contract with Dairy Marketing, Inc. The Food and Agricultural Policy Research Institute (FAPRI) estimated a structural econometric model used for simulating changes in dairy policy. Model parameters were estimated for fluid milk consumption using annual per capita consumption data for whole and lowfat milk as a function of the U.S. average retail price of whole milk. The results of these studies of fluid milk elasticities are in table 1.

There are a number of academic studies that estimated demand systems as part of a total dairy industry model. Liu et al. estimated a two-regime dairy structural system. Kaiser (1997) and Suzuki and Kaiser (1997) estimated dairy industry models to model the economic impact of generic dairy advertising. Both models estimated farm milk supply, Class I demand and manufacturing demand using two-stage least squares and quarterly data.

Cox et al. developed an interregional competition model of the U.S. dairy industry denoted the UW Dairy IRCM (Cox (1998), Cox et al. (1995), and Cox et al. (1994)). The model is specified for multiple regions that represent separate milk and dairy product production/consumption areas that correspond to federal and state marketing orders. Heien and Wessells estimated the structure of dairy product demand using Household Food Consumption Survey data. They estimated a complete demand system for food incorporating price and income effects, as well as demographic effects. Huang estimated a disaggregate U.S. food demand system.

Finally, the Office of Management and Budget (OMB) developed an economic simulation model used to estimate the price, income, production, and consumption effects of the Northeast Interstate Dairy Compact. This model used milk production and consumption elasticities based on previous USDA econometric studies. The model was consistent with baseline data for 1997 used in preparing the 1999 President's Budget.

Results of this review of dairy industry elasticities are summarized in table 2. The elasticities used in the Dairy Compact model are listed in the last column. Regional intermediate-run milk supply elasticities were adopted from earlier work by Schiek. That study suggests regional differences in milk supply response to changes in farm prices. The retail elasticity for fluid milk demand used in the Dairy Compact model is −0.32. This number

Table 2. Own Price Elasticities from U.S. Dairy Industry Models

	Heien & Wessells (1988)	Huang (1993)	Suzuki & Kaiser (1997)	Cox et al.	FAPRI	OMB	Dairy Compact Model
Farm Supply			0.59[a]	0.56[b]	0.07 to 0.20[c]	0.10[c]	NA[b]
Milk used for:							
Fluid			−0.16			−0.08	
Manufacturing:			−0.22			−0.25	
Soft products				−0.42	−0.11		−0.25
Cheese					−0.88		0.20[e]
Butter/nonfat					−1.62		
Retail Demand:							
Fluid	−0.63	−0.04		−0.14	−0.10 to −0.23		−0.32
Cheese	−0.52	−0.25		−0.16[d]	−0.37		−0.35
Butter	−0.73	−0.24		−0.09	−0.25		−0.50
Nonfat dry milk				−0.45	−0.58		−0.60
Ice cream		−0.08		−0.33			

Note: FAPRI = Food and Agricultural Policy Research Institute; OMB = Office of Management and Budget. See the bibliography for references.
[a]Long-run elasticity.
[b]Intermediate run elasticities: Northeast and Appalachian: 0.28; Southeast and Florida: 0.17; Mideast: 0.18; Upper Midwest: 0.24; Central: 0.18; Southwest, Western, and Arizona-Las Vegas: 0.47; and Pacific NW: 0.35. Based on an earlier study by Schiek.
[c]Short-run elasticity.
[d]American cheese.
[e]This is not a price elasticity. It applies to the proportion of excess milk used for Class 3 use. See the model specifiction.

represents the low end of the elasticity range reported in the AC Nielsen study. While it is considerably lower than estimates reported by Maynard and Gould, it is three times higher than those reported by FAPRI and Cox. It is the author's conclusion that the AC Nielsen and Maynard and Gould studies are more recent and use less aggregated data than the FAPRI study.

The elasticity of milk used for Class 2 products in the Dairy Compact model was adopted from the OMB study. The specification for milk used for Class 3 purposes in the dairy compact study is reviewed in the next section. It is a new specification and the elasticity used cannot be compared to the literature.

In this study fluid milk demand is modeled at the retail level and demand for manufactured dairy products (cheese, butter and nonfat dry milk) is modeled at the wholesale level. Most of the commercial disappearance of fluid milk is at the retail level. Most manufactured dairy products, on the other hand, are purchased at the wholesale level for food service uses or for further processing into value-added products. The wholesale demand elasticities in this study for manufactured dairy products increase in magnitude from cheese to butter to nonfat dry milk. This is consistent with the literature. Most milk not used for either fluid purposes or for manufacture into cheese or butter is processed into nonfat dry milk in "balancing plants." Thus the elasticity used in this study for nonfat dry milk demand (−0.60) is higher than that for butter (−0.50) or cheese (−0.35). These elasticities are well within the bounds of estimates from prior academic studies.

Multi-Region Economic Model

The Dairy Compact model presented in this study is similar in structure to policy models developed by Gardner. Supply and demand equations were specified using a constant elasticity functional form. The model is a static equilibrium model that reflects intermediate-run adjustments in the milk supply. It is multi-regional in that it reflects milk supply, milk allocation and class prices by federal marketing order. The model reflects 13 regions: the 11 federal order regions specified in federal order reform, an unregulated region, and California. Detailed equations describing federal order prices are included in the model. The overall supply and demand for dairy products, however, is modeled at the national level.

The Dairy Compact model is presented in table 3. Milk marketings and milk allocations are in equations 1–8. Milk marketings S^i by federal order i are specified as a function of the farm price of milk P^i_b. The farm price is equal to the federal order blend price plus any market over-order premiums for fluid milk. Regional milk marketings vary with changes in both the farm price and the magnitude of the supply elasticity α_i.

Table 3. Dairy Compact Simulation Model

Marketings and Milk Use

1. $S^i = A^i (P_b^i)^{\alpha i}$
2. $C1U^i = TFC^i$
3. $C2U^i = C^i(C2P^i)^{\theta}$
4. $CGE = P_c * 9.87 + P_w * 5.6 + (P_{bt} - 0.10) * 0.238$
5. $BPGE = P_{bt} * 4.27 + P_n * 8.07 + P_{bm} * 0.42$
6. $C3U^i = \xi^{i*} (S^i - C1U^i - C2U^i)$
7. $\xi^i = D^i * CGE^{\delta} * BPGE^{-\delta}$
8. $C4U^i = S^i - C1U^i - C2U^i - C3U^i$

Price Identities

9. $C4P = f(P_n, P_{bt})$
10. $C3P = f(P_c, P_{bt})$
11. $C2P = C4P + 0.70$
12. $C1MOVER = \max(C3P, C4P)$
13. $C1P^i = C1DIF^i + C1MOVER$
14. If $C1P^i < CP^i$, then CP^i, else $C1P^i$
15. $CPR^i = CP^i - C1P^i$
16. $P_b^i = ((C1P^i + PR^i + CPR^i) * C1U^i + C2P * C2U^i + C3P * C3U^i + CAP * C4U^i)/S^i$

Retail Fluid Milk Consumption

17. $PCF^i = B^i (RPF^i)^{\beta}$
18. $RPF^i = C1PG^i + \$MU^i$
19. $C1PG^i = (C1P^i + PR^i + CPR^i) * 8.62/100$
20. $TFC^i = PCF^i * POP^i$
21. $RFME^i = (TFC^i/8.62) * RPF^i$

Commodity Production Identities

22. $PRD_c \sum_i C3U^i * MEC_c$
23. $PRD_{bt} = \sum_i (C3U^i + C4U^i * \lambda) * MEC_{bt}$
24. $PRD_n = \sum_i C4U^i * MEC_n$

Commodity Demand and Market Clearing Conditions

25. $DU_j = E(P_j)^{\eta_j}$
26. $DSTK_j = F(P_j)^{\eta_j} * (PRD_j)^{\rho_j}$
27. $PRD_j + IMP_j + DSTK(-1)_j = DU_j + DSTK_j + EXP_j$

Endogenous Variables

BPGE:	butter/nonfat dry milk gross earnings, \$/cwt. milk
C1MOVER:	class 1 mover, \$/cwt.
$C1P^i$:	class 1 price, \$/cwt., federal order i
$C1PG^i$:	class 1 cost of fluid milk to processors, \$/gal., federal order i
$C1U^i$:	class 1 use, mil. lbs., federal order i
C2P:	class 2 price, \$/cwt.
$C2U^i$:	class 2 use, mil. lbs., federal order i
C3P:	class 3 price, \$/cwt.
$C3U^i$:	class 3 use, mil. lbs., federal order i
C4P:	class 4 price, \$/cwt.
$C4U^i$:	class 4 use, mil. lbs., federal order i
CGE:	cheese gross earnings, \$/cwt milk
CPR^i:	dairy compact premium, \$/cwt., federal order i
$DSTK_j$:	ending commercial stocks, mil. lbs., dairy commodity j
$DSTK(-1)_j$:	beginning commercial stocks, mil. lbs., dairy commodity j
DU_j:	domestic use, mil. lbs., dairy commodity j
P_{bt}:	price of grade AA butter, Chicago, \$/lb.
P_c:	price of 40-lb. block cheese, Chicago, \$/lb.
P_b^i:	farm price of milk, \$/cwt., federal order i
P_n:	price of nonfat dry milk, Central States, \$/lb.
PCF^i:	per capita fluid milk consumption, lbs., federal order i

Table 3. Dairy Compact Simulation Model (continued)

PRD_j:	production, mil. lbs, dairy commodity j
$RFME^i$:	retail fluid milk expenditures, mil. dollars, federal order i
RPF^i:	retail fluid milk price, \$/gal., federal order i
S^i:	milk marketings, mil. lbs., federal order i
TFC^i:	total fluid milk consumption, mil. lbs., federal order i
ξ:	the proportion of residual milk used for class 3 use, percent, federal order i

Exogenous Variables

αi:	milk supply elasticity, federal order i
β:	retail fluid demand elasticity
θ:	class 2 elasticity δ: class 3 elasticity
λ:	proportion of class 3 milk used to make butter from whey cream
ρ_j:	stock elasticity with respect to production, dairy commodity j
η_j:	demand elasticity, dairy commodity j
$\$MU^i$:	farm to retail markup, \$/gal., federal order i
$C1DIF^i$:	class 1 differential, \$/cwt., federal order i
CP^i:	compact price set by compact commission, \$/cwt., federal order I
EXP_j:	exports of dairy commodities, mil. lbs., dairy commodity j
IMP_j:	imports of dairy commodities, mil. lbs., dairy commodity j
MEC_j:	milk equivalent conversion factor, dairy commodity j
P_{bm}:	price of dry buttermilk, Central States, \$/lb.
P_w	price of dry whey, Central States, \$/lb.
POP^i:	civilian residential population, mil., federal order i
PR^i:	class 1 market over-order premium, \$/cwt., federal order i
j:	dairy commodity (c = cheese, bt = butter, n = nonfat dry milk)
$A^i - F^i$:	model constants

Milk marketings are then allocated to alternative class uses in the remaining equations. There are four classes of milk use under federal order reform. Milk handlers (processors) must pay a minimum federal order class price for milk depending on how it is used. The highest class price is milk used for fluid purposes (Class I), the lowest for butter/nonfat dry milk production (Class IV). The Class II price is for milk used for soft manufactured dairy products such as ice cream and yogurt, and Class III is to price milk used for cheese production. Thus raw milk is allocated according to alternative class uses depending upon the relative class prices and returns to processing.

The Dairy Compact model in table 3 uses the Kaiser-Liu model that reflects a conventional exogenous fluid differential model. Class prices are determined simultaneously in the model by solving for a manufacturing price (i.e. commodity prices for cheese, butter, and nonfat dry milk) and using fixed class differentials and other parameters.

Milk is allocated to Class I purposes in each federal order ($C1U^i$) based on an identity that is equal to retail demand (equation 2). This is based on the assumption that all milk used at the wholesale processing level (less shrink and waste) is also consumed at the retail level. The retail demand specification for fluid milk (TFC^i) in turn is specified in equations 17–21. The fluid retail demand equation is a function of the retail price RPF^i. That retail price is equal to a farm-to-retail price identity that starts with the Class I price mover C1MOVER, adds a regional Class I differential $C1DIF^i$ and any over-order premiums PR^i to define the wholesale cost of milk to processors $C1PG^i$ (equations 12, 13 and 19). Then a wholesale/retail markup is used $\$MU^i$ to derive a retail fluid milk price (equation 18).

Milk is allocated to Class II uses (equation 3) based on the Class II federal order price $C2P^i$. Equations 4–8 describe how Class III and IV milk is allocated. These equations start with milk in excess of Class I and II uses, and then allocates it to Class III and IV uses on a proportionate basis. This specification reflects the fixity of plant investments (i.e. cheese plants must be kept full in order to lower per unit costs) as well as the relative returns between a cheese and a butter/nonfat dry milk plant.

The proportion of milk used for Class III purposes (equation 7) is defined as a function of the relative earnings of milk used in either a cheese plant or a butter/nonfat dry milk plant. Those earnings (equations 4 and 5) are simply product yields times product prices. Equation 8 is a residual identity that defines Class IV use for milk and clears the market for raw milk.

There are a number of equations in the model that describe milk marketings, milk use and class prices for California. The multiple component pricing formulas describing class prices under the California milk order system in this model were provided by the California Department of Food and Agriculture (see Bailey and Gamboa 1999, and Sumner and Wolf).

Supply and demand for dairy commodities and market-clearing conditions are described in equations 22–27. The production of dairy commodity *j* is equal to the sum of Class III and IV milk in all federal orders multiplied by the appropriate milk equivalent conversion factor that translates raw milk into finished dairy products (see Bailey 1997, pp. 24–31). Demand for these products is then specified as a function of wholesale dairy commodity prices. All other variables that affect demand (i.e. competing prices, income, tastes and preferences) are implicitly reflected in the intercept terms and do not vary under model simulation. Stocks of dairy commodities are modeled as a function of wholesale commodity prices (negative elasticity) and production of the commodity (positive elasticity) as per Novakovic and Thompson and Salathe et al. Imports and exports of dairy commodities were assumed to be exogenous in this study.

The Dairy Compact model solves simultaneously for three wholesale prices: butter, nonfat dry milk, and cheese. The model solves for a price that will set supply equal to demand for each of these dairy commodities. Any changes in these prices will affect class prices, which in turn affects milk marketings and milk allocation. Changes in both class prices and milk allocation will also change the blend price at the farm level. That in turn will affect the level of milk marketings. Marketings and milk allocation are in fact simultaneously determined since milk allocation alters the blend price.

Model Simulations

Baseline

The baseline used in this study reflects the proposed changes in federal milk marketing orders. A full year of data for supply, demand and prices that reflects these new changes is not available. A baseline for 2000 was therefore created that incorporates all of these proposed changes in federal orders.

To do this, a baseline was first created for 1997 that reflects milk marketings, class use and class prices for 31 federal orders, California, and the residual unregulated states and regions. The major source of data for the 1997 baseline was the Agricultural Marketing Service of USDA (April 1998, June 1998). Additional sources were provided by annual summaries and reports provided by individual federal market administrators. Data for California was provided by the California Department of Food and Agriculture.

Next, a forecast of milk marketings and class use for each of the 31 federal orders and California, and dairy commodity supply, use and prices was created for 2000 based on the 1997 baseline and forecasts provided by the FAPRI. The original 31 federal orders in the 1997 baseline were aggregated into the 11 proposed federal orders. Formu-

Table 4. Regional Boundaries for Dairy Compacts Used in Model Simulation

Dairy Compacts	Proposed Federal Orders included in the Compacts	Unregulated Areas included in the Compacts
Northern Dairy Compact	Northeast	Maine
Mid-Atlantic Dairy Compact	Appalachian	Virginia
Southeast Dairy Compact	Southeast, Florida, and the northern portion of Missouri that will be in the proposed Central order.	

las for the new class prices were linked to forecasts of dairy commodity prices. Glickman's Option 1B proposal for Class I differentials was announced in the final rule for order reform and was therefore used. The elasticities and model equations outlined above were then incorporated into the model. All model intercepts were aligned to the new baseline (see appendix table 1 in Bailey and Gamboa 1999).

Model Assumptions and Scenarios

Dairy compact scenarios were evaluated in this study relative to the baseline. These scenarios all include a number of regional dairy compacts. The impacts of these regional compacts were then compared to the baseline. Since the baseline did not reflect any dairy compacts (not even the Northeast Interstate Dairy Compact), the difference between the two reveals the economic impact of regional dairy compacts.

Three regional dairy compacts were created for these scenarios (see table 4) and were incorporated into a combined multi-region dairy compact. All the scenarios below reflect this combined multi-regional dairy compact. The Northern Dairy Compact is geographically different from the existing Northeast Interstate Dairy Compact. The proposed Northern Dairy Compact includes the proposed Northeast federal order and the state of Maine. It will expand the Northeast Interstate Dairy Compact, but will not include central Pennsylvania and Virginia. Most of the milk produced in Pennsylvania will be marketed into either the proposed Mideast or Northeast federal order.

Virginia will be accounted for in a Mid-Atlantic Dairy Compact along with the proposed Appalachian order. Also, a Southern Dairy Compact is formed that includes both the Southeast and Florida proposed federal orders, and that portion of northern Missouri that will be in the proposed Central federal order. This northern portion of Missouri accounts for about 16.4% of the state's total milk production.[1]

The combined Dairy Compact scenario accounts for 27% of all milk marketings in the baseline.

The results of the compact study are conditioned on the following critical assumptions:

1. The level of compact prices used in the compact scenarios,
2. Level of market over-order premiums used in the compact scenarios,
3. Whether a fixed dollar mark up or a fixed percentage mark up is used in the farm-to-retail margin for fluid milk prices.
4. The number of states defined in the Combined Dairy Compact scenario.

The more effective the compact is in generating additional over-order premiums, the greater the impact of the compact on the model results. It is assumed that the objective of the Compact Commission is to set a compact price high enough so that an economic benefit to dairy farmers is generated. That benefit is defined as the average compact premium (the difference between the compact price and the minimum Class I price) generated over the course of a year. Thus, while the compact is designed to place a floor under the monthly Class I price, we have reduced the economic impact of the compact to an annual average premium. Thus the model will reflect regional compacts via an annual average premium that will be the same across all three compact regions. This makes intuitive sense since each compact commission will effectively enforce a similar economic tax to all fluid milk processors in the compact regions.

Thus two questions remain. First, at what level should the compact price and hence compact premium be set in this study in order to analyze the economic impacts of dairy compacts? Second, what assumptions are made regarding the level of existing market over-order premiums in the event a compact is enforced? Cooperatives typically bargain for market over-order premiums in excess of minimum federal order prices. If a compact is enforced, one could argue that these market over-order premiums could decline, or fall to some minimum level (i.e. the minimum cost of procuring milk is around \$0.25 to \$0.45 per cwt). However, one could also argue that there is no reason to form

[1] Based on country milk marketings for December, 1997. Source: Market Administrator's Office, Tulsa, Oklahoma.

a compact and enforce an effective compact premium only to have it exactly offset by lower market over-order premiums. The net amount would be zero. The objective of forming regional dairy compacts is to stabilize monthly fluid milk prices and enhance farm level milk prices. It is the combined total of compact premiums and market over-order premiums that should be analyzed in any compact scenario.

In order to account for multiple alternatives, four scenarios are developed for this study. Each reflects the combined dairy compact (three regional compacts). Half the scenarios reflect a $1 per cwt effective compact premium and the others $2 per cwt. And, half of the scenarios maintain market over-order premiums at baseline levels, and half reduce these premiums to 50% of baseline levels. All of these scenarios would result in some net increase in the sum of the compact and market over-order premiums:

Scenario 1: $1 per cwt compact premiums with 100% of baseline market over-order premiums.

Scenario 2: $1 cwt compact premiums with 50% of baseline market over-order premiums.

Scenario 3: $2 per cwt of compact premiums with 100% of baseline market over-order premiums, and

Scenario 4: $2 per cwt of compact premiums with 50% of baseline market over-order premiums.

Model Results

The results of the model simulations were computed by region. The model reflects 11 federal order regions, an unregulated region, and California. In order to simplify the presentation of these results, the four federal order regions that incorporated dairy compacts (Northeast, Appalachian, Southeast and Florida) were consolidated into one region called Compact Regions. The rest were aggregated into a Non-compact Region. The results are presented in table 5.

The results of the four compact simulations are generally similar to that of the OMB study. Within a compact region, dairy producers receive a higher effective farm price—$0.19 to $0.43 per cwt. under a $1 compact premium and $0.62 to $0.86 per cwt. under a $2 compact premium. Farmers in the compact regions responded to higher farm prices by expanding milk production. Milk marketings rose 0.4 to 0.7% under the $1 compact premium and 1.1 to 1.4% under the $2 compact premium. Consumers in the compact regions paid more for fluid milk due to the compact. Compact premiums net any reductions in market over-order premiums raised the cost of milk to consumers by 4–9 cents per gallon under the $1 per cwt compact premium and 13–17 cents per gallon under the $2 compact premium. Hence total fluid milk consumption and Class 1 use declined 0.5–1.9% depending on the scenario. Total consumer spending on fluid milk in the compact region increased 1.0–2.1% under the $1 per cwt. scenario and 3.1–4.2% under the $2 per cwt. scenario. The margin for fluid processors and retailers was defined in this study as the difference between retail price and wholesale milk cost times fluid consumption. These margins declined 0.5–1.0% under the $1 per cwt. scenario and 1.4–1.9% under the $2 per cwt. scenario due to declining fluid milk consumption.

Greater milk marketings and less fluid milk consumption in the compact regions resulted in more milk allocated to Class III and IV purposes. That resulted in increased production of butter, nonfat dry milk and cheese in the compact regions. Those products were sold on the national market which lowered wholesale prices for butter 0.3–1.0 percent, nonfat dry milk 0.3–0.8% and cheese 0.5–1.7%.

The increase in dairy product production in the compact region impacted dairy farmers and consumers outside the compact region. Lower wholesale prices for butter, nonfat dry milk and cheese resulted in lower class prices in all federal milk marketing orders. That's because the new formulas for class prices under order reform are directly linked to dairy commodity prices. Lower dairy commodity prices resulted in a lower Class I price mover, and lower prices for Class II, III, and IV milk.

As a result, the farm price of milk in non-compact regions fell $0.04–$0.07 cents per cwt. under the $1 compact premium, and $0.10–$0.14 per cwt. under the $2 compact premium. Farmers in non-compact regions responded by producing less milk. Total farm milk sales in non-compact regions fell 0.4–0.7% under a $1 per cwt. compact premium and 1.1–1.4% under a $2 per cwt. compact premium. Consumers in non-compact regions and states, however, faced a slightly lower price for fluid milk and marginally increased their fluid milk consumption.

Sensitivity Analysis

The impact results in this study are conditioned on the assumptions made earlier. One particular as-

Table 5. Economic Impact of Regional Dairy Compacts Under Alternative Scenarios

		Scenario #1 Comp Prem: $1 MOOP: 100%		Scenario #2 Comp Prem: $1 MOOP: 50%		Scenario #3 Comp Prem: $2 MOOP: 100%		Scenario #4 Comp Prem: $2 MOOP: 50%	
	Baseline	Change	% Chng	Change	% Chng	Change	% Chng	Change	% Chng
Compact Regions 1/[a]									
Farm price ($/cwt)	14.44	0.43	3.0	0.19	1.3	0.86	5.9	0.62	4.3
Farm milk (mil $)	5,831.1	218.0	3.7	98.5	1.7	431.7	7.4	314.8	5.4
Milk marketings (mil. lbs.)	40,388.7	287.2	0.7	151.4	0.4	560.5	1.4	431.9	1.1
Farm-to-retail markup ($/gal.)	1.38	0	0	0	0	0	0.0	0	0
Fluid processor/retail margin (mil. $)	3,596.4	−35.4	−1.0	−17.5	−0.5	−68.2	−1.9	−50.9	−1.4
Per capita fluid consumption (lbs.)	199.0	−2.0	−1.0	−1.0	−0.5	−3.8	−1.9	−2.8	−1.4
Retail milk price ($/gal.)	2.76	0.09	3.1	0.04	1.5	0.17	6.2	0.13	4.6
Retail milk expenditures (mil. $)	7,211.8	153.3	2.1	74.2	1.0	299.6	4.2	221.1	3.1
Non-Compact Regions									
Farm price ($/cwt)	12.94	−0.07	−0.6	−0.04	−0.3	−0.14	−1.1	−0.10	−0.8
Farm milk sales (mil $)	15,402.4	−114.3	−0.7	−56.4	−0.4	−217.8	−1.4	−163.0	−1.1
Milk marketings (mil. lbs.)	119,042.2	−212.3	−0.2	−106.2	−0.1	−406.6	−0.3	−305.6	−0.3
Farm-to-retail markup ($/gal.)	1.53	0	0	0	0	0	0	0	0
Fluid processor/retail margin (mil. $)	6,511.7	0.9	0	−0.9	0	1.9	0	0.1	0
Per capita fluid consumption (lbs.)	228.5	0	0	0	0	0	0	0	0
Retail milk price ($/gal.)	2.81	0	0	0	0	0	0	0	0
Retail milk expenditures (mil. $)	11,974.6	−2.7	0	4.3	0	−5.7	0	1.0	0
U.S. Total									
Farm price ($/cwt)	13.32	0.06	0.4	0.02	0.2	0.12	0.9	0.08	0.6
Farm milk sales (mil $)	21,233.5	103.7	0.5	42.1	0.2	214.0	1.0	151.8	0.7
Milk marketings (mil. lbs.)	159,431.0	74.8	0	45.2	0	153.9	0.1	126.3	0.1
Farm-to-retail markup ($/gal.)	1.47	0	0	0	0	0	0.1	0	0.0
Fluid processor/retail margin (mil. $)	10,108.0	−34.5	−0.3	−18.4	−0.2	−66.3	−0.7	−50.7	−0.5
Per capita fluid consumption (lbs.)	216.3	−0.8	−0.4	−0.4	−0.2	−1.5	−0.7	−1.2	−0.5
Retail milk price ($/gal.)	2.79	0.03	1.2	0.02	0.6	0.06	2.3	0.05	1.7
Retail milk expenditures (mil. $)	19,186.4	150.6	0.8	78.5	0.4	293.9	1.5	222.1	1.2

Notes: Comp Prem = compact premium; MOOP = market over-order premium as a percent of the baseline level.
[a]The Compact Regions include the Northeast, Appalachian, Southeast, and Florida federal orders. The balance of the 11 federal orders, unregulated regions and California are lumped into the Non-Compact Regions.

sumption that could have strong implications for the model results is the level of the retail fluid milk elasticity. In this study a retail elasticity of −.32 was employed. How would the results change if the elasticity was lowered to −0.23? One would expect *a priori* that there would be less reduction in fluid milk consumption in response to higher retail prices compared to other scenarios with a larger elasticity. That would mean less milk allocated away from higher-value fluid uses and into lower-value Class III or IV uses. Hence less additional dairy commodities would be produced, class prices would fall less and farm prices would be higher in compact regions relative to the other scenarios.

Another important assumption was the selection of a farm-to-retail mark up. A fixed dollar mark up was used in this study to determine retail fluid milk prices. What if the mark up was instead replaced with a fixed percent mark up? One would expect *a priori* that the farm-to-retail mark up and hence retail milk prices would respond more to compact

Table 6. Sensitivity Analysis: Response of the Model and Alternative Compact Scenarios to Changes in the Retail Fluid Demand Elasticity (e) and the Farm-to-Retail Markup

		Scenario #4 Comp Prem: $2 MOOP: 50%		Scenario #5 Same as #4 with e = −.23 1/[a]		Scenario #6 Same as #4 with Alt Mark-up 2/[b]	
	Baseline	Change	% Chng	Change	% Chng	Change	% Chng
Compact Regions 3/[c]							
Farm price ($/cwt)	14.44	0.62	4.3	0.64	4.4	0.55	3.8
Farm milk sales (mil $)	5,831.1	314.8	5.4	325.2	5.6	282.3	4.8
Farm-to-retail markup ($/gal.)	1.38	0	0	0	0	0.12	9.0
Fluid processor/retail margin (mil. $)	3,596.4	−50.9	−1.4	−36.8	−1.0	217.7	6.1
Per capita fluid consumption (lbs.)	199.0	−2.8	−1.4	−2.1	−1.0	−5.5	−2.7
Retail milk price ($/gal.)	2.76	0.13	4.6	0.13	4.6	0.25	9.0
Retail milk expenditures (mil. $)	7,211.8	221.1	3.1	252.3	3.5	433.9	6.0
Non-Compact Regions							
Farm price ($/cwt)	12.94	−0.10	−0.8	−0.09	−0.7	−0.14	−1.1
Farm milk sales (mil $)	15,402.4	−163.0	−1.1	−145	−0.9	−217.6	−1.4
Farm-to-retail markup ($/gal.)	1.53	0.00	0	0	0	0	−0.2
Fluid processor/retail margin (mil. $)	6,511.7	0.1	0	−0.3	0	−11.6	−0.2
Per capita fluid consumption (lbs.)	228.5	0	0	0	0	0.2	0.1
Retail milk price ($/gal.)	2.81	0	0	0	0	−0.01	0
Retail milk expenditures (mil. $)	11,974.6	1.0	0	3.7	0	−17.3	−0.1
U.S. Total							
Farm price ($/cwt)	13.32	0.08	0.6	0.1	0.7	0.04	0.3
Farm milk sales (mil $)	21,233.5	151.8	0.7	180.2	0.8	64.7	0.3
Farm-to-retail markup ($/gal.)	1.47	0	0.0	0	0	0.05	3.1
Fluid processor/retail margin (mil. $)	10,108.0	−50.7	−0.5	−37.2	−0.4	206.0	2.0
Per capita fluid consumption (lbs.)	216.3	−1.2	−0.5	−0.9	−0.4	−2.2	−1.0
Retail milk price ($/gal.)	2.79	0.05	1.7	0.05	1.7	0.09	3.2
Retail milk expenditures (mil. $)	19,186.4	222.1	1.2	255.9	1.3	416.6	2.2

Notes: Comp Prem = compact premium; MOOP = market over-order premium as a percent of the baseline level.
[a]The baseline uses a retail fluid demand elasticity of −.32. The elasticity falls to −.23 in this scenario.
[b]The baseline uses a fixed dollar farm-to-retail markup. This scenario employs a fixed percentage farm-to-retail markup.
[c]The Compact Regions include the Northeast, Appalachian, Southeast, and Florida federal orders. The balance of the 11 federal orders, unregulated regions and California are lumped into the Non-Compact Regions.

premiums under a fixed percent mark up than a fixed dollar mark up. That would result in a greater reduction in fluid milk consumption, more milk allocated to manufacturing purposes, and lower commodity and farm prices.

The sensitivity of the model to these two changes was tested by re-simulating scenario 4 (using a $2 compact premium and reducing baseline over-order premiums 50%) under a lower fluid milk elasticity (scenario 5) and using a fixed percent farm-to-retail mark up (scenario 6). These two scenarios were then compared to scenario 4 in table 6. The results matched *a priori* expectations. Most surprising was the impact of a change in the method of determining the farm-to-retail mark up for fluid milk. The farm price of milk fell $0.07 per cwt. and the retail price of milk increased 12 cents per gallon relative to scenario 4 just by changing the definition of the farm-to-retail mark up.

Conclusions

This analysis indicates that multi-regional dairy compacts will result in clear economic tradeoffs between dairy farmers, processors, retailers, and consumers. While dairy farmers within a compact region will economically benefit from higher farm milk prices, processors, retailers and consumers in the compact region and dairy farmers outside the compact region face economic losses.

It was assumed in all scenarios evaluated in this study that only 27% of the nations' milk supply is involved in three regional dairy compacts. Currently six northeast states are considering expanding the existing Northeast Interstate Dairy Compact, and a number of other states are in the process of forming a Southern Dairy Compact. Thus it is conceivable that 40–50% of the nation's milk supply could one day fall under several interstate dairy compacts. Clearly the economic impacts of this study would be greater if more than 27% of the nation's milk supply was involved in regional dairy compacts.

The magnitude of the economic gains and losses can also change depending on a number of other assumptions. The level of the compact price and the resulting compact premium are within the control of the compact commission. The level of market over-order premiums, however, are outside the control of the commission and may decline with increases in the compact premium. But it is the combined impact of the compact and market over-order premiums that determine the economic consequences of regional dairy compacts. Other factors that affect the analysis of dairy compacts are the model parameters and elasticities used.

Currently the Northeast Interstate Dairy Compact will expire when federal order reform is complete. Congress has the authority to extend this deadline, expand the Northeast Compact to include other states, and/or create a new Southern Dairy Compact. Clearly this will be a divisive issue since some farmers will gain an economic advantage over others, processors and retailers in compact regions will face a reduction in fluid sales, and consumers in compact regions will pay more for fluid milk. Congress should consider the economic tradeoffs presented in this study before deciding on the future of interstate dairy compacts.

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