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The Effect of the Northeast Dairy Compact on Producers and Consumers, with Implications of Compact Contagion

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Executive Summary

We model and measure the effects of the Northeast Dairy Compact on prices, quantities, and producer and consumer welfare, underscoring the distribution of these effects across regions and among producer and buyers. Using 1999 as a base year, simulations show that the Compact raised the farm price of milk in the Northeast by $0.45/cwt., lowered the farm price of milk in the rest of the country by $0.02/cwt., and transferred income from producers outside the Compact region and buyers in the Compact region to producers in the Compact region. Non-Compact producer losses exceeded Compact producer gains. Similar results are found for a scenario of Compact contagion—extension of the Compact to include additional states. In both cases, the Compact changed the distribution of the costs and benefits of price discrimination as practiced by milk marketing orders. The implication is that the regional distribution of the Compact's welfare effects raises again the question of the organization of a government-sponsored milk marketing plan such as the federal milk marketing order system.

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Federal and state regulation has played an important role in the United States dairy industry dating back to Depression-era programs. Program categories include: (i) federal and state marketing orders that regulate raw milk prices; (ii) government purchases of manufactured dairy products to support the farm price of milk; (iii) import barriers for manufactured dairy products; and (since 1985) (iv) export subsidies for manufactured dairy products (Benedict; Manchester and Blaney; Manchester; Erba and Novakovic; Sumner and Cox). In addition to these price and quantity regulations, federal and state governments also have played an active role in setting food safety and sanitary regulations for milk and dairy products. All of these policy instruments are still in effect today, although with modifications.

The Northeast Interstate Dairy Compact (hereafter Northeast Compact or Compact) added a new element to dairy regulation in the United States. The Compact has potentially important implications for prices, production, and policy in the United States, including the pricing of raw milk through the federal milk marketing order (FMMO) system. The Northeast Compact raised the price paid to New England producers, thus increasing production of producers in the Compact and lowering the milk price received by producers outside the Compact. In effect, the Compact allowed New England producers to increase the benefits they received from the system to the detriment of local consumers and of producers in other regions.

Several authors have examined aspects of the Northeast Compact. Bailey (2000) and the U.S. Office of Management and Budget (OMB) used models of price discrimination (Parish; Ippolito and Masson) to reason that the Compact would raise revenues for Northeast producers and find this reasoning consistent with the data. Nicholson, Resosudarmo and Wackernagel provided econometric evidence that the Compact encouraged increased milk supply from the Northeast region. Wackernagel used a farm simulation model to show that, by raising the farm price of milk and lowering price variability, the Compact improved the financial performance of a representative Vermont dairy farm.

This paper lays out in an explicit and consistent framework the quantitative market-level effects of the Northeast Compact on producers and consumers in New England[1]. Further, we analyze the Compact's effects on producers and consumers in the rest of the United States. Unlike previous studies, we model milk supply and demand to which FMMO and Compact regulations are applied, and simulate counter-factual scenarios against which we measured the Compact's effect. This paper goes beyond the immediate effects of the current Compact to consider the potential welfare implications of what we call Compact contagion—the expansion of the Northeast Compact and the formation of new regional dairy compacts, as well as the implications for FMMO stability.

[1] We do not attribute consumer surplus to different groups beyond the farmgate, and remain agnostic about the distribution of consumer surplus measures among milk processors, retailers, and final consumers. See Cotterill and Franklin, and Bailey (2001) for analysis and discussion of the Compact's effects on retail milk margins and prices.

Although the Northeast Compact is no longer in operation, regional dairy compacts continue to be proposed as part of future U.S. dairy policy. Indeed, the 2002 Farm Bill mandated the USDA to study interstate dairy compacts along with other dairy policy instruments (Farm Security and Rural Investment Act of 2002). Our analysis of the Northeast Compact lends insight into the likely effects of further regional dairy compacts, and can be extended to model explicitly other dairy compact scenarios. Further, our discussion of an expanded Compact and FMMO stability is particularly relevant to on-going debate about the pros and cons of regional compacts as dairy policy.

As expected, and as our analysis shows, Northeast producers—who produce a relatively small portion of the country's milk—have a correspondingly small effect on national milk prices. Nonetheless, the Compact was controversial because (i) its welfare effects were distributed unevenly among producers and consumers of different regions, and (ii) because it set the precedent for other states to possibly join the Northeast Compact or establish new compacts. We analyze and discuss both of these points. We show that an expanded Compact or more compacts would have greater influence on milk markets throughout the country. Further, we argue that independent, regional administration of classified prices by compacts puts pressure on the FMMO system, a central part of U.S. dairy regulation for more than 60 years.

A Brief Description of Milk Marketing Orders

Milk marketing orders use price discrimination to raise the average price received by Grade A producers, setting minimum prices that may be paid for Grade A (eligible for the fluid market) milk according to how that milk is used. The minimum prices for milk used in cheese, and milk used in butter and dry milk are set by federal orders according to formulae that take into account the wholesale prices of these products. The minimum price for milk used in fluid products in each order is set as a fixed differential over the manufacturing-use minimum prices[2]. These administratively determined fluid differentials are not uniform across orders, but generally increase with an order's distance from Wisconsin. Each marketing order pools milk revenues from all end-use classes and pays a uniform, market-wide average price to individual farmers delivering milk to that order (U.S. Department of Agriculture, Agricultural Marketing Service(a), Blaney, Miller and Stillman; Erba and Novakovic; Sumner and Cox). The average, or blend price in any order depends not only on the classified prices but also on the utilization rates of the various milk classes, which also vary from order to order. Thus, producer prices vary across orders.

Each federal order is analytically similar to a certain type of cartel, as typically considered by economists. Members of a cartel, such as OPEC, increase profits by colluding to limit supplies. Federal milk marketing orders do not limit total quantity of raw milk, but achieve added revenue through price discrimination. A federal milk marketing order raises the price of milk sold for fluid uses. By raising the fluid milk price and pooling revenues from that market with revenues from sales for manufactured product uses (for which demand is more elastic), the marketing order reduces fluid sales and raises overall production.

[2] Although the details of the FMMO pricing rules have changed over time, the key element of price discrimination remains; the minimum price for milk used in fluid products is set at a premium over the minimum price set for milk used in manufactured dairy products. The changes in FMMO pricing rules do not change this fact, and do not change our results or conclusions. Manchester and Blaney discuss the evolution of the FMMO pricing rules and the current set of pricing rules.

The entire FMMO system also can be thought of as a type of “cartel.” By establishing the relationship among minimum prices across regions, the FMMO system creates a certain distribution of producer benefits among regions (Cox and Chavas). Further, by setting different minimum prices (and thus different relative producer benefits) in different regions, the FMMO system creates potential for arbitrage, but limits arbitrage activity with disincentives to ship milk between regions (Manchester). This system has endured with modifications for more than 60 years in part because coordinated administration and enforcement of the classified pricing system has reduced independent action by the regional marketing orders.

Basic economic reasoning and evidence from many industries indicate that response to higher prices by individual cartel members makes many such arrangements difficult to sustain. The economics literature of oligopoly refers to analogous behavior of cartel members as “cheating” on a cartel (Stigler (1964); Stigler (1975)). Because marketing orders do not control supply, “cheating” in this context takes on a novel form that we discuss in a later section.

Most major milk markets are regulated by the federal system of marketing orders. In 1998, about two-thirds of the Grade A milk produced in the country was regulated by the FMMO system. Most of the markets not covered by the federal system belong to a state order. California is the most important of the state marketing orders, producing about 18% of the country’s Grade A milk. California’s pricing mechanism differs from that of the FMMO, but the differences are not crucial for our analysis. The California milk-pricing system also can be described as a government-sponsored cartel[3]. Because it is administered independently of the FMMO, the California system does not bear the same implications for stability, as we discuss later.

A Brief Description of the Northeast Dairy Compact

With approval from Congress and the USDA, the state legislatures of New England granted the Compact Commission authority to regulate the minimum fluid-use (Class I) price within the region starting in July 1997[4]. The Compact's regulatory rules worked in conjunction with the New England FMMO, based in Boston, Massachusetts. The Compact set a fixed minimum price (as opposed to a fluid differential) for Class I milk sold to processors in New England. Thus the minimum price for Class I milk in those states effectively was the greater of the Compact minimum price or the FMMO announced minimum Class I price in the New England order[5]. The Compact did not set minimum prices for non-fluid end-use classes. Congressional authority for the Northeast Dairy Compact expired in September 2001.

The Class I price determined to be acceptable—by two-thirds vote of New England state delegations, and by producer referendum—was $16.94 per hundredweight

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[3] Sumner and Wilson document the development of the California system, and Sumner and Wolf model the difference between California and federal milk marketing orders.

[4] The Compact system also passed federal district court challenges brought by processor groups in January 1998 and November 1998 (Northeast Dairy Compact Commission).

[5] Federal milk marketing order reform resulted in consolidation and realignment of marketing orders starting January 1, 2000, as of which date the FMMO price relevant to the Compact is the announced minimum Class I price for the newly formed Northeast Order, based in Boston, MA. Throughout this paper, we describe and model the Compact as originally legislated, building from the New England order. The realignment of marketing orders does not change our analysis in an important way, requiring only the substitution of the Northeast order's minimum Class I price for that of the now defunct New England order.

of milk (cwt). If the FMMO minimum Class I price in a particular month fell below $16.94, processors were obligated to pay the difference to the Compact Commission on all Class I purchases. The Commission, in turn, distributed the revenue back to producers[6]. For detailed discussion of Compact history and rules, see Bailey (2000), Alexander et al., and the Northeast Dairy Compact Commission.

Qualitative Implications for Prices and Welfare

The Northeast Compact deviated from the pricing rules of the FMMO system for milk sold in New England by administering a minimum Class I milk price independent of the FMMO pricing system, thereby raising the average producer price for dairy farms delivering milk to New England processors. As a result, fluid milk consumers in those states faced higher milk prices. Dairy farms not selling to New England processors lost, since the higher producer price in New England increased milk supply in those states and lowered the price of milk for producers throughout the rest of the country.

Thus, it is not surprising that the Compact faced controversy on two fronts. By raising Class I prices, the Compact transferred income from milk consumers to dairy farms within New England. The transfer can also be seen as a payment from relatively populous states, such as Massachusetts, to states with many dairy farms, such as Vermont. Indeed, such an interpretation prompted the Massachusetts state legislature to consider seriously the possibility of withdrawing from the Compact (Tynan, Clancy).

[6] Payments to producers are made only after adjustments are made to reimburse the Special Supplemental Food Program for Women Infants and Children (WIC) program, school lunch programs, and other government outlays that may increase due to a higher milk price caused by the Compact. In approving the Compact, Congress did not hold the Commission responsible for a similar compensation to private consumers of fluid milk. See Wang, et al. for the effects of the Compact on WIC.

The Compact was also controversial because of its effects on milk markets outside of the Compact region. As our results show quantitatively, the Compact raised the producer price in New England, which increased milk production from those states. Under classified pricing, additional production was allocated to the lower-priced manufacturing milk market, resulting in lower minimum class prices and blend prices for producers throughout the country. In the context of the FMMO system as a government-sponsored "cartel", the Compact legally evaded the FMMO rules. The Compact acted as a type of cartel within the larger FMMO system (Pindyck and Rubinfeld, p.456). But the FMMO system is not the typical, quantity-restricting cartel, and evasion or cartel cheating here takes a novel form. The Compact raised prices in its own region and, thus, increased production without regard for those producers outside the Compact who received a lower milk price as a result of the increased production.

Because New England produces a relatively small portion of the country's milk, the Northeast Compact had a relatively small effect on the price of manufacturing milk. However, dairy farms in other regions have a similar incentive as New England producers to raise Class I prices through regional compacts. New regional compacts that include a larger portion of U.S. milk production would impose even greater costs on fluid milk consumers and non-compact producers. Further, the potential for local administration of independent, regional classified prices raises questions about the continued sustainability of a nationally coordinated milk marketing system.

In the next section, we model and measure the effects of the Northeast Compact on milk prices and quantities, and on various producer and consumer groups. In a later section, we use the model to illustrate the effect of an expanded dairy compact or additional regional compacts.

Modeling the Effects of the Compact

Ippolito and Masson developed a well-known model of FMMO regulation, building from Kessel's model of price discrimination (see also Parish, who precedes this literature but applies his model to the Australian case). As with many intervening articles (Blaney, Miller and Stillman; Kwoka; Dahlgran; Cox and Chavas; Sumner and Cox; and Sumner and Wolf, among others), we use this general framework to model marketing order price regulation. We use the same model to analyze the Northeast Compact's modification of marketing order regulation, and we compare market equilibrium under the two regimes. We describe the model in this section. In the next section, we parameterize the model and simulate the effects of the Compact.

We assume for simplicity that the FMMO system distinguishes between only two end-use of Grade A milk[7]. Milk used in fluid products is designated Class f, while milk used in manufactured products is designated Class m. Figure 1 depicts the model of the New England Grade A milk market. Due to the cost of shipping fluid milk and FMMO regulations that restrict the movement of milk across regions, the demand for Class f milk facing New England, $D_f(P_f)$, is regional and relatively inelastic. On the other hand, since manufactured dairy products are traded across the United States, New England faces a

[7] Marketing orders actually work with three, four or five classes of milk: one for fluid uses; two or three for soft products such as cottage cheese or ice cream; and one or two for butter, non-fat dry milk, and cheese. Aggregating all the non-fluid use classes into a single class for all manufactured dairy products simplifies the exposition while still capturing the essence of price discrimination.

national demand for milk in manufacturing[8]. Since New England produces only a small fraction of the country's manufacturing milk, the portion of the national demand for Class m milk facing New England, $D_m(P_m)$, is relatively elastic. The supply of Grade A milk in New England is labeled $Q^S(P)$ and represents supply from all Grade A producers who deliver milk to processors regulated by the New England FMMO (including those producers who ship milk into the region from outside of New England).

In the absence of the Compact, we assume all Grade A milk is sold at the minimum prices set by the New England FMMO. The marketing order sets a fixed fluid differential, d, so that the price paid for fluid milk is

(1) $$P_f \equiv P_m + d\,.$$

We assume that the price paid for manufacturing milk, P_m, is determined in a competitive market[9]. Each producer selling milk in this region receives a market-wide average price[10] determined by

[8] Since manufactured dairy products are traded across the country, we use a factor-price equalization argument to argue that the price of manufacturing milk is approximately equal across the country. Alternatively, we can argue that the minimum price formulae for milk used in cheese and in butter and skim powder are the same across all federal orders, so that these prices are equal across regions and highly, positively correlated. Further, the California and federal systems use pricing formulae that are based on prices for the same, publicly traded dairy products. In any case, it is at least approximately true that there is a single price of manufacturing milk across the country, and this is certainly true relative to the wide variation in the price of milk used for fluid products.

[9] In reality, marketing orders set minimum prices for manufacturing milk according to formulae that take into account the wholesale prices of manufactured dairy product traded in a competitive market. Our assumption that P_m is set by a competitive market is equivalent to assuming that marketing orders set minimum prices that clear markets.

[10] As with the other literature on milk marketing orders, we ignore over-order premiums here. Inclusion of over-order premiums would not change our analysis significantly, and the direction of the Compact's effects would be the same as found here as long as the Compact Class f price is set above the price that would have been paid for Class f milk. To the extent that over-order premiums are paid in the absence of the Compact, our results will overestimate the increase in the Class f price due to the Compact.

(2a) $$P_b(P_m; d) = \frac{D_f P_f + D_m P_m}{D_f + D_m}$$

(2b) $$= P_m + \frac{D_f}{D_f + D_m} d\,.$$

The average, or blend price, represented by the curved line in figure 1, asymptotically approaches the aggregate demand curve under the FMMO's fixed differential policy, $D_f(P_m+d)+D_m(P_m)$, as P_m falls and an increasing share of milk is sold as Class m.

Equilibrium in this market is determined by the intersection of the blend price curve and the supply curve. Given this quantity supplied, the price for manufacturing milk, labeled P_m*, is read off the aggregate demand curve. The marketing order sets the fluid price at $P_f^*=P_m^*+d$, at which price fluid demand is $D_f(P_f^*)$. The quantity of milk sold to the manufacturing market is the difference between supply and fluid demand.

Unlike the FMMO, the Compact set a fluid price directly (as opposed to setting a differential) such that the effective fluid price under the Compact was no lower, and often higher, than the price set by the marketing order. To be effective, the Compact had to raise the minimum price of Class f milk and transfer the additional revenues to producers. Figure 2 represents the same supply curve and fluid demand curve (those for New England) as in figure 1. The manufacturing demand curve, also the same as in figure 1, is omitted for clarity. However, the aggregate demand curve and blend price curve (in bold) corresponding to the Compact's policy are slightly different. Subscript c denotes equilibrium prices and quantities under the Compact's policy. If the Compact sets a minimum Class f price at P_c, the effective minimum fluid price for the region becomes $\max(P_c, P_f)$. The Compact sets the fluid price such that $P_c>P_f$, so the aggregate demand for milk becomes $D_f(P_c)+D_m(P_m)$, where the fluid milk price and quantity demanded are now fixed.

The blend price paid to producers under the Compact's pricing rule is

(3) $$P_{bc}\left(P_m;P_c\right)=\frac{D_f P_c + D_m P_m}{D_f + D_m},$$

which asymptotically approaches the aggregate demand curve under the fixed Class f price policy as P_m falls and an increasing share of milk is sold as Class m. This is similar to the case under the FMMO pricing scheme, but, as we just noted, aggregate demand is slightly different under the two regimes.

The arrows in figure 2 indicate the direction of the Compact's effects on the equilibrium prices and quantities in this market, relative to the FMMO equilibrium of figure 1. By raising the minimum fluid class price, the Compact reduces Class f sales. The blend price line thus shifts upward under the Compact rules, intersecting the supply schedule at a higher price than the FMMO blend price. The higher blend price encourages an expansion in the milk supply along the supply schedule. With more milk supplied and less milk used in Class f, the supply of Class m milk from New England expands relative to the FMMO equilibrium, lowering the price for manufacturing milk.

By raising the blend price in the Compact region, the Compact raises the revenues of New England dairy farms (and of other farms that ship milk to Compact region handlers). Additional producer revenues come at the expense of fluid milk consumers, who pay higher milk prices. The additional loss in fluid milk consumer surplus due to the Compact can be seen in figure 2 as the area to the left of the fluid demand curve, and between the Compact and FMMO minimum Class f prices.

The Compact's effects on producers and consumers in other regions work through the price of manufacturing milk. If New England produces and sells more milk on the manufacturing market, the prices of manufactured dairy products and the price for Class m milk throughout the country are driven lower[11]. Class f prices in other marketing orders also decrease due to the Class m-plus-differential formula used to obtain Class f minimum prices. Milk supply in non-Compact regions contracts due to lower producer prices[12]. On the other hand, consumers of manufactured dairy products, and consumers of fluid milk outside of the Compact enjoy lower prices.

The Compact's effects on producers and consumers outside of the Compact region depends on Compact producers' ability to affect the prices in the manufacturing milk market. If the Compact's share of the manufacturing market had grown—either through expansion of the Northeast Compact to include more states or through the formation of new regional dairy compacts—the effect on national milk prices would have been larger.

In the following section, we parameterize the model and estimate the Compact's effect on prices, quantities, and producer and consumer welfare. In a later section, we explore the effects that a Compact that would include a larger share of national milk production.

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[11] If minimum prices for manufacturing class milk are at or below support prices, additional sales of milk on the manufacturing market could result in government purchases of manufactured products. We ignore government purchases in this paper.

[12] The lower manufacturing price has a similar effect on producers of manufacturing grade (Grade B) milk, including those located within the Northeast region, since Grade B and Class m milk are substitutes in manufactured dairy products. This also applies to Grade A producers who are outside both federal and state marketing orders.

Measuring Policy Incidence

Like previous users of similar models (Ippolito and Masson; Blaney, Miller, and Stillman; Kwoka; Dahlgran; Cox and Chavas; Sumner and Cox; and Sumner and Wolf), we assume locally linear supply and demand throughout the paper. Our results would be similar under a constant elasticity or other functional form specification. Our methodology is as follows:

1. Use public data collected under the Compact regime and elasticities from previous studies to parameterize the New England milk supply curve, the New England fluid milk demand curve, and the share of the national demand curve for manufacturing milk facing New England.
2. Using these supply and demand curves, simulate the equilibrium for the counter-factual scenario in which milk is priced according to the FMMO pricing rules in the absence of the Compact.
3. Compare prices, quantities, and welfare under the two regimes.
4. Consider the influence of parameter choices through sensitivity analysis (see appendix).

We parameterize the linear supply and demand model of figure 2 using annual milk marketing data and supply and demand elasticities drawn from the agricultural economics literature. We use 1999 as a base year for our simulations.[13] Our data consist of annual quantities and annual average prices of Class I milk and all milk published by USDA and the Compact Commission. Data for the Compact region and the entire

[13] The specific numerical results depend on our choice of base year. We use the most recent data available at the time of writing. The Compact played less of a role in 1998 due to higher FMMO prices. Thus, had we used 1998 as a base year, the effects of the Compact would be smaller in magnitude but in the same direction as our findings.

FMMO system are included in table 1. The annual average Compact fluid premium is $1.20/cwt. That is, the Compact raised the Class I price in New England by $1.20/cwt. relative to the announced FMMO Class I price. We impute the average manufacturing milk price from equation (2a), given the announced blend and minimum Class I prices, the quantity of Class I milk sold, and total milk marketed. We calculate the FMMO differential as the average FMMO Class I price less the imputed average manufacturing price. These data give us an observation on the fluid demand curve, one on the supply curve (which is also on the blend price curve), and another on the manufacturing demand curve.

A range of raw milk supply elasticities can be found in the agricultural economics literature. We consider an intermediate time horizon of 3 to 6 years to allow for adjustments in milk production through managed changes in herd size and productivity in response to an expected, permanent change in the relative price of milk. Chavas and Klemme estimated supply elasticity to range from 0.22 to 1.17 for this time frame. Cox and Chavas specify their model with supply elasticity of 0.37. Ippolito and Masson used estimates of 0.4 to 0.9 in their work. Helmberger and Chen estimated the "long run" milk supply elasticity to be 0.583, and Chen, Courtney and Schmitz estimated a supply elasticity of 2.53. We choose a supply elasticity of 1.0, which is well within the range of estimates found in prior studies.

The milk demand elasticities used to parameterize the model are also drawn from the agricultural economics literature. Estimates of the long run demand elasticity for fluid class milk range from -0.34 (Ippolito and Masson) to -0.076 (Helmberger and Chen). Estimates of the demand elasticity for manufacturing milk range from -0.350

(Helmberger and Chen; Dahlgran) to -0.2 (Ippolito and Masson). Heien and Wessells estimated own-price elasticities of -0.63 for retail demand for milk, -0.52 for cheese and -0.73 for butter. Huang estimated own-price elasticities of -0.26 for retail demand for milk, -0.33 cheese and -0.17 butter. We assume that the elasticity of the national demand for manufacturing milk (at the farm level) is -0.2. We also assume a regional fluid demand elasticity of -0.2. Both of these are within the range of estimates found in prior studies.

Our numerical results depend on our choice of supply and demand elasticity values. In the appendix, we examine the sensitivity of our results to our assumptions on supply and demand elasticities. We find that our results do not vary greatly over a reasonable range of parameter values.

Following Ippolito and Masson, we calculate the elasticity of demand for manufacturing milk facing New England producers as

$$(4) \qquad \eta^{NE} = \frac{1}{s}\eta^{US} + \left(1 - \frac{1}{s}\right)\varepsilon^{ROC},$$

where η^{i} is the demand elasticity in i (i = New England, United States); ε^{ROC} is the milk supply elasticity from all U.S. producers less New England; and s is New England's share of U.S. manufacturing milk production. In 1999, the New England states supplied only 3% of the U.S. manufacturing milk. Given a supply elasticity of 1.0 and a national demand elasticity of -0.2, the elasticity of demand for manufacturing milk facing the Northeast is -39. Manufacturing milk demand facing New England is very elastic because New England produces such a small portion of the nation's manufacturing milk. Although figures 1 and 2 focus attention on the New England milk market, the effects of the Compact on the rest of the country are built into the model through our specification of the demand for manufacturing milk. In our model, price changes along the manufacturing milk demand curve facing New England (depicted in figures 1 and 2) represent changes in the national price for manufacturing milk.

Using the data (table 1) to anchor our supply and demand curves, the elasticities we choose imply the following (locally) linear specifications of the supply and demand curves:

New England milk supply: $Q^S(P) = 4.3390P$;

New England inverse fluid demand: $P_f(Q_f) = 108.60 - 3.0046Q_f$;

New England inverse manufacturing demand: $P_m(Q_m) = 13.5221 - 0.0092Q_m$.

We simulate the equilibrium for the No-Compact scenario by applying the FMMO price discrimination policy (figure 1) to the market defined by these supply and demand equations. The No-Compact equilibrium is found as the intersection of the supply curve and the blend price curve, given a fluid differential of \$3.72/cwt. (imputed from the data in table 1).

Table 2 compares the simulated equilibrium prices, quantities and welfare measures under the No-Compact scenario to those observed under the Compact regime. The higher fluid class price paid under the Compact rules raises the producer blend price in New England by \$0.447/cwt., encouraging more production and raising producer revenues. New England producers gain \$29.4 million as a result of the Compact. The Compact raises the price of fluid milk in New England by \$1.180, resulting in a loss in New England fluid consumer surplus of \$35.8 million. With increased production and reduced fluid consumption, New England expands manufacturing class sales causing a \$0.022 or 0.2 percent fall in the price of that milk[14].

The difference between the gain in producer surplus and the loss in New England fluid consumer surplus does not equal deadweight loss because the Compact affects producers and consumers outside of New England by lowering the price for manufacturing milk. Producers delivering to other marketing orders also receive a blend price as described previously in equation (2b). We can express the blend price in a single order, i, equivalently as

$$(5) \qquad P_{bi}(P_m; d_i) = P_m + s_i(P_m; d_i)d_i ,$$

where $s_i(P_m;d_i)$ is the fluid class utilization rate, or the share of total production in region i used in fluid products. From equation (5), the marginal effect of the manufacturing milk price in the blend price in i is

$$(6) \qquad \frac{\partial P_{bi}}{\partial P_m} = 1 + \frac{\partial s_i}{\partial P_m} d_i .$$

Because manufacturing milk demand is more elastic than fluid demand, the derivative of s_i with respect to P_m is positive; for a given fall in the price of manufacturing milk, manufacturing quantity demanded rises by a greater amount than

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[14] The Northeast Compact eventually instituted a complex supply tax and redistribution scheme. Starting in July 2000, \$0.075 per cwt. of all Class I milk was withheld from the Compact's revenues and paid into an escrow fund. These funds were then paid back to producers who increased production by no more than one percent of the previous year's production. Half of the fund was distributed uniformly to all eligible producers, regardless of an individual farm's level of production. The other half was paid to eligible producers on a per hundredweight basis (Northeast Dairy Compact Commission; Bailey (2000)). The scheme does not guarantee success in preventing growth in milk production. If the minimum fluid price set by the Compact is more than \$0.075 greater than the minimum FMMO price, some producers will find it profitable to increase production under the Compact. Moreover, the supply management mechanism introduces yet another distortion, giving perverse incentives to Compact dairy farms by forcing larger and/or growing farms to subsidize smaller farms.

does fluid quantity demanded, causing the fluid utilization rate to fall. Thus, a fall in P_m due to the Compact causes the blend price in other federal orders to fall by more than the change in P_m. But for small changes in the manufacturing milk price we can ignore the change in fluid utilization and approximate the effect on order i's blend price as

$$(7) \qquad \frac{\partial P_{bi}}{\partial P_m} \approx 1 .$$

Thus, to a very close approximation, the fall in the manufacturing milk price due to the Compact translates into fall of the same magnitude in the blend price received by producers in other regions.

The effects of lower manufacturing milk prices on producers outside the Compact region (who do not deliver milk to New England) are presented in table 3. To highlight the interests of producers in various regions, we show losses to producers in California, Wisconsin, and Minnesota,[15] as well as the effect on all producers outside the Compact region. We assume a supply elasticity of 1.0 in each state. From equation (7), the $0.022 drop in the price of manufacturing milk causes a $0.022 drop in blend prices throughout the country. As a result, non-Compact producers lose $33.7 million in producer surplus.

The lower manufacturing milk price benefits consumers of that milk. Consumers of manufacturing milk, who accounted for 1,070 million cwt. of milk in 1999, gained about $23.1 million in consumer surplus thanks to the lower manufacturing price due to

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[15] California's milk pricing policy is different than the FMMO system (see California Department of Food and Agriculture, and Sumner and Wolf). However, the formulae used to set minimum prices for manufacturing milk in California, like those for the FMMO system, are based on the prices of publicly traded manufactured dairy products. Further, the formula used to set fluid class prices in California is approximately equal to the fixed differential formula used by the FMMO. Thus, in measuring the effects of the Compact on the rest of the country, we treat California as any other region under federal regulation.

the Compact. Consumers of fluid milk outside the Compact region also gained from a lower manufacturing milk price. Because of the fixed differential policy, the price of fluid milk falls by the same amount as the change in the price of manufacturing milk ($0.022). Non-Compact producers sold about 527 million cwt. of milk to the fluid market (U.S. Department of Agriculture, Agricultural Marketing Service (a), (b)). Thus, fluid milk consumers outside of New England gained about $11.4 million in consumer surplus thanks to lower fluid milk prices due to the Compact.

The net effect of the Compact on producers and consumers throughout the United States is the sum of the welfare effects reported in tables 2 and 3. Again, Compact producers gain $29.4 million and non-Compact producers lose $33.7 million, thus, interestingly, producers as a nation-wide group lose $4.2 million. Fluid consumers in the Compact region lose $35.8 million, those outside the Compact region gain $11.4 million, and manufacturing consumers gain $23.1 million; consumers as a group lose $1.3 million. The deadweight cost of the Compact is $5.6 million.

Our results are consistent with those of previous studies. Bailey (2000) assumes a Compact premium of $2 per cwt. and finds slightly larger effects on milk prices, although in the same direction as our results. Our results are qualitatively similar to those found by the Office of Management and Budget for an earlier period, and are consistent with those of Nicholson, Resosudarmo and Wackernagel who provide empirical evidence that the growth in New England production is linked to the higher producer price due to the Compact. Moreover, our welfare analysis makes explicit the income transfers caused by the Compact. The Compact makes New England producers better off at the expense of New England fluid consumers and producers in the rest of the country. The Compact transfers income from New England fluid milk consumers and from producers in the rest of the country to New England producers and consumers in the rest of the country.

Compact Contagion

Compact contagion refers to the potential growth of the dairy compact movement. Six additional states were eligible to join the Northeast Compact, conditional on Congressional consent and the stipulation that a state be contiguous to the current Compact region at the time of their entry. New York, New Jersey and Maryland were approved participation in the Compact, but still needed Congressional approval. Legislation to join the Compact was introduced in the Pennsylvania House and Senate. Compact growth may also come in the form of new compacts formed in other regions of the country. Ten southern states have already approved the formation of a Southern Dairy Compact that could stretch from Kansas to Virginia, and from Texas to Florida. States in the West and Midwest have also shown some interest in forming similar agreements (Northeast Dairy Compact Commission). In all of these cases, Congressional approval is necessary for the formation of an interstate compact. Although the 2002 Farm Bill did not grant continued approval to the Northeast Compact, it did mandate the study of compacts, suggesting that regional compacts are among the set of policy instruments from which future of U.S. dairy regulation will be formed.

Regional compacts that include a larger share of the nation's milk production—and more specifically, the nation's milk sold for manufacturing uses—will have a greater effect on the national manufacturing milk price. In our model, equation (4) captures this relationship. As the Compact's share of the country's manufacturing milk market grows, manufacturing milk demand facing the Compact becomes less elastic, thus increasing the price effect of a given expansion in Compact manufacturing milk sales on the national market.

To illustrate, we simulate the effects of adding New York and New Jersey to the Northeast Compact. The methodology is similar to steps (1) through (4) in the previous section, only here we specify the supply and demand curves of the New York-New Jersey (NY-NJ) federal marketing order, then simulate the effects of adding NY-NJ to the Compact. We then consider the price, quantity, and welfare effects of this policy relative to the (observed) scenario in which only New England is included in the Compact.

The 1999 data for the NY-NJ federal marketing order are listed in the "No Contagion" column of table 4. These data reflect the pricing rules of the NY-NJ marketing order, as well as the effects of the original Northeast Compact analyzed in the previous section. The NY-NJ order regulated the sale of 116.61 million cwt. of raw milk, of which 69.92 million cwt. were used in manufacturing. NY-NJ accounts for about six percent of the country's manufacturing milk, almost twice New England's share of manufacturing milk.

We assume the Compact raises the monthly minimum Class I price in NY-NJ to $16.40, the Compact's minimum Class I price in New England. The minimum Class I price announced by the NY-NJ federal order was less than $16.40 during six months in 1999, such that the Compact minimum would have raised the annual average Class I price in the region from $16.82 to $17.78. We assume a fluid demand elasticity of -0.2, national manufacturing demand elasticity of -0.2, and supply elasticity of 1.0, the same parameter values we assumed for the analysis of New England. By equation (4), the manufacturing demand elasticity facing NY-NJ is -19. The resulting linear approximations to the NY-NJ supply and demand curves are:

NY-NJ milk supply: $Q^S(P) = 7.9327P$;

NY-NJ inverse fluid demand: $P_f(Q_f) = 100.92 - 1.8012Q_f$;

NY-NJ inverse manufacturing demand: $P_m(Q_m) = 13.9835 - 0.0100Q_m$.

The prices and quantities resulting from raising the fluid class price to $17.78 are reported in table 4 in the column labeled “Contagion.” Table 4 compares the effects of adding NY-NJ to the Compact relative to the prices, quantities and welfare resulting from the New England-only Compact regime[16]. Expansion of the Compact to include NY-NJ raises the price of fluid milk in that region, resulting in a reduction in fluid consumption and a welfare loss of $44.6 million to fluid milk consumers in NY-NJ. The expanded Compact raises the NY-NJ blend price by $0.310/cwt. and NY-NJ producers gain $36.5 million in producer surplus. The pattern of welfare costs and benefits within NY-NJ is similar to that found for the New England states in table 2. However, because NY-NJ accounts for almost twice as much production and fluid consumption as New England, the magnitude of the welfare effects is larger in NY-NJ even though the expanded Compact has a smaller effect on Class I and blend prices in NY-NJ than the original Compact has in New England.

The size of the NY-NJ region also translates into larger effects on the rest of the country through a larger effect on the price of manufacturing milk. NY-NJ producers sell

[16] The model, data, and parameter values used to analyze the effects of Compact expansion are consistent with the model, data, and parameters used to analyze the original Compact. Thus, the sum of the welfare effects in tables (2) through (5) is equivalent to the welfare effect of a Compact that includes both New England and NY-NJ, relative to a no-Compact scenario.

an additional 3 million cwt. of manufacturing milk due to expansion of the Compact. This additional manufacturing milk lowers the national manufacturing milk price by $0.029/cwt., resulting in a fall in class and blend prices in other regions by approximately the same amount. Table 5 presents the effects on the rest of the country of adding NY-NJ to the Compact relative to the New England-only regime. Producers in California, who lose $6.6 million due to the original Compact (table 3), lose an additional $9 million when the Compact includes NY-NJ. Similar results hold for producers in Wisconsin and Minnesota. Producers in New England also lose due to the addition of NY-NJ to the Compact, but the blend price in New England falls by less than the $0.029 since the Compact fixes the fluid price in that region. The decrease in the price of manufacturing milk only affects the 55 percent of New England's milk sold on the manufacturing market, resulting in a fall in New England's blend price of $0.016. New England producers, who gain $29.4 million by joining the Compact, lose $1.4 million due to the addition of NY-NJ to the Compact. Producers outside of NY-NJ but including New England, lose $43.6 million. Producers as a nation-wide group, who lose $4.2 million due to the original Compact, lose an additional $7.1 million due to "contagion" of the Compact to NY-NJ.

Fluid consumers outside the NY-NJ region gain an additional $13.9 million in consumer surplus. U.S. manufacturing milk consumers gain $31.6 million in consumer surplus due to the expanded Compact. As a nation-wide group, consumers of all dairy products, who lose $1.3 million due to the original Compact, gain almost $1 million due to expansion of the Compact.

The deadweight cost of the original Compact is $5.6 million. Compact "contagion" to NY-NJ generates an additional deadweight cost of $6.2 million. Since the net effect on consumers is small, most of the net welfare loss comes from producers. Non-Compact producer losses exceed Compact producer gains, so that the Compact actually makes U.S. dairy farms worse off.

The income transfers induced by the Compact change the regional distribution of costs and benefits of price discrimination. Producers within the Compact benefit at the expense of local consumers and all other producers. Expansion of the Compact to additional states benefits producers in those states at the expense of local fluid consumers and all other producers, including those who are already in the Compact. In the next section, we discuss some implications of the Compact's distributional effects.

Federal Milk Marketing Order Stability

The emergence of regional compacts in U.S. dairy policy raises questions about the organization of the FMMO system. How would independent administration of regional classified prices affect the FMMO system?

A challenge for the typical, supply-limiting cartel is to enforce supply controls despite incentives created by the cartel for individual members to increase production (Stigler 1964). In the case of the U.S. dairy industry, the FMMO has served as enforcer of an implicit agreement among dairy farms across the country regarding how milk prices should be set in the various regions of the country. The terms of trade set and enforced by the FMMO system for each order determine the distribution of the benefits and costs of price discrimination among producers and consumers of the various regions (Cox and

Chavas). The commerce clause of the U.S. Constitution puts clear limits on the authority of individual states or groups of states to operate regional compacts. The Compact threatened FMMO stability by permitting producers in individual regions to legally deviate from the implicit agreement to which non-Compact producers adhere, ignoring the consequences for producers outside their region, and upsetting the distribution of benefits resulting from FMMO policies. New regional compacts would have the same destabilizing effect on the FMMO.

Dairy farms in regions that determine and enforce their own regional prices may not suffer from the breakdown of the FMMO system. But federal enforcement and coordination of the milk marketing system are lost in such a scenario. Each individual regional compact could adjust classified prices strategically in order to raise local producer revenue at the expense of local consumers and producers in other regions. One possible result of this competition is that producers in regions with lower fluid utilization rates (i.e., those who benefit the least from the FMMO system) will withdraw from the federal system. This is exactly what the Upper Midwest producers and their political representatives threatened in 1996 when the FAIR Act included authority for the Northeast Compact.

Conclusion

The Northeast Dairy Compact raised milk prices for those producers whose milk it regulated, creating for them additional producer surplus at the expense of fluid milk consumers in the Compact region and producers not delivering milk to New England. We found that the Compact raised New England producer prices by $0.447/cwt., causing an expansion in the New England milk supply. Private consumers paid more for fluid milk in the Compact region, and thus reduced consumption. Additional manufacturing milk marketed by Compact producers lowered the average price for that milk by $0.022/cwt., resulting in a loss for producers and a gain for consumers in all other regions.

In giving the New England states authority to form the Compact, Congress allowed them to act collectively to regulate the interstate commerce of milk. States in other regions were poised to join the Compact or form additional regional compacts. For the past 60 years, the Federal milk marketing order system has determined the regional pattern of milk prices in much of the country, preserving those terms of trade by providing disincentives to ship milk across regions. By setting up a separate Compact, the New England states put pressure on the federal system by increasing the benefits its producers received from price discrimination relative to producers in other regions in the federal system. By lowering the milk price for non-Compact producers, the Compact raised the incentive for producers in other regions to form similar pricing arrangements.

Multiple regional compacts, which continue to be considered for U.S. dairy policy, would regulate a larger share of U.S. milk than did the Northeast Compact. The clear losers would be private consumers of fluid milk in any compact region, and producers not delivering to compact regions. Moreover, the compact movement raises again the question of the organization of a government-sponsored milk marketing plan. Independent, regional administration of regulated milk prices threatens the continued operation of the FMMO system.

Thus, the Northeast Compact had implications beyond its immediate effects on consumers and producers across the country. This paper brings these to light, and illustrates a methodology that can be extended to analyze milk markets under various possible policy scenarios involving marketing orders and compacts.

References

Alexander, C., J. Siebert, D. Anderson and R. Knutson. "State Milk Marketing Order Regulation and Interstate Dairy Compacts." *Dairy Markets and Policy: Issues and Options* No. 0-11, Cornell Program on Dairy Markets and Policy, Oct. 1998. Available online at http://www.cpdmp.cornell.edu/.

Bailey, K. "Evaluating the Economic Impacts of Regional Milk Pricing Authorities: The Case of Dairy Compacts." *Ag. and Res. Econ. Rev*. 29 2(October 2000):208-219.

Bailey, K. *Impact of the Northeast Dairy Compact on Consumer Prices for Fluid Milk*. Dept. of Ag. Econ. and Rural Soc. Staff Paper 341, Pennsylvania State Univ., June 1, 2001. Available online at http://dairyoutlook.aers.psu.edu/reports/NECompactStudy.htm.

Benedict, M. R. *The Farm Policies of the United States, 1790-1950*. New York, NY: The Twentieth Century Fund, Inc., 1953.

Blaney, D. P., J. J. Miller and R. P. Stillman. *Dairy: Background to the 1995 Farm Legislation*. Washington, DC: U.S. Department of Agriculture, Agr. Econ. Report 705, April 1995.

California Department of Food and Agriculture. "Dairy Programs" web page. Available online at http://www.cdfa.ca.gov/dairy.

Chavas, J.-P., and R. M. Klemme. "Aggregate Milk Supply Response and Investment Behavior on U.S. Dairy Farms." *Am. J. Agr. Econ.* 68(February 1986):55-66.

Chen, D., R. Courtney and A. Schmitz. "A Polynomial Lag Formulation of Milk Production Response." *Am. J. Agr. Econ.* 54(February 1972):77-83.

Clancy, E. J. "Northeast Dairy Compact leaves sour taste." *Boston Business Journal*, May, 15 1998.

Cotterill, R. W., and A. W. Franklin. "The Public Interest and Private Economic Power: A Case Study of the Northeast Dairy Compact." Food and Marketing Policy Center, Univ. of Connecticut, May 2, 2001. Available online at http://www.are.uconn.edu/fmktc.html.

Cox, T. L., and J.-P. Chavas. "An Interregional Analysis of Price Discrimination and Domestic Policy Reform in the U.S. Dairy Sector." *Am. J. Agr. Econ.* 83(February 2001):89-106.

Dahlgran, R. A. "Welfare Costs and Interregional Income Transfers Due to Regulation of Dairy Markets." *Am. J. Agr. Econ*. 62(May 1980):288-296.

Erba, E. M. and A. M. Novakovic. "The Evolution of Milk Pricing and Government Intervention in Dairy Markets." Cornell Program on Dairy Markets and Policy, Bulletin 95-05, 1995. Available online at http://www.cpdmp.cornell.edu/.

Heien, D. M. and C. Roheim Wessells. "The Demand for Dairy Products: Structure, Prediction, and Decomposition." *Am. J. Agr. Econ*. 70(May 1998):219-228.

Helmberger, P. and Y. Chen. "Economic Effects of U.S. Dairy Programs." *J. Agr.Res. Econ.* 19(December 1994):225-238.

Huang, K. S. *U.S. Demand for Food: A Complete System of Price and Income Effects*. Washington, DC: U.S. Department of Agriculture, Econ. Research Service Technical Bulletin 1714, 1985.

Farm Security and Rural Investment Act of 2002. Public Law 107-171, May 13, 2002.

Ippolito, R. A., and R. T. Masson. "The Social Cost of Government Regulation of Milk." *J. Law Econ.* 21(April 1978):33-65.

Kessell, R. "Economic Effects of Federal Regulation of Milk Markets." *J. Law Econ.* 10(October 1967):51-78.

Kwoka, J. E., Jr. "Pricing under Federal Milk Market Regulation." *Economic Inquiry*. 15(1977):367-384.

Manchester, A. C. *The Public Role in the Dairy Economy: Why and How Governments Intervene in the Milk Business*. Boulder CO: Westview Press, 1983.

Manchester, A. C. and D. P. Blaney. *Milk Pricing in the United States*. Washington DC: U.S. Department of Agriculture, Econ. Research Service, Agr. Information Bull. 761, February 2001.

Nicholson, C. F., B. Resosudarmo and R. Wackernagel. "Impacts of the Northeast Interstate Dairy Compact on New England Milk Supply." Paper presented at AAEA annual meeting, Nashville, TN, August 1999.

Northeast Dairy Compact Commission. "Northeast Dairy Compact Commission" web page. Available online at http://www.dairycompact.org.

Parish, R. M. "The Costs of Protecting the Dairy Industry," *Economic Record* 38, no. 92(1962):167-92.

Pindyck, R. S. and D. L. Rubinfeld. *Microeconomics,* 5th ed. New York: Prentice Hall, 2001.

Stigler, G. J. "A Theory of Oligopoly." *J. Polit. Econ.* 72(February 1964):44-61.

Stigler, G. J. *The Citizen and the State: Essays on Regulation*. Chicago, IL: University of Chicago Press, 1975.

Sumner, D. A. and T. Cox. "FAIR Dairy Policy," *Contemporary Economic Policy*, 16(January 1998):58-68.

Sumner, D. A. and N. Wilson. "Creation and distribution of economic rents by regulation: Development and evolution of milk marketing orders in California," *Agr. History*, 74(Spring 2000):198-210.

Sumner, D. A. and C. Wolf. "Quotas Without Supply Control: Effects of Dairy Quota Policy in California." *Am. J. Agr. Econ*, 78(May 2000):354-366.

Tynan, T. "Supporters Protest Massachusetts Proposed Withdrawal from Compact," *Portsmouth Herald*, May 22, 2000.

U.S. Department of Agriculture, AMS (a). "Federal Milk Marketing Orders" web page. Available online at http://www.ams.usda.gov/dairy/orders.htm.

U.S. Department of Agriculture, AMS (b). *Federal Milk Order Market Statistics*, various issues.

U.S. Department of Agriculture, NASS (a). *Agricultural Statistics*, various issues.

U.S. Department of Agriculture, NASS (b). *Milk Production, Disposition and Income, 1999 Summary*.

U.S. Office of Management and Budget. *The Economic Effects of the Northeast Interstate Dairy Compact*, Washington, DC, 1998.

Wackernagel, R. "Potential Economic Impacts of the Northeast Interstate Dairy Compact on Vermont Dairy Farms." *Agr. Res. Econ. Rev.* 27(April 1998):53-62.

Wang, Q., Z. Anne, C. Halbrendt, C. Nicholson and J. Sung. "Impacts of the Northeast Dairy Compact on the WIC Program: Evidence from Boston and Hartford." Published in *Milk Market Impacts of the Northeast Dairy Compact: Report to the Northeast Interstate Dairy Compact Commission*, Dept. of Community Development and Applied Econ., Univ. of Vermont and Dept. of Res. Econ., Univ. of Massachusetts, Amherst, November 1999.

Appendix

We examined our simulation results for sensitivity to our assumptions on supply and demand elasticities. The table below shows the change in the national manufacturing price due to the Compact (without NY-NJ) under a range of supply, fluid demand and manufacturing demand elasticities that can be found in the literature. The elasticity of manufacturing demand facing New England (in parentheses) is calculated using equation (4), given that New England produces three percent of the country's manufacturing milk.

Sensitivity Analysis. Change in the manufacturing milk price due to the Compact ($/cwt.)

		New England Supply Elasticity		
		0.5	1	2
National manufacturing Demand Elasticity (New England manufacturing Demand elasticity in parentheses)	-0.1	-$0.0228 (-19.5)	-$0.0220 (-35.7)	-$0.0200 (-68.0)
	-0.2	-$0.0223 (-22.8)	-$0.0215 (-39.0)	-$0.0197 (-71.3)
	-0.3	-$0.0218 (-26.2)	-$0.0211 (-42.3)	-$0.0194 (-74.7)

Figure 1. Milk marketing order equilibrium

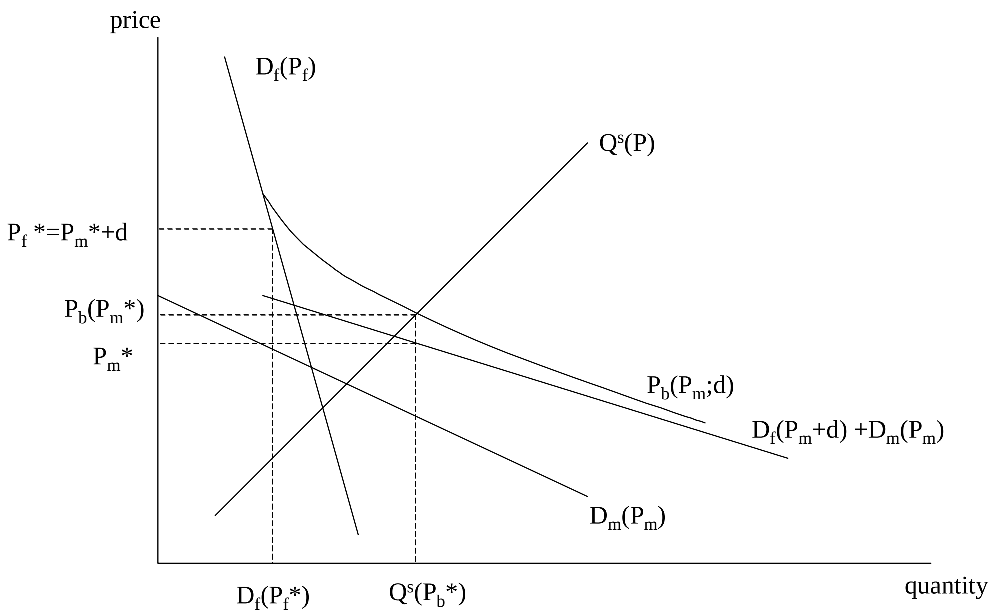

Figure 2. Compact equilibrium

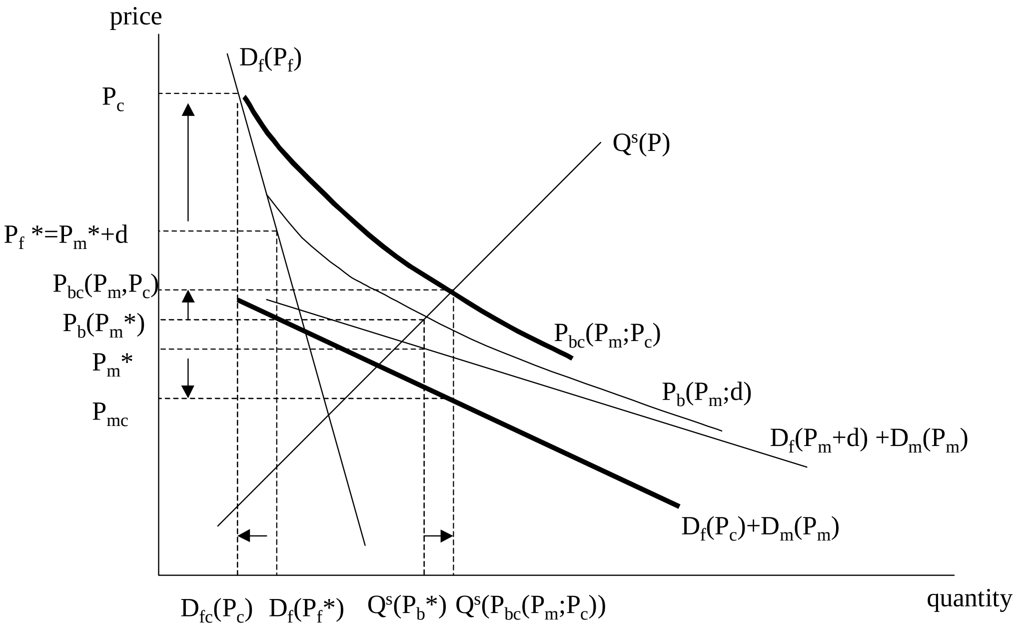

Table 1. Prices and quantities used in base year simulations (1999)

	New England	All FMMO
	$/cwt.	
Avg announced FMMO Class 1 price	16.90	16.24
Avg Compact Class 1 price	18.10	-
Avg Compact fluid premium	1.20	-
Avg blend price	15.40[1]	14.09
Avg manufacturing price[2] (imputed)	13.18	12.45
Avg FMMO fluid differential (imputed)	3.72	3.79
	Million cwt.	
Total milk marketed	66.82	1,044.79
Total Class 1 milk	30.12	452.16
Total manufacturing milk	36.70	592.63

Source: USDA-NASS (a and b), Northeast Interstate Dairy Compact Commission

1. Includes Compact payment of $0.49/cwt. (= $1.20(Class I sales)/(Total sales) – adjustments for WIC, etc.).

2. The average price of manufacturing milk in the Compact regions is higher than that of the FMMO due to a higher rate of utilization of milk in manufacturing classes with relatively high prices. The minimum price for each manufacturing class varies little, if at all, across regions, and the average price of manufacturing milk is highly positively correlated across regions due to the formulae used to calculate minimum class prices.

Table 2. Effects of the Northeast Dairy Compact on New England producers and consumers[1]

	No Compact	Compact	Change	% change
Prices ($/cwt.)				
Fluid class	16.920	18.100	1.180	7.0
Manufacturing class	13.206	13.184	-0.022	-0.2
Blend price	14.953	15.400	0.447	3.0
Quantities (million cwt.)				
Fluid class	30.51	30.12	-0.39	-1.3
Manufacturing class	34.37	36.70	2.33	6.8
Total	64.88	66.82	1.94	3.0
Welfare[2] ($million)				
Compact producers[3]			29.43	3.0
Compact fluid consumers[4]			-35.77	-6.9

1. 1999 base year.
2. The difference between gains in producer surplus and losses in fluid consumer surplus is not deadweight loss because of the Compact's effects on producers and consumers outside the Compact region. We calculate these effects in table 3.
3. Percentage change is change in producer surplus as a share of revenue.
4. Percentage change is change in consumer surplus as a share of expenditure.

Table 3. Effects of the Compact on the rest of the Country[1]

	No Compact[2]	Compact	change	%change
California				
Blend price ($/cwt.)	13.472	13.45	-0.022	-0.16
Production (million cwt.)	304.57	304.08	-0.49	-0.16
Producer surplus ($million)			-6.56	
Wisconsin				
Blend price	13.882	13.86	-0.022	-0.16
Production	228.34	227.99	-0.35	-0.16
Producer surplus			-4.92	
Minnesota				
Blend price	14.012	13.99	-0.022	-0.15
Production	93.87	93.73	-0.14	-0.15
Producer surplus			-2.02	
U.S. except New England				
Blend price	14.358	14.34	-0.022	-0.15
Production	1,562.63	1,560.29	-2.34	-0.15
Producer surplus			-33.67	
Fluid consumer surplus[3] ($million)			11.36	
U.S. manufacturing consumer surplus[4] ($million)			23.08	

1. 1999 base year.

2. We simulate the No Compact scenario by raising class prices and producer prices by $0.022 (see table 2).

3. Fluid use in the United States was 556.74 million cwt. in 1999. We subtract New England fluid use of 30.12 million cwt. (table 2) to get non-Compact fluid consumption of 526.63 million cwt.

4. Consumption of manufacturing milk in the United States was 1,070.36 million cwt. in 1999.

Table 4. Effects on NY-NJ producers and consumers of adding NY-NJ to the Compact[1]

	No Contagion	Contagion	Change	%change
Prices ($/cwt.)				
Fluid class	16.820	17.780	0.960	5.7
Manufacturing class[2]	13.284	13.255	-0.029	-0.2
Blend price	14.700	15.010	0.310	2.1
Quantities (million cwt.)				
Fluid class	46.69	46.16	-0.53	-1.1
Manufacturing class	69.92	72.90	2.98	4.3
Total	116.61	119.06	2.45	2.1
Welfare[2] ($million)				
NY-NJ producer[3]			36.53	2.1
NY-NJ fluid consumer[4]			-44.57	-5.7

1. 1999 base year.

2. The difference between gains in producer surplus and losses in fluid consumer surplus is not deadweight loss because of Compact's effects on producers and consumers outside the Compact region. We calculate these effects in table 5.

3. Percentage change is change in producer surplus as a share of revenue.

4. Percentage change is change in consumer surplus as a share of expenditure.

Table 5. Effects on the rest of the Country of adding NY-NJ to the Compact[1]

	No Contagion	Contagion	Change	%change
California				
Blend price ($/cwt.)	13.450	13.421	-0.029	-0.22
Production (million cwt.)	304.08	303.41	-0.667	-0.22
Producer surplus ($ million)			-8.96	
Wisconsin				
Blend price	13.860	13.831	-0.029	-0.21
Production	227.99	227.50	-0.485	-0.21
Producer surplus			-6.72	
Minnesota				
Blend price	13.990	13.961	-0.029	-0.21
Production	93.73	93.53	-0.198	-0.21
Producer surplus			-2.76	
New England				
Blend price	15.4	15.384	-0.016	-0.11
Production	66.82	66.75	-0.070	-0.11
Producer surplus			-1.08	
U.S. except NY-NJ[3]				
Blend price	14.355	14.326	-0.029	-0.21
Production	1,510.50	1507.40	-3.103	-0.21
Producer surplus			-43.61	
Fluid consumer surplus[4] ($ million)			13.87	
U.S. manufacturing consumer surplus[5] ($million)			31.57	

1. 1999 base year.

2. We calculate the effect of NY-NJ on the New England blend price as $0.029 times 0.55, the share of New England's milk sold to manufacturing uses.

3. Including New England. Since New England produces less than five percent of non-NY-NJ production, the smaller effect on the New England blend price lowers the effect on all non-NY-NJ producers by less than one-tenth of a cent.

4. Fluid use in the United States was 556.74 million cwt. in 1999. Fluid consumers within the Compact do not benefit from lower prices. Thus, we subtract New England fluid use of 30.12 and NY-NJ fluid use of 46.69 million cwt. (table 2) to get non-Compact fluid consumption of 479.94 million cwt.

5. Consumption of manufacturing milk in the United States was 1,070.36 million cwt. in 1999.