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The Impact of the Northeastern Dairy Compact
On New England Consumers:
A Report from the Milk Policy Wars

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Contents

List of Tables and Figures

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Preface

This paper presents a comparative analysis of three different economic studies that played major roles in the policy debate over the Compact. It draws an important distinction between before-after and counterfactual impact analysis and highlights constraining assumptions in models. Over time the Compact increased raw milk price 2-3 cents per gallon, but if the Compact had not been in place during the first 3 years of its operation raw milk prices would have been approximately 10 cents lower. Over time retail prices went up by much more than 2-3 cents because other costs increased and channel firms increased tacit collusion and net profits. Studies give different counterfactual estimates for retail prices without the Compact. They range from a drop of 5.7 cents per gallon to 20.7 cents per gallon and are very sensitive to modeling approach. Comparative analysis, as done in this article, should contribute to policy formulation rather than appearing ex post.

Key words:

1. Introduction

The Northeast Dairy Compact established a price floor for raw fluid milk sold to processors in the six participating New England states. Effective July 1, 1997 processors were required to pay the higher of the Federal Market Order Class I fluid price or $1.46 per gallon ($16.94 per hundred weight). During the 3 years after Compact implementation processors paid the Compact floor price 75 percent of the time. At other times farmers selling into New England received a FMO Class 1 price that was above the price floor. The Compact had no impact.

When establishing the Dairy Compact, Congress and the USDA expected that reducing raw milk price volatility would, *ceteris paribus*, lower the marketing margin and thereby somewhat mitigate the Compact's impact on consumers (Federal Register, 4/28/1997, p. 23049). The Compact also sought to eliminate price drops in the raw fluid milk market that they believed at best are only partially passed on to consumers, thereby increasing farm income without commensurate damages to consumers (Federal Register, 5/30/1997, p. 29629).

The Northeast Dairy Compact expired on September 30, 2001. The debate for and against renewal was particularly fierce with fluid milk processors, food retailers, and midwestern dairy interests opposed to extension. Key issues were the Compact's impact on consumers in the Compact region and its impact on dairy farmers in other regions of the country. This article addresses the consumer impact issue. Consumer impact however feeds into interregional impacts to the extent that higher consumer price reduces demand for fluid milk in New England, thereby increasing the supply of milk to non-fluid uses and lowering manufacturing milk prices throughout the country.

During the debate several very disparate estimates of consumer impact surfaced. The *Wall Street Journal* and many other media stories (e.g. Murdock, 2001) cited Bailey (2000) who concludes the Compact raised New England retail milk prices 14 cents per gallon. *The New Republic* (Chait, 2001) and *Barron's* cited Bailey (2001), an expanded study wherein Bailey claims the Compact raised New England retail milk prices 20 cents per gallon. Other media pieces cited Cotterill and Franklin (2001a) who find a 4.5 cents per gallon impact over time (Daley, 2001; Groves, 2001; Kelly, 2001). In a subsequent study Cotterill and Franklin (2001c) take changes in cooperative over- order premiums into account and report a 2.7 cents per gallon impact. Balagtas and Sumner (2001) assume a competitive market channel and thus assume that the retail impact is identical to the Compacts' elevation of the raw fluid milk price. Lass et al. (2001) assume a competitive market channel but find when they estimate a price transmission model that the retail price impact is roughly equal to one half of the raw milk price impact.

Different impact estimates, as this article will show, are due to different approaches to the analysis of pricing in the milk marketing channel. Some of the differences may be permissible and provide perspective on the consumer impact question. Examples include the before-after and counterfactual approaches described below. Other differences, however as we demonstrate, are based on questionable constraining assumptions in economic models. At the time that these results were fed into the policy debate the impact of these constraints on results often was not acknowledged. Therefore, ex post, there is a need for a comparative analysis of these studies. The goal is to provide a more detailed understanding of how the Compact affected retail markets.

We proceed by explaining the difference between a before/after and a counterfactual policy analysis of the Dairy Compact in the next section of this article. Section III explains the different economic models that underpin price transmission research. Section IV, reviews and critically evaluates the main research studies to date of the Compact's impact on New England consumers. The last section presents conclusions.

2. Before and After versus Counterfactual Impact Analysis

Policy impact analysis can ask what happened over time, comparing information in a period from before policy implementation to information in an after period. This is before-after impact analysis. Alternatively counterfactual analysis measures a hypothetical or conjectural situation. It compares performance during a time period with a policy such as the Compact to what would have occurred if that policy did not exist during that same time period.

The measured impacts on consumers from these two approaches generally are not equal. Bailey (2000) and Cotterill and Franklin (2001c) report that during an 18 months "before" compact period the raw fluid price the Compact averaged $1.46 per gallon. Bailey's study demonstrates that the Compact raises price on average 2.4 cents per gallon during the 18 months after the Compact. Cotterill and Franklin finds an average 2.7 cents elevation during the three years after. The counterfactual analysis by Bailey (2000) and Cotterill and Franklin (2001c) indicates if the

Compact had not existed, raw fluid milk prices would have been on average approximately 10 cents lower after the Compact. Thus we have two different raw milk price changes, a 2.4 or 2.7 cent per gallon increase over time and a 10 cent per gallon increase in the counterfactual case.

Proceeding to analysis of the impact of change in raw fluid price on retail prices, i.e. price transmission, before-after impact analysis is simpler than counterfactual analysis. One can use the economic positions of all players before the Compact as benchmarks. Then one can determine who gains and who loses after the Compact relative to those benchmarks. One does not have to specify formally the economic game that stakeholders (farmers, other input suppliers, consumers, and market channel firms) are playing. That unknown game generates the actual prices that we observe. This benchmark approach is unconstrained and therefore gives an unbiased measure of who actually gains and loses over time. In fact the goal of the Compact was not so much to raise raw milk prices over time but to avoid drops in the raw milk price over time. Seen in this light the Compact could have minimal impact on consumers over time and allow farmers to avoid drops in raw fluid prices, the counterfactual result.

When doing counterfactual analysis of the retail price impact, one cannot avoid specifying a price transmission model. One needs to forecast what retail prices would be with and without the Compact in the raw milk market. Actual retail prices contribute to this approach to the extent that they determine the model chosen. As we shall see some models of price transmission in the studies reviewed have no empirical basis and others are theoretically constrained.

3. Alternative Economic Models for Analyzing the Impact of the Compact on Consumers

In his classic article Gardiner (1975) developed a model for a competitive market channel with three stages, farm production, a marketing industry, and consumers. He demonstrated that even if the farm production and marketing industry are perfectly competitive and if constant returns to scale exists in marketing, there is not a unique and stable relationship between farm and retail prices. One response to Gardiner was a concerted effort by empirically oriented economists to ascertain under what more restrictive conditions one could estimate the relationship between farm and retail prices and be confident that the empirical result captured economic behavior.

The most common approach is Hein's (1980) model. Hein shows that if one is willing to assume the following then one can estimate the popular reduced-form relationship between retail prices, farm raw product price and other input prices.

- perfect competition in the marketing industry, i.e. retail price equals the marginal cost of supplying the final product to consumers.
- constant returns to scale (CRTS) in the marketing industry.
- fixed proportion production technology in the marketing industry
- a perfectly elastic supply of the nonfarm inputs to the marketing industry so shifts in input demand from this industry have no impact on their price.
- unidirectional shocks to the system that emanate from shifts in the farm supply curve, i.e. shocks to the agricultural cost of production not retail demand.
- a static equilibrium exists.

Under these conditions Heins specifies a fixed-markup model (Hein, p. 11 p. 14) where the coefficients on the raw agricultural product price and other input prices are the Leontieff production function coefficients.

The assumptions that Hein adds to the Gardner model seem eminently reasonable for fluid milk. The variation in milk processed in a region such as New England is unlikely to affect the supply conditions for other inputs and their supply prices. Milk demand is relatively stable compared to milk production so unidirectional shocks from the raw product supply side enable us to identify the farm-to-retail transmission rate in Gardner's model. For now we will

also accept static equilibrium assumption however Lass et al. (2001) relax it in an ad hoc fashion to explore asymmetry in price transmission.

Note what this model predicts for Compact impact. Since the Leontief production coefficient on raw milk price in this model is unity, i.e. it takes one gallon of raw milk to produce a gallon of processed milk, the price transmission rate is 100%. For example a 10 cents per gallon increase in the raw fluid price due to the Compact increases retail price an identical 10 cents in the Hein model.

One can decompose the price transmission rate for any model into two components:

$$\frac{\partial P_R}{\partial P_f} = \frac{\partial P_R}{\partial MC_M} \cdot \frac{\partial MC_M}{\partial P_f} \tag{1}$$

where:

P_R = retail price,

P_f = farm price,

MC_M = the marginal cost of the marketing industry firms.

In the Hein fixed-markup model $\partial P_R / \partial MC_m = 1$ since the perfect competition assumption requires: $P_R = MC_M$. Other assumptions in the Hein fixed-markup model combine to assure that $\partial MC_m / \partial P_f = 1$.

If one relaxes the perfect competition assumption one obtains models that predict price transmission rates above or below 100 percent. One approach to relaxing the perfect competition assumption is the conjectural variation oligopoly model.[1] It replaces the price equals marginal cost assumption with the following pricing equation:

$$P_R = \frac{1}{1 - \frac{\Theta}{\eta}} MC_m , \tag{2}$$

where: Θ = the conjectural elasticity, i.e. the conjectured percent change in industry output for a given percent change in a firm's output,

η = the retail market elasticity of demand ($\eta > 0$).

Now one has:

$$\frac{\partial P_R}{\partial MC_m} = \frac{1}{1 - \frac{\Theta}{\eta}} . \tag{3}$$

Retaining the other assumptions in the Hein model one continues to have:

$$\frac{\partial MC_m}{\partial P_f} = 1 . \tag{4}$$

[1] Alternatively one can specify Bertrand price rather than Cournot quantity games for the marketing industry and estimate the price transmission rate. This is very attractive because one can analyze differentiated products.

So now one obtains:

$$\frac{\partial P_R}{\partial P_f} = \frac{1}{1 - \frac{\Theta}{\eta}}. \tag{5}$$

For a monopoly, Θ=1 and η>1, so the price transmission rate is always greater than 100%. For a Cournot oligopoly Θ=1/n where n is the number of firms in the industry and transmission also is always greater than 100%.

As presented the conjectural variation model assumes a constant elasticity demand function. For more flexible functional forms one can have transmission rates above or below 100% for oligopolies as well for a monopoly (Cotterill et al. 2001). If demand is linear, then in combination with the other Hein production function assumptions, a monopolist always has a 50 percent price transmission rate. Finally if one models the channel as two successive industries, processing and retailing, and if one has successive monopolists with linear demand and the Hein production function assumptions the price transmission rate from farm to retail would be 25 percent.

In conclusion there are more general economic models than the Hein competitive fixed-markup model that predict price transmission rates above or below 100 percent. Moreover the Compact may have affected the price transmission rate by inducing a change in price strategy in New England's tight oligopoly.

4. Studies that Analyze the Compacts' Impacts on New England Consumers

Several studies analyze the Compact's impact on different groups including consumers in New England, consumers in the rest of the U.S., dairy farmers that sell into New England and those that sell milk elsewhere, and finally federal taxpayers (General Accounting Office). Here we focus on a subset of studies that address impacts on New England consumers.

4.1 Balagtas and Sumner

Balagtas and Sumner (2001) use a simulation model to do a counterfactual consumer impact analysis for only 1999. They do not conduct an econometric analysis of the New England market. Instead, they use elasticities from previous studies of the U.S. milk industry to parameterize a New England raw milk supply curve, a New England raw fluid milk demand curve, and a share of the national demand curve for raw manufacturing milk facing New England. The authors also assume that these raw milk supply and demand curves are linear in the range of the analysis. This simulation model uses relatively little actual data from New England. Aggregate 1999 New England production, and raw fluid milk price data, including Compact premiums close their model. No retail price or quantity data are used.

Balagtas and Sumner simulate their model's equilibrium for the market in 1999 with and without the Compact. In the counterfactual scenario raw fluid milk is priced at the federal market order announced Class I price at all times. With the Compact, the raw fluid price is the higher of the Compact floor price and the announced Class I. They ignore cooperative premiums that vary over time and were collected on approximately 75% of raw fluid milk (Cotterill and Franklin, 2001c, p.5).

Balagtas and Sumner compare equilibrium raw fluid milk prices, quantities, and welfare with and without the Compact. To do consumer impact analysis, Balagtas and Sumner assume that any increase by the Compact in the raw fluid milk price over the FMMO Class 1 minimum price is passed on to consumers penny for penny, i.e. the Hein fixed-markup model is valid. They do not address or test in any fashion the possibility that the Dairy Compact influenced the transmission rate by reducing the marketing margin via its hoped for elimination of asymmetric pricing and reduction in risk premiums due to input price stabilization (Federal Register, 5/30/97, p. 29629, 4/28/97, p. 23049). Also, they do not consider that possibility that price transmission was greater than 100 percent because tacit collusion in response to the Compact program became more effective.

Balagtas and Sumner estimate that processors would have paid 10 cents a gallon less for raw milk if the Compact had not been in place during 1999. With their 100 percent transmission assumption consumers also would have paid

10 cents a gallon less for processed milk. New England consumers suffer a total loss in consumer surplus of 35.8 million dollars in 1999 (Balagtas and Sumner, p. 18).

This is a seriously constrained empirical analysis of the Compact's impact on New England consumers. No econometric analysis of New England data provides parameter estimates for the simulation model. By virtue of their specification of the Hein fixed-markup model with its 100 percent pass through assumption the authors ignore the impact of imperfect competition and other factors, including the Compact, on the market margin and the transmission rate. Thus this policy analysis does not give the Compact a chance to have its targeted impact, nor does it capture the strategic response by powerful firms in the channel that may more than offset any actual Compact impact.

4.2 Lass, Adanu and Allen

This study estimates the Hein fixed-markup model, computes price transmission rates, and tests for asymmetric pricing. Lass et al. estimate a monthly retail milk price model on monthly data from January 1982 through June 1996 for Boston and Hartford. Then they use their model to predict retail prices from July 1996 through June 1998, a period that contains 12 months of Compact operation.

The retail price data used are collected by the Boston Federal Milk Market Administrator's office. In Boston staff check prices in one store for each of two leading supermarket chains and a leading convenience store chain at some time during the first 10 days of each month. They check the price of the most popular sized leading brand of whole milk sold. Essentially this means they are pricing gallons of private label whole milk. The Administrator's series reports the average of this price from 3 stores as the price of milk for Boston that month. The same procedure generates the retail price series for Hartford.

These data are not a scientific sample and are far less detailed than the Information Resources (IRI) or A.C. Nielsen scanner data. Nonetheless these price series are highly correlated with IRI prices during 1996-2000.

Figure 1 displays the monthly retail price and the Federal Market Order (FMO) Class 1 price for raw fluid milk in Boston for 1982 through September 2001. Lass et al. at the time of their study had data through June 1998. Figure 1 also has the Compact price floor at $1.46 per gallon for the months when it was operative. The gap between the Compact minimum and the Class 1 price is the over-order premium. The chart shows that farmers received higher prices than they would have if there were no Compact in many months after July 1997 (counterfactual impact).

Three vertical lines identify key points in this price series. Line 1 indicates the end of government dominated prices via the setting of the support price for manufacturing milk and the purchase of cheese and butter to sustain that price. After July 1988 cheese prices moved above the support level that was repeatedly lowered in the earlier part of the decade. They became "market driven." This generated a significant increase in the volatility of the class 1 raw fluid milk price. Note that the Dairy Compact clearly reduced that price volatility.

Lines 2 and 3 delineate the major price cycle that occurred immediately prior to the implementation of the Dairy Compact in July 1997 (line 3). Note that retail prices do not respond to changes in farm price during this major raw milk price cycle in 1996-1997. In the other major raw price cycle that peaked in June 1990, retail prices clearly respond to the farm price cycle. A major conclusion from visual inspection of this price series is that pricing strategies by market channel firms have changed over time.

Lass et al. do not adjust this raw milk price series for cooperative and state mandated premiums. During the Regional Cooperative Marketing Agency era in the late 1980's and at other times over-order premiums significantly increased raw milk price. For example in September 1988, RCMA and other cooperative over-order premiums totaled $1.35/cwt or 11.6 cents per gallon (Cotterill et al. 1990, p.4). Exclusion of over-order premiums may decrease estimated price transmission rates.

Lass et al. find that retail prices in Boston and Hartford are significantly related to Class 1 prices during the 1982 to June 1996 period that they use to estimate their model. They also report an immediate asymmetric price response. In both cities retail prices respond more strongly to increases rather than decreases in the contemporaneous raw fluid milk price. After three months, however the up and downside retail price adjustments are not significantly different. Nonetheless the contemporaneous asymmetry does allow firms to increase cash flows and profits when raw milk prices drop.

To analyze the Compact's impact on retail prices Lass et al. use their model to predict retail prices in the 12 months prior to and 12 months after Compact implementation, i.e. they predict monthly retail prices for July 1996 through June 1998. Since their time series model does an excellent job of predicting actual prices during this period,

the Compact and channel firm strategic responses to it seem to have no impact on price asymmetry or transmission rates; however, the authors do not discuss or statistically test this point. They proceed to do a counterfactual analysis of the Compact's floor price provision on retail prices using the transmission rates that they estimated for the 1982-1996 period. Lass et al. report that if the Compact had not been in operation during the July 1997 to June 1998 period retail milk prices would have been on average 6.9 cents per gallon lower in Boston and 5.7 cents per gallon lower in Hartford (Lass et al., p. 90). Since the monthly Compact over-order premiums for that year averaged 10.1 cents the average price transmission rates are 68 percent for Boston and 43 percent for Hartford.

Recall that the Hein fixed-markup model hypothesizes that one has 100 percent pass through. Lass et al. do not discuss or test this hypothesis, however their low transmission results seem to reject the Hein fixed-markup model.

To obtain a price transmission rates this far below 100 percent one has to have significant input substitutability, economies of scale, or imperfect competition. Given that effectively it takes a gallon of raw milk to produce a gallon of processed milk we doubt that a firm can switch from milk to other inputs in sufficient magnitude to avoid roughly 4.5 cents of a 10 cents increase in raw milk price. Also we doubt that the channel enjoys sufficient economies of plant utilization or scale so that the slight decreases in output due to higher retail prices elevate unit costs 4.5 cents per gallon. If one discounts measurement problems in the raw fluid milk price series due to excluding cooperative premiums, noncompetitive pricing conduct is most likely the primary source of the partial price transmission estimated during the 1982 to 1998 era in these New England markets. Yet one would hardly expect the conduct in the industry to be constant over that 16 year period given the dramatic changes that occurred in the structure of the industry. The Lass et al. empirical results capture some more complex underlying long run economic phenomena than the Hein fixed markup model.

4.3 The Bailey Studies

At the height of the Compact debate the most common consumer impact number cited was Bailey's estimate that the Compact increased Boston area retail milk prices 14 cents per gallon. Bailey (2000) used the same FMA retail price and class 1 raw fluid price series as Lass et al., however he adjusted the raw price series for cooperative premiums. This study addresses both before-after and counterfactual impacts of the Compact. It uses monthly data from January 1996 through December 1999 so one has eighteen months before and eighteen months after Compact implementation. Bailey gives no explanation for his choice of time periods.

Bailey's economic model for counterfactual analysis is a proportional markup model. It is not a version of the Hein fixed-markup model as he claims (Bailey 2000, p.14, 2001, p.10). He observes that retailers routinely mark a product up X percent over its wholesale price to cover in-store costs. Therefore, he maintains that firms in the milk processing and distribution channel collectively mark retail milk up a fixed percent over raw fluid milk costs to cover channel costs. One could call this the stock boy markup model.[2]

Bailey's model is:

$$P_R = mP_f,$$

and differentiating gives the following impact equation:

$$dP_R = mdP_f,$$

where:

P_R= retail price,

P_f = raw fluid price,

[2] No one in the supermarket industry would claim that this is how product is priced. Since the late 1980's, the industry has embraced direct product profit and category management techniques to maximize profit. See for example the now classic 1992 Marsh Supermarket Study in *Progressive Grocer*. Also, Cotterill and Putsis (2001d) test for proportional markup pricing by retailers and reject it in ten of twelve cases.

m= the markup parameter.

This looks like the proportional mark-up in the conjectural variation model, but it is not, since m in this simple markup model covers all nonmilk costs. In the CV model other costs are specified in the cost function and their prices appear in the marginal cost function. Bailey's change in retail price when raw milk price changes is not a partial derivative, i.e. it is not the change in retail price assuming all other input prices are constant. His markup includes increased revenues to cover increases in other input prices and net profits when the raw milk price changes. Note also that in Bailey's model the price transmission rate is constrained to be the ratio of the retail and raw milk price, which is well above 100 percent. At this juncture one should realize why the International Dairy Foods Association disseminated Bailey's estimate to the press. By construction it produces a very high Compact impact on retail prices.

Bailey (2000) obtains a 14 cents per gallon Compact impact during the July 1997 through December 1999 period as follows. First he correctly notes if the Compact had not been in force during that period the average raw milk price would have been 9.9 cents lower because farmers would not have had the benefit of the Compact's price floor. Bailey then computes the after-Compact ratio of retail and raw milk prices and obtains an average markup of 71.6 percent and a price transmission rate that is 171.6 percent. Applying his markup model he reasons, if the Compact had not been operating the retail price would be (9.9) (1.716) = 17 cents lower (Bailey 2000, Appendix Table 1).

Bailey gets to 14 cents by adjusting for changes in cooperative premiums. He assumes that if there were no Compact premiums would revert to their pre-Compact level. We, and others, have no problem with this assumption. Bailey finds that if there were no Compact, cooperative premiums would increase 1.8 cents and retail prices would increase (1.8) (1.716) = 3 cents. Thus the net impact of eliminating the Compact is a 14 cents decrease in the retail price.

This is a valid counterfactual analysis only if one accepts Bailey's markup model. That model, however, is flawed because it forces the farmers to accept responsibility not only for a change in their own price, it forces them to accept responsibility for changes in the prices of other inputs and changes in net profit. Think about it in the context of the counterfactual "get rid of the Compact" situation. When the farm price drops 10 cents do market channel firms demand 7 cents of wage, other input prices and profit givebacks and drop the retail price 17 cents? If this were true retail prices would be more volatile than farm prices. Even casual inspection of Figure 1 indicates that this is not true.

Bailey also claims that this 14 cent counterfactual estimate accurately measures the impact of the Compact on consumers over time. It does not. As presented in the paper, his impact analysis is a confusing mixture of counterfactual and before-after components. Bailey claims:

> The results of this simple analysis imply that the retail price of milk rose $0.24 per gallon during the compact period July 1997 – December 1999 when compared to the period January 1996 – June 1997. (Our emphasis.) Part of this increase in the retail price of milk--$0.17 per gallon – was directly due to the compact. This increase was partially offset by a 3-cent-per-gallon decline in the retail price of milk due to the reduction in the cooperative market over-order premium. One could argue that this was an indirect impact of the compact. The rest of the increase in the retail price of milk -- $0.10 per gallon – appears to be related to other factors (Bailey 2000, p. 17).

This analysis assumes that the Compact increased the price of milk over time 14 cents per gallon. In fact the Compact impact over time, in the raw milk market, net of the change in cooperative premiums, in Bailey's study was only 2.4 cents per gallon (Cotterill and Franklin 2001c, p. 26). Thus even if one applies Bailey's markup model one obtains only a (2.4) · (1.716) = 4.1 cent per gallon impact for the Compact over time. Again this estimate is overstated because its increases retail prices for others as well as farmers.

Finally note that the 10 cents of the increase in the price over time that Bailey attributes to "other factors" is due to the increase in the markup parameter from 1.653 before the Compact to 1.716 after the Compact (Bailey 2000, p. 16). Clearly this increase in the markup accounts for more of the consumer price increase over time than does the Compact.

Bailey's second paper appeared in June 2001 during the debate for Compact renewal. In this updated study he specifies the same proportional markup equation in a two equation model that also analyzes the impacts of other costs

on the markup. The impact of the Compact on retail prices in Boston, net of changes in co-op premiums increases to 20.7 cents per gallon (Bailey 2001, p. 14). This estimate was for a longer period from July 1997 to December 2000 (another year). During that period the Compact premium in the raw milk market average 11.3 cents per gallon (Bailey 2001, p. 14) so Bailey's markup in this expanded model averages 83 percent and his price transmission rate is 183 percent. These are higher than in his prior paper.

Although Bailey's markup is related to costs in this expanded model, the criticisms of his first markup model presented in this paper also apply to this expanded model counterfactual estimate. Adding a second equation does not affect his analysis of the impact of a raw milk price change on retail prices. It is still a proportional markup model.

4.4 Cotterill and Franklin

Cotterill and Franklin use IRI scanner data from four New England markets, Boston, Providence, Hartford/Springfield and Northern New England, in combination with raw fluid milk price data to analyze the Dairy Compact's impact on retail prices (2001a). The four IRI market areas combine to cover approximately 90 percent of New England. The IRI data are collected from all supermarkets of the leading chains and a sample of stores from smaller supermarkets. Thus the data are nearly a census measure of supermarket activities. The IRI data also are very disaggregate. They report price per gallon, gallons sold, and other marketing variable by brand, for whole milk, 2 percent, and 1% skim, for individual large supermarket chains and an "all other supermarkets" residual category in each IRI market area. This enables Cotterill and Franklin to analyze individual supermarket chain and brand level retail pricing strategies in local markets. They identify price leaders, estimate brand level demand curves for Garelick, Hood, and private label milk in the Boston IRI market area and document that price elevation is profitable (Cotterill and Franklin, 2001a, p. Sections VI, IX, and X).

In their initial report and subsequent papers (Cotterill and Franklin 2001 a, b, c, and Cotterill 2001c) these authors focus only on a before-after impact analysis of the Compact. The IRI data cover 58 four-week periods commencing with the period ending February 3, 1996 and continuing through the period ending July 16, 2000. This data set has 18 observations prior to Compact implementation, offering essentially the same before Compact time period as in Bailey (2000).[3]

Cotterill and Franklin recognize that the choice of the time periods to include in the before Compact period to obtain an estimate of the "benchmark" market conditions can critically affect the results of the analysis (Cotterill and Franklin, 2001b p.3-4, 2001c, p. 6-7). They analyze the pre Compact data to identify a before Compact period that is consistent with profit maximizing behavior by firms. As visually documented in Figure 1 in this paper and as econometrically analyzed by Cotterill and Franklin (2001a, p.12) there is no contemporaneous or lagged price relationships between raw milk and retail prices during the 18 periods before Compact Implementation. Note in Figure 1 that these 18 observations capture nearly all of the major price cycle that preceded the Compact. Channel firms for whatever reason, did not accelerate retail prices over trend in response to raw fluid price increases during the up swing of the cycle, nor did they decelerate retail prices during the downswing of the raw milk price cycle.

Absent any relationship the authors use the average raw fluid price for the 18 periods as the before Compact raw fluid milk price. This is consistent with Bailey (2000) and actual firm conduct because profit maximizing firms in any market structure would transmit at least part of cost changes forward to retail prices. Since there is no observable relationship in the 18 periods before the Compact, profit maximizing firms seem to be using the before Compact period average raw fluid price as an estimate of their long-run raw milk cost in a risky input market (Cotterill and Franklin 2001 b,c). Cotterill and Franklin analyze the impact of the Compact using a raw milk price series without cooperative premiums (2001a, 2001b) and with cooperative premiums (2001c). Here we only discuss the latter result.

Table 1 reports their results for all New England and for the after Compact period, July 1997 to July 2000.[4] All prices are per gallon. The average before Compact retail price is $2.49.[5] It increases 29 cents to $2.78 after the

[3] Space precludes providing a graph of the IRI data; however, at the market level the IRI data for 1996 through July 2000 is essentially identical to the retail price data in Figure 1.

[4] Cotterill and Franklin analyze three after Compact periods. The first is the 15 periods immediately after Compact implementation wherein the Compact was active. Second is the remaining 25 periods, which contain two raw milk price spikes that moved the Class 1 FMO price above the Compact floor price inactivating the Compact. The third after Compact period is the entire period from July 1997 through July 2000.

Compact. The before Compact raw fluid price (FMO Class 1 price plus cooperative premiums) averages $1.461. After the Compact it averages $1.553, an increase of 9.2 cents.

In Table 1 Cotterill and Franklin decompose this raw milk price increase into its three components: changes in cooperative premiums, the Compact, and strong raw milk markets. Cooperative premiums decreased 1.8 cents per gallon after the Compact because Cooperatives eliminated power-based premiums and covered only services performed (General Accounting Office, p. 70).

Over time the Compact increases raw milk prices only 4.5 cents. One obtains this estimate as follows. In the before Compact period the FMO Class I milk price averaged $1.40. Based upon their retail price conduct in the period before the Compact, this is the price level that channel firms expected class I prices to approximate in the future. In any period when the Compact was in effect it increased this expected price 6 cents to the Compact floor price, $1.46 per gallon. When the Class 1 price was above $1.46 the Compact was inactive due to strong milk markets. During the three years after Compact implementation the Compact was only active 75 percent of the time so its contribution to the 9.2 cent increase in raw fluid price is (.75 x 6.0) = 4.5 cents. Once one has netted out the change in cooperative premiums one has a 2.7 cents per gallon Compact impact over time. The remaining portion of the 9.2 cents increase in raw milk prices is 6.5 cents and is due to strong milk markets when Class 1 prices were above the 1.46 Compact floor price.

Finally in Table 1 the before Compact dollar margin is $0.963 and it increases to $1.183 after the Compact. The dollar margin increases 20.2 cents. Margin widening factors contribute more than twice as much to retail price increases than do changes in the raw milk price due to the combined effect of the Compact, cooperative premiums, and strong raw milk markets.

Figure 2 illustrates before-after and counterfactual impacts of the Compact program in the raw fluid milk market. Before the Compact, processors paid $1.461 and the price increased to $1.553 due to the 2.7 cents net-of-changes-in-cooperative-premiums Compact impact and the 6.5 cents increase due to strong raw milk markets. If the Compact had not been in force and cooperative premiums reverted to the higher before-Compact level, processors would have paid farmers 10.1 cents per gallon less for raw fluid milk.

The counterfactual impact is larger than the before-after impact. This is hardly surprising given that the Compact is a price floor policy. The Compact sought to increase and stabilize farm income not so much by increasing raw fluid prices over time, but by avoiding future drops in the Class 1 price below the floor price. In fact the actual net increase in raw fluid milk price due to the Compact, 2.7 cents per gallon, is less than 1 percent of the after Compact retail price, $2.78 per gallon.

The prices for the raw fluid and the retail market reported in Table 1 and Figure 2 are incontrovertible facts. One needs no economic model to compute these averages for the before and after time periods.

The widening of the dollar marketing margin by 20.2 cents per gallon may be due to increases in processing and distribution costs not related to raw milk costs. After examining several measures of nonmilk cost increases over 1996 to 2000 in New England and the total U.S. milk processing industry Cotterill and Franklin conclude that a reasonable estimate for the growth in the dollar marketing margin is 3 percent per year. With this assumption in hand Cotterill and Franklin, 2001c, p. 29 decompose the 29 cents increase in retail milk prices into its constituent parts. Their results are reproduced as table 2.

New England consumers paid 122.8 million dollars more for milk in supermarkets during the after-Compact period because the price increased 29 cents per gallon over the before-Compact price. Dairy farmers received 11.4 million dollars more from the sale of milk in the supermarket channel because the Compact increased the price 2.7 cents per gallon. Dairy farmers also received 27.5 million dollars more for milk sold through supermarkets because strong raw milk markets during the 3 year post-Compact period raised price above the Compact minimum price 25 percent of the time. Increases in other costs (7 cents per gallon) accounted for 29.6 million dollars of the 122.8 million dollar increase in the milk bill. Finally, since they have accounted for the increases due to all inputs, the

[5] This retail price is the average of the four markets linear trend line forecast prices for June 1997. If one uses the average retail price across the 18 periods between February 1996 and June 1997 one obtains a $2.44 average before Compact price. Using this lower before Compact average price ignores the clear upward trend in retail price before the Compact which is not likely due to steady marketing costs other than raw milk. It also increases the marketing margin by 5 cents and this increase falls to the bottom line to increase net profits. Cotterill and Franklin (2001c) analyze this case as well as the one reported here.

remaining 54.2 million dollars falls to the bottom line of the market channel firms as an increase in net profits. It is 13 cents per gallon.[6]

One must look beyond competitive markets to explain actual observed retail price conduct and the widening of the net profit margin post-Compact that the Bailey and Cotterill and Franklin studies document. Cotterill and Franklin document that the data and historical events in the New England milk industry support a tacit collusion strategy at Compact implementation (Cotterill and Franklin, 2001a). That event served as a focal point for joint retail price elevation. The industry's public responses in opposition to the Compact enabled them to signal each other and unite behind a retail price hike equal in size to any government imposed increase in the price of raw milk on July 1, 1997. This enabled the industry to lock in the extremely wide market margins that exist during the low raw milk phase of the pre-Compact price cycle (See Figure 1, January-June 1997). Inspection of Figure 1 also indicates that asymmetric pricing reappeared in a very strong form during the Compact period. The Compact eliminated margin widening conduct by channel firms at the expense of farmers, however, it did not prevent such conduct against consumers.

Lets now shift to counterfactual impact analysis and employ Table 2. Under a counterfactual approach what do we know? We know prior to specifying any economic model that if there were no Compact farm revenue would decrease 10.1 cents per gallon. This amounts to a farm revenue loss of 111.8 million dollars on all Class 1 milk. For the supermarket channel milk, which takes roughly 40% of this milk, one has a 42.8 million dollar decrease in farm revenue. This number is the amount that processors would have saved on their milk procurement bill if there had been no Compact. How much would have been passed forward to consumers depends on the model of price transmission that one assumes or estimates. The Balagtas and Sumner, Lass et al. and Bailey models reviewed in this paper provide very disparate, and thus no consensus estimate of price transmission for this counterfactual event.

Today we also have very useful "post mortem" evidence on these counterfactual models. The Dairy Compact expired on September 30, 2001. Opponents to the policy won the political debate in the U.S. Congress. After the Compact's demise the Boston federal order price of raw fluid milk plunged from $1.65 per gallon in October 2001 to $1.15 gallon in October 2002. Boston retail milk prices, however, dropped only from $3.08 to $2.97 per gallon (Cotterill 2002, Table 1). A nine cent retail price decline when raw price drops 50 cents amounts to under an 18% price transmission rate. According to Bailey's final markup model with its 183% markup, retail prices should have dropped 92 cents per gallon. According to the Balagtas and Sumner model the retail price should have equaled the farm price drop: 50 cents per gallon. The Lass price transmission model for Boston comes closest with its predictions that only 68% of the raw price decline, i.e. a 34 cent drop in price would occur. Given the ex post performance of the Boston market and our inadequate understanding of how the market operates, the issue of farm retail milk price transmission remains a critical issue. Senator Olympia Snowe (D-Maine) and other New England and New York senators have called for a General Accounting Office investigation of New England milk pricing (Snowe, March 7, 2003).

5. Concluding Comments

After this review of studies that address the impact of the Compact on New England consumers, several conclusions seem warranted. Contrary to Congressional expectations the Compact did not lower market channel margins and it did not eliminate asymmetric pricing. The Compact however, independent of the reactions by milk channel firms, had little impact on consumers over time. It increased consumers prices less than 1 percent; but, farmers received a higher price than they otherwise would have received due to the Compact's minimum price floor. This in fact was the core rationale for the Compact: not increase consumer prices but limit the ability of market channel firms to capture large increases in their profits (windfall profits) at the expense of farmers when the raw fluid milk price drops.

Clearly the Compact, by itself, did redistribute channel income without significantly affecting consumer prices over time. Other factors, including increased net profit margins, account for 90 percent of the increase in milk prices

[6] Cotterill and Franklin (2001a, p. 55) examine the sensitivity of their results to a 4 and 5% growth rate in non milk input prices. Net margin increases are lower but remain a substantial component of the retail price increase.

over time. Only if one attributes the industry's margin widening price reaction to the Dairy Compact does one obtain a sizable impact of 16 cents per gallon on retail prices over time.

Perhaps channel firms would claim that the documented increase in net profits at the expense of consumers is necessary because the Dairy Compact program prevented them from increasing profits at the expense of farmers. In response to this conjecture, one should note that the benchmark net profit rate in the before-Compact period is an average across a major farm price cycle, including a major run-up and crash in farm prices. As such it allows firms a profit rate that reflects all farm price conditions that they face. The benchmark is not based on a stage of the farm price cycle with a squeezed and low farm-retail margin. Moreover it should not be based on the low farm price stage of the cycle where channel firms have very high gross and net profit margins.

Moving beyond positive economic analysis of the facts, in the normative public policy arena analysis of the Dairy Compact is a tale of economists, their models, the data, and the demand by political interest groups for a result that supports their view of the problem. Winston Churchill stated "when I call for statistics about the rate of infant mortality, what I want is proof that fewer babies died when I was prime minister than when anyone else was prime minister". The Dairy Compact policy debate clearly illustrates phenomenon. Give an economist one assumption and some data, and he can prove anything you wish. Assume a competitive market channel and one has 100 percent pass through. Estimate a very long run reduced firm, time series model and one finds price transmission rates of 43 percent in Hartford and 68 percent in Boston. Assume that the channel uses proportional markup rather than profit maximizing pricing and one obtains pass through rates in excess of 170 percent. Assume profit maximizing conduct and employ data only from the years near the policy event and one can document very clever non-competitive channel pricing strategies that enhanced channel profits while attributing the price increase to farmers and the Dairy Compact.

This paper would suggest that there is a dangerous disconnect in the policy game as currently played in Washington.[7] No model captures economic reality perfectly but some models are clearly more deficient than others. Yet partisans quickly promote in the mass media and policy arena the model that serves their interests. Also, we routinely publish the results of research based on models where assumptions are clearly stated and the analysis is technically correct and possibly even innovative. For policy purposes, however, a higher standard may be in order.

There is a clear and present need for comparison of alternative models and alternative approaches as done in this paper. Can one blame the public, and for that matter the U.S. Congress, for being wary of economic analyses when economists say, "on one hand this, on the other that." The public and policy decision makers deserve more perspective on economic analysis of policy issues. The formulation of milk policy would benefit from a shift back towards careful economic analysis of the options including, as done in this paper, comparative analysis of alternative economic models and empirical results.

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[7] For a detailed analysis of this policy disconnect in the context of globalization and industrial concentration see Cotterill (2003b).

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Table 1. Cotterill and Franklin Average Farm-to-Retail Margins and Mark-ups Before and After the Compact: All New England

	Before Compact	After Compact	Increase
Avg. Retail Price	2.485	2.779	.294
Avg. Raw Fluid Price	1.461	1.553	.092
Avg. Coop Premium	.061	.043	-.018
Change Due to Compact			.045
Net Change Due to Compact			.027
Change Due to Strong Markets			.065
Dollar Margin	.963	1.183	.202

Table 2. Cotterill and Franklin: Impacts on Consumers and Farmers: All New England

	Total Impact		
	$/gal	$ Million	Percent
Actual Increase in Consumers Supermarket Milk Bill ($0.29 x gals)	0.29	122.8	100.0
Increase Due to Compact	0.027	11.4	9.2
Increase Due to Strong Milk Markets	0.065	27.5	22.4
Increase Due to Other Costs	0.070	29.6	24.1
Increase in Profits	0.13	54.2	44.1
Decrease in Farm Revenue from Supermarkets Sales of Milk if no Compact ($0.101 x gals)	0.101	42.8	

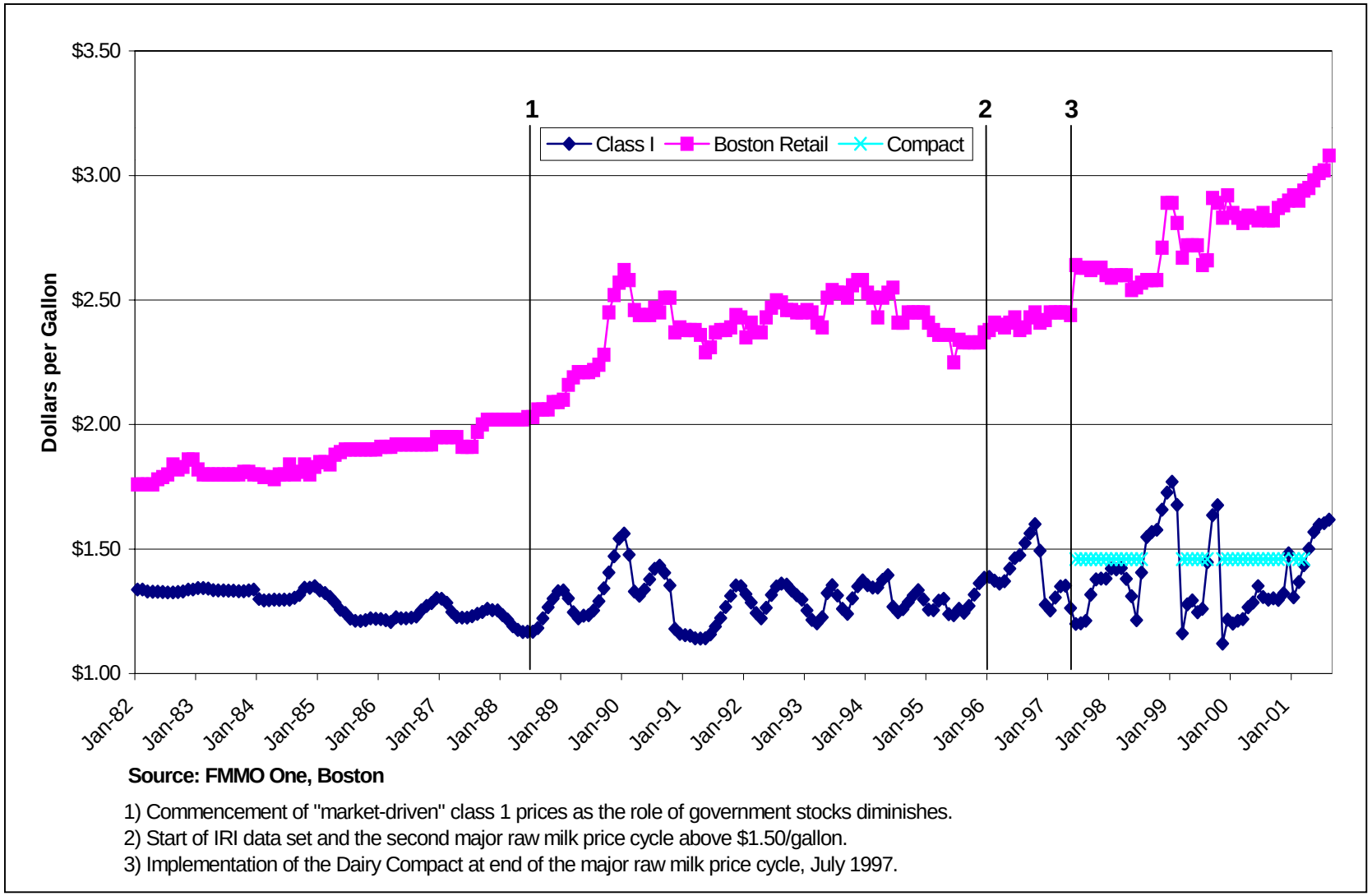

Figure 1. Boston Class 1, Compact and Retail Milk Price: January 1982 – September 2001

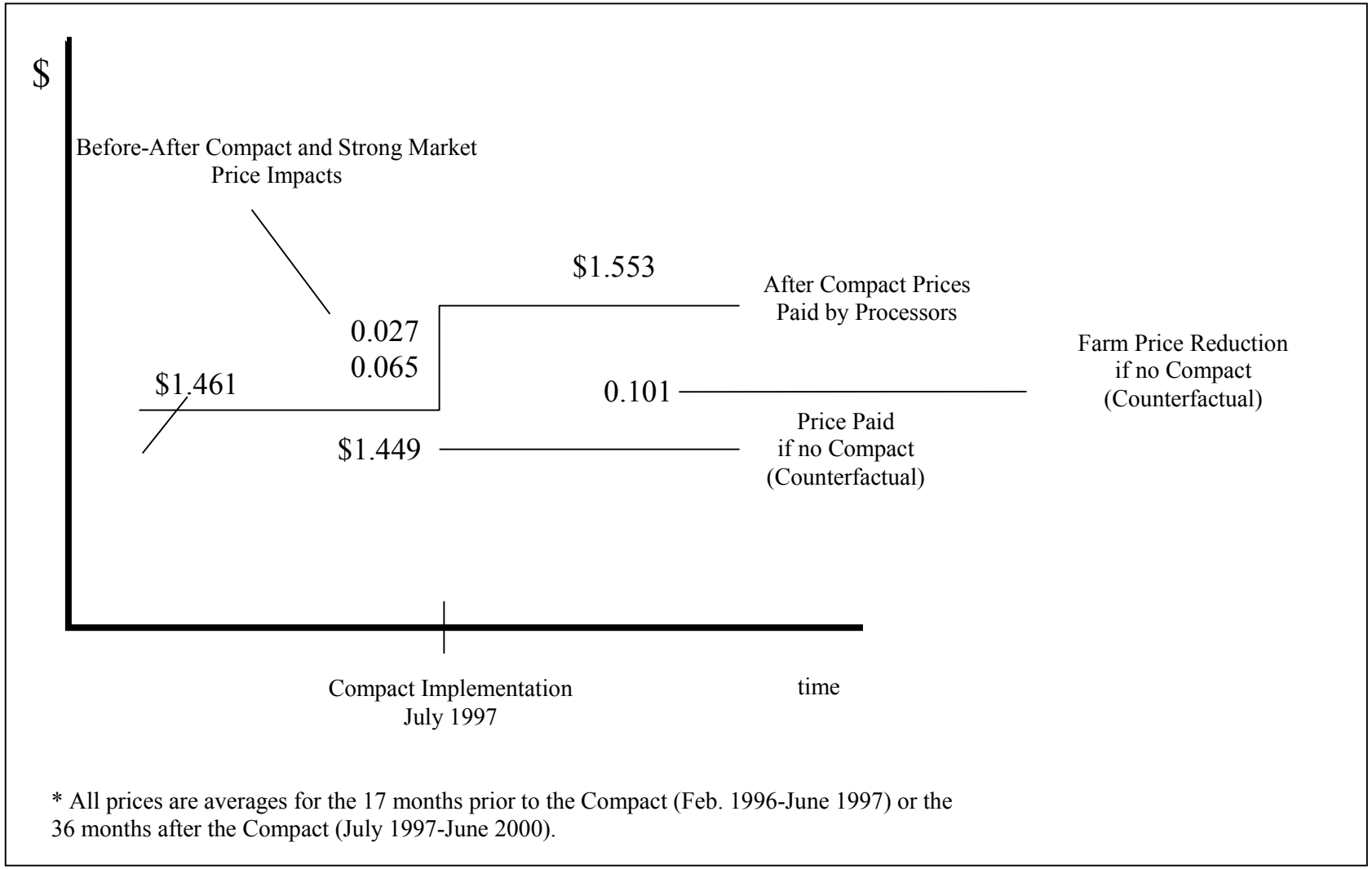

Figure 2. Before-After and Counterfactual (if no Compact) Average Cooperative Prices Paid by Processors* for Raw Fluid Milk Paid by Processors*

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