

Over-order Premiums and Price Wars in the Michigan Milk Market

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Abstract: We examine behavior in the Michigan fluid milk market. Over-order premiums exist because fluid milk demands are inelastic. Collusion by cooperatives is required to realize these profits. In absence of collusion, the minimum prices defined by federal milk marketing orders prevails as excess fluid milk is always present. Proprietary firms in Michigan joined the fluid milk cartel because of the threat of a state marketing order. Proprietary firms profits may be increased and information gathered in the short run through price wars that result when behavior deviates from collusion.

Over-order Premiums and Price Wars in the Michigan Milk Market

Policies define minimum milk prices based on end-use in most U.S. markets. However, fluid milk prices are often above these minimums. Cooperative associations operate in the dairy industry, where 82 percent of the milk is marketed through cooperatives. Important to generating over-order premiums, the Capper-Volstead Act allows the formation of marketing agencies-in-common which coordinate price conduct within commodity markets. These associations collude to bargain for over-order premiums, an amount extracted from milk buyers above federally regulated minimum prices. Since 1956, cooperatives and proprietary milk processing firms have extracted over-order premiums through marketing agency-in-common, a form of cartel agreement, now known as the Producers' Equalization Committee (PEC).

The existence of over-order premiums is not widely understood. Their existence depends crucially on the inelasticity of fluid milk relative to manufactured dairy products, cooperative market power, successful collusion by cooperatives cartels, and the information provided by federal milk marketing orders.

The PEC is a form of price-fixing cartel which redistributes cartel rents between its members. Economic theory suggests that, in general, price-fixing cartel agreements are not stable as participating firms have the incentive to deviate from the agreement and drive prices to competitive levels. Since 1980, the PEC has experienced three price wars where at least one participating firm deviated from the cartel agreement. After each price war, the PEC has regrouped and continued operation. The PEC most recently experienced a price war from September 1997 through April 1998, when proprietary firms stopped pooling collected premiums and withheld \$3.5 million in fluid premiums from the PEC.

We examine the existence of over-order premiums in milk markets, assess the cause of recent PEC price wars, and explain the participation of proprietary firms in the PEC.

Mechanics and the Existence of Over-order Premiums

Dairy farmers historically had limited bargaining power because milk is harvested daily and is perishable in its raw form. Proprietary milk processing firms controlled price negotiations and offered relatively low uniform milk prices, regardless of end-use to all producers. To stabilize and improve this market environment, dairy producers organized marketing cooperatives and lobbied for policies to counter the market power of proprietary firms. The result was federal milk marketing orders that require all milk processors pay at least minimum class prices for milk based on end-use. Federal orders also pool market revenues across classes and pay an average price to all dairy producers. Through classified pricing institutionalized into federal orders, the rents captured by price discrimination are transferred to the farm level.

The Michigan fluid milk market has three significant participants, two cooperatives and a proprietary firm. The two cooperatives can be characterized as a *bargaining* and a *balancing* cooperative. Modeled in aggregate, the Michigan bargaining cooperatives, denoted *Cooperative B*, concentrate on collective bargaining functions and securing a high fluid utilization. The balancing or manufacturing cooperative, *Cooperative M*, performs the functions of the bargaining cooperative and also operates facilities to convert excess market fluid production into manufactured dairy products. Proprietary firms are also grouped together into one representative firm, *Firm P*.

In 1998, Cooperative B marketed approximately 19 percent, Cooperative M 65 percent, and Firm P 16 percent of total milk production. These proportions are different for the fluid market where Cooperative B controlled approximately 27 percent, Cooperative M 44 percent,

and Firm P 29 percent. The resulting firm-level fluid utilizations are 69 percent for Cooperative B, 32 percent for Cooperative M, and 90 percent for Firm P. Fluid premiums are pooled across all milk so net cartel member revenue is inversely related to firm-level fluid utilization.

Figure 1 depicts the operation of the Michigan milk market using market information from May 1997 (prices in December 1998 dollars). The demand curves, D_f , and D_m , represent the demand for fluid and manufacturing milk. Fluid demand is inelastic reflecting the perishability and local scope of the market. The demand for manufacturing milk is perfectly elastic as the products are storable and the market is national in scope.

The May 1997 minimum federal order fluid price, P_f^{\min} was \$19.82/cwt. In the absence of the fluid milk cartel, the market fluid price equals the minimum federal order fluid price as excess milk is available for fluid use. The competitive equilibrium in the fluid market is at (Q_f^c, P_f^{\min}) . In this competitive situation, the effective blend price is P_{Bld}^c resulting in total milk production of Q_T^c .

The PEC collects a fluid premium by setting the fluid price above the federal order minimum price. In May 1997, this premium raised the price of fluid milk \$1.39/cwt, $(P_f^{PEC} - P_f^{\min})$. The fluid market equilibrium with the premium in place is (Q_f^*, P_f^{PEC}) . In May 1997, this was (1.7 million cwt, \$21.21/cwt). The blend price increases to P_{Bld}^* and total production is Q_T^* . The milk produced beyond fluid needs, $(Q_T^* - Q_f^*)$, flows to the manufacturing market.

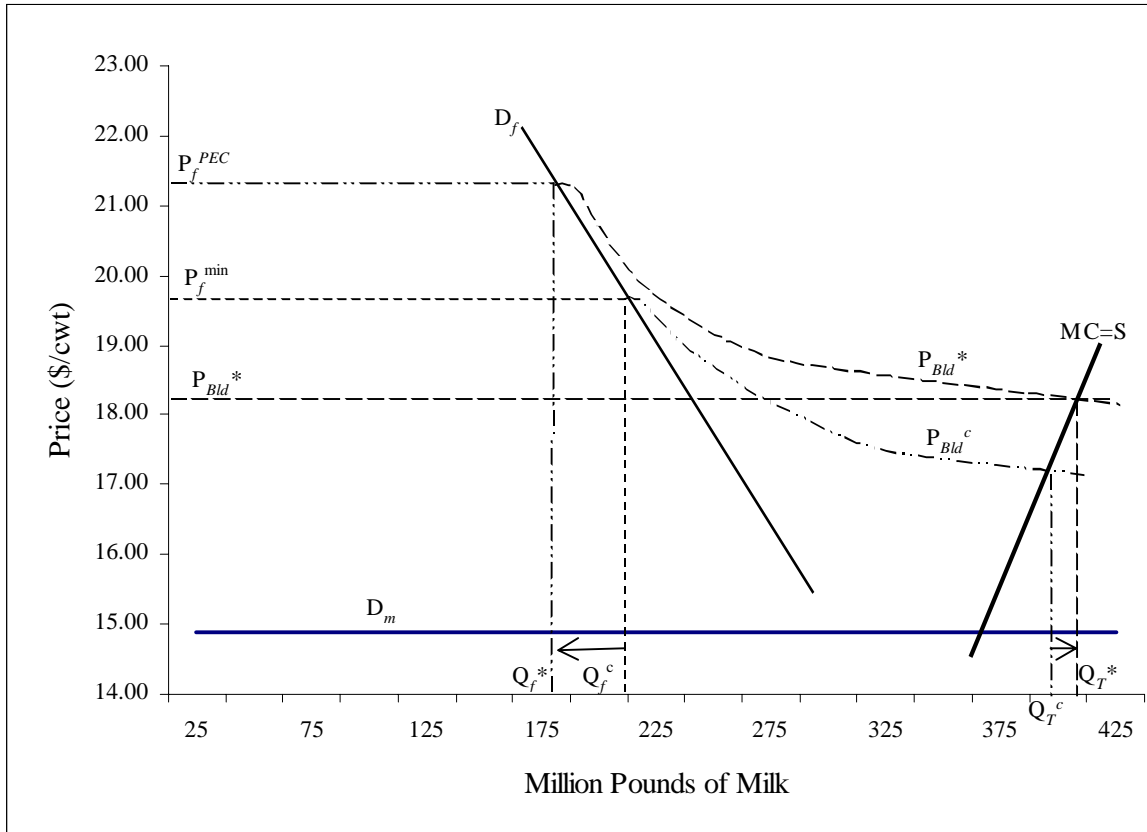
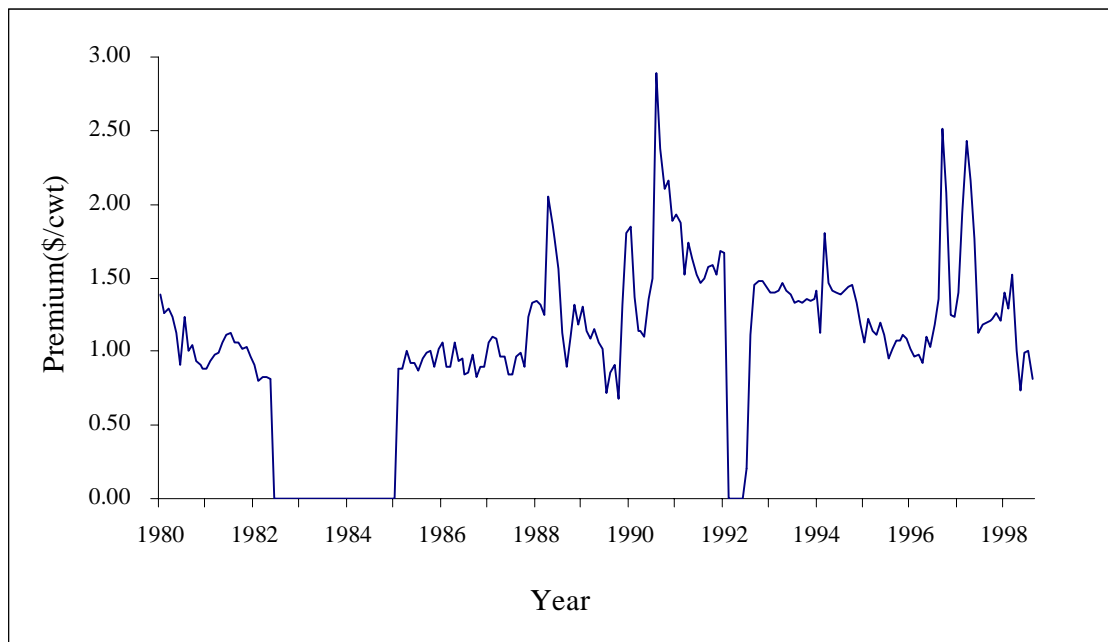


Figure 1. Michigan Milk Market, May 1997

The arrows in Figure 1 indicate the PEC over-order effects on the Michigan milk market. These effects include a decrease in fluid sales, an increase in total milk production, and an increase in total market revenue. That is, the total revenue generated by the product of the cartel blend price and cartel output is greater than the product of the competitive blend price and competitive output because demand for fluid milk is sufficiently inelastic. Specifically, $(P_{Bld}^*)(Q_T^*) > (P_{Bld}^c)(Q_T^c)$, as the increase in total market revenue offsets the increasing weight of a higher manufacturing utilization under the cartel situation.

Figure 2 displays the PEC fluid premium on a per hundredweight basis in constant December 1998 dollars. Premiums range from a high of \$2.89 in December 1990, to a low of zero during the two price wars when the cartel agreement was void.

Figure 2. PEC Premium, May 1980-December 1998 (Dec. 1998 Dollars)



Price Wars, Agreements, and Payoffs

The benefits to milk marketing organizations of forming and operating an over-order cartel are obvious. However, not all industry organizations have participated in the PEC, and at times some firms have opted to not cooperate and instigate a price war rather than collect and pool these over-order premiums.

Price wars occur any time at least one PEC member deviates from the cartel agreement. Upon such an action, the cartel stops pooling fluid premiums and often stops collecting these premiums. This does not necessarily mean that cartel members do not tacitly collude, or extract over-order premiums individually. Rather, a price war means that the PEC does not jointly pool and transfer premiums to all of the previous PEC members.

Cartel members may initiate a price war to increase short-run revenues, alter distribution of cartel rents, change membership, or change negotiation position. Since 1980, three price wars have disrupted market-wide pooling of fluid premiums for a total of 46 months. Each price war

resulted in a structural change to the PEC agreement which includes provisions for collecting, pooling, and transferring cartel rents between members, as well as delineating governance of the cartel.

Table 1 summarizes these price wars in terms of the initial drop of the fluid premium, minimum fluid premium, duration, market revenue foregone, initial cause, and PEC results. Market revenue foregone was calculated using a fixed fluid premium of \$1.00 per hundredweight, the typical long-run premium (inflated to constant December 1998 dollars). Fluid quantities were estimated using average monthly utilization and total production.

Table 1. Characteristics of PEC Price Wars

PEC Price War	1982	1992	1997
Initial Premium Drop	\$0.61	\$1.18	\$0.22
Minimum Premium	\$0.00	\$0.00	\$0.78
Duration (mo.)	32	6	8
Market Revenue Foregone	-	\$13,525,480	\$3,484,179
Initial Cause	Co-op B desires change in distribution of cartel rents.	Co-op B desires change in distribution of cartel rents.	Firm P desires to retain collected fluid premiums.
PEC Results	Governance of PEC changes; No change to pooling mechanism.	Firm P joins PEC; Members retain portion of collected fluid premiums.	All members retain higher portion of collected fluid premiums.

The PEC agreement specifies the mechanics that transfer collected premiums between PEC members. Traditionally, Firm P and Cooperative B have a negative balance with the PEC, or pay into the PEC, as they have a high fluid utilization. Conversely, Cooperative M usually has a positive balance with the PEC, or receives payment from the PEC, because the PEC pools fluid premiums over total market milk. Therefore, Cooperative M with a lower fluid utilization than Cooperative B and Firm P, receives payments from the other PEC members to compensate it for a low fluid utilization. This net pay situation has caused strife between cartel members and

contributed to the three price wars between 1980 and 1998. In 1982, Cooperative B withdrew from the cartel in November because it felt it was subsidizing Cooperative M and being penalized for its high fluid utilization. The 1982 price war lasted almost three years until the PEC reformed in July 1985 without changing the distribution of the cartel rents. Cooperative B returned to the PEC as the payoffs from the PEC were greater than what it could generate independently in a market without fluid premiums. In June 1992, Cooperative B again terminated the PEC agreement for six months. The cartel resumed operation in December 1992 after cartel members agreed to alter the pooling mechanism. Perhaps the most important change following the 1992 price war was that Firm P joined the cartel. Most recently, the cartel collapsed in September 1997 when Firm P exited the PEC but rejoined in May 1998 because of a perceived policy threat.

Table 2 reports net payoffs on a per hundredweight basis under the three PEC agreements (May 1980 – December 1998). The payoffs are calculated under each agreement using May 1998 quantities while price are expressed in December 1998 dollars. Note that the pooling mechanism did not change as a result of the 1982 price war, and thus payoffs in the first two columns of Table 2 are identical.

Table 2 PEC Net Payoffs (\$/cwt) Calculated Under Different PEC Agreements for May 1998 Quantities in December 1998 Dollars

Participant	May 1980 - 1982 Price War	June 1985 - 1992 Price War	Dec. 1992 - 1997 Price War	May 1998 - Dec. 1998
Firm P	1.23	1.23	0.77	0.85
Cooperative B	0.51	0.51	0.58	0.64
Cooperative M	0.52	0.52	0.62	0.58

Many theories, usually involving explicit market conditions, exist to explain the cause of cartel price wars. However, Levenstein suggests bargaining price wars occur when a cartel member violates a cartel agreement to gain a more favorable distribution of the rents. This firm

instigates a bargaining price war to force the cartel to negotiate a new equilibrium with a more favorable rent distribution. The price war changes firm expectations and moves the industry to a new equilibrium with a different rent distribution.

The 1982 and 1992 PEC price wars were bargaining price wars involving Cooperative B and Cooperative M. In both instances, Cooperative B attempted to change the distribution of the rents. Cooperative B was unsuccessful in 1982 but was successful in 1992. The Price War of 1997 appears to be a bargaining price war, but upon further review, Firm P had motivation beyond simply altering the distribution of the rents. Explaining the 1997 price war requires an understanding of Firm P's voluntary participation in the PEC cartel. In fact, participation by Firm P is surprising as they were able to free-ride on the PEC over-order premiums from 1956 to 1992. We focus our analysis by explaining Firm P's decision to join using cooperative game theory.

Participation by Proprietary Firms

Since 1980, Firm P's fluid market share had steadily increased from about 10 percent or about 15 million pounds of fluid sales per month, to approximately 20 percent representing 30 million pounds of monthly fluid sales. During this period, the existing PEC members, Cooperative B and Cooperative M, were losing market share, income, and membership to Firm P which was free-riding on the PEC over-order premiums. This loss motivated an effort to force Firm P into the PEC through a state order which would formalize and institutionalize the PEC to include all Michigan fluid milk. The potential effect of proprietary firm fluid milk was significant to the PEC. For example, in January 1992 Firm P's participation in the PEC would have increased revenues by \$362,700.

To model the decision faced by Firm P, a two-player cooperative game is utilized. In the game, the players are Firm P and the existing PEC cartel consisting of Cooperative B and Cooperative M. Players form coalitions if and only if the expected payoff to each member is greater than that player's security level, the payoff a player receives outside the coalition. Therefore, assessing Firm P's conduct requires a comparison of Firm P's PEC payoffs to its security level.

With a fluid utilization of over 90 percent, if Firm P joins the PEC it transfers a significant portion of its premiums to other PEC members which have lower utilization. If Firm P remains outside the PEC, it might reasonably expect to free-ride on the PEC's fluid price and retain premiums as was the case from 1956-1992. Outside the PEC, Firm P's security level, v_p , is the product of the PEC fluid premium, ρ , and its monthly fluid sales, Q_f^P . Formally, this security level may be expressed as:

$$(1) v_p = (Q_f^P)(\rho).$$

If Firm P joins the PEC, it transfers a portion of the premium to the PEC, S^P , which results in fluid payoffs, π_p , of:

$$(2) \pi_p = (Q_f^P)(\rho) - S^P.$$

Firm P joins the PEC in any period if and only if its payoff, π_p , is greater than its security level, v_p . Because $S^P > 0$, then $\pi_p < v_p$, and Firm P rationally remains outside the PEC.

However, Firm P joined the PEC in December 1992. Since this decision is irrational in the above game, that characterization is not complete. Specifically, we have not accounted for the credible threat to profits in the form of a potential state marketing order discussed above. A

state marketing order would make Firm P profits expressed in (2) permanent as the current PEC agreement is not strictly binding law and therefore temporary. Whereas under the current agreement, Firm P deviations to achieve profits from (1) are possible.

Under a state order Firm P profits are:

$$(3) \pi_p^{so} = \sum_i ((Q_p^f)(\rho) - S^P),$$

where this condition holds forever.

In contrast, when Firm P voluntarily joins the PEC, profits are:

$$(4) \pi_p^{PEC} = (\sum_i ((Q_{Pi}^f)(\rho) - S^P) + (\sum_j (Q_{Pj}^f)(\rho))),$$

where the first term represents profits during periods of collusion, i , equal to profits under the state order, and the second term represents profits during deviation from the PEC agreement, j .

Clearly, $\pi_p^{PEC} > \pi_p^{so}$ so the rational decision under threat of a state order is voluntary participation in the PEC.

Of course, the decision is not quite this simple. The state order is not a sure thing. Deviation from the voluntary agreement increases the probability of a state order. Generally, this probability is a function of legislative leadership, political prowess of Michigan cooperatives, public opinion, who holds the governor's office, and many other factors. During periods when Firm P deviates, j , they realize profits expressed in (1). This deviation, or price war, results in increased lobbying effort by the Cooperatives increasing the probability of a state marketing order. When the probability of a state order, and thus the potential that profits will be limited to (3) forever, reaches a critical level, Firm P voluntarily returns to the PEC. If the probability of a state order is low, Firm P rationally remains independent from the PEC. In this way, Firm P's

deviation provides both added profits and information about the probability of a state order to Firm P.

Using this framework, recent conduct of Firm P is easily explained, including the 1997 price war. In 1992, the two Michigan cooperatives were close to receiving legislative approval for a state order. This resulted in Firm P's voluntary participation in the PEC. Realizing that higher profits existed outside the PEC and desiring new information to re-estimate the probability of a state order, Firm P exited the PEC in September 1997. As discussed, Firm P observed the reaction by the cooperatives and state government and formed a new expectation of the state order feasibility. In the spring of 1998, Michigan cooperatives were moving forward with a proposed state order and Firm P voluntarily returned to the fluid cartel agreement.

Conclusions

We examine behavior in the Michigan fluid milk market. Over-order premiums exist because fluid milk demands are inelastic. The fluid premium is worth around \$20.4 million annually to Michigan farmers. Collusion by cooperatives is required to realize these profits. This collusion is allowed under legislation that grants limited anti-trust exemptions to agricultural cooperatives. In absence of collusion, the minimum prices defined by federal milk marketing orders prevails as excess fluid milk is always present.

The distribution of fluid rents has historically been contentious in Michigan resulting in three price wars since 1980. Price wars result in new bargaining positions. Proprietary firms in Michigan joined the fluid milk cartel because of the threat of a state marketing order. Joining the fluid cartel is rational only under the threat of the state-order. Proprietary firms profits may be increased and information gathered in the short run through price wars that result when behavior deviates from collusion.

References

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