

Commodity Policies and Product Differentiation: the California Milk Marketing Order and the Organic Dairy Sector

Abstract

This paper evaluates the economic consequences of milk marketing orders for producers and consumers in organic and conventional milk markets. We develop a multi-market equilibrium displacement model that disaggregates the organic and conventional segments of the California milk market in order to evaluate the economic effects of alternative policies. We find that exemption of organics from marketing order regulation would make organic farmers better off at the expense of conventional farmers, but that complete deregulation would make both organic and conventional farms worse off.

Keywords: California, cartel, dairy, equilibrium displacement model, milk marketing orders, organic, product differentiation

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Milk marketing orders have been a central element of dairy policy in the United States since they were established as part of the Depression-era farm programs of the 1930s. Marketing orders set minimum prices that processors must pay for milk based on end use, implementing a price discrimination scheme (a higher price is set for milk used in beverage products) with revenue pooling. A substantial literature on the economic of milk marketing orders shows that they effectively raise the farm-level price, and thus increase economic surplus for participating dairy farmers (e.g., Ippolito and Masson; Cox and Chavas; Sumner and Wolf).

The finding that all dairy producers benefit from milk marketing orders depends on the assumption that dairy farmers produce a homogeneous product. Indeed, the rationalization for revenue pooling is that all Grade A dairy farms produce the same product and thus should receive a similar price. However, the assumption of a homogenous product has become increasingly tenuous as producers and processors within the dairy sector increasingly use product differentiation (e.g., organic, “traditionally” farmed, grass-fed, regional denominations, etc.) as a means to increase profits (Lansink, Pietola and Backman 2002). This gradual transition away from commodity-oriented agriculture raises questions about the economic consequences of milk marketing orders and other commodity-based farm programs. Specifically, commodity-oriented regulation such as milk marketing orders may have differential effects on different types of producers.

Notably, organic dairy products are differentiated from conventional products by a set of regulations that affect the production process. The National Organic Program (NOP), which was established by the USDA in 1990, restricts the use of certain inputs (e.g., non-organic feed, antibiotics) and mandates the use of other inputs (e.g., organic feed and pasture) (Rawson 2005).

Consumers do not view organic and conventional products as perfect substitutes, as evidenced by significant premiums for organic products (Dhar and Foltz 2005). According to Dhar and Foltz, consumers are willing to pay as much as \$3.00 per gallon more for milk from cows not treated with genetically-modified hormones and antibiotics, and fed organic feed. Yet milk marketing orders do not recognize organic milk as a distinct product. Rather, marketing order regulations apply equally to organic and conventional products. Given that the organic milk market differs from the conventional market in both supply and demand, milk marketing order regulations likely have different implications for prices, quantities, and welfare in organic and conventional milk markets.

Milk marketing order regulation is not the only commodity-oriented policy that may have different implications for producers of differentiated products. Recent manifestations of this conflict include legal challenges to commodity check-offs from producers, and different commodity policy preferences for small and large producers. Generic commodity promotion funded by check-offs have come under legal challenge from producers who are attempting to produce a differentiated product and do not want to be associated with a commodity. In two recent court cases, producers argued that generic advertising hurts producers of higher quality products by sending an unintentional signal to consumers that all generically-advertised brands are of the same quality (Crespi and Marette 2002).

In 2002, a dairy farm filed a lawsuit challenging the constitutionality of the USDA's mandatory dairy promotion program. The farm argued that it uses "traditional" dairy farming methods, meaning no hormones or antibiotics are used on the cows and the cows are grazed feed, and objected to paying the check-off which funded generic advertising for milk because the advertising does not differentiate between conventional and non-conventional milk. The courts

ruled in favor of the plaintiffs stating that “the government may not compel individuals to fund speech or expressive associations with which they disagree” (Pittman 2004). These types of arguments have been made against other commodity based programs including California peach and nectarines, the national beef check-off, and the national pork check-off (Becker 2005). The 2002 Farm Bill contained provisions that exempted any person who produced and marketed only 100 percent organic products from paying assessments under a commodity promotion law.

The California milk marketing order has faced similar legal challenges. In 2002, two organic processors in California filed suit against the California Department of Food and Agriculture to allow for the exemption of organic milk from the California milk marketing order. The plaintiffs argued that the state-imposed revenue pooling effectively required them to subsidize the conventional dairy industry. Furthermore, one of the companies argued that organic consumers pay about \$0.50 per gallon more due to pooling (Johnston 2002). However, in late 2003 the courts ruled against the organic processors and decided that marketing order regulation should treat organic milk similarly as non-organic milk.

This paper attempts to answer the question: Do marketing orders have differential economic effects on organic and conventional producers and consumers? Our specific application is to California milk marketing orders, although some inference extends to federal milk marketing orders. We develop conceptual and simulation models that capture salient features of the regulation and of the markets for organic and conventional milk. We use the models to measure the economic effects of the regulation on organic and conventional milk markets relative to alternative policy scenarios in which (i) organics are exempted from the regulation, and (ii) the regulation is eliminated from both organic and conventional markets.

Background: Federal and California Milk Marketing Orders

Marketing orders are the center piece of a menu of public policies and regulations that have influenced U.S. milk markets since the New Deal-era farm programs. As of 2005, a system of ten federal marketing orders regulated the sale of 60 percent of all milk produced in the country. California, which operates its own marketing order, regulates the sale of 21 percent of the country's milk. Most of the remainder is regulated by other state orders (Maine, Montana, Virginia), and a small portion is unregulated (CDFFA).

Milk marketing orders use price discrimination and revenue pooling to increase returns to dairy farming for participating producers. Marketing orders set minimum prices that processors must pay for raw farm milk based on end-use, raising farm revenue for milk by setting a higher minimum price for milk in the fluid (i.e., beverage) market which has relatively inelastic demand. Milk revenue from all uses is then pooled and an average or blend price is then paid to all producers. Price discrimination and pooling of milk effectively raise the farm-level price, and thus economic surplus, for participating dairy farmers (e.g., Ippolito and Masson 1978; Sumner and Wolf 1996; Cox and Chavas 2001).

Although the California is administered independently of the federal milk marketing orders, it mirrors the federal order in that it has a classified pricing system (prices based on end-use, with fluid milk receiving the highest price), pools the revenues from all milk sales (fluid and manufacturing milk), and distributes the revenues to California dairy producers. As in the federal order, the California order pays producers a monthly blend price that reflects the poolwide (i.e. statewide) milk utilization of all classes. The main difference between the California and Federal order is California's milk quota system. California producers who own quota receive \$0.195 per pound of nonfat solids, or \$1.70 per hundredweight of milk (Sumner

and Wilson 2000). California's quota system can be viewed as a modified pooling mechanism in which the quota is used to distribute a portion of the rents created by price discrimination.

Because marketing orders raise prices to benefit producers, they have been described as a government-sponsored cartel (see, for example, Pindyck and Rubinfeld, p. 456). Unlike other cartels, milk marketing orders do not control supply but raise the average price by law through price discrimination. However, like textbook examples of cartels, the ability of marketing orders to raise the price of milk depends on keeping producers and processors within the order. Defection of producers from marketing orders undermines the regulatory structure. Government enforcement of milk marketing order regulations prevents such defection.

Several authors have examined the effects and social costs associated with milk marketing order regulation. Ippolito and Masson (1978) developed a widely used model of the federal milk marketing order regulation, which built on Kessel's (1967) model of price discrimination. Both Kessel (1967) and Ippolito and Masson (1978) found that marketing orders increase the milk price paid by fluid processors (i.e., Class 1 milk), which increases the blend price for regulated producers and decreases the price paid by manufacturing plants (i.e., Class 2). By raising the Class 1 price, marketing orders reduce consumption of fluid milk; by raising the average producer price, marketing orders increase milk production. Thus, Class 2 production is subsidized as the supply of milk to manufacturing uses increases.

The same basic framework used by Ippolito and Masson (1978) has been adopted by the subsequent literature. Cox and Chavas (2001) and Balagtas and Sumner (2003) extend the basic framework to consider the regional implications of marketing orders. These papers examine the spillover effects that each regional milk marketing order has on producers and consumers in other regions. A key result here is that each marketing order benefits producers in that marketing

order at the expense of producers outside the marketing order, including producers regulated by other marketing order. Sumner and Wolf (1996) used a similar framework to evaluate the economic implications of the California milk marketing order and found that the quota program lead to more milk production than a typical marketing quota program (i.e. supply controls), but less milk production than blend pricing without milk quota (i.e. the federal milk marketing order).

Nearly the entire extant literature on milk marketing order regulation treats assumes dairy farms within each marketing order are homogeneous, with the implication that higher incentive prices for milk make all producers better off. However, farms exhibit heterogeneity in many dimensions, including farm size, production technology, and milk quality, and these differences may have implications for the distribution of welfare effects of milk marketing orders, or other policies, across producers. We build an equilibrium displacement model that distinguishes between organic and conventional (i.e., not organic) milk, a particular type of heterogeneity that is of growing importance in U.S. dairy markets. As discussed above, there has been some pressure from organic producers to be exempted from marketing order regulation, which is itself an indication that marketing orders may have different implications for organic and conventional farms. We apply our model to quantify the effects of California milk marketing order regulation on prices, quantities, and welfare in markets for organic and conventional milk.

Conceptual Model of the California Dairy Industry

Consider a stylized model of the California milk market in which farm milk is sold to two uses, fluid milk and manufacturing milk. Moreover, dairy farms produce two types of milk: conventional milk, which may be used in conventional fluid or manufacturing products, and

organic milk which is used only in organic fluid products. Conventional and organic fluid milk are imperfect substitutes in consumption.

Current California milk marketing order regulation sets the minimum price paid by fluid milk processors as a fixed differential over the processor price for (conventional) manufacturing milk. The fixed differential is, in essence, a per unit tax levied on conventional and organic fluid milk. The regulation does not distinguish between conventional and organic milk. Rather, fluid milk processors of both types pay the differential into a pool. A portion of the tax revenue collected from the fluid milk market is given to owners of quota. The remaining revenue is pooled with manufacturing milk revenue and paid out to producers in the form of a blend price.

Figure 1 illustrates equilibrium in the conventional and organic milk markets under current California milk marketing regulation. In panel a, $D_{cf}^0(W_{cf})$ is the relatively inelastic demand for conventional fluid milk, and demand for manufacturing milk is assumed to be perfectly elastic at price W_{cm}^0 . Under marketing order regulation $W_{cf}^0 = W_{cm}^0 + D$ and is the minimum price that conventional processors must pay for fluid milk. In panel b, $D_{nf}^0(W_{nf})$ is demand for organic milk. Price discrimination drives a wedge, D , between the price organic processors pay, W_{nf}^0 and the price received by organic producers, WB_n^0 . Equilibrium quantity in the organic market is M_{nf}^0 . Tax revenue from the organic market, DM_{nf}^0 , is equal to the area marked by horizontal hash markets.

In panel a of Figure 1, revenue pooling is modeled by adding tax revenue generated from the organic market (again represented by the area with horizontal hash marks) to the tax revenue from the conventional market, DM_{cf}^0 . Of the total pooled revenue from both fluid markets, the portion allocated to quota owners is represented by the area marked by diagonal hash marks. The remaining pool revenue is paid out as an average price to all producers. The equilibrium

average price, or blend price, occurs where the curved line labeled “Blend Price⁰” intersects total milk production (the supply of conventional milk, S_c , plus organic production, M_{nf}^0), at WB_c^0 . The blend price is then the incentive price for conventional dairy farms, resulting in conventional production M_c^0 , of which M_{cf}^0 is supplied to the fluid market and M_{cm}^0 to the manufacturing market. It is assumed here that the price paid to organic producers is higher than the blend price, the difference representing a premium that organic processors pay for organic milk relative to conventional milk; that is, the incentive price for organic farms is $WB_n^0 + OOP$, where OOP is the over-order premium.

Figure 2 graphically depicts market equilibrium under a policy scenario in which organic milk is exempted from the milk marketing order (we refer to this scenario as Scenario 1). In panel b, elimination of the implicit tax, D , decreases the price processors pay for organic milk and increases the organic farm price. Organic market equilibrium is price W_{nf}^1 and quantity M_{nf}^1 . Both organic producers and consumers benefit from the policy change. Producer surplus for organic farms increases as farm prices rise, and consumers benefit from reduced prices.

In panel a of Figure 2, exemption of organics reduces pool revenue, resulting in a lower blend price. The downward shift of the blend price curve causes the blend price to drop in the equilibrium from WB_c^0 to WB_c^1 , and a reduction in conventional milk production from M_c^0 to M_c^1 .

For ease of exposition, this graphical analysis makes two simplifying assumptions that mask potentially important effects of exempting organics from the marketing order. First, the graphical analysis ignores the cross-price effects in demand for conventional and organic fluid milk. Allowing for substitution in demand for organic and conventional fluid milk, the lower consumer price of organic milk resulting from organic exemption would cause a reduction in

conventional fluid milk demand and thus exacerbate the negative effects of organic exemption on conventional dairy farms. At the same time, the lower price of conventional fluid milk would decrease demand for organic milk, and thus make organic exemption less beneficial to organic dairy farms than if organic and conventional milk products were unrelated in demand.

Second, the stylized graphical analysis takes demand for conventional manufacturing to be perfectly elastic. In fact, with downward-sloping demand for manufacturing milk, the reduction in conventional milk production, which causes a reduction in the quantity of milk sold to the manufacturing market, would cause an increase in the price of manufacturing milk. The conventional fluid milk price would also rise, given the fixed fluid milk differential.

Both of these simplifying assumptions are relaxed in the numerical simulation model developed below.

Figure 3 illustrates the competitive market equilibrium under an alternative policy scenario that eliminates the California milk marketing order and results (we refer to this scenario as Scenario 2). Equilibrium in each market is found at the intersection of supply and demand. In the organic market, the equilibrium is similar to that in Figure 2. In the absence of government-enforced price discrimination, all conventional milk receives the same price regardless of end-use. In the conventional market, total demand is the horizontal sum of the two demand curves, resulting in price W_{cm}^0 , production M_c^2 , and conventional fluid milk consumption M_{cf}^2 .

Here again, however, the simplifying assumptions discussed above—no cross-price effects in demand and perfectly elastic demand for manufacturing milk—have important implications for the economic effects of deregulation. The assumption of no cross-price effects in demand can be particularly important, given the potentially large changes in relative fluid milk prices. Allowing for cross-price effects, the reductions in the price of conventional milk causes a

decrease in demand for organic milk, and the reduction in the price of conventional milk causes an increase in demand for conventional milk. Cross-price effects have particularly important implications for the organic market. Deregulation of the California marketing order would cause a large decrease in the price of conventional milk, causing a reduction in demand for organic milk, the magnitude of which depends on the degree of substitution between conventional and organic milk. Indeed, the effect of deregulation on the producer price of organic milk, and thus on organic producer welfare, is ambiguous.

In the numerical simulation model that follows, both of these simplifying assumptions are relaxed, and the economic effects of the alternative policies are quantified.

Empirical Model of the California Dairy Industry

We develop a multi-market equilibrium displacement model (EDM) of the California milk market for the purpose of measuring the implications of removing organic milk from the marketing order and the full elimination for the California marketing order (see Alston, Norton, and Pardey 1995 for a thorough treatment of equilibrium displacement models). In this section we describe the model. In the next section we present model parameters and simulate the effects of the organic milk market on the California milk marketing order.

We disaggregate horizontally-linked dairy markets, with explicit supply and demand equations for conventional fluid milk, conventional manufactured products, and organic fluid milk. For each of these products, the vertical relationships that link farm production to retail demand are modeled (i.e. farm, processor, and retail levels). The link between the conventional and organic markets is that consumers view the two as imperfect substitutes. Finally, milk marketing order regulation—price discrimination, the California milk quota, and revenue pooling—are all represented in the model.

In the EDM, we disaggregate the milk by production method, conventional, c , and organic, n , and allow for the use of milk in the manufacture of two distinct dairy products, fluid products, f , and manufactured products, m . For organic milk we assume that all raw milk is used in fluid products. This assumption abstracts from the small portion of organic milk used to produce manufactured products. However, the vast majority of organic milk is sold to the fluid market. Additional assumptions of the model include fixed proportions technology in the production of dairy products and perfectly competitive dairy markets in the absence of marketing order regulation. That is, it is assumed that neither producers, processors, nor consumers exercise market power in unregulated dairy markets.

The multi-market model is written in general form as follows:

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|------|-------------------------------------------------------------|---------------------------------------------|
| (1) | <i>Farm supply of conventional milk</i> | $MT_c = M_c(WB_c)$ |
| (2) | <i>Farm supply of organic milk</i> | $MT_n = M_n(WB_n)$ |
| (3) | <i>Production of conventional fluid products</i> | $X_{cf} = \gamma_{cf}M_{cf}$ |
| (4) | <i>Production of conventional manufactured products</i> | $X_{cm} = \gamma_{cm}M_{cm}$ |
| (5) | <i>Production of organic fluid products</i> | $X_{nf} = \gamma_{nf}M_{nf}$ |
| (6) | <i>Retail demand for conventional fluid products</i> | $X_{cf} = X_{cf}(P_{cf}, P_{nf})$ |
| (7) | <i>Retail demand for conventional manufactured products</i> | $X_{cm} = X_{cm}(P_{cm})$ |
| (8) | <i>Retail demand for organic fluid products</i> | $X_{nf} = X_{nf}(P_{nf}, P_{cf})$ |
| (9) | <i>Conventional milk adding up condition</i> | $MT_c = M_{cf} + M_{cm}$ |
| (10) | <i>Organic milk adding up condition</i> | $MT_n = M_{nf}$ |
| (11) | <i>Pricing of conventional fluid products</i> | $W_{cf} = \gamma_{cf} [P_{cf} - MAKE_{cf}]$ |
| (12) | <i>Pricing of conventional manufactured products</i> | $W_{cm} = \gamma_{cm} [P_{cm} - MAKE_{cm}]$ |
| (13) | <i>Pricing of organic fluid products</i> | $W_{nf} = \gamma_{nf} [P_{nf} - MAKE_{nf}]$ |

- (14) *Price discrimination for conventional milk* $W_{cf} = W_{cm} + D$
- (15) *Price paid by processors for organic milk* $W_{nf} = WB_n + \theta D$
- (16) *Pooled quantity of milk* $MPOOL = MT_c + \theta MT_n$
- (17) *Pooled milk revenue* $TR = M_{cf}W_{cf} + M_{cm}W_{cm} + \theta(M_{nf}W_{cf})$
- (18) *Pooled milk revenue less quota revenue* $PR = TR - QR$
- (19) *Conventional blend price of milk* $WB_c = PR / MPOOL$

Equations (1) and (2) express the farm supplies of conventional and organic milk, M_i , $i = (c, n)$, as a function of the farm prices of milk, WB_i , $i = (c, n)$. Equations (3)-(5) are the fixed-proportion production functions that transform raw milk into dairy products, X_{ij} , where γ_{ij} is the marginal product of milk for production method i and product j , $i = (c, n)$, $j = (f, m)$.

Equations (6)-(8) are the retail demands for dairy products. Demands for organic and conventional fluid dairy products are interdependent, as each demand function is a function of the retail prices for both fluid products, P_{cf} and P_{nf} . Conventional manufacturing demand is expressed as a function of the retail price of milk used in manufacturing products, P_{cm} , and fluid and manufacturing products are assumed to be unrelated in demand.

Equations (9) and (10) are adding-up conditions such that supply equals demand for each type of milk. Equations (11)- (13) express the competitive equilibrium condition for milk, that the price paid by processors for milk in fluid or manufactured products is equal to the value of the marginal product of milk less the manufacturing costs, or make allowance (*MAKE*), for that particular dairy product. Equation (14) captures price discrimination by the California milk marketing order, which raises the price of milk paid by conventional fluid processors by a fixed mark-up, D_c , over the price paid for manufacturing milk. Similarly, equation (15) expresses

price discrimination by the marketing order in organic markets. Under our assumption of no manufacturing organic milk, price discrimination essentially acts as a tax that drives a wedge between the price processors pay for organic milk and the price organic farms receive.

Parameter θ is a dummy variable that equals one if organic milk is included in the marketing order, as it is in the status quo, and zero otherwise. Equation (16) calculates the total quantity of milk in the California marketing order, or as it is commonly referred to as “the pool.” Under current policy the pool includes all conventional and organic milk produced within the state. Equation (17) is total milk revenue pooled under the regulation. Equation (18) is pool revenue, or the residual revenue after the quota revenue, QR , has been removed to pay quota owners. Equation (19) defines the blend price of milk paid to conventional producers under the marketing order regulation.

Measuring the Effects of Alternative Policies

Simulation of the model is used to quantify the effects of California milk marketing regulation.

The status quo policy is compared to two alternative policies:

1. Exemption of organic milk from the California marketing order, with the regulation applied only to conventional milk.
2. Full elimination of the California marketing order.

Exemption of organics from the marketing order (alternative policy Scenario 1) is simulated by setting $\theta = 0$. Full elimination of the California marketing order (alternative policy Scenario 2) is simulated by eliminating price discrimination ($D = 0$) and eliminating quota revenue ($QR = 0$), in addition to $\theta = 0$.

Our simulations assume locally linear functional forms for farm supply of milk (equations (1) and (2)) and retail demand (equations (6)-(8)). The model is calibrated to 2005

data on California milk markets, and parameterized using supply and demand elasticities drawn, wherever possible, from agricultural economic literature. Data were obtained from the California Department of Food and Agriculture, and are summarized in Table 1. No data are available on production of organic milk; however, estimates on market share are available. The California Certified Organic Farmers Association (CCOF) estimated that the organic market share in California was approximately three percent in 2006. Thus, for the purpose of this study we estimate that organic production is three percent of the conventional farm production. Additionally, no data is available for organic prices. The organic processor price for organic fluid milk is estimated to be a mark-up of 45 percent over their conventional counterpart, a figure we obtained from private correspondence with officials at the CDFA. Using this mark-up, the organic farm price in the base model is \$21.51 per hundredweight. Based on observed retail prices, the organic retail price is estimated to be \$7 per gallon.

An intermediate time range for supply elasticity of three to seven years is used to allow producers to adjust to permanent regulation changes. With this time frame, adjustments in milk production due to changes in prices and regulation modifications should be seen. Chavas and Klemme (1986) estimated supply elasticities to range of 0.22 and 1.41 for this time period. In their research, Ippolito and Masson (1978) used an estimated range of 0.4 to 0.9. Sumner and Wolf (1996) used a range of 0.5 to 2.0 for their 1996 study on California dairy policy. Cox and Chavas (2001) used a milk supply elasticity estimate of 0.37. Balagtas and Sumner (2003) used an elasticity of supply of 1.0 for their study. Chen, Courtney, and Schmitz (1972) estimated supply elasticity to be 2.53. In this study we use a supply elasticity of 1.0 for conventional milk. Based on previous work that has found organic milk supply to be less elastic than

conventional supply (e.g., Glaser and Thompson 2000), we assume an organic supply elasticity of 0.5.

Estimates of own-price elasticity of demand for fluid milk range from -0.34 (Ippolito and Masson 1978) to -0.076 (Helmberger and Chen 1994). For manufacturing milk, demand elasticities range from -0.35 (Helmberger and Chen 1994; Dahlgran 1980) to -0.2 (Ippolito and Masson 1978; Balagtas and Sumner 2003). However, these studies do not estimate potential cross-price effects in demand for organic and conventional milk. To compute own- and cross-price elasticities of demand for fluid milk we adopt an Armington demand specification in which consumers distinguish between organic and conventional milk production processes and view these two types of milk as imperfect substitutes. The resulting own- and cross-price elasticities follow the well-know Armington forms:

$$(20) \quad \text{Own-price elasticity} \quad \eta_{ii} = \eta v_i - \sigma(1 - v_i), \quad i = (\text{organic, conventional})$$

$$(21) \quad \text{Cross-price elasticity} \quad \eta_{ij} = \eta v_j - \sigma v_j, \quad i \neq j,$$

where η_{ii} denotes own-price elasticity of demand for milk type i ; η_{ij} is the cross-price elasticity of demand for milk type i with respect to the price of milk type j ; η is the own-price elasticity for all milk; v_i is the milk type i 's share of all milk expenditure; and σ is the elasticity of substitution between organic and conventional milk. Based on the literature, we assume an own-price elasticity for all milk = -0.4. Further, we assume an elasticity of substitution equal to 1.0. The own-and cross-price elasticities resultling from these assumptions and an expenditure share of 0.68 for conventional milk in 2005 are reported in Table 2.

Estimates of demand elasticities for manufactured milk range from -0.35 (Helmberger and Chen 1994; Dahlgran 1980) to -0.2 (Ippolito and Masson 1978; Balagtas and Sumner 2003). In this analysis the elasticity of the national demand for manufacturing milk is assumed to be -

0.3. The elasticity of manufacturing milk demand facing California is calculated as the elasticity of excess demand facing California:

$$(22) \quad \eta^{CA} = \frac{1}{s^{CA}} \eta^{US} + \left(1 - \frac{1}{s^{CA}}\right) \epsilon^{ROC},$$

where η^i is the demand elasticity in i ($i = \text{California, United States}$), ϵ^{ROC} is the milk supply elasticity from all United States producers minus California, and s^{CA} is California's share of United States manufacturing milk. Given a supply elasticity of 1.0 and a national demand of -0.3, the elasticity of demand for manufacturing milk facing California is -5. Manufacturing milk demand elasticity facing California is more elastic than the United States because California producers face a higher level of competition that includes the United States and the world.

Supply and demand elasticities used in the model are reported in Table 2.

Results

Table 3 reports the simulated annual effects of the two alternative dairy policies: scenario 1, the exemption of organic milk from the marketing order; and scenario 2, the full elimination of the California milk marketing order. For both scenarios, the table reports the equilibrium changes in prices and quantities of milk and dairy products, as well as in producer and consumer surplus for both conventional and organic markets, relative to the status quo.

Exemption of organic milk from the California milk marketing order would eliminate the implicit tax on the sale of organic milk, thus increasing the price received by organic farmers and decreasing the price paid by organic processors. Farm-level prices of organic milk rise by \$0.951 per hundredweight, or 4.7 percent. Organic processors see a decrease of \$2.300 per hundredweight, or 9.7 percent. Organic milk production rises by 0.250 million hundredweight, or 2.3 percent. In turn, lower processor prices for organic milk result in lower prices and increased consumption of organic milk at retail. Retail prices of organic milk decrease by

\$0.198 per gallon, or 2.8 percent, and consumption of organic milk increases by 2.897 million gallons, or 2.3 percent.

Exemption of organics from the marketing order causes a decrease in demand for conventional fluid milk, resulting in lower milk production and a reduction in the share of conventional milk sold to fluid uses. The reduction in total milk production causes minimum class prices all uses rises by \$0.032 per hundredweight. However, the share of milk sold to conventional products rises, causing a net reduction in the conventional blend price of \$0.059 per hundredweight, or 0.5 percent. Conventional production falls by 1.690 million hundredweight, or 0.5 percent. With the small increase in farm prices, retail prices of conventional milk and dairy products rise, although almost imperceptibly. The small increase in retail prices, together with a decrease in demand for conventional dairy products, causes a reduction in consumption of conventional dairy products. Consumption of conventional fluid milk falls by 3.897 million gallons, or 0.6 percent and consumption of conventional manufactured dairy products made in California falls by 13.812 million pounds, or 0.4 percent.

Exemption of organic milk from the marketing order makes organic producers better off. Organic dairy producer surplus rises by \$10.29 million per year. However, conventional dairy producers are made worse off, as producer surplus for conventional farms declines by \$22.21 million annually. Fluid milk consumers as a group are better off as a result of reduced prices for organic milk, while consumers of manufactured dairy products are also made worse off.

Full elimination of California's milk marketing order regulation removes the price differential between conventional fluid-use and manufacturing-use milk, so that a single price prevails for conventional milk in all uses. The price paid by conventional fluid milk processors falls by \$3.150 per hundredweight, while the price paid by manufacturing processors falls by

\$0.100 per hundredweight. The retail price of conventional fluid milk falls by \$0.272 per gallon, or 9.8 percent, and consumption of conventional fluid milk increases by 32.431 million gallons, or 5.0 percent. The quantity of manufacturing milk decreases by 0.059 million hundredweight, or 0.5 percent, as more milk is allocated to fluid uses. The price received by conventional dairy farms falls by \$0.051 per hundredweight, or 0.4 percent. Lower incentive prices for conventional farms cause conventional farm production to fall by 1.459 million hundredweight, or 0.4 percent.

Elimination of the California milk marketing order results in lower retail prices for organic milk, but also causes a reduction in the retail price of conventional fluid milk, which, in turn, causes a reduction in demand for organic milk. On net we find that retail consumption of organic milk falls by 0.687 million gallons, or 0.6 percent, despite a lower organic price. Farm production of organic milk falls by 0.059 million hundredweight, or 0.5 percent. Elimination of price discrimination, together with reduced demand for organic milk, causes the farm price for organic milk to fall by \$0.225 per hundredweight, or 1.1 percent.

Notably, and in contrast to the organic exemption scenario, organic dairy farmers are made worse off by the elimination of the marketing order; organic producer surplus falls by \$2.4 million per year. This result is driven by the substitution between organic and conventional milk in consumption, and the lower price for conventional milk caused by the elimination of the marketing order. Elimination of the marketing order eliminates the implicit tax on organic milk, but also does the same for conventional milk, resulting in reduced demand for organic milk. We find that the net effect is decreased consumption of organic milk and lower prices for organic dairy farmers.

Lower farm prices for conventional milk cause a reduction in conventional producer surplus of \$19.18 million. In addition, quota owners lose the annual value of the quota, \$159.63 million. Aggregating these losses (and thus ignoring the distribution of quota rents across conventional farmers), conventional farmers as a group stand to lose \$242.8 million per year from elimination of the marketing order.

Not surprisingly, fluid milk consumers are the main beneficiaries of deregulation. Retail prices for both conventional and organic milk fall, and total consumption of fluid milk rises. Consumer surplus for all fluid consumers rises by \$242.81 million per year. This result is consistent with previous research that has shown that marketing orders harm the consumer.

Conclusion

This study examines the likely economic consequences of changes in California milk marketing order regulation for two related market segments: conventional and organic. An equilibrium displacement model is developed that explicitly allows for differentiated products (conventional and organic) in order to evaluate the effects of policy on the two markets. Results from the simulation analysis indicate that producers of organic milk would be made better off by a policy that exempted organics from milk marketing order regulation. Exemption of organics from marketing order regulations results in higher farm prices of organic milk, lower processor prices of organic milk, lower consumer prices for organic products, and increased production and consumption of organic milk. At the same time, exemption of organics from marketing order regulation reduces pool revenue, thereby decreasing the blend price received by conventional producers. That is, exemption of organics from marketing order regulation reduces the regulatory benefits for conventional producers.

However, a different story emerges from results from a simulation in which the California marketing order regulation is eliminated for both conventional and organic markets. We find that elimination of the marketing order makes organic producers worse off. This result is driven by the substitution of conventional fluid milk and organic fluid milk in consumption. Previous research has shown that marketing orders raise the price of fluid milk which in turn causes fluid consumption to fall (Kessel 1967; Ippolito and Masson 1978). Organic producers benefit from the high price of conventional fluid milk caused by the marketing order. However, elimination of the marketing order causes a reduction in retail prices for conventional fluid milk, which, in turn, causes a reduction in demand for organic milk. In addition to making organic producers worse off, the elimination of the California marketing order also harms conventional dairy farmers, whether or not they own quota. Thus, deregulation makes both organic and conventional producers worse off.

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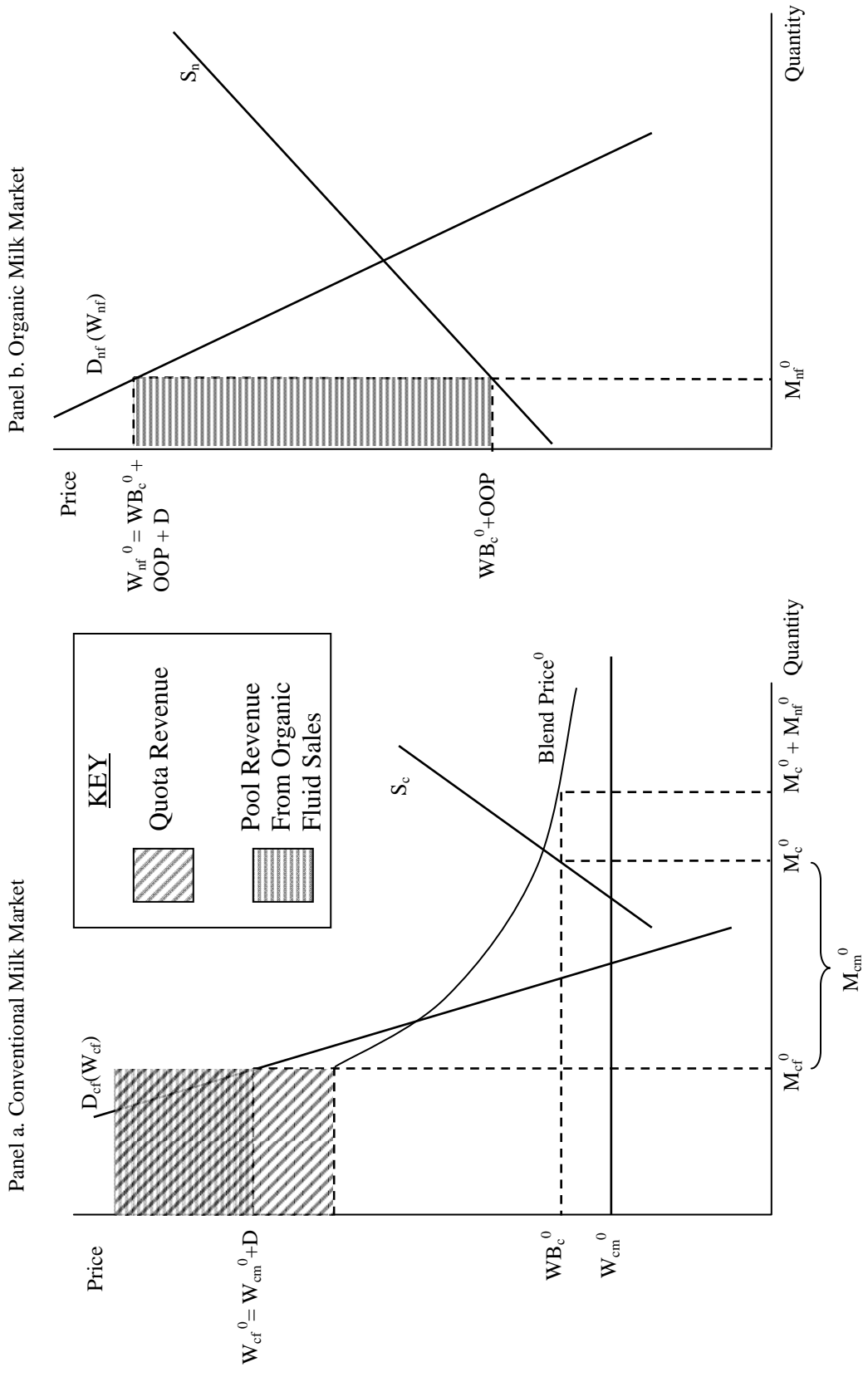
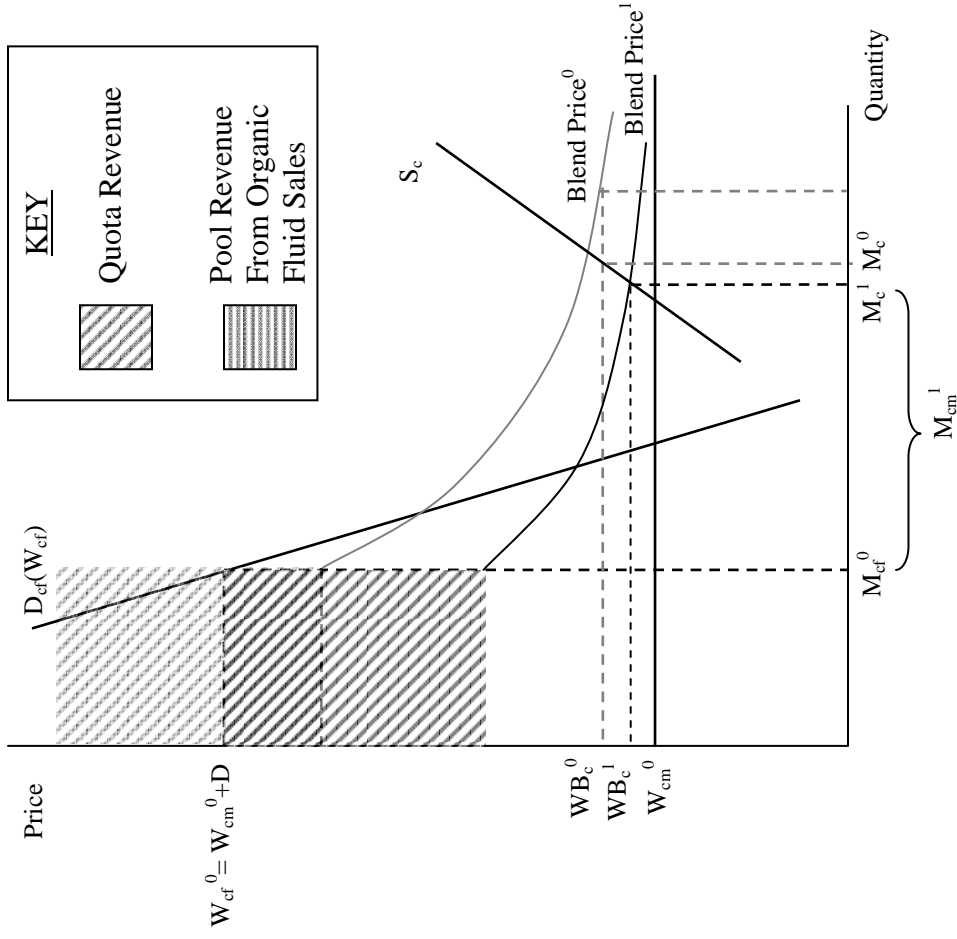


Figure 1. Milk Market Equilibrium under Current California Milk Marketing Order Regulation

Panel a. Conventional Milk Market



Panel b. Organic Milk Market

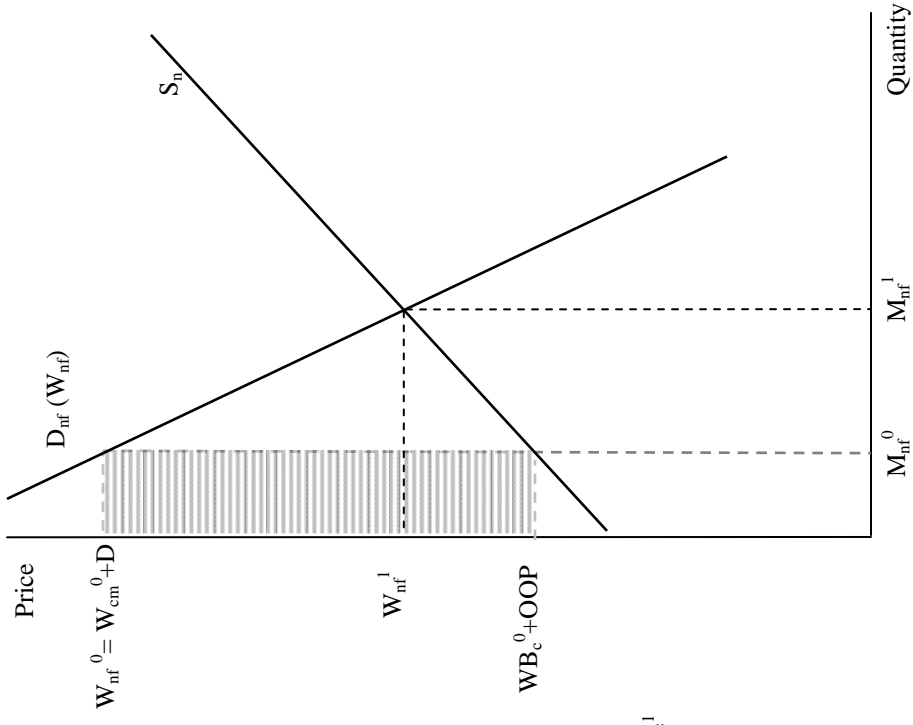


Figure 2. Milk Market Equilibrium under Scenario 1—Exemption of Organic Milk from Marketing Order Regulation

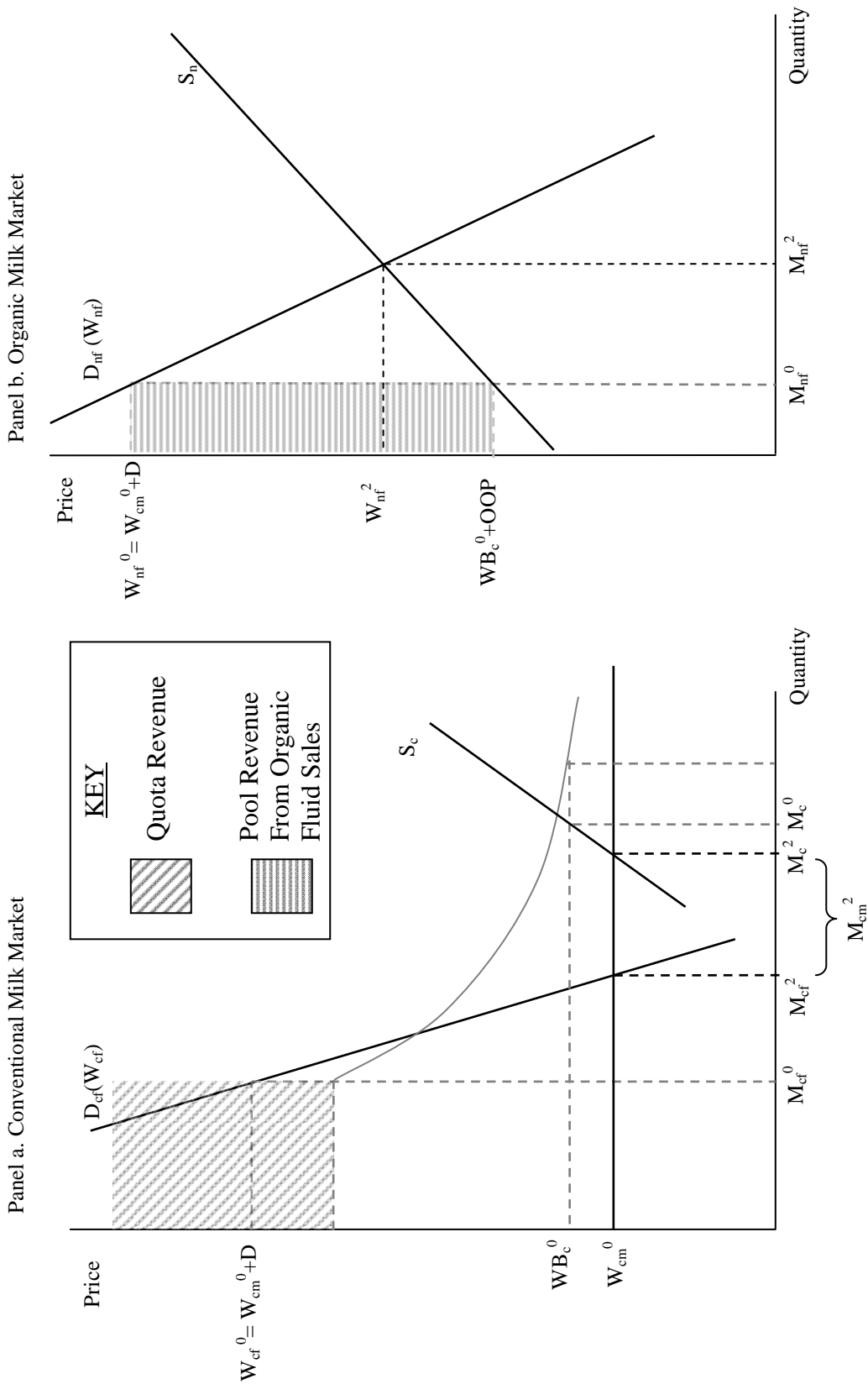


Figure 2. Milk Market Equilibrium under Scenario 2—Elimination of the California Marketing Order

Table 1. California Dairy Market Data, 2005

PRICES	
Retail Organic Fluid (\$/gal)	7.00
Retail Conventional Fluid (\$/gal)	2.77
Retail Conventional Mfg (\$/lb)	3.66
Processor Organic Fluid (\$/cwt)	23.61
Processor Conventional Fluid (\$/cwt)	15.74
Processor Conventional Mfg (\$/cwt)	13.70
Farm Organic (\$/cwt)	21.57
Farm Conventional (\$/cwt)	13.64
Organic Premium (\$/cwt)	7.93
QUANTITY	
Retail Organic Fluid (millions of gallons)	124.16
Retail Conventional Fluid (millions of gallons)	611.26
Retail Conventional Mfg (millions of lbs.)	3,101.57
Production Organic Fluid (millions of cwt)	10.70
Production Conventional Fluid (millions of cwt)	52.70
Production Conventional Fluid (millions of cwt)	304.08
Milk Supply Organic (millions of cwt)	10.70
Milk Supply Conventional (millions of cwt)	356.77
REVENUE (millions of \$)	
Total Revenue	5,163.72
Pool Revenue	5,004.09
Quota	159.63

Source: CDFA, and authors calculations.

Table 2. Supply and Demand Elasticities Used in Simulations

	Organic Milk	Conventional Milk
Elasticity of:		
Farm Supply of Milk	0.5	1.0
Retail fluid Milk Demand		
Own price	-0.81	-0.59
Cross price	0.41	0.19
Retail Manufacturing Milk Demand		
National Demand		-0.3
Regional Demand		-5.0

Demand and supply elasticities reflect published estimates based on Chen, Courtney, and Schmitz 1972; Ippolito and Masson; Dahlgran 1980; Chavas and Klemme 1986; Helmberger and Chen 1994; Cox and Chavas 2001; Balagtas and Sumner 2003, as well as an Armington demand structure for organic and conventional milk, in which the own-price elasticity of demand for all milk is -0.4, and the elasticity of substitution between organic and conventional milk is 1.0.

Table 3. Simulated Effects of Scenarios 1 and 2 on Prices, Quantities, and Welfare in California Milk Markets Relative to the Status Quo

	Scenario 1: Organic Exemption		Scenario 2: Deregulation	
	LEVEL CHANGE	% CHANGE	LEVEL CHANGE	% CHANGE
PRICES				
Retail Conventional Fluid (\$/gal)	0.003	0.1	-0.272	-9.8
Retail Organic Fluid (\$/gal)	-0.198	-2.8	-0.300	-4.3
Retail Conventional Mfg (\$/lb)	0.003	0.1	-0.010	0.3
Processor Conventional Fluid (\$/cwt)	0.032	0.2	-3.150	-19.4
Processor Organic Fluid (\$/cwt)	-2.300	-9.7	-3.475	-14.7
Processor Conventional Mfg (\$/cwt)	0.032	0.2	0.100	0.8
Farm Conventional (\$/cwt)	-0.059	-0.5	-0.051	-0.4
Farm Organic (\$/cwt)	0.951	4.7	-0.225	-1.1
QUANTITY				
Retail Conventional Fluid (mil. gal.)	-3.897	-0.6	32.491	5.0
Retail Organic Fluid (mil. gal.)	2.897	2.3	-0.687	-0.6
Retail Conventional Mfg (mil. lbs)	-13.812	-0.4	-43.452	-1.3
Conventional Fluid Utilization (mil. cwt)	-0.336	-0.6	2.801	5.0
Organic Fluid Utilization (mil. cwt)	0.250	2.3	-0.059	-0.6
Conventional Mfg Utilization (mil. cwt)	-1.354	-0.4	-4.260	-1.3
Conventional Farm Milk Production (mil. cwt)	-1.690	-0.5	-1.459	-0.4
Organic Farm Milk Production (mil. cwt)	0.250	2.3	-0.059	-0.6
ECONOMIC WELFARE				
Producer Surplus				
Organic Dairy Farms	10.29		-2.40	
Conventional Dairy Farms	-22.21		-140.45 ^a	
Fluid Milk Consumer Surplus	10.50		242.81	
Manufacturing Milk Consumer Surplus	-10.09		-31.59	
Total Surplus	-11.51		68.37	

a/ Includes the foregone quota rents worth \$159.63 million per year. Counting quota owners separately from conventional milk producers, conventional milk producers would gain \$19.18 million from elimination of the California milk marketing order.