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Impact of National Generic Dairy Advertising on Dairy Markets, 1984–95

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ABSTRACT

The impacts of generic dairy advertising on retail, wholesale, and farm dairy markets are estimated in this study at the national level. The results indicate that generic dairy advertising had a major impact on retail, wholesale, and farm markets for the dairy industry. The main conclusion of the study is that farmers are receiving a high return on their investment in generic dairy advertising, i.e., an average rate of return of $3.40 for every dollar invested over the period 1984–95. Moreover, the return on investment in advertising was higher in the most recent year, almost double the average for the previous 11 years.

Key Words: dairy, generic advertising, industry econometric model, simulation.

Dairy farmers pay a mandatory assessment of 15¢ per hundred pounds of milk marketed in the continental United States to fund a national demand expansion program. The aims of this program are to increase consumer demand for milk and dairy products, enhance dairy farm revenue, and reduce the amount of surplus milk purchased by the government under the Dairy Price Support Program. Legislative authority for these assessments, which exceed $200 million annually, is contained in the Dairy and Tobacco Adjustment Act of 1983. To increase milk and dairy product consumption, the National Dairy Promotion and Research Board (NDPRB) was established to invest in generic dairy advertising and promotion, nutrition research, education, and new product development.

The purpose of this study is to estimate the impacts of the NDPRB generic advertising effort on the U.S. dairy industry. The model used is based on a dynamic econometric model of the U.S. dairy industry estimated using quarterly data from 1975 through 1995, and is unique from previous models of the U.S. dairy sector in its level of disaggregation. For instance, the dairy industry is divided into retail, wholesale, and farm markets, and the retail and wholesale markets separately include fluid milk, cheese, butter, and frozen products. Econometric results are used to simulate market conditions with and without the national program.

The results of this study are important for dairy farmers and policy makers given that the dairy industry has the largest generic promotion program of all U.S. agricultural commodities. Moreover, since the constitutionality of some commodity promotion organizations (including dairy) is currently being challenged in court, measurements of the economic impacts of generic advertising are particularly important at this time. Hence, this study provides information that may help the discussion in

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future legal debates concerning commodity promotion programs.

Conceptual Model

There has been a great deal of research on the impacts of generic dairy advertising. For example, in an annotated bibliography of generic commodity promotion research, Ferrero et al. listed 29 economic studies on dairy over the period 1992–96. Some of this research has been at the state level, with New York state being studied extensively (e.g., Kinnucan, Chang, and Venkateswaran; Kaiser and Reberte; Reberte et al.). These studies have used single-equation techniques to estimate demand equations, usually for fluid milk, as functions of own price, substitute price, income, population demographics, and advertising. There have been several recent national studies conducted as well (e.g., Blisard and Blaylock; Liu et al. 1990; Cornick and Cox; Suzuki et al.; Wohlgenant and Clary). Of these analyses, the most disaggregated in terms of markets and products is that of Liu et al. (1990), who developed a multiple-market, multiple-product dairy industry model to measure the impacts of fluid milk and manufactured dairy product generic advertising.

The econometric model presented here is similar in structure to the industry model developed by Liu et al. (1990, 1991). Following Liu et al. (1990, 1991), the current study employs a partial equilibrium model of the domestic dairy sector (with no trade) that divides the dairy industry into retail, wholesale, and farm markets. However, while Liu et al. (1990, 1991) classified all manufactured products into one category (Class III), the present model disaggregates manufactured products into three classes: frozen products, cheese, and butter. This greater degree of product disaggregation provides for additional insight into the impacts of advertising on individual product demand, e.g., cheese, butter, and frozen product demand.

In the farm market, Grade A (fluid eligible) milk is produced by farmers and sold to wholesalers. The wholesale market is disaggregated into four submarkets: fluid (beverage) milk, frozen products, cheese, and butter.[1] Wholesalers process the milk into these four dairy products and sell them to retailers, who then sell the products to consumers. The model assumes that farmers, wholesalers, and retailers behave competitively in the market. This assumption is supported empirically by two recent studies. Liu, Sun, and Kaiser estimated the market power of fluid milk and manufacturing milk processors, concluding that both behaved quite competitively over the period 1982–92. Suzuki et al. measured the degree of market imperfection in the fluid milk industry and found the degree of imperfection to be relatively small and declining over time.

It is assumed that the two major federal programs that regulate the dairy industry (federal milk marketing orders and the Dairy Price Support Program) are in effect. Since this is a national model, it is assumed that there is one federal milk marketing order regulating all milk marketed in the nation. The federal milk marketing order program is incorporated by restricting the prices wholesalers pay for raw milk to minimum class prices. For example, fluid milk wholesalers pay the higher Class I price, while cheese wholesalers pay the lower Class III price.[2] The Dairy

[1] All quantities in the model are expressed on a milkfat equivalent (me) basis. Consequently, nonfat, dry milk was not considered in the model.

[2] Until recently, there was no uniform classification of raw milk among federal milk marketing orders in the United States. Some orders utilized a two-class pricing system for raw milk (Class I = beverage milk, Class II = manufactured milk), while others used a three-class pricing system (Class I = beverage milk, Class II = soft manufactured products, and Class III = hard manufactured products). Today, all federal milk marketing orders utilize four product classes, with Class I being fluid products, Class II being soft dairy products, Class III being mostly hard dairy products, and Class IIIa being nonfat, dry milk. The current model assumes a two-class pricing system for raw milk, which is a valid assumption for the wholesale fluid, cheese, and butter equations in the model. However, the Class II price should be used for the wholesale frozen product supply equation. Unfortunately, for much of the 1975–95 period, it is difficult to get a national average Class II price. Moreover, the Class II price, for most of this period, was usually only marginally higher than the Class III price, ranging from

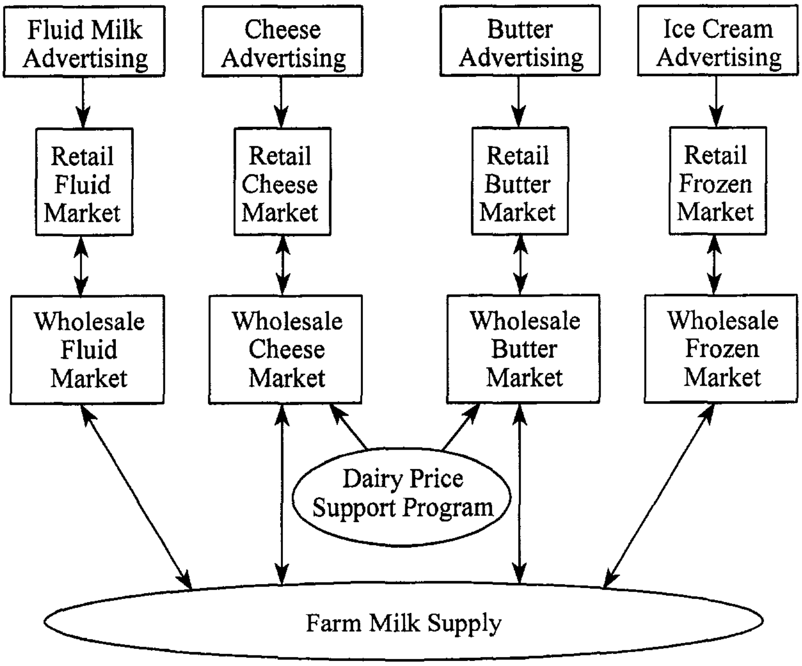

Figure 1. Conceptual overview of U.S. dairy industry model

Price Support Program is incorporated into the model by restricting the wholesale cheese and butter prices to greater than or equal to the government purchase prices for these products. With the government offering to buy unlimited quantities of storable manufactured dairy products at announced purchase prices, the program indirectly supports the farm milk price by increasing farm-level milk demand. A conceptual overview of the model is presented in figure 1.

Retail markets are defined by sets of supply and demand functions, in addition to equilibrium conditions that require supply and demand to be equal. Since the market is disaggregated into fluid milk, frozen products, cheese, and butter, there are four sets of these equations, with each set having the following general specification:

$$(1.1) \quad RD = f(RP \mid S^{rd}),$$

$$(1.2) \quad RS = f(RP \mid S^{rs}),$$

$$(1.3) \quad RD = RS \equiv R^*,$$

zero to 20¢ higher than the Class III price. Therefore, this assumption is not much of a departure from reality.

where RD and RS are retail demand and supply, respectively, RP is the retail own price, S^{rd} is a vector of retail demand shifters including generic advertising, S^{rs} is a vector of retail supply shifters including the wholesale own price, and R^* is the equilibrium retail quantity.

The wholesale market is also defined by four sets of supply and demand functions, and equilibrium conditions. The wholesale fluid milk and frozen product markets have the following general specification:

$$(2.1) \quad WD = R^*,$$

$$(2.2) \quad WS = f(WP \mid S^{ws}),$$

$$(2.3) \quad WS = WD \equiv W^* \equiv R^*,$$

where WD and WS are wholesale demand and supply, respectively, WP is the wholesale own price, and S^{ws} is a vector of wholesale supply shifters. In the wholesale fluid milk supply equation, S^{ws} includes the Class I price, which is equal to the Class III milk price (i.e., the Minnesota-Wisconsin price) plus a fixed fluid milk differential. In the frozen products, cheese, and butter wholesale supply functions, S^{ws} includes the Class III price, which is the most important variable cost to dairy processors. Note that the wholesale level demand functions do not have to be estimated since the equilibrium conditions constrain wholesale demand to be equal to the equilibrium retail quantity. The assumption that wholesale demand equals retail quantity implies a fixed-proportions production technology. Research by Wohlgenant and Haidacher suggests this may not be a realistic assumption. Unfortunately, the data used as a proxy for national demand are commercial disappearance figures which do not distinguish between wholesale and retail-level demand. Consequently, this assumption is necessary.

The direct impacts of the Dairy Price Support Program occur at the wholesale cheese and butter markets level. It is at this level that the Commodity Credit Corporation (CCC) provides an alternative source of demand at announced purchase prices. In addition, cheese and butter can be stored as inventories, which represent another source of demand not present with the other two products. Consequently, the equilibrium conditions for the butter and cheese wholesale markets are different than those for the fluid milk and frozen wholesale markets. The wholesale cheese and butter markets have the following general specification:

$$(3.1)\quad WD = R^*,$$

$$(3.2)\quad WS = f(WP \mid S^{ws}),$$

$$(3.3)\quad WS = WD + \Delta INV + QSP \equiv Q^w,$$

where WD and WS are wholesale demand and supply, respectively, WP is the wholesale own price, S^{ws} is a vector of wholesale supply shifters including the Class III milk price, ΔINV is change in commercial inventories, QSP is quantity of product sold by specialty plants to the government, and Q^w is the equilibrium wholesale quantity. The variables ΔINV and QSP represent a small proportion of total milk production and are assumed to be exogenous in this model.[3]

The Dairy Price Support Program is incorporated into the model by constraining the wholesale cheese and butter prices to be not less than their respective government purchase prices, i.e.:

$$(4.1)\quad WCP \geq GCP,$$

$$(4.2)\quad WBP \geq GBP,$$

where WCP and GCP are the wholesale cheese price and government purchase price for cheese, respectively, and WBP and GBP are the wholesale butter price and government purchase price for butter, respectively.

Because of the Dairy Price Support Program, four regimes are possible: (*a*) $WCP > GCP$ and $WBP > GBP$, (*b*) $WCP > GCP$ and $WBP = GBP$, (*c*) $WCP = GCP$ and $WBP > GBP$, or (*d*) $WCP = GCP$ and $WBP = GBP$. In the cheese and butter markets, specific versions of equilibrium condition (3.3) are applicable to the first regime, which is the competitive case. In the second case, where the cheese market is competitive but the butter market is not, the wholesale butter price is set equal to the government purchase price for butter and the equilibrium condition is changed to

$$(3.3b)\quad WBS = WBD + \Delta INV_b + QSP_b + GB \equiv WB,$$

where GB is government purchases of butter, which becomes the new endogenous variable replacing the wholesale butter price. For the third case, where the butter market is competitive but the cheese market is not, the whole-

[3] Certain cheese and butter plants sell products to the government only, regardless of the relationship between the wholesale market price and the purchase price. These are general balancing plants that remove excess milk from the market when supply is greater than demand, and process the milk into cheese and butter which is then sold to the government. Because of this, the quantity of milk purchased by the government was disaggregated into purchases from these specialized plants and other purchases. In a competitive regime, the "other purchases" are expected to be zero, while the purchases from specialty plants may be positive. The QSP_c and QSP_b variables were determined by computing the average amount of government purchases of cheese and butter during competitive periods, i.e., when the wholesale price was greater than the purchase price for these two products.

sale cheese price is set equal to the government purchase price for cheese and the equilibrium condition is changed to

$$(3.3c) \quad WCS = WCD + \Delta INV_c + QSP_c + GC \equiv WC,$$

where GC is government purchases of cheese, which becomes the new endogenous variable replacing the wholesale cheese price. Finally, for the last case where both the cheese and the butter markets are not competitive, the wholesale cheese and butter prices are set equal to their respective government purchase prices and the equilibrium conditions are changed to (3.3b) and (3.3c).[4]

The farm raw milk market is represented by the following milk supply equation:

$$(5.1) \quad FMS = f(E[AMP] \mid S^{fm}),$$

where FMS is commercial milk marketings in the United States, $E[AMP]$ is the expected all milk price, and S^{fm} is a vector of milk supply shifters. As in the model developed by LaFrance and de Gorter, and by Kaiser, a perfect foresight specification is used for the expected farm milk price.

The farm milk price is a weighted average 7of the class prices for milk, with the weights equal to the utilization of milk among products:

$$(5.2) \quad AMP = [(PIII + d) \times WFS + PIII \times (WFZS + WCS + WBS)] \div [WFS + WFZS + WCS + WBS],$$

where $PIII$ is the Class III price, d is the Class I fixed fluid milk differential (therefore the Class I price is equal to $PIII + d$), WFS is wholesale fluid milk supply, $WFZS$ is wholesale frozen product supply, WCS is wholesale cheese supply, and WBS is wholesale butter supply.

Finally, the model is closed by the following equilibrium condition:

$$(5.3) \quad FMS = WFS + WFZS + WCS + WBS + FUSE + OTHER,$$

where $FUSE$ is on-farm use of milk and $OTHER$ is milk used in dairy products other than fluid milk, frozen products, butter, and cheese. Both of these variables represented a small share of total milk production and were treated as exogenous.

Econometric Estimation

The equations were estimated simultaneously using two-stage least squares and quarterly data from 1975 through the third quarter of 1995. The econometric package used was EViews (Hall, Lilien, and Johnston). All equations in the model were specified in double-logarithm functional form. In terms of statistical fit, most of the estimated equations were found to be reasonable with respect to R^2. In all but two equations, the adjusted coefficient of determination was above 0.88. The two equations that were the most difficult to estimate were the retail butter demand and supply equations, which had the lowest R^2 values (0.47 and 0.55, respectively). Estimation results are available from the author upon request.

The retail market demand functions were estimated on a per capita basis. Retail demand for each product was specified to be a function of the following variables: (*a*) retail product price, (*b*) price of substitutes, (*c*) per capita disposable income, (*d*) quarterly dummy variables to account for seasonal demand, (*e*) a time trend variable to capture changes in consumer tastes and preferences over time,[5] and

[4] Because the market structure is different under each of these four regimes, using conventional two-stage least squares to estimate equations (1.1) through (4.2) may result in selectivity bias. Theoretically, a switching simultaneous system regression procedure should be applied, which is described in Liu et al. (1990, 1991). However, this procedure was not used here because it was beyond the scope of this project. Applying this procedure to the level of disaggregation of this model's manufactured product market would have been extremely cumbersome, and the costs of doing so were judged to be greater than the potential benefits.

[5] Several functional forms were specified for the time trend, including linear, log-linear, and exponential forms. The form yielding the best statistical results was chosen for each equation.

(*f*) generic advertising expenditures to measure the impact of advertising on retail demand. In all demand functions, own prices and income were deflated by a substitute product price index. This specification was followed because there was strong correlation between the substitute price and own price for each dairy product. The consumer price index for nonalcoholic beverages was used as the substitute price in the fluid milk demand equation, the consumer price index for meat was used as the substitute price in the cheese demand equation, the consumer price index for fat was used as the substitute price in the butter demand equation, and the consumer price index for food was used as the substitute price in the frozen product demand equations. To measure the advertising effort of the NDPRB, generic advertising expenditures for fluid milk and cheese were included as explanatory variables in the two respective demand equations.[6] Generic advertising expenditures for butter and frozen products were not included for two reasons. First, the NDPRB has not invested much money into advertising these two products. Second, including generic butter and frozen product advertising expenditures in an earlier version of the model resulted in highly statistically insignificant estimated coefficients. Branded advertising expenditures were initially included in the estimation, but were omitted from the final regression because the coefficients were highly statistically insignificant.

To capture the dynamics of advertising, generic advertising expenditures were specified as a second-order polynomial distributed lag with both endpoint restrictions imposed. Based on previous research (e.g., Liu et al. 1991; Kaiser), a lag length of four quarters was chosen. Finally, a first-order moving average error structure was imposed on the retail fluid milk demand equation and a first-order autoregressive error structure was imposed on the retail cheese demand equation to correct for autocorrelation.

Based on the econometric estimation, generic fluid milk advertising had the largest long-run advertising elasticity of 0.021, and was statistically different from zero at the 1% significance level.[7] This means a 1% increase in generic fluid advertising expenditures resulted in a 0.021% increase in fluid demand on average over this period, which is comparable to the results of previous studies. For example, Liu et al. (1990) estimated a long-run fluid milk advertising elasticity of 0.0139 using national data; Kinnucan (1986) estimated a long-run fluid milk advertising elasticity of 0.051 for New York City; and Kinnucan, Chang, and Venkateswaran estimated a long-run fluid milk advertising elasticity of 0.016 for New York City. Generic cheese advertising was also positive and statistically significant from zero at the 1% significance level and had a long-run advertising elasticity of 0.016.

The retail supply for each product was estimated as a function of the following variables: (*a*) retail price; (*b*) wholesale price, which represents the major variable cost to retailers; (*c*) producer price index for fuel and energy; (*d*) average hourly wage in the food manufacturing sector; (*e*) time trend variable; (*f*) quarterly dummy variables; and (*g*) lagged retail supply. The producer price index for fuel and energy was used as a proxy for variable energy costs, while the average hourly wage was used to capture labor costs in the retail supply functions. All prices and costs were deflated by the wholesale product price associated with each equation. The quarterly dummy variables were included to capture seasonality in retail supply, while the lagged supply variables were incorporated to represent capacity constraints. The time trend variable was included as a proxy for technological change in retailing. Not all of these variables remained in each of the final estimated retail supply equations due to statistical significance and/or wrong sign on the coefficient. Finally, a first-order moving average error structure was im-

[6] All generic advertising expenditures came from various issues of *Leading National Advertisers*.

[7] The long-run advertising elasticity was computed by simulating a 1% permanent increase in advertising expenditures for the period 1984–95, which was used with the baseline simulation results for actual historical advertising expenditures to determine the elasticity.

posed on the retail cheese and frozen product supply equations.

The wholesale supply for each product was estimated as a function of the following variables: (*a*) wholesale price; (*b*) the appropriate class price for milk, which represents the main variable cost to wholesalers; (*c*) producer price index for fuel and energy; (*d*) average hourly wage in the food manufacturing sector; (*e*) time trend variable; (*f*) quarterly dummy variables; (*g*) lagged wholesale supply; and (*h*) two dummy variables for the cheese and butter demand functions corresponding to the Milk Diversion Program and the Dairy Termination Program, which were two supply control programs implemented over some of this period. The producer price index for fuel and energy was included because energy costs are important variable costs to wholesalers, while the average hourly wage was used to capture labor costs in the wholesale supply functions. All prices and costs were deflated by the price of farm milk, i.e., class price. The quarterly dummy variables were used to capture seasonality in wholesale supply, lagged wholesale supply was included to reflect capacity constraints, and the trend variable was incorporated as a measure of technological change in dairy product processing. Not all of these variables remained in each of the final estimated wholesale supply equations due to statistical significance and/or wrong sign on the coefficient. Finally, a first-order moving average error structure was imposed on the wholesale fluid milk and frozen product supply equations.

For the farm milk market, the farm milk supply was estimated as a function of the following variables: (*a*) ratio of the farm milk price to feed price (16% protein content), (*b*) ratio of the price of slaughter cows to the feed price, (*c*) lagged milk supply, (*d*) intercept dummy variables to account for the quarters that the Milk Diversion and Dairy Termination Programs were in effect, (*e*) a dummy variable for the second quarter, and (*f*) time trend variable. The 16% protein feed price represents the most important variable costs in milk production, while the price of slaughtered cows represents an important opportunity cost to dairy farmers. Lagged milk supply was included as biological capacity constraints to current milk supply.

Market Impacts of the NDPRB

To examine the impacts that the NDPRB had on the market over the period 1984.3–1995.3, the model was simulated under two scenarios based on generic advertising expenditures: (*a*) a historic scenario, where advertising levels were equal to actual generic advertising expenditures, and (*b*) a no-NDPRB scenario, where quarterly values of generic advertising expenditures were equal to quarterly levels for the year prior to the adoption of the NDPRB, i.e., 1983.3–1984.2. A comparison of these two scenarios provides a measure of the impacts of the NDPRB on the dairy markets. Table 1 presents the quarterly averages of price and quantity variables for two time periods: 1984.3–1995.3, and 1994.3–1995.3. The last two columns in the table give the percentage change in each variable due to the NDPRB for the life of the program and the most recent year, respectively. The results for the longer time period are discussed first.

It is clear from these results that the NDPRB had an impact on the dairy market for the period 1984.3–1995.3. For example, the generic advertising effort of the NDPRB resulted in a 0.91% increase in fluid sales and a 5.62% increase in retail fluid price compared to what would have occurred in the absence of this national program. Note that since the own price elasticity of fluid milk demand was estimated to be quite inelastic (−0.12), the modest increase in fluid sales due to advertising caused a sizable increase in price. The increase in fluid sales also caused the wholesale fluid price to increase by 4.10%. The increase in advertising expenditures due to the NDPRB also had positive impacts on the retail cheese market. Retail cheese quantity and price were 0.48% and 0.81% higher, respectively. The increase in cheese sales caused the wholesale cheese price to rise by 2.75%.

Although generic butter and frozen product advertising were not included in the retail demand equations, generic fluid milk and cheese advertising by the NDPRB had some indirect,

Table 1. Simulated Quarterly Values for Market Variables With and Without NDPRB, Averaged over 1984.3–1995.3, and over 1994.3–1995.3

		1984.3–1995.3 Average			1994.3–1995.3
Market Variables	Units	With NDPRB	Without NDPRB	Avg. % Change	Avg. % Change
Fluid demand/supply	bil. lbs. me[a]	13.59	13.47	0.91	1.72
Frozen demand/supply	bil. lbs. me	3.16	3.16	−0.16	−0.24
Cheese demand	bil. lbs. me	12.26	12.20	0.48	0.27
Cheese supply	bil. lbs. me	12.31	12.26	0.42	0.27
Butter demand	bil. lbs. me	5.24	5.24	−0.06	−0.21
Butter supply	bil. lbs. me	6.65	6.67	−0.39	−0.47
Total demand	bil. lbs. me	34.25	34.07	0.51	0.70
Retail fluid price	1982–84 = 100	114.94	108.47	5.62	10.11
Retail frozen price	1982–84 = 100	130.11	129.16	0.73	1.10
Retail cheese price	1982–84 = 100	123.38	122.38	0.81	0.49
Retail butter price	1982–84 = 100	95.41	95.31	0.10	0.39
Wholesale fluid price	1982 = 100	124.94	119.82	4.10	6.74
Wholesale frozen price	1982 = 100	126.59	125.23	1.07	1.62
Wholesale cheese price	$/lb.	2.46	2.40	2.75	1.78
Wholesale butter price	$/lb.	1.10	1.09	0.27	1.12
Class III price	$/cwt	12.65	12.39	2.03	3.04
All milk price	$/cwt	13.60	13.34	1.93	2.93
CCC cheese purchases	bil. lbs. me	0.06	0.07	−12.00	0.00
CCC butter purchases	bil. lbs. me	1.42	1.44	−1.59	−2.25
CCC purchases	bil. lbs. me	1.48	1.51	−2.01	−2.25
Milk supply	bil. lbs.	36.52	36.38	0.40	0.62
Producer surplus	bil. $	4.63	4.52	2.34	3.52

[a] The notation "me" stands for milk equivalent.

but minor impacts on butter and frozen product markets. For example, the retail and wholesale frozen product price increased, on average, by 0.73% and 1.07%, respectively, due to the NDPRB advertising effort. The increases in frozen product prices were primarily due to the higher Class III milk price that manufacturers had to pay under the NDPRB advertising scenario. Advertising by the NDPRB had little impact on retail and wholesale butter prices, but butter supply declined by 0.39% under NDPRB advertising. The decline in butter supply was due to a higher average Class III price.

The NDPRB also had an impact on purchases of cheese and butter by the government. The modest increase in cheese demand relative to the increase in wholesale supply due to NDPRB advertising caused cheese purchases by the government to fall by 12%, on average, over this period. Likewise, while butter demand did not change, the 0.39% decrease in butter supply due to generic advertising by the NDPRB caused butter purchases by the government to decrease by 1.59% over the period. Total dairy product purchases by the government were 2.01% lower in the NDPRB scenario.

The introduction of the NDPRB also had an impact on the farm market over the previous 11 years. The Class III and farm milk prices increased by 2.03% and 1.93% under the national program due to an increase of 0.51% in total milk demand. Farm supply, in turn, increased by 0.40%. Farmers were better off under the NDPRB since producer surplus averaged 2.34% higher with the program. One bottom-line measure of the net benefits of the NDPRB to farmers is the rate of return, which gives the ratio of benefits to costs of the national program. Specifically, this rate-of-return measure was calculated as the change in producer surplus, due to the NDPRB, divided by the costs of funding this program. The cost of the program was measured as the 15¢ per hundredweight assessment times total milk marketings. In the year prior to the program, farmers voluntarily contributed 6.3¢ per hundred weight. Therefore, the difference in cost due to the national checkoff was assumed to be the difference between 0.0015 times milk marketings (in billion pounds) under the NDPRB scenario minus 0.00063 times milk marketings in the no-NDPRB scenario. The results showed that the rate of return from the NDPRB was 3.40 over the 11-year period. This means that an additional dollar invested in generic advertising would return \$3.40 in producer surplus to farmers. The farm-level rate of return was lower than estimates of 4.77 by Liu et al. (1990) for the period 1975.1–1987.4, 4.60 by Kaiser and Forker for the period 1975.1–1990.4, and 5.40 for the period 1975.1–1993.4 by Kaiser. A 95% confidence interval was calculated for the rate-of-return estimate by simulating the two scenarios separately with the lower and upper limits of the 95% confidence interval for the fluid milk and cheese advertising coefficients in the retail demand equations. The lower and upper limits of the 95% confidence interval for the rate of return were 0.60 and 7.93, respectively.

The last column in table 1 gives the impacts of the NDPRB for the most recent year. In general, the most recent year's results demonstrate larger market impacts of the NDPRB advertising effort than the 11-year average. For example, generic advertising by the NDPRB in the last four quarters resulted in a 1.72% increase in fluid sales and a 10.11% increase in retail fluid price relative to what would have occurred without NDPRB advertising. The increase in fluid sales caused the wholesale fluid price to increase by 6.74%, on average, over the last year in the simulation. One reason for larger NDPRB advertising impacts on the fluid market in the recent period is due to greater emphasis on fluid advertising in recent years.

While the advertising effort of the NDPRB in the last year continued to have a positive impact on the cheese market, the magnitude of impacts was smaller than the overall average for the 11-year period. Again, this was due to the increase in fluid milk advertising and decrease in cheese advertising in recent years. Retail cheese sales and prices were 0.27% and 0.49% higher, respectively, due to NDPRB advertising. The modest increase in cheese sales resulted in an average increase of 1.78% in the wholesale cheese price as well.

The most recent year's advertising impacts on government purchases were smaller than the 11-year average because purchases were at much smaller levels to begin with. For example, purchases of cheese by the government were predicted to be zero both with and without NDPRB advertising. Butter purchases, however, were 2.25% lower with advertising.

The farm market impacts due to the NDPRB were larger in the most recent year than the 11-year period. The Class III and farm milk price increased by 3.04% and 2.93%, respectively, on average for the past year due to the national program. This was due to an increase in total milk demand of 0.70% because of generic advertising. Farm supply, in turn, was 0.62% higher in the NDPRB scenario. Farmers were better off under the NDPRB since producer surplus was 3.52% higher, and the rate of return was 6.43. The lower and upper limits of the 95% confidence interval for the rate of return were 1.44 and 13.74, respectively. Note that the rate of return was almost twice as high for the most recent year than it was, on average, for the past 11 years. Therefore, the results suggest that the net benefits of the NDPRB to farmers have become larger in recent years.

Conclusion

The purpose of this study was to analyze the impacts of generic dairy advertising by the National Dairy Promotion and Research Board on retail, wholesale, and farm dairy markets. The results indicated that the NDPRB had a major impact on retail, wholesale, and farm markets for the dairy industry. The main conclusion of the study is that farmers are receiving a high return on their investment in generic dairy advertising. Moreover, the return on investment in advertising has been higher in the most recent year than the average for the previous 11 years. The higher profitability of generic advertising in recent years may be attributed to increases in efficiency by program managers due to experience in running the program.

Given the current legal debate over mandatory commodity checkoff programs, the evidence from this study can be used to demonstrate that generic advertising does have a significant impact on the market. The impacts of advertising tend to be more profound in increasing price than quantity, which is due to the inelastic nature of demand for milk and cheese. These estimated impacts need to be compared with other options producers have for marketing their product (e.g., nonadvertising promotion, research, new product development, etc.) in order to determine the optimality of the current investment of advertising. Consequently, these results should be viewed as a first step in the evaluation process.

While there are advantages to the industry model used in this study, there are also several shortcomings that need to be pointed out. First, the advertising impacts may be overstated due to the assumption of fixed proportions. As Kinnucan (1997) points out, the fixed proportions assumption does not allow for input substitution, which may cause derived-demand elasticities for farm output to be understated and profits from advertising to be overstated. Second, the interaction of related commodities in the retail demand equations is somewhat limited, especially compared with other econometric techniques, particularly demand system models. Hence, cross-commodity effects are not measured. Finally, the model did not include several other activities of the NDPRB such as nonadvertising promotion and research. While advertising is by far the largest investment by the NDPRB, these other activities may also have an impact on demand for milk and dairy products. Unfortunately, these data could not be obtained for this study.

There are two directions that could be useful for future research. Obviously, inclusion of other marketing activities by the NDPRB would be useful because then the model could be used to determine the optimal allocation of dairy farmer checkoff funds across marketing activities. In addition, spatial disaggregation of the model into several regions of the United States, particularly for fluid milk, would be valuable. Although manufactured dairy products are well represented as a national market, fluid milk markets tend to be regional in scope, and fluid milk marketing orders cause different price surfaces for fluid milk. Regional disaggregation of fluid milk markets would also make the model a valuable tool in examining dairy policy questions on such issues as federal milk marketing order consolidation.

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