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Economic Effects of U.S. Dairy Programs

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Based on econometric analysis, this article estimates effects of terminating the milk order system and milk price support, singly and together, over the period 1966–90. Since 1980, milk orders have raised the national blend price by 1–2%; price support has raised the blend price to well above the market clearing price, by over 21% in 1983. Short- and long-run benefits and costs are estimated for various policy options under 1990 conditions.

Key words: benefits, costs, dairy programs, milk orders, milk price effects, price support.

Introduction

Many would argue, particularly with the advantage of hindsight, that the dairy price support program was badly managed in the decade of the 1980s. Support prices were set well above market-clearing levels; the consequences included large government stocks of surplus dairy products, annual budget outlays that exceeded $2 billion in some years, and production control programs that had never before been deemed necessary to reduce milk output.

Quantifying the departures from competitive performance of the market for raw milk caused by the price support program during the 1980s is the main objective of this study. Other aspects of national dairy policy and other time periods also are considered. More particularly, we consider three policy options. Under Option I, price discrimination in the pricing of fluid milk under federal orders and counterpart state programs is terminated in a simulation analysis. Under Option II, the net government removals of dairy products under the milk price support program, together with the supply management programs of the 1980s, are discontinued. Analysis of Option III, which combines the first two options, generates estimates of competitive performance subject to the continuation of dairy import quotas.[1] The research method employed involves the construction and estimation of an 11-equation econometric model designed for policy analysis estimated using three-stage least squares (3SLS) and annual time series data for 1966–90. Our findings lead to some significant modifications of recent research on the 1980s but tend to support, with some exceptions, the conclusions reached in the landmark studies by the U.S. Department of Agriculture (USDA) and the American Agricultural Economics Association (AAEA) Policy Task Force on Dairy Marketing Orders (AAEA Task Force) that summarize and synthesize findings from the earlier research, particularly that completed during the 1970s.

This article builds upon and adds to the findings of recent papers on dairy policy. Dixon, Susanto, and Berry studied the production effects of the Milk Diversion Program (MDP) and the Dairy Termination Program (DTP) implemented in the 1980s, concluding that both programs effectively reduced milk output, but in the short run only. Bausell, Belsley,

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and Smith concluded that during the latter half of the 1980s, lowering the support price would have been effective, relative to the MDP and DTP, in reducing the costs to the government and to consumers and lowering income transfers to milk producers. Unfortunately, their quantitative estimates of benefits and costs are open to serious question. The model by Bausell, Belsley, and Smith implicitly assumes an aggregate farm-level commercial demand for milk (rather than the traditional blend price function that allows for price discrimination) in which the current quantity of milk demanded is expressed implicitly as a function of: (*a*) lagged quantity; (*b*) government net removals, measured in milk equivalent; (*c*) the government's support price; (*d*) the Class I utilization rate under federal milk orders; and (*e*) real disposal income per capita. Except for the income variable, population apparently is ignored. In the Bausell, Belsley, and Smith model, the support program sets the market price rather than placing a floor on price. Unfortunately, the market price, sometimes below and oftentimes well above the support price, is not included in the demand equation. The market price likely will exceed the support price in the very case they presume to analyze, viz., the case where the support price is decreased to relatively low levels, to $6.87 per cwt in 1987.[2]

The analysis given below harks back to that by LaFrance and de Gorter, who quantified the welfare impacts of policy options similar to those noted above for the years 1965 through 1980. We believe the present analysis both improves and updates the LaFrance–de Gorter work. Importantly, following several previous researchers, LaFrance and de Gorter used the concept of milk equivalent (milk fat basis) to measure the net government removals of manufactured dairy products in wholesale markets. This procedure risks serious bias in that it gives improper weight to the removals of nonfat dried milk and cheese. We estimate, for example, that the ratio of pounds of fat removed to nonfat removed equaled .48 in 1983 and 14.7 in 1989. Instead of using milk equivalent measures, we insert in the farm-level demand for "manufacturing" milk two variables that measure the levels of fat and nonfat solids embodied in government net removals. For this and other reasons, our results differ significantly from those of LaFrance and de Gorter.[3]

Model Specification

An economic model designed to explain the performance of the farm-level market for milk must take account of national dairy policy. This policy has three components.[4] One component is a price support program for milk purchased by manufacturers who use milk in the production of specified nonfluid milk products: cheddar cheese, butter, and nonfat dry milk. Briefly, when necessary, the federal government removes these manufactured products from wholesale markets to elevate milk product prices. The assumption is that competition among processors, many of whom are farmer-owned cooperatives, will ensure that product price increases will increase prices to producers. The idea is to strengthen farm-level demand in those periods when farm prices would otherwise fall below support levels. The surpluses are stored and made available to commercial buyers at 110% of the government's purchase price. If prices fail to improve, surpluses are donated to various domestic and foreign feeding programs. For much of the post-World War II period, the objective was to keep prices from falling below specified levels of parity, but the role of parity has greatly diminished since 1982.

A second component of dairy policy consists of a system of federal milk orders that, together with counterpart state programs, set minimum purchase prices for Grade A (fluid grade) milk according to use classification. Milk used for fluid (beverage) purposes is assigned to Class I, the highest value-use class.[5] Under federal milk orders, Class I prices are set equal to the two-month lagged Minnesota–Wisconsin price, the price paid by a sample of 166 Minnesota–Wisconsin milk manufacturing plants, plus Class I price differentials that are, for markets east of the Rocky Mountains, positively related to distances from Eau Claire, Wisconsin. For example, in 1990, the average Class I price differential for all federal milk orders was $2.65 per cwt, with the Minnesota–Wisconsin price equaling

Table 1. List of Variables and Definitions

Variable	Definition
Endogenous Variables:	
BLP	= Average price of milk received by producers (dollars per cwt).
CIM	= Number of milk cows (thousands).
*FM**	= Total milk sales to processors for fluid milk production (millions of pounds).
FMP	= *FM* per capita (pounds).
MFPR	= Ratio of the milk price to the price of dairy feed, 16% protein (pound-per-pound basis).
MM	= Total milk sales to processors for the manufacturing of nonfluid milk products (millions of pounds).
MMP	= *MM* per capita (pounds).
PFM	= Class I price established by federal milk orders for 3.5% butterfat content, all market average (dollars per cwt).
PMM	= Price of milk allocated to manufactured products as measured by the Minnesota–Wisconsin price (dollars per cwt).
QMS	= Total milk production minus milk used on farms (millions of pounds).
YLD	= Milk production per cow (thousands of pounds).
Exogenous and Predetermined Variables:	
AHE	= Average hourly earnings in the private sector excluding agriculture (dollars per hour).
CPI	= Consumer price index for all items (average for 1982–84 = 100).
DTP	= Dummy variable equaling one for years 1986–90 and zero otherwise (Dairy Termination Program).
FGP	= Net government purchases of fat solids, per capita.
IMFP	= Index of prices for meat, fish, and poultry (1967 = 100).
L1CIM	= Number of cows milked (*CIM*) lagged one year (thousands).
L2CIM	= Number of cows milked (*CIM*) lagged two years (thousands).
MDP	= Dummy variable equaling one for years 1984 and 1985, and zero otherwise (Milk Diversion Program).
MMFPR	= Four-year moving average of the milk–feed price ratio (*MFPR*), excluding the current year.
NGP	= Net government purchases of nonfat milk solids, per capita.
TREND	= Trend with 1966 set equal to one.

Note: A detailed statement of the data, data sources, and estimation procedures used in preparing the data set has been written by Greg Mode and can be obtained by writing to the senior author.
* *FM* equals total fluid milk consumption plus corrections for the pounds of fat solids removed from raw milk and the pounds of nonfat solids added.

$12.21. The Class I price differentials in the Chicago and New York/New Jersey orders were, respectively, $1.50 and $3.22. In many parts of the country, moreover, milk producer cooperatives bargain with processors and secure over-order premiums for milk used in fluid distribution.

The third component of national dairy policy is a set of strict import quotas on manufactured dairy products that are equivalent to or compete with the products acquired under the price support program. These quotas, justified on the basis of the need to protect the domestic price support program under Section 22 (Agricultural Adjustment Act of 1933), severely limit imports. We estimate that in 1990, for example, the fat solids (nonfat solids) embodied in imported dairy products accounted roughly for 2.1% (.9%) of U.S. production.

As noted, our analysis is based on an 11-equation model of the farm-level market for milk estimated using annual time series for 1966–90 and 3SLS. Several equations are definitional.[6] The variables are defined in detail in table 1.

The average (blend) milk price function is given by:

$$BLP = \frac{PFM \cdot FM + PMM \cdot MM}{QMS} \quad \text{blend price,} \tag{1}$$

where *BLP* is the national average annual price of milk received by producers; *FM* is the total milk sold to processors for fluid milk (beverage) production, with *PFM* being the corresponding price per cwt; *MM* is the total milk sold to manufacturers for production of nonfluid products, with *PMM* being the corresponding price per cwt; and *QMS* is total farm sales of milk. (The Minnesota–Wisconsin milk price is used as the best measure of *PMM*.) All of the variables in this equation are endogenous. Total milk sales (excludes milk consumed on the farm) equals the sum of fluid and manufacturing milk. Importantly, equation (1) is not a demand equation as in the formulation proposed by Bausell, Belsley, and Smith. The blend price reflects the widespread existence of discrimination in the pricing of milk through both federal milk orders and state milk control programs.

The processor demand for fluid milk is given by:

$$FMP = D_1(PFM, CPI, AHE, TREND) \quad \text{demand for fluid use,} \tag{2}$$

where *FMP* is fluid milk (*FM*) per capita, *CPI* is the consumer price index, *AHE* is average hourly earnings in the private sector, and *TREND* is trend with 1966 set equal to one. Average hourly earnings was used instead of per capita income because national income has become increasingly concentrated among the well-to-do in recent years.

The processor demand for manufacturing milk is given by:

$$MMP = D_2(PMM, IMFP, FGP, NGP, TREND) \quad \text{demand for manufacturing use,} \tag{3}$$

where *MMP* is manufacturing milk (*MM*) per capita; *IMFP* is the index of prices for meat, fish, and poultry; and *FGP* and *NGP* are the net government removals of fat solids and nonfat solids, respectively, both on a per capita basis.

The inclusion of *FGP* and *NGP* is necessitated by the government's price support program for manufacturing milk and other food programs such as school lunch. It is mainly in this respect that our model differs from previous models. In most of the sample years, the government acquired and removed from wholesale channels of trade butter, nonfat dried milk, and, on several occasions, cheese, mainly to increase the farm-level demand for manufacturing milk. Modest net quantities of dairy products have been acquired by the government for food programs for the needy even in those years when market prices exceeded support levels, e.g., in 1973–76. Importantly, the price support program does not displace a pricing system at the farm level based on *private* demand and supply. The government does not stand willing to purchase raw milk at the support level.

The quantity of milk produced annually is expressed as the product of the number of cows milked (*CIM*) and milk production per cow (*YLD*). The supply for cows milked is:

$$CIM = S_c(MMFPR, DTP, MDP, L1CIM, L2CIM) \quad \text{herd size,} \tag{4}$$

where *MMFPR* is a four-year moving average of the ratio of price of milk (*BLP*) to the price of dairy feed. This moving average excludes the current year and is inserted as a proxy for the expected returns to investment in dairy cows. The size of the dairy herd is taken as a simple but accurate measure of the size of the milk production industry's fixed plant. To take account of the Milk Diversion Program, a dummy variable (*MDP*) was included, which equals one for the years 1984 and 1985, and zero otherwise. Under this program, milk producers were paid to reduce production. To take account of the Dairy Termination Program, a dummy variable (*DTP*) was included, which equals zero for the years 1966–85 and one for 1986–90. Under this program, dairy farmers were paid to liquidate their herds and to refrain from producing milk for five years. Following the suggestion of Chavas and Klemme, cows milked lagged one year (*L1CIM*) and cows milked lagged two years (*L2CIM*) were included to take account of the dynamics of changing herd size. Experimentation with various combinations of lagged variables led to the choice of *L1CIM* and *L2CIM* as the best predictors.

Table 2. Structural Parameters of a Model of the U.S. Farm-Level Market for Milk, Estimated Using Three-Stage Least Squares and Time Series for 1966–90

Variate	Parameter Estimate	Asymptotic *t*-Ratio
Per Capita Demand for Milk Used in Fluid Milk Production (*FMP*):		
*CON1**	+287.5394	75.94
PFM	−1.6439	3.58
CPI	−.2173	.75
AHE	−8.8820	1.58
TREND	+.6621	1.04
$R^2 = .982$		
Per Capita Demand for Milk Used in Manufactured Dairy Products (*MMP*):		
CON2	+229.2198	19.73
PMM	−12.2585	5.49
FGP	+10.5855	1.86
NGP	+8.3578	3.25
IMFP	+.8997	4.77
TREND	−1.7902	1.07
$R^2 = .910$		
Number of Cows Milked (*CIM*):		
CON3	−1,226.5896	1.38
MMFPR	+888.2464	2.19
DTP	−284.1255	3.46
MDP	−168.3872	1.60
L1CIM	+.4613	3.12
L2CIM	+.3070	2.44
$R^2 = .975$		
Milk Production per Cow (*YLD*):		
CON4	+6.9405	11.48
MFPR	+.6227	1.45
TREND	+.2498	37.30
$R^2 = .984$		

Note: R^2 is the coefficient of multiple correlation.
* *CONi* is the constant term ($i = 1, \ldots, 4$).

The milk production per cow (*YLD*) equation is:

$$YLD = S_Y(MFPR, MDP, TREND) \quad \text{milk yield per cow,} \tag{5}$$

where *MFPR* is the current milk–feed price ratio. The dummy variable *MDP* was included to take account of the Milk Diversion Program. Trend was included to capture the effect of technological progress.

The price of milk for fluid use (*PFM*) was set equal to the Minnesota–Wisconsin price (*PMM*), an endogenous variable, plus the average Class I price differential for all federal milk orders (*C1DIF*), the latter taken as exogenously determined by the government. Over-order premiums negotiated by milk producer cooperatives are hypothesized to equal, approximately, the price for services provided by cooperatives, services that lower the procurement costs of buyers (see Babb and Bessler).

Additional equations were required to define per capita demand quantities for fluid and manufacturing milk. One equation was required to define the milk–feed price ratio.

Econometric Results and Validation

The estimated structural parameters of the econometric model are given in table 2. All estimated own-price coefficients have the correct sign and, with the exception of the milk

yield equation, the asymptotic *t*-ratios are in excess of 2.0. The demand elasticities, estimated for mean values, equal −.076 and −.350 for fluid milk and manufacturing milk, respectively. The elasticity of short-run supply (holding dairy herd size constant) equals +.081. The steady-state or long-run elasticity that allows for changes in both feeding rates and herd size equals +.583. These elasticity estimates are plausible in light of previous research (AAEA Task Force). The per capita consumption of fluid milk has long been held to be unresponsive to changes in price. The same is true for milk production per cow, which has trended upward as a result of better herd management, more productive cows, and other technological advances. In response to sharp price decreases, for example, farmers likely cut back on feeding rates to a limited extent. In addition, many farmers give up leisure in order to increase production and maintain income. Milking cows three times a day instead of only twice is an example of how this can be accomplished. In keeping with other research, we find that production per cow tends to be rather insensitive to the prices of milk and feed.

Regarding the effects of exogenous shocks, we note that, as expected, government removals of fat and nonfat solids from wholesale markets increase significantly the demand for manufacturing milk at the farm level. The Milk Diversion Program, and particularly the Dairy Termination Program, decreased herd size, again as expected. It may be noted that experimentation with the price of margarine, per capita incomes, price of nonmilk beverages, and demographic variables (percentage of population under age 18, for example) as potential shifters of milk demands led to unsatisfactory signs or levels of significance of estimated coefficients.

As a means of validation, the entire equation model was used in a dynamic simulation of market performance over the period 1966–90. All exogenous variables were assigned their actual values year after year. Herd sizes were simulated. Simulated and actual values for all endogenous variables then were compared. For example, both the actual and simulated average or blend prices to farmers over the sample period are shown in figure 1. Though simple, the model does a good job of tracking price history. The mean absolute percentage (MAP) error for the blend price (*BLP*) equaled 5.7%. The MAP errors for the other variables are shown below.[7]

Variable	MAP Error
Total milk sales (*QMS*)	1.6
Milk used in fluid production per capita (*FMP*)	.7
Milk used in manufacturing per capita (*MMP*)	2.4
Price of fluid milk (*PFM*)	5.5
Price of manufacturing milk (*PMM*)	7.4
Number of milk cows (*CIM*)	1.5
Milk production per cow (*YLD*)	1.5

The model tracks the histories of quantity variables more closely than of price variables, largely, one suspects, because demand and supply functions tend to be inelastic. Overall, in light of the signs and asymptotic *t*-ratios of estimated coefficients and the model's ability to track history, we believe the econometric model provides a plausible quantified explanation of the performance of the U.S. farm-level market for milk. The implications of the model with regard to the effects of changes in national dairy policy are therefore of interest.

Terminating Dairy Programs

Three policy options that diminish government intervention in milk pricing are considered. Under Option I, price discrimination under federal milk orders and state control programs is terminated, but the price support program is maintained. The Class I price differential is set equal to zero. Under a variant of this option, the price differential is set at 50¢ per cwt.[8] It is assumed that any price premiums received by milk producer co-

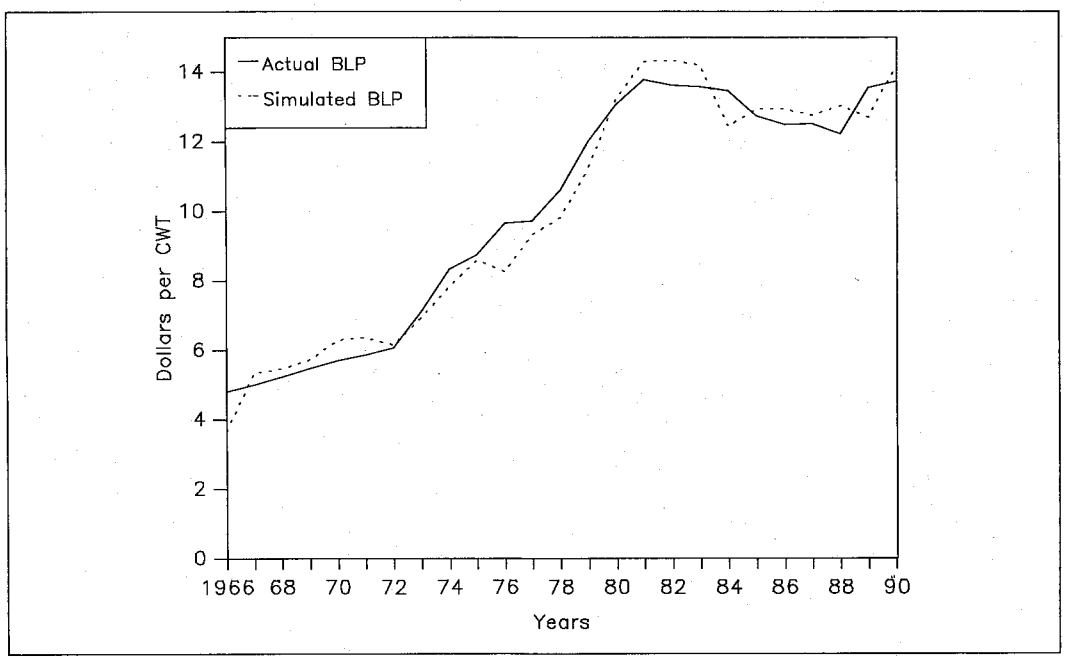

Figure 1. Actual and simulated blend prices (*BLP*) for milk

operatives would cover exactly the cost of services provided to milk handlers. Under Option II, net governmental withdrawals of manufactured dairy products (butter, cheese, and nonfat dried milk) are eliminated, but federal milk orders are maintained. The two variables, *FGP* and *NGP*, appearing in equation (3) are set equal to zero. The two dummy variables, *DTP* and *MDP*, appearing on the supply side in equations (4) and (5) also are set equal to zero for the entire sample period, thus eliminating the Dairy Termination and Milk Diversion Programs. Option III eliminates both federal milk orders and price support, yielding estimates of the "competitive" outcome. As noted, the relaxation of dairy import quotas is not analyzed in this study.

Using the model set forth above, the performance of the market for raw milk was simulated dynamically over the sample period with and without dairy programs. The percentage changes in the blend price (*BLP*), fluid milk price (*PFM*), and manufacturing milk price (*PMM*) under Option I are shown in figure 2. Setting the Class I price differential equal to zero (50¢ per cwt) caused the simulated national blend price to fall by 5.7% (4.3%) on average over the five-year period 1966–70. For the rest of the sample period, the annual declines were less than 1.8% (1.4% for the 50¢ differential), with no apparent trend. The relatively large decline in the early five-year period partly reflects initial excess capacity due to preexisting price discrimination.

The modest declines in the blend price caused by setting the Class I price differential equal to zero mask the dramatic effects on fluid and manufacturing milk prices. The percentage declines in fluid milk prices trended downward, from 27.2% in 1966 (19.5% with the 50¢ differential) to 9% in 1982 (6.8%), and then rose to 12% by 1990 (9.8%). In contrast, over the period 1966–90, the manufacturing milk price increased.[9] The percentage increases trended downward, from 17.2% in 1966 (12.2% with the 50¢ differential) to 5.2% in 1982 (3.9%), and then rose slightly to 5.9% in 1990 (4.7%).

Figure 3 is a graphic presentation of the estimated blend price history with programs in effect, the base simulation, and the estimated price history without the price support program (Option II). (Milk orders are maintained.) Importantly, the period 1961–65 was one of considerable government intervention with relatively large net withdrawals of manufactured dairy products. By 1965, market performance had veered substantially

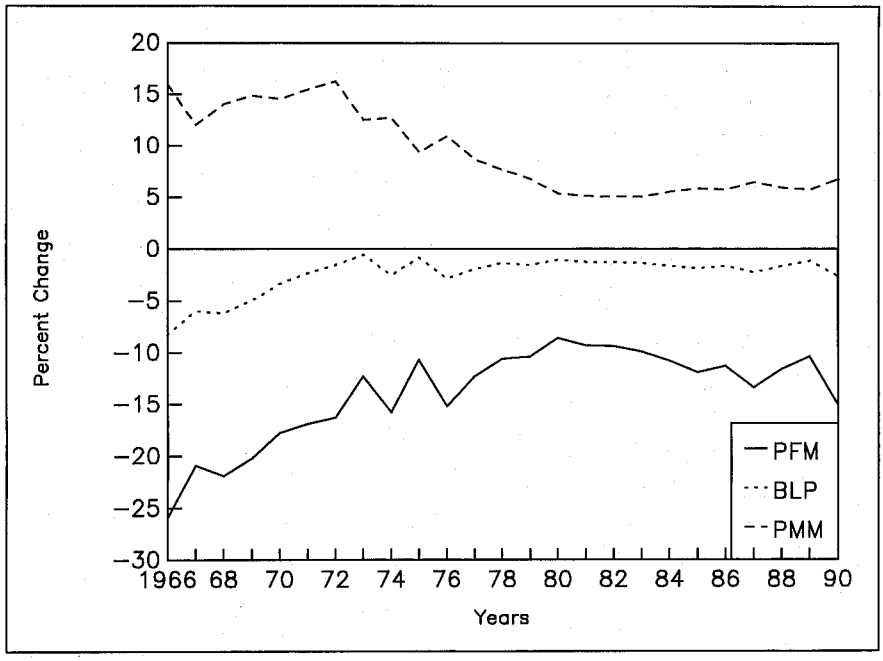

Figure 2. Percentage changes in blend price (*BLP*), fluid milk price (*PFM*), and manufacturing milk price (*PMM*) under Option I

away from competitive performance. In figure 3, the effects of two alternative ways of eliminating surplus capacity are presented. Simply terminating the price support program would have reduced the milk price on average by 13.2% over the period 1966–72. The nation's dairy herd would have fallen by 19.7% of its 1966 value to 11.4 million cows in

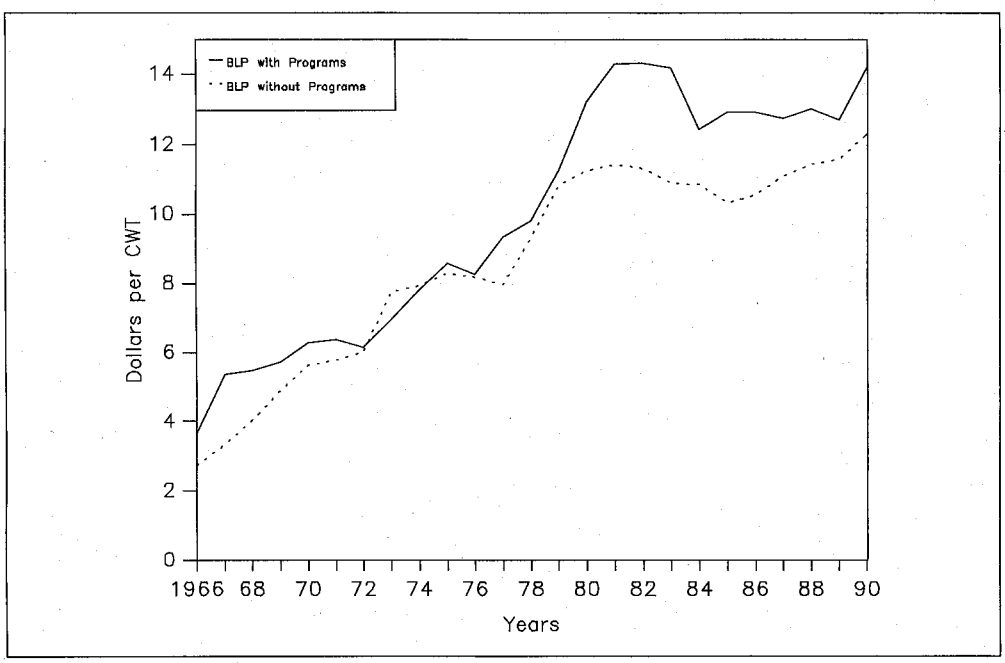

Figure 3. Simulated blend prices (*BLP*) for milk with and without price support

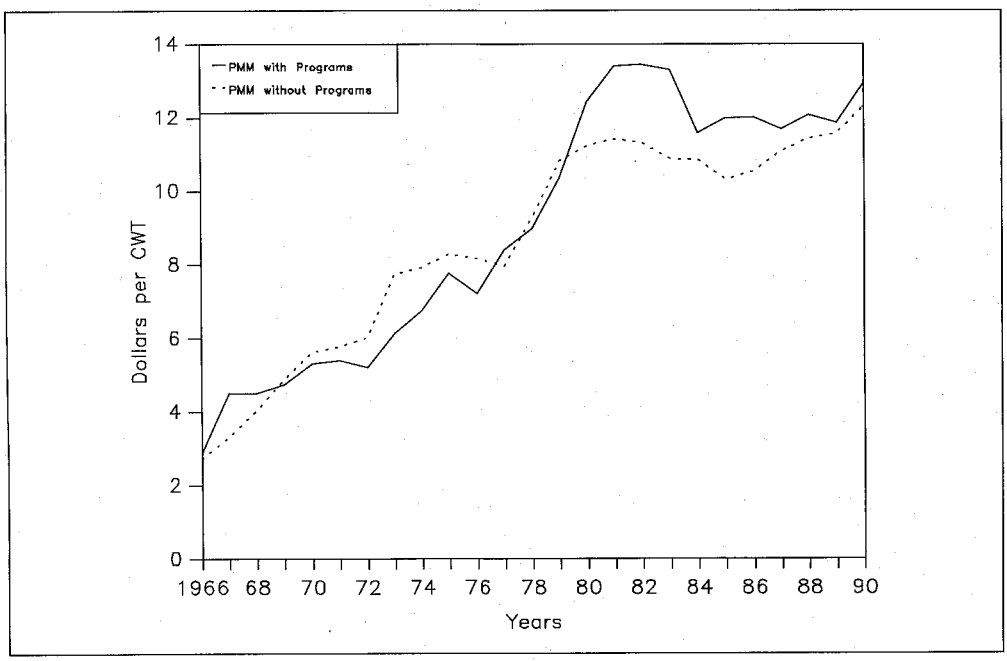

Figure 4. Simulated manufacturing milk prices (*PMM*) with and without dairy programs

1972. Actual price support policy consisted of reducing government withdrawals of nonfat milk solids, beginning in 1967, and holding fat solid withdrawals roughly constant until market conditions improved. With programs, the estimated size of the dairy herd fell by 16% of its 1966 value to 12 million cows in 1992. Over the period 1966–73, blend prices rose more slowly with price support than without.

The period 1979–83 was not unlike that of 1960–65 in that government policy again involved relatively high price supports and greatly increased net withdrawals of dairy products. Again, market performance veered sharply away from the competitive outcome. The withdrawals of milk fat and milk nonfat solids increased in 1979 from 81.7 million pounds and 261.8 million pounds, respectively, in 1979 to 610.2 million pounds and 1,286 million pounds, respectively, in 1983. The percentage increases in the national blend price as a result of the support program rose from 2% in 1979 to 21.6% in 1983. The size of the nation's dairy herd, which had declined continuously over the period 1966 through 1980 with programs in effect, suddenly began to increase. Thus, toward the mid-1980s, the dairy industry was burdened with excess capacity, much as it was in the mid-1960s. Government withdrawals, especially of nonfat solids, were decreased starting in 1985. In addition, the Dairy Termination and Milk Diversion Programs represented new weapons created to do battle with the excess capacity that the government itself had created through its management (one is tempted to say "mismanagement") of the price support program. Even so, by 1990, the blend price with programs was still more than 10% above the Option II price.

We estimate that the Option II regime would have kept the blend price at around $11.20 per cwt over 1979–84, in stark contrast to the price support program, with prices falling to $10.54 in 1985 and $10.80 in 1986. The milk–feed price ratio, on the other hand, would have plummeted from 1.41 in 1979 to 1.16 in 1984. The nation's dairy herd would have fallen by 2.2% over this same period. Relative to the price support program, the blend price would have risen briskly after 1984 to $12.52 in 1990. The milk–feed price ratio would have recovered to previous levels and the nation's dairy herd would have increased.

Figure 4 is a graphic presentation of the estimated manufacturing milk price simulated

dynamically over the period 1966–90 with and without dairy programs (Option III). This price is of particular interest to Minnesota and Wisconsin producers who rely heavily on the manufacturing market as an outlet for their milk. To these producers, national dairy policy has been something of a mixed blessing. The price support program, if properly managed, can be used to elevate the farm-level demand for manufacturing milk, at least in the short run. Federal milk orders, on the other hand, tend to decrease the proportion of milk output going to fluid consumption while at the same time expanding production in those areas with large population centers, particularly in the northeastern states. As can be seen in figure 4, producers who relied heavily on the manufacturing milk market would have enjoyed higher prices in the years 1970–76 and 1978–79 had there been no programs at all.

Figure 4 also raises a question with regard to the position often advanced in the literature on farm policy that programs are needed to stabilize markets. This view overlooks the possibility of government mismanagement of commodity programs. The coefficient of variation of the simulated manufacturing milk price (blend price) with and without dairy programs over the period 1966–90 equaled, respectively, 38.9% (35.1%) and 33.8%. (The blend price equals the manufacturing price under Option III.)

We next turn to policy simulations used to assess the short-run and long-run effects of terminating dairy programs under 1990 conditions. In 1990, government net withdrawals of fat solids equaled 6.1% of U.S. production. The corresponding figure for nonfat solids was 1.1%. The analysis that follows is useful in assessing the welfare effects of government intervention on a modest but sustained basis as might happen if the Dairy Export Incentive Program continues to grow as it has in recent years (see Dobson and Knapp). By definition, effects are short run if the number of dairy cows is held fixed. Long-run effects allow for changes in the size of the dairy herd in response to changes in the milk–feed price ratio. The three policy options described above are again considered. The estimated market performance effects are given in table 3.

To understand how these estimates were obtained, consider Option I, which involves setting the Class I price differential equal to zero. Initially, exogenous variables, including program variables, are set equal to their 1990 values. The "expected" milk–feed price ratio (*MMFPR*) is set equal to the average price ratio for the four years 1986–89. Market performance was estimated on the basis of the 11-equation model set forth above for 1990, holding number of cows constant, and in the long run (steady state), allowing the milk–feed price ratio and herd size to reach their equilibrium levels. Because the DTP was a five-year program, the dummy variable *DTP* was set equal to one for 1990, but zero thereafter. (Steady state was reached in eight years.) The entire procedure was then repeated, except the Class I price differential was set equal to zero. The changes in the endogenous variables caused by this policy change are given in table 3 for both the short and long run. Percentage changes (given in parentheses) are estimated using the with-government-program values as bases. Similar procedures were used to analyze the effects of Options II and III.

The estimated effects given in table 3 are in line with the results of previous research, with some exceptions. Summarizing the work prior to 1986, the AAEA Task Force concludes that milk orders have elevated the national blend price by 2–5%. Our estimated short-run effect under Option I (4.2%) falls within this range, whereas our long-run effect (1.8%) suggests that the lower part of the range may be closer to the truth. Ippolito and Masson (for 1973) and Dahlgran (for 1976) estimate that eliminating milk orders would in the long run lower fluid milk price by about 8 to 9%, less than both our short-run effect (14.2%) and our long-run effect (13.3%). For manufacturing milk, the estimates of Ippolito and Masson (p. 54) and Dahlgran for Option I are a positive 5.6% and 11%, respectively. Both are considerably larger than our estimated short-run effect (+3.1%), but closer to our long-run effect (+6.4%). (As a percentage of the national blend price, the Class I price differential equaled 29.8% in 1973, 21.7% in 1976, and 19.3% in 1990.)

The U.S. Department of Agriculture concluded in 1984 that eliminating the price support program would, in the short run, lower the blend price by 15–20%, quite in line

Table 3. Estimated Short-Run and Long-Run Market Performance Effects of Changes in National Dairy Policy under 1990 Conditions

Policy Changes	Changes/(% Changes) in Endogenous Variables					
	Total Milk Output (*QMS*)	Blend Price (*BLP*)	Fluid Milk Use Per Capita (*FMP*)	Fluid Milk Price (*PFM*)	Manufacturing Milk Use Per Capita (*MMP*)	Manufacturing Milk Price (*PMM*)
Short-Run Options:						
I. Discontinue milk orders	−327 (−4.2)	−.6 (+1.7)	+3.69 (−14.2)	−2.24 (−1.4)	−4.99 (+3.1)	+.51 (+3.9)
II. Discontinue milk price support	+2,630 (+1.8)	−2.39 (−14.67)	+3.42 (+1.6)	−2.08 (−13.1)	+7.1 (+2.0)	−2.08 (−15.8)
III. Competitive markets	+2,225 (+1.6)	−2.65 (−18.7)	+7.1 (+3.3)	−4.3 (−27.1)	+1.8 (+.5)	−1.65 (−12.5)
Long-Run Options:						
I. Discontinue milk orders	−1,517 (−1.0)	−.23 (−1.8)	+3.16 (+1.4)	−1.9 (−13.3)	−9.19 (−2.5)	+.75 (+6.4)
II. Discontinue milk price support	−2,959 (−2.0)	−.45 (−3.6)	+.82 (+.4)	−.47 (−3.3)	−12.56 (−3.4)	−.47 (−4.0)
III. Competitive markets	−4,522 (−3.0)	−.69 (−5.4)	+3.9 (+1.8)	−2.36 (−16.5)	−21.97 (−5.9)	+.29 (+2.5)

Notes: Dairy import quotas are maintained under all options. Dropping milk orders means that the Class I price differential was set equal to zero. Dropping the milk price support program means that government removals of both fat and nonfat milk solids were set equal to zero. Competitive markets mean that milk orders and price supports both were dropped. Long-run values are steady-state values after seven years. Percentage changes given in parentheses were calculated using simulated values under 1990 conditions, including milk orders and price supports, as base values.

with our short-run estimate of 14.7% when allowance is made for the limited withdrawals of dairy products in 1990 relative to those in the early 1980s. Our estimated long-run effect (−3.6%) reflects the substantial moderating effect of a downward adjustment of cow numbers in response to a price decline.

As a final comment regarding table 3, we estimate that elimination of both milk orders and price support (Option III) lowers the national blend price by 18.7% in the short run and 5.4% in the long run. The 2.5% long-run increase in the manufacturing milk price again reflects the remarkable tilt of national dairy policy in favor of the producers of milk for fluid consumption.

Estimates of both the short-run and long-run welfare impacts of dairy program termination are given in table 4.[10] Fluid milk buyers would be the big gainers from program termination (Option III), with benefits equaling $2,375 million in the short run and $1,276 million in the long run. Expressed as percentages of fluid milk expenditures at the farm level in 1990, these gains amount to 37% in the short run and 19% in the long run.

Manufacturing milk buyers lose from terminating milk orders, but gain from terminating price supports. The net effect is a small loss in the long run, equaling $265 million. This amounts to 3% of manufacturing milk expenditures.

The loss of producer surplus equals $3,958 million in the short run and $1,171 million in the long run. Expressed as percentages of total farm receipts, these losses amount to 24% in the short run and 7% in the long run. The short-run loss per cow equals $273.15, which means a farmer with a 40-cow herd would lose $10,926 per year. Long-run profits equal zero, in the absence of barriers to entry, and the long-run decrease in producer surplus must be interpreted as a loss to suppliers of inputs to the dairy industry, particularly to land owners.

A rough estimate of the short-run efficiency gain (increase in net benefits) associated with dairy program termination (Option III) can be obtained by subtracting from the sum

Table 4. Estimated Short-Run and Long-Run Welfare Effects of Changes in National Dairy Policy under 1990 Conditions ($ millions)

Policy Changes	Change in Fluid Milk Consumer Surplus	Change in Manufacturing Milk Consumer Surplus	Change in Producer Surplus
Short-Run Options:			
I. Discontinue milk orders	+1,205.8	−353.8	−859.5
II. Discontinue milk price support	+1,207.4	+1,880.0	−3,067.7
III. Competitive markets	+2,375.0	+1,518.0	−3,957.5
Long-Run Options:			
I. Discontinue milk orders	+1,052.0	−648.0	−443.8
II. Discontinue milk price support	+220.3	+449.1	−763.03
III. Competitive markets	+1,275.5	−264.5	−1,171.4

Note: Welfare effects are measured by changes in consumer and producer surpluses in short-run and long-run equilibria.

of the gains to consumers and taxpayers the loss to milk producers. Since net government expenditure on the 1990 price support program amounted to roughly $608 million, the short-run efficiency gain under Option III amounts to about $543 million. This estimate does not take into account the costs and benefits to people living abroad and to the needy.

Reflections on National Dairy Policy

The experience gained under dairy programs, particularly during the 1980s, calls into question the need for such programs. The argument that milk orders are needed to forestall market failure in fluid milk distribution is consistent with neither theory nor available evidence (see, for example, Helmberger, pp. 162–64.) Milk orders must be viewed as income redistribution devices that have elevated the national blend price between 1 and 2% since 1980. Fluid milk price increases, caused by price discrimination, rose from about 7–10% in 1980 to about 10–12% in 1990. Manufacturing milk price decreases amounted to about 4–6% over this period, with no apparent trend. (The limits of the interval estimates depend on whether the Class I price differential is set at zero or 50¢ per cwt.) Why should fluid milk consumers and Minnesota–Wisconsin milk producers, who rely heavily on the market for manufacturing milk, get "socked" for the benefits to manufactured dairy product consumers and to those milk producers who happen to live close to big cities distant from Eau Claire?

Whether the milk price support program makes any sense depends on whether the United States wants to play the European Community's game—i.e., subsidize milk production heavily through price support and dump the surplus into foreign markets. The recent experience with the Dairy Export Incentive Program points in that direction, and the above analysis of dairy programs for 1990 provides ballpark estimates of the likely short-run and long-run domestic effects of dumping about 6.1% (1.1%) of the nation's milk fat (nonfat) production into foreign markets.

In the absence of dumping into world markets, the outlets for surplus dairy products removed from wholesale markets are very limited. Support prices set in excess of market-clearing levels cause problems. The larger the disparity, the bigger the problems. The decade of the 1980s provides ample evidence of what can go wrong. According to our estimates, the price support program elevated the price of milk above the market clearing level by 14% in 1980, 19% in 1981, 20% in 1982, and 22% in 1983. Without price support, the number of milk cows would have continued to fall, as it had since 1966. Under price supports, the nation's dairy herd increased by 1% over the four-year period 1980–83.

Broadly speaking, the government created milk production capacity in the early 1980s

that wasn't needed until the early 1990s. It then had to scramble to undo the damage. Downsizing the fixed plant of the dairy industry involves painful adjustments on the part of producers, which likely explains why the government first paid farmers not to use all their production capacity (milk diversion) and then to scale back capacity (dairy herd termination).[11] The experience of the 1980s was similar in several respects to that of the 1960s.

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Notes

[1] Import quotas may not be continued under current law in the absence of a price support program, but, as has happened in the past, support levels could be set well below competitive market-clearing levels, which is functionally equivalent to terminating the support program.

[2] The actual support price for 1 January through 20 September 1987 equaled $11.35 at the average milkfat test. We estimate that in the absence of price support and supply management programs over the period 1966–90, the market price would have equaled $11.38 per cwt in 1987 (see fig. 3), well above the support price proposed by Bausell, Belsley, and Smith. Also, estimating U.S. milk production for prices as low as those envisaged in the Bausell, Belsley, and Smith paper is problematic because such prices are far removed from historical experience.

[3] LaFrance and de Gorter found that over the four-year period 1969–72, when the government was removing substantial quantities of fat and nonfat solids, the blend price with programs exceeded on average the simulated competitive price by 10.5¢ per cwt. Over the four-year period 1973–76, when government removals were relatively small and with the market price often exceeding the support price, the blend price with programs exceeded the simulated competitive price by 26.7¢ on average. These findings are puzzling and are not in accord with those reported below. We estimate, for example, that over the four-year period 1973–76, the simulated competitive price exceeded the simulated price with dairy programs in place by 1.8% on average.

[4] For a detailed description of national dairy policy, refer to the 1984 U.S. Department of Agriculture staff report.

[5] Grade A milk is produced under farm sanitary conditions that make it eligible for fluid products. Grade B milk can be used only for manufacturing purposes. About 80% of U.S. milk is Grade A.

[6] For further theoretical justification of the model analyzed here, see the report of the AAEA Task Force and the pioneering studies cited therein.

[7] If one outlier (for 1966) is omitted, the MAP error for the price of manufacturing milk falls by nearly 1%.

[8] Estimating what the price differential between fluid and manufacturing milk would be under "competitive" conditions poses grave difficulties. After reviewing the literature, the AAEA Task Force put the differential between 15 and 20¢ per cwt. Others (e.g., Manchester) believe the differential is much higher, more on the order of 50¢ as of 1977. We use the 50¢ differential as an approximate upper bound that may be useful, along with the zero differential, in making interval estimates.

[9] On the basis of a two-regime structural dairy model, Liu et al. (p. 371) estimate that raising the Class I price differential actually elevates the manufacturing price. They do not explain how this could be.

[10] Estimates like those reported in tables 3 and 4 also were made for 1980. Our estimated welfare effects in absolute value for 1980 are a good deal less than those reported by LaFrance and de Gorter for the same year. Our estimated long-run gains to fluid milk buyers and manufacturing milk buyers as percentages of the LaFrance–de Gorter estimates are, respectively, 75% and 52%. The corresponding figure for loss of producer surplus is 78%.

[11] Bausell, Belsley, and Smith suggest that the federal government should not have used the Milk Diversion and Dairy Termination Programs to reduce capacity, but should have slashed the support price instead. One might argue, however, that having been the prime cause for the creation of excess capacity, the government was under some obligation to ease the burden of production adjustment.

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