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Report to Congressional Requesters

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DAIRY TERMINATION PROGRAM

An Estimate of Its Impact and Cost-Effectiveness

GAO/RCED-89-96

GAO

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The Honorable Jesse Helms
The Honorable Pete Wilson
United States Senate

In response to your request and subsequent agreements with your offices, this is the second of two reports on the U.S. Department of Agriculture's (USDA) Dairy Termination Program. The Congress authorized the program in 1985 to reduce milk production and federal purchases of surplus dairy products. Under the program, USDA paid participating farmers to dispose of their entire dairy herds either by slaughtering or by exporting them. Additionally, the program participants agreed not to reenter dairying for 5 years.

Our first report presented information on milk production, showing that it leveled off during the program.[1] Additionally, it provided the results of a questionnaire sent to dairy farmers who bid to participate in the program. We used the questionnaire to develop a profile of these farmers. We also obtained information on the extent to which program participants planned to reenter dairying at the end of 5 years.

This second report presents estimates of the cost-effectiveness of the Dairy Termination Program and its impact on milk production and dairy surpluses through 1990. These estimates are based on the results of an economic model that we developed. The model was designed to isolate the effects of the Dairy Termination Program from other factors that can also influence milk production, such as milk and feed prices. (See app. I.)

Results in Brief

According to our estimates, the Dairy Termination Program will reduce milk production from 1986 through 1990 by 39.4 billion pounds below what it would have been without the program. However, our estimates of annual reductions decline each year after 1987, indicating that the program will not have a lasting effect on milk production. We also estimate that because of lower production the program reduced federal purchases of surplus dairy products. This reduction in surplus purchases led to an estimated net program savings for the federal government of $2.4 billion for fiscal years 1986 through 1990.

[1]Dairy Termination Program: A Perspective on Its Participants and Milk Production (GAO/RCED-88-157, May 31, 1988).

The program did temporarily reduce surplus purchases in a cost-effective manner. However, it is difficult to predict the benefits or costs of a similar program that might be used to address future dairy surplus problems. This is because of difficulties in predicting certain key variables, such as how much farmers would bid to participate in a future program.

Background

In recent years milk production has increased significantly more than the consumption of dairy products. This situation is important to the federal government because, under the milk price-support program, USDA purchases surplus dairy products in the form of cheese, butter, and nonfat dry milk. Consequently, the larger the surplus, the greater the federal expenditures. Dairy surplus purchases increased from about $247 million in fiscal year 1979 to a high of $2.7 billion in fiscal year 1983. The country continues to be in a surplus situation—in fiscal year 1988, USDA spent approximately $1.16 billion to purchase 9.7 billion pounds of surplus dairy products. In 1987 and 1988, over half of the surplus dairy stocks were distributed through domestic and foreign food assistance programs.

Over the past 6 years, the Congress has initiated a number of different actions to control dairy production. In 1983, it authorized the Milk Diversion Program, which paid farmers to reduce milk production for 15 months.[2] In 1985, the Congress authorized price reductions in its dairy support program that were intended to lower incentives for milk production. Additionally, it authorized the Dairy Termination Program, which was designed to reduce milk production by slaughtering or exporting entire dairy herds.

Reductions in Milk Price Supports

Under the price-support program, the federal government purchases any quantities of butter, cheese, and nonfat dry milk that are offered to it and meet specifications. It pays a legislated milk support price plus an allowance toward the manufacturing costs of these products. The Food Security Act of 1985 requires that on January 1 of 1988, 1989, and 1990, the Secretary of Agriculture reduce the support price by 50 cents per hundredweight of milk if the projected annual federal purchases of dairy surplus exceed 5 billion pounds of milk equivalent. The reduction in price supports is intended to reduce incentives to produce milk and

[2] Our report, entitled Effects and Administration of the 1984 Milk Diversion Program (GAO/RCED-85-126, July 29, 1985), concluded that the program had had only a temporary effect.

therefore help decrease surpluses. Conversely, if the Secretary projects that purchases will be 2.5 billion pounds or less, the price support will increase 50 cents per hundredweight. The Secretary reduced the price support level by 50 cents in 1988, putting it temporarily at $10.60 per hundredweight. However, drought legislation enacted in August 1988 precluded a January 1989 reduction and raised the support price by 50 cents per hundredweight for the April through June quarter. The objective of this higher support price was to compensate dairy farmers for higher feed costs that they might experience as a result of the 1988 drought. On January 1, 1990, the level of price support would again be determined by the quantity of projected surplus milk.

Dairy Termination Program

In conjunction with authorizing reductions in dairy price supports, the Food Security Act of 1985 authorized the Dairy Termination Program. The program was designed to remove 12 billion pounds of milk over an 18-month period, or about 8.7 percent of milk marketings, using 1985 marketings as a base. Milk marketings include all milk that is not used on the farm. USDA asked any interested dairy farmers to submit bids for program participation. Bids refer to the amount of federal payment a dairy farmer was willing to accept in return for his or her participation in the program. Program participants had to slaughter or export their entire dairy herd sometime between April 1, 1986, and September 30, 1987. About 1.62 million dairy cattle were slaughtered or exported. Approximately 40,000 producers submitted bids for the program. USDA accepted bids from about 14,000 of these producers, which accounted for 12.3 billion pounds of 1985 milk marketings. The accepted bids ranged from $3.40 to $22.50 per hundredweight of milk, with an estimated federal payout to the participants of $1.8 billion. The average payment to participants was $15.80 per hundredweight of their milk marketing base.

To help pay for the program, the Congress authorized assessments on dairy producers. Producers paid 40 cents per hundredweight of production from April 1 through December 31, 1986, and 25 cents per hundredweight from January 1 through September 30, 1987. These assessments totaled about $677 million.

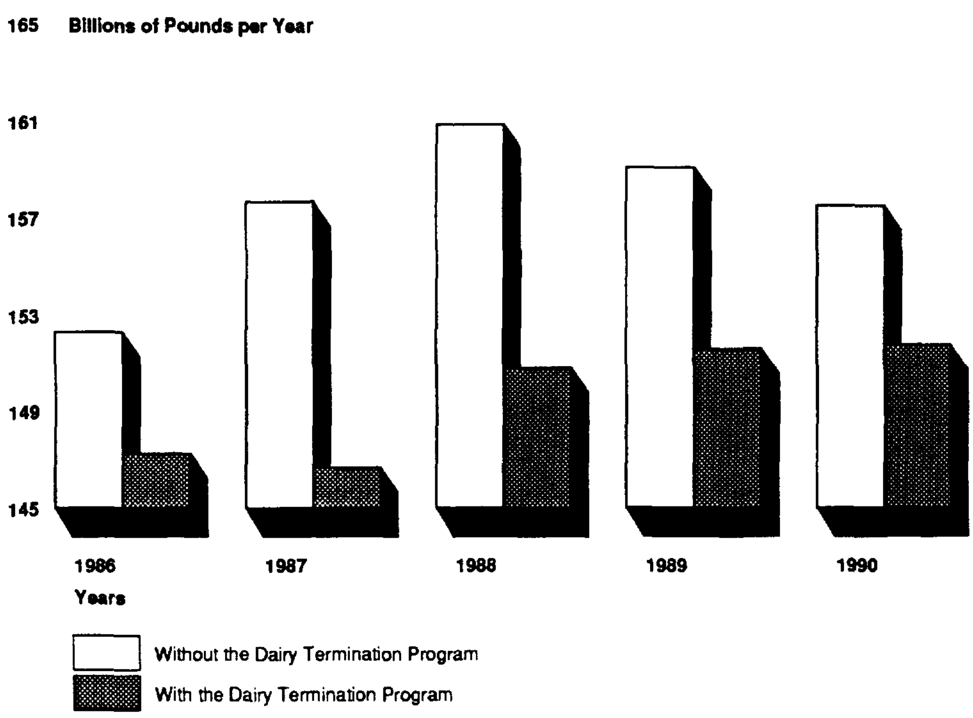
Milk Production and Surplus Purchases Temporarily Lower Under Dairy Termination Program

The Dairy Termination Program resulted in both lower milk production and lower dairy surplus purchases by the federal government than would have occurred without the program. Using our economic model, we estimate that the program will reduce (1) milk production by 39.4 billion pounds during 1986 through 1990 and (2) federal purchases of dairy surplus by 38.1 billion pounds during the same period.[3] Although the Dairy Termination Program reduced dairy production and surpluses, the effects appear to be temporary.

Reduced Milk Production

Figure 1 shows our estimates of milk production with and without the Dairy Termination Program. According to our estimates, the program had its greatest impact during 1987, when production was reduced by about 11.0 billion pounds from what it would have been without the program.

Figure 1: Estimated U.S. Milk Production With and Without the Dairy Termination Program



[3]The program's impact on production does not exactly equal its impact on surplus purchases because a change in production affects milk prices and demand that, in turn, affect the surplus level.

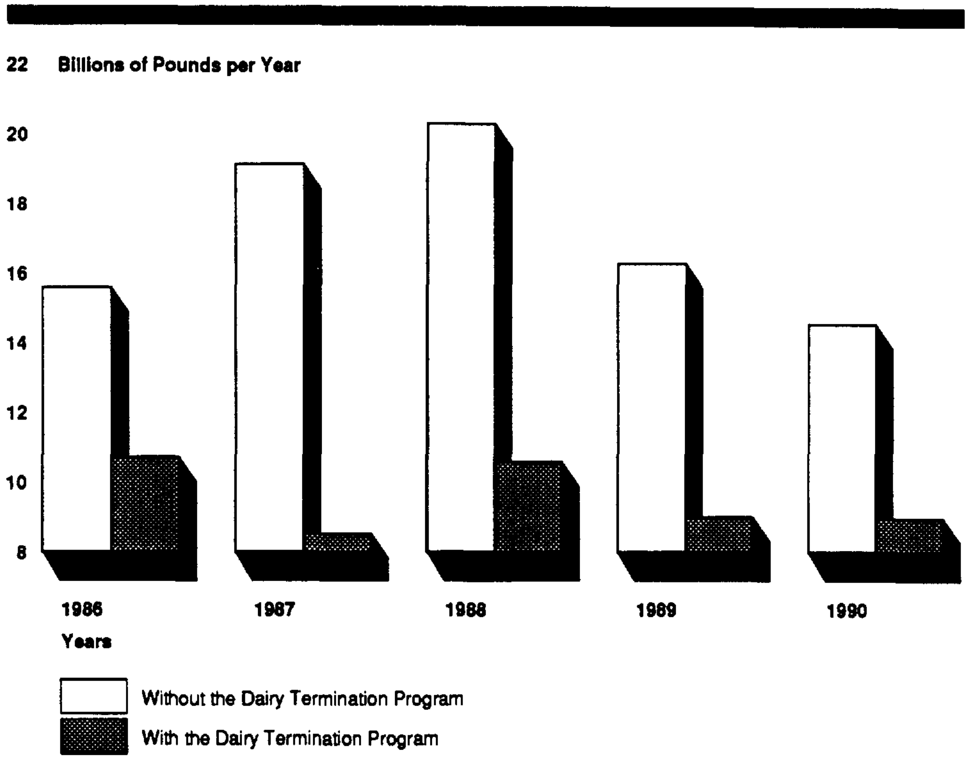
Our estimates, which extend through 1990, continue to show some program impact on milk production and federal surplus purchases at the end of that period. Our projection suggests that sometime after 1990 the program will cease to have any annual impact. One factor that could accelerate the diminishing effects of the program would be the return of a large number of program participants to dairying starting in 1991, when they are eligible to do so. According to the questionnaire results included in our previous report, approximately 26 percent of the program participants said they will definitely go back to dairying, will probably go back, or are just as likely to go back as not. Furthermore, program participants said it would be easy to recondition and/or acquire the needed land, dairy equipment, and buildings to go back to a dairy operation.

Even without the Dairy Termination Program, milk production would have started declining in 1988, according to our estimates. This downturn probably reflects the effects of reduced milk price support levels in accordance with the 1985 farm legislation and higher feed costs caused by the drought.

Reduced Dairy Surplus Purchases

Figure 2 shows our projections of the government's dairy surplus purchases with and without the Dairy Termination Program. According to our estimates, the program's impact on surplus purchases is similar to its impact on production. That is, the program reduced federal purchases of surplus dairy products below what they would have been without the program, but again this reduction diminishes over time.

Figure 2: Estimated U.S. Surplus Purchases With and Without the Dairy Termination Program



Another Perspective

To get a different perspective on the program's impact, we used our model to analyze the magnitude of price-support reductions necessary to achieve the same impact over the same period of time. According to our model, it would take an additional price-support reduction of about $1.25 in each of 3 years—1986, 1987, and 1988—to achieve the same reductions in production and surpluses we estimate the Dairy Termination Program will have through 1990, but at less government cost. However, unlike the temporary impact of the Dairy Termination Program, price-support reductions have a permanent impact.

The above approach would be a severe reduction in the price-support level—about $3.75 over the 3-year period, in addition to the $1.00 reduction that actually occurred during that same period. We did not determine the impact that this combined reduction (40.9 percent of the 1986 price-support level) would have on producers, processors or consumers.

Dairy Termination Program Appears to Be Cost-Effective

According to our estimate (see table 1), the Dairy Termination Program results in a net savings to the government of about $2.4 billion from fiscal years 1986 through 1990.[4] The net savings estimate includes both financial benefits associated with the program and federal costs or payments under the program. Financial benefits include the amount of savings from reduced federal surplus purchases, which our model estimated, and revenues from assessments on dairy farmers' production. Costs include direct Dairy Termination Program payments to program participants, administrative costs, and the net cost of red meat purchases.[5]

It should be noted that there is a degree of uncertainty associated with the estimated net program savings. Estimates of surplus purchases are very sensitive to changes in estimates of milk production and consumption. Consequently, a small change in production or consumption could mean a rather large percentage change in surplus purchases. Additionally, we did not attempt to assign any value to surplus dairy stocks distributed in government food assistance programs, nor did we attempt to determine possible implications for consumers or the crop support programs.

Table 1: Estimated Savings of the Dairy Termination Program Through 1990

Dollars in billions

Savings/costs[a]	Estimated savings/costs
Reduced surplus purchases	$3.67[b]
Assessments on producers	.64
Subtotal	**$4.31**
Costs	
Payments to program participants	(1.53)
Administrative costs	(0.01)
Red meat purchases	(0.39)
Subtotal	**(1.93)**
Net savings	$2.38

[a]1986 present values.

[b]On the advice of USDA, we used the dairy support price plus a manufacturer's margin of $1.30 per hundredweight as a measure of the purchase cost of excess dairy products. Purchase costs were then reduced by 4 percent to account for the government's sales of some surplus dairy products. This 4-percent factor is based on historical and projected data.

[4]Our estimate is based on 1986 present values. We used an 8.4-percent discount rate that, at the time of our analysis, was applicable to government securities maturing in 1990.

[5]To minimize the effect of the Dairy Termination Program on beef, pork, and lamb producers, USDA was required to purchase 400 million pounds of red meat in addition to the amount normally purchased.

Like the effects on milk production and surpluses, the annual savings associated with the program generally decrease over time.

The Cost-Effectiveness of a Future Termination Program Is Unknown

As the Congress considers new farm legislation, it may again be faced with the issue of how to control the production of surplus milk. While another Dairy Termination Program has appeal, at least as a temporary measure, the cost and impact of such a future program is unknown because of the numerous factors influencing farmers' decisions to bid on a future program. For example, if dairy farmers expect dairying to be a lucrative enterprise in the future, their reaction to a Dairy Termination Program would be different than if they anticipate less government support. It is possible that bids on a future program would be considerably higher than the bids on the last program.

Conclusions

The dairy surplus situation is a continuing problem that the Congress has attempted to address over the years through a number of different programs—most recently through the Dairy Termination Program. Our analysis of this program indicates that it has reduced milk production and corresponding surpluses in a cost-effective manner. However, its effects on milk production and surpluses appear to be temporary. As a result, it is very likely that the Congress once again will be faced with determining how to best address the surplus issue, particularly in view of technological advances that may significantly increase milk production. While our model suggests that the last Dairy Termination Program was cost-effective, we cannot predict the cost and impact of a future program.

Agency Comments and Our Evaluation

We requested and received written comments on our draft report from USDA. USDA's comments, dated May 8, 1989, are included in this report as appendix II.

USDA stated that the model we used in conducting our study was a reasonable tool for measuring the impact and effectiveness of the Dairy Termination Program. However, USDA did have several comments regarding the report. USDA believed that our report implied that the Dairy Termination Program was designed to, in and of itself, eliminate future dairy surpluses. USDA noted that, in fact, the program was designed to temporarily reduce surpluses, followed by support-price adjustments that would help retain the supply-demand balance. We did not intend to imply that the program was designed to have a long-term or permanent effect. Rather, we think it is important to point out that the program should not be considered a permanent solution to the dairy surplus problem. Additionally, the report does recognize the reductions that have taken place in the price-support level.

Finally, USDA believed that the report should emphasize that the cost-effectiveness of the Dairy Termination Program may not provide a good basis for estimating the cost-effectiveness of future programs. We agree that this point is very important. While we mentioned it in the draft we submitted to USDA, we have given added emphasis to this point by devoting a section of the report to that issue.

We performed our work between August 1987 and April 1989. The methodology we used is described in detail in appendix I. We developed an economic model that identified the key variables that affect the price and quantity of dairy products, and specified how these variables relate to each other. One variable represents the Dairy Termination Program. We used our model to estimate the effect of the program on milk production and federal purchases of surplus dairy products. We then used this estimate of the reduction in surplus purchases to estimate the net savings to the federal government. We used a similar approach to examine the effects and costs of reducing milk price-support levels.

Throughout the model's development, we consulted with the following expert economists: Dr. David Belsley of Boston College, Dr. Bruce Gardner of the University of Maryland, and Dr. Ronald Knutson of Texas A&M University. We also discussed our modeling efforts with economists from USDA, and we reviewed dairy sector models that had been published previously.

We are sending copies of this report to the Secretary of Agriculture; the Administrator, Agricultural Stabilization and Conservation Service; the Director, Office of Management and Budget; and other interested parties. Major contributors to this report are listed in appendix III.

John W. Harman
Director, Food and
Agriculture Issues

Contents

Abbreviations

GAO	General Accounting Office
USDA	U.S. Department of Agriculture
RCED	Resources, Community, and Economic Development Division

Technical Description, Methodology, and Sensitivity Analysis of Dairy Sector Model

The overall purpose of our model was to enable us to isolate the effect of the Dairy Termination Program on U.S. dairy surpluses. Dairy surpluses are the excess of milk supply over demand. These surpluses are, therefore, affected by the many factors that influence the supply and demand for milk. For example, milk demand can be affected by consumer preferences for milk products, per capita income, and milk prices. Milk production can be affected by milk prices, feed prices, advances in dairy farming technology, and government programs such as the Dairy Termination Program. Our model attempts to describe the interaction of milk supply and demand variables, including the Dairy Termination Program, through a system of simultaneous equations. In developing our model, we used a non-linear, three-stage, least-square regression technique to quantify relationships among the model's variables. More specifically, this technique allowed us to estimate values for coefficients of the model's variables. After estimating coefficient values, we were then able to use the model to simulate milk production and surpluses both with and without the Dairy Termination Program from 1986 through 1990. The difference between the two simulations represented our estimate of the program's effect.

This appendix provides (1) a description of the equations and variables included in the model, (2) a discussion of the methodology for estimating the coefficients of the model and of the estimation results, (3) an explanation of the methodology for simulating the Dairy Termination Program's effects, (4) an examination of the model's forecasting ability, and (5) a sensitivity analysis that includes estimation results for different specifications of the model.

The Model's Variables

Each of the seven equations in our model attempts to explain a variable that is endogenous in the dairy market—that is, a variable whose value is determined jointly, conditional upon the other factors or variables in the dairy model. The seven endogenous (or dependent) variables are (1) quantity of milk supplied, (2) quantity of milk demanded, (3) price of milk received by farmers, (4) level of government dairy surplus purchases, (5) number of milk cows, (6) milk production per cow, and (7) commercial disappearance. Additionally, the model includes 14 exogenous variables such as per capita income, feed prices, and government-support prices. The values of all exogenous variables are assumed to be predetermined, or to be determined by factors that are considered outside the influence of the market system described by the model. The values of endogenous variables from prior time periods are also considered predetermined. The model's seven equations are shown in table I.1 and a description of the variables is contained in table I.2.

Table I.1: Dairy Sector Model

Demand equations
(1) QMD(t) = BQDC(t) + BQDF(t) + BSTC(t) - BSTC(t-1).
(2) BQDC(t) = A1 + A2*BQDC(t-1) + A3*RPMLK(t) + A4*DIPC(t).
Supply equations
(3) QMS(t) = COWS(t) * YIELD(t) + IMPTS(t).
(4) COWS(t) = B1*COWS(t-1) + B2*DTPSL(t) + B3*MDPSL(t) +B4*[RPMLK(t-2) - RDED(t-2)]/RPFEED(t-2) + B5*[RPMLK(t) - RDED(t)]/RPUTIL(t) + B6*REPHEF(t-1).
(5) YIELD(t) = C1 + C2*YIELD(t-1) + C3*TREND(t) + C4*MDPM(t) + C5*[RPMLK(t-3) - RDED(t-3)]/RPFEED(t-3) + C6*REPHEF(t-8) + C7*REPHEF(t-12)
Price and government net removals equations
(6) RPMLK(t) = D1 + D2*BNRMLK(t) + D3*RPSMLK(t) + D4*PERCFX(t).
(7) BNRMLK(t) = QMS(t) - QMD(t).

Table I.2: Model Variables

Endogenous variables	
BNRMLK	Government net removals (purchases) of excess dairy products (billions of pounds).
BQDC	Commercial demand (disappearance) of dairy products, including exports (billions of pounds).
COWS	Number of milk cows (millions).
QMD	Quantity of milk demanded (billions of pounds).
QMS	Quantity of milk supplied (billions of pounds).
RPMLK	All-milk price received by farmers (in constant dollars) per pound.
YIELD	Milk production per cow (thousands of pounds).
Exogenous variables	
BSTC	Ending commercial stocks of dairy products (billions of pounds).
BQDF	Consumption of milk on farms (billions of pounds).
DIPC	Disposable income per capita (in thousands of constant dollars).
DTPSL	Milk cows only disposed of through slaughter or port under the Dairy Termination Program (millions).
IMPTS	Imports of dairy products (billions of pounds).
MDPM	Milk Diversion Program payments (in millions of constant dollars), adjusted to exclude payments made for production reductions achieved through slaughter, and lagged one quarter to better align with corresponding reductions in production.
MDPSL	Estimated slaughter of milk cows because of the Milk Diversion Program (millions).
PERCFX	Percentage of producer deliveries used in Class 1 under federal milk marketing orders.
RDED	Payments per pound (in constant dollars) made by farmers to the government under various dairy collection programs since 1983.
REPHEF	Replacement heifers expressed as a percentage of the dairy cow herd.
RPFEED	Price of feed for dairy cows (in constant dollars per pound).
RPUTIL	Price of utility cows, Omaha (in constant dollars per 10,000 pounds).
RPSMLK	Government-support price for milk (in constant dollars per pound).
TREND	Time trend equal to 1 in 1976.1, 2 in 76.2, etc. The purpose of the trend term is to reflect the rather steady improvements in dairy products technology and some aspects of dairy management.

t= time measured in quarters.
A1...A4,B1...B8,C1...C7,D1...D4 Coefficients to be estimated.

In some cases, the decision to assume whether a variable is either endogenous or exogenous in a model is not obvious. In our model, six of the variables that we treat as exogenous could be considered endogenous. Three of these variables, on-farm milk consumption (BQDF), ending commercial stocks (BSTC), and imports of dairy products (IMPTS), account for only very small variations in milk supply and demand. Therefore, treating them as exogenous substantially reduces the complexity of estimating the model while not appreciably compromising the estimation results.

Two other variables that could be considered endogenous are the price of feed (RPFEED) and utility cow price (RPUTIL). We treated these variables as exogenous because we believe that changes in the dairy sector caused by the DTP likely had little impact on the domestic feed grains and beef markets, given that there are many other major influences on those markets, such as government programs and foreign markets. In a November 1987 report on cattle futures markets, we noted that cash prices and cattle futures prices dropped sharply when the DTP was announced, but quickly rebounded to pre-program levels.[1] In addition, the Food Security Act of 1985 attempted to minimize the DTP's impact on red meat markets by requiring the federal government to purchase red meat to compensate for possible reductions in beef prices caused by the DTP. As a check on the significance of these assumptions for our results, we include in our sensitivity analysis, discussed in a later section, simulations of our model assuming that the DTP could have resulted in 5-percent lower feed costs and 5-percent lower utility cow prices.

Finally, the variable PERCFX, the percentage of milk sold as fluid under federal milk marketing orders, could also be considered endogenous. This is because its value is determined by supply and demand for each of the different milk products, i.e., cheese, butter, fluid milk, and nonfat dry milk, and should be determined simultaneously with the two elements of the all-milk price (RPMLK), the fluid and manufacturing milk prices. Nonetheless, treating PERCFX as exogenous is justified to the extent that its value is dominated by exogenous and stable elements of the market. Specifically, the demand for fluid milk has been very stable and price inelastic in the relevant price range. Fluid milk demand has changed slowly over time with changes in tastes and preferences, which are treated as exogenous. Non-fluid milk production can be considered as residual or excess production beyond fluid milk demand, and is greatly influenced by the status of government programs designed to encourage or support dairy production. Government programs or policies are treated as exogenous to the model.

Use of Lagged Dependent Variables

Our model includes lagged dependent variables on the right-hand side of equations (2), (4), and (5). These lagged dependent variables are expected to capture any inertial elements in the behavior of the corresponding dependent variable. They can be interpreted as representing

[1]Commodity Futures Trading: Purpose, Use, Impact, and Regulation of Cattle Futures Markets (GAO/RCED-88-30, Nov. 10, 1987).

the combined influence of many lagged variables on the long-run behavior of dairy farmers and consumers. For example, in the demand equation (2) the lagged dependent variable, BQDC(t-1), is intended to reflect variables such as population size and tastes and preferences for milk products. In the two supply equations, the lagged dependent variables are intended to reflect past price and feed cost information and, perhaps, some progress in dairy management.[2]

The values of the lagged dependent variables in any period might be interpreted, in the context of their respective equations, as starting points from which adjustments are made to the dependent variable during the period in response to recent changes of the different supply and demand factors. For example, while a variable such as DTPSL in the COWS equation (4) measures the number of cows per quarter that were slaughtered and exported because of the DTP, the lagged dependent variable, COWS(t-1), in that same quarter will reflect, among other things, the cumulative cows slaughtered and exported because of the DTP from all previous quarters.

In the YIELD equation (5), we include a TREND variable along with the lagged dependent variable. The specific purpose of this TREND term is to reflect the rather steady improvements in dairy production technology and some aspects of dairy management. Although the lagged dependent (YIELD) term should also capture these trend effects among others, our analysis of different specifications of this equation suggested that both the TREND and YIELD(t-1) variables should be included to enhance forecast accuracy.

Other Considerations in Specifying the Model

In general, the structure of our model is similar to that commonly found in the literature in that we include separate equations for both cows (herd size) and yield per cow. Also, as is often done in other modeling work, our model uses a milk-price feed-cost ratio in the COWS and YIELD equations to represent the relative profitability of milk production. Other relationships suggested by our model, however, are much less conventional and/or may be unique to our model. These relationships are discussed below, and in some cases, are the focus of a sensitivity analysis presented in a later section.

[2]We examined other specifications of the model where lagged dependent variables were replaced by multiple lagged price terms and found summarily inferior estimation results.

One atypical feature of our model is the lack of a constant, or intercept, term in the COWS equation (4). Model builders typically include intercept terms as a matter of course since their presence is usually warranted a priori and rarely causes problems. In this case, however, the presence of an intercept term causes collinearity problems, making it difficult to measure the effects of other variables in the equation. Specifically, the collinearity exists between the constant term and linear combinations of the lagged dependent variable and the milk price terms. There is, however, no compelling theoretical reason to include the intercept term in this particular equation. Consequently, we specify this equation without an intercept term. Inclusion of an intercept term in the COWS equation is discussed later in the sensitivity analysis section.

Both the COWS (4) and YIELD (5) equations include a variable to measure the effects of the Milk Diversion Program, since that program resulted in participating dairy farmers adjusting both cow herd size and yield to lower production. There is only one variable in the model, appearing in the COWS equation, to capture the effects of the Dairy Termination Program. We did consider including a DTP variable in the YIELD equation since it is conceivable that the average yield of DTP participants' herds was different from that of nonparticipants' herds. Such a difference in yield between the two herds should mean that yield was affected coincidently with the DTP-related slaughters/exports. However, available data do not suggest that the DTP had an immediate effect on YIELD, nor do they show that DTP participants' herds had lower (or different) average yields versus nonparticipants' herds. This finding supports the position of USDA economists who point out that dairy farmers either close to retirement or in financial difficulty, as opposed to those with lower-than-average yields, dominated the list of DTP participants.

Both the COWS and YIELD equations also contain the variable REPHEF, the number of replacement heifers expressed as a percentage of the number of dairy cows. This variable is intended to reflect the age composition of the herd, where age composition serves as a biological constraint on both herd size and yield. The lags for REPHEF in the YIELD equation correspond with the fact that a cow's milk production will typically be below average in the first lactation and above average in either the second or third lactation.[3]

[3]According to dairy experts we interviewed, a cow's milk production will typically be less than average in its first one or two lactations, peak in the second or third lactation, and then level off. Therefore, REPHEF might have a negative influence on yield with about a 2-year lag and a positive influence on yield with about a 3-year lag.

The relationship among the three variables of the price (RPMLK) equation (6) is explained as follows. The all-milk price, RPMLK, is a blend of the fluid and manufacturing milk prices. The fluid milk price is the more likely of the two to be influenced by supply and demand conditions in the market. This is because the fluid milk price is affected by both over-order premiums and the manufacturing milk price, where both of these price elements are in turn influenced in the same direction by the amount of excess supply (or government net removals). As a result, the net removals variable, BNRMLK, reflects the negative influence of excess supply on the fluid milk price, and consequently the all-milk price. The manufacturing milk price is the price paid for all milk used for non-fluid purposes. When the government removes surplus milk from the market by purchasing manufactured milk products, the manufacturing price should be close to the federal dairy support price. In effect, this federal price supports the manufacturing price. Therefore, RPSMLK, the support price, is included in the price equation to reflect the positive influence of the federal support price on manufacturing milk prices and thus the all-milk price. Finally, the variable PERCFX, the percentage of milk sold as fluid, is included to account for variations over time in the weights (or blend) of the fluid and manufacturing prices in arriving at RPMLK. PERCFX is expected to have a positive influence on RPMLK because fluid milk prices exceed prices of milk used for manufacturing.

Estimation Methodology and Results

Our model includes seven equations that are jointly determined. Only four of these equations, (2), (4), (5), and (6), contain coefficients that had to be estimated. The coefficients of all four equations were estimated simultaneously using non-linear, three-stage, least squares, which is a regression technique designed to incorporate all information contained in the model in the estimation of the coefficients for each equation. The data set used to estimate the model consists of quarterly observations beginning with the first quarter of 1976 and ending with the first quarter of 1988.[4] All data were seasonally adjusted. Data were obtained from USDA and Wharton Econometric Forecasting Associates, a commercial forecasting company.

[4]Data were available as far back as the 1960s. Nonetheless, all estimation results reported here are only for the sample period 1976 through the first quarter of 1988. We used the shorter sample period both to enhance the possibility that the estimates would reflect the current rather than past dairy market structure, and to remove from the data set some observations that we and other modelers consider to be outliers (occurring in the early to mid-1970s).

Table I.3 presents our estimation results. These results represent the specification considered by us as "best" among all different specifications of the model estimated. Estimation results for other specifications are discussed in the sensitivity analysis section.

Table I.3: Estimation Results

Equation/variables	Coefficient estimate for variable			t ratio
Demand Eq. (2)				
CONSTANT	A1	=	11.69	2.47
BQDC(t-1)	A2	=	.22	1.82
RPMLK	A3	=	−27.09	−2.58
DIPC	A4	=	1.60	4.16
COWS Eq. (4)				
COWS(t-1)	B1	=	.94	63.84
DTPSL	B2	=	−1.02	−13.33
MDPSL	B3	=	−1.30	−6.10
RPMLK(t-2)/RPFEED(t-2)	B4	=	1.48	1.11
RPMLK/RPUTIL	B5	=	.32	1.79
REPHEF(t-1)	B6	=	1.11	5.86
YIELD Eq. (5)				
CONSTANT	C1	=	.76	2.22
TREND	C2	=	.005	2.59
YIELD(t-1)	C3	=	.63	5.37
MDPM	C4	=	−.0004	−3.37
RPMLK(t-3)/RPFEED(t-3)	C5	=	1.52	1.54
REPHEF(t-8)	C6	=	−.79	−1.89
REPHEF(t-12)	C7	=	1.16	2.52
Price Eq. (6)				
CONSTANT	D1	=	−.02	−1.73
BNRMLK	D2	=	−.001	−2.09
RPSMLK	D3	=	.87	19.17
PERCFX	D4	=	.001	3.99

Summary statistics	R-square	RHO (T-Ratio)
Demand Eq. (2)	.909	Not significant
COWS Eq. (4)	.980	Not significant
YIELD Eq. (5)	.994	.33 (1.94)
Price Eq. (6)	.981	.46 (4.36)

All estimates of coefficients in table I.3 have signs consistent with our expectations. For example, as economic theory would suggest, the coefficient for the price of milk in the demand equation, A3, is negative while the coefficients for the milk-price feed-cost ratios in the herd and yield equations, B4 and C5, are positive. Additionally, all coefficients, except the price-feed cost ratios in both the COWS and YIELD equations, are statistically significant (different from zero) at the 95-percent confidence level or higher for a one-tailed test. The two price-feed cost ratios are significant for one-tailed tests at 80-percent and 90-percent confidence levels, respectively.

Elasticity estimates cannot be observed directly from the estimation results but can be derived using the estimated coefficients and the values of the relevant variables over a specified time period. For the estimates presented here, we used the mean value of the variables over the entire sample period of estimation. According to the coefficient estimates presented in table I.3, the estimated milk price elasticity of demand is about -.11, the estimated per capita income elasticity of demand is nearly .51. These estimates are for the short-run, however, specifically only a one-quarter time period. Elasticities are typically larger (more elastic or greater in absolute value) for longer periods of time and, given the lag structure of the demand equation, that rule of thumb holds true here. For example, with a two-quarter period of time instead of one-quarter, the estimate of the milk price elasticity of demand increases (in absolute value) to about -.14 from -.11. Because of the lagged price terms in the YIELD and COWS equations, the price elasticity of supply is more complicated in concept. For example, the price elasticity of supply for one quarter is only .01, but after five quarters it is up to .65. This elasticity grows rapidly with time in the first year because, with the lagged price terms in the YIELD and COWS equations, it is not until a full year before all the effects of a given price change are accounted for.

Table I.3 also shows the R-squared for each equation, which measures the proportion of variance in the dependent variable explained by the estimated equation. For two equations, YIELD (5), and RPMLK (6), the table also shows estimates of RHO, the autocorrelation coefficient. As indicated by the reported t-statistics for each RHO, autocorrelation was found to be significant in these equations. Therefore, both equations were adjusted for (first order) autocorrelation using the corresponding estimated RHO.

The Role of Government in the Estimated Model

The role of government in the dairy market is captured in the model through the variables DTPSL, MDPSL, MDPM, and RPSMLK, which correspond to Dairy Termination Program (DTP) slaughter/export, Milk

Diversion Program (MDP) estimated slaughter, MDP expenditures (estimated as net of slaughter-related expenditures), and the dairy support price. An understanding of the estimated coefficients of these variables is important to an overall understanding of the model's results. Accordingly, they are discussed in more detail below.

If the direct result of the DTP was the disposal of all participants' cows, and no more or less net of normal culling, then the coefficient for the DTP variable in the COWS equation should equal -1.00. The estimate of that coefficient, B2, is -1.02, which is not significantly different from -1.00 at the 90-percent confidence level for a two-tailed test. Thus, our point estimate of -1.02 implies that every dairy cow disposed of under the DTP would not have been disposed of without the program (net of normal culling).

The coefficient, B2, should capture the actions of the program participants. An estimate of B2 that is significantly less than -1.00 might indicate slippage in the program, where some of the participants cows disposed of under the DTP would have been disposed of even without the DTP.[5] Since our estimate of B2 is not significantly different from -1.00, we cannot conclude that there was such slippage. It is likely, however, that there was some slippage in view of our previously reported survey results that suggested that 26 percent of the program's participants whose holdings accounted for about 15 percent of the dairy cows in the program, probably would have quit dairy operations without the program. However, the number of cows these exiting dairy farmers would have slaughtered rather than sold to other dairy operations, hence the slippage they might represent, is unknown. Nonparticipants' actions can be captured directly through B2 as well but also indirectly through the effects of the DTP on milk price, for example. Since the estimate of B2 is not significantly different from -1.00, it does not appear that there were any significant actions by nonparticipants to alter herd size directly in response to the DTP.

Since the model results suggest there was little slippage in achieving the removal of participants' herds from production, it might seem reasonable to expect that the program would have resulted in reducing annual production by an amount equal to the expected production of the participants' herds, or about 12 billion pounds per year. However, the slaughter/export of participants' cows was spaced out over an 18-month

[5]By "slippage" we do not mean to imply that these effects were unanticipated by either the authors or administrators of the DTP.

period, so that the entire effect of the DTP on production would not occur until the fourth quarter of 1987, at the earliest. Further, during this 18-month period, nonparticipants could react by initiating steps to increase their herds. These steps could include a reduced rate of culling, with an immediate effect on herd size (hence, immediate slippage), and/or raising more dairy cows, with a lagged effect on herd size (hence, lagged slippage). In other words, slippage in the form of nonparticipants' direct and indirect responses probably builds over time so that the accumulating slippage prevents the achievement of the 12-billion-pound reduction in annual production in any given period.

The variable MDPSL is the number of dairy cows that dairy farmers reported to USDA that they would slaughter under the MDP. Assuming the actual slaughters associated with the program were close to farmers' expected slaughters, we would expect the coefficient on MDPSL, B3, to be close to -1.00.[6] The estimate of that coefficient is -1.30, and is significantly different from -1.00 at the 90-percent confidence level for a one-tailed test. This result lends some support to the observation of at least one dairy expert that MDP participants, in order to meet their obligations to lower production, had to slaughter more cows than they originally planned so as to compensate for unanticipated improvements in yield. The other variable that accounts for the effects on milk production of the MDP is MDPM, government payments to dairy farmers for reducing production under the MDP. We adjusted MDPM, however, to represent only those payments that reflect farmers' efforts to reduce the yield of the existing herd, and therefore not to account for reductions in milk production achieved through slaughter. Slaughter-related reductions in milk production because of the MDP are already accounted for by the MDPSL variable in the COWS equation. The coefficient on MDPDM is negative and significant, suggesting that the MDP did result in less production per cow during the period of the program.

In the model, RPSMLK, the variable that represents the dairy support price level, appears in the price (all-milk) equation. The estimate of the coefficient for RPSMLK, D3, is .87, which suggests that increasing the support price by $1.00 will lead to an increase in the all-milk price received by farmers of about 87 cents. This is consistent with our expectation that the support price is positively related to the milk price received by farmers. The federal government does not actually purchase fluid milk at the support price, but rather manufactured milk products such as cheese, butter, and nonfat dry milk, and at prices that are based

[6]Assuming that non-participants of the MDP did not alter their herd sizes in response to the MDP.

on the support price plus a manufacturing margin. This price typically is close to the manufactured milk price. The all-milk price or the price received by farmers, RPMLK, is a blend of the fluid and manufactured milk prices. Although the fluid milk price is also tied to the manufactured milk price, other factors, such as over-order premiums under the milk-marketing order system, could also affect fluid milk prices. The influence of the support price on the all-milk price, then, depends in part on the proportion of milk sold that is for non-fluid uses.

Simulation Methodology and Results

To estimate the effects of the Dairy Termination Program, we used the model to simulate milk production and net removals both with and without the program from 1986 through 1990 (the limit of our data set). The difference in both milk production and net removals between these two simulations is our estimate of the effects of the DTP on those variables. The simulation without the DTP assumes that no government program (beyond the federal milk marketing orders system and dairy price-support program already in place) would have been implemented in place of the DTP.

For this analysis, we assume that the dairy price-support program is independent of both the DTP and MDP. In other words, the model does not permit the presence of either the DTP or the MDP to affect the price-support level. Consequently, in our simulations of the model under the assumption that the DTP never existed, we use the same support-price levels as existed with the DTP. Beyond the DTP period, support prices are adjusted in the simulations in accordance with the Food Security Act of 1985, and assuming the Secretary of Agriculture has perfect foresight regarding excess dairy production. In any case, the result is that in both simulations the support prices are reduced each year by the maximum allowed by law.

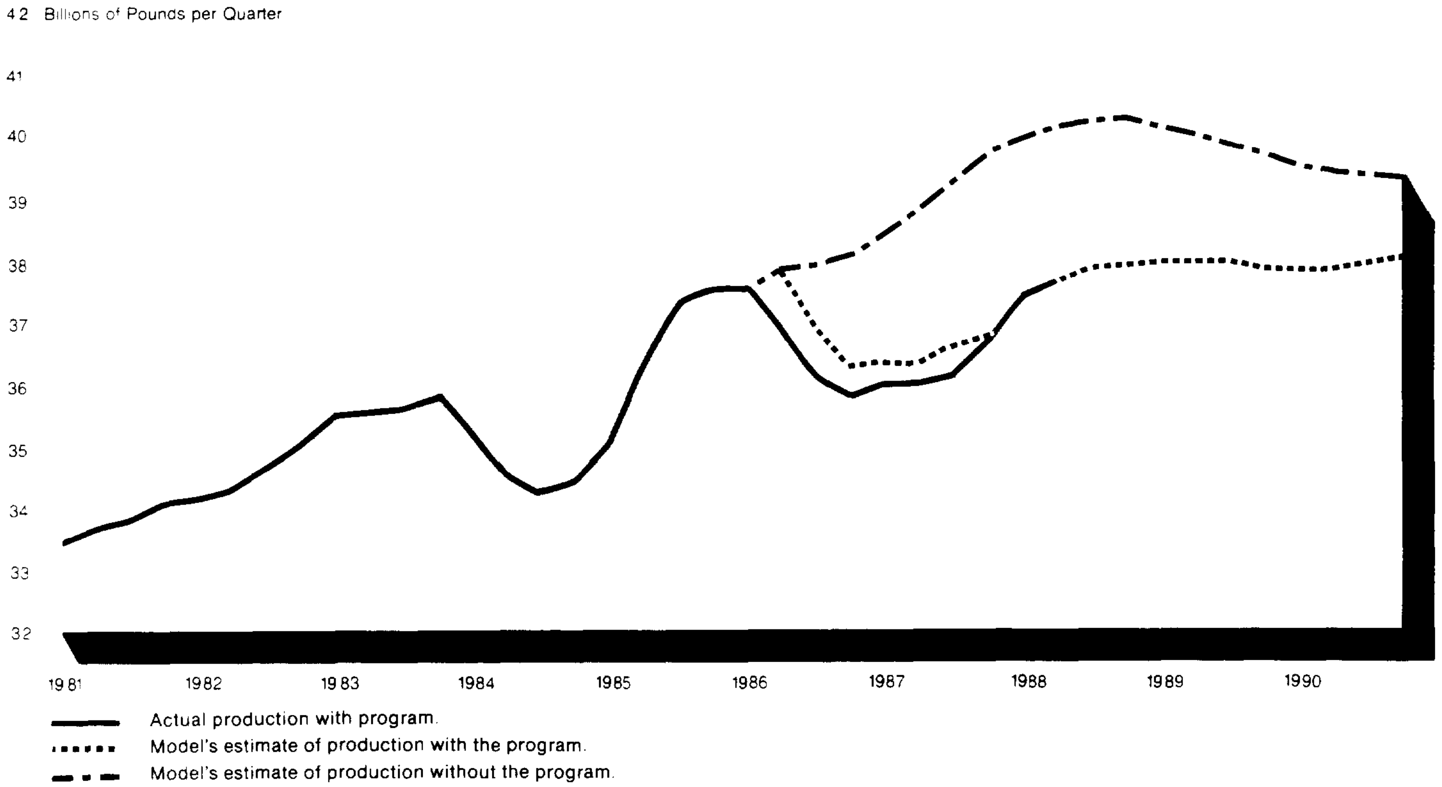
Simulation Methodology

All simulations covered the period from the first quarter of 1986, one quarter prior to the start of the DTP, through 1990. For each period of the simulations, namely each quarter, current values of the endogenous variables in the model are determined using the estimated coefficients and the values of the predetermined variables (both exogenous and lagged endogenous variables). The simulations are dynamic in that solved values of endogenous variables are used by the lagging functions to solve for the endogenous variables in subsequent periods. Thus, the simulation feeds on its own solutions for endogenous variables. We obtained from Wharton Econometric Forecasting Associates forecasts of the exogenous variables from 1988 through 1990 to complete our data set for the simulations.

One simulation was designed to show milk production under the assumption that the DTP never existed. This required that we set the coefficient on the DTPSL variable in the COWS equation to zero. It was also necessary to adjust RDED to show the absence of deduction payments associated with the DTP. The results of this first simulation were then compared with a second simulation in which the DTP is assumed to exist. This simulation required no adjustments to coefficients or variables. Since the simulations are dynamic, random deviations or shocks in the actual data will result in errors in our forecasts that may cause our forecasted values to deviate from actual values for an extended period of time. Consequently, for our analysis to be a valid comparison of the two scenarios, it is necessary that each of the two simulations not only covers the same period of time but is dynamic over that period, even though actual data are available for 1986-87, when the DTP did exist. In this way, any random errors or shocks will be reflected equally in both simulations and should not greatly affect our effort to estimate the effects of the DTP from the difference in the two simulations.

Figure I.1 shows our simulation estimates of milk production with and without the DTP. All data are seasonally adjusted. The solid line through the first quarter of 1988 represents actual production. The lower dashed line is our simulation of production with the DTP. The gap between the lower dashed line and the solid line represents our forecast error for the 2-year period 1986 through 1987. The difference between the two simulations diminishes over time, indicating that the effects of the DTP on production will not be permanent.

Figure I.1: Quarterly Milk Production With and Without DTP



Note 1: Data are seasonally adjusted.

Note 2: The Milk Diversion Program operated from January 1984 through March 1985.

Summary of Simulation Results

The differences in milk production and net removals projected by the two simulations represent the effect of the DTP on those variables. Our analysis shows that the DTP has affected milk production and net removals during the period of the program, 1986-87, and will continue to affect production and net removals throughout the period to the limit of our data set range, 1990, at least. Because our results suggest that the DTP's effects on milk production and net removals will extend beyond 1990, we probably understate the consequences of the DTP when we focus only on the period 1986 through 1990.

The simulations suggest that milk production depends on cow herd size. This result reflects that yield, or milk per cow, the other factor in milk production, is projected to increase steadily in both simulations, although reaching a slightly higher level in the scenario with the DTP because of the effects of the DTP on milk price. Milk price, specifically the constant dollar all-milk price received by farmers, is projected under both scenarios to decline throughout the forecast period. Of course, the dairy support price is assumed to decline annually throughout this period as well, except as provided in the Disaster Assistance Act of 1988. However, milk price is projected to decline more rapidly under the scenario when the DTP does not exist compared with when it does. This result simply reflects the effect on price of a greater dairy surplus projected for the case when the DTP never existed.

Examination of the Model's Forecasting Accuracy

The accuracy of our estimate of the DTP's effects through 1990 depends, in part, on how accurately the model forecasts milk supply and demand. To obtain some evidence concerning the forecast accuracy of our model, we used the model to simulate values for its endogenous variables during a period for which actual values for these variables were available (first quarter of 1977 through the last quarter of 1987). Comparing the simulated values of the endogenous variables with their actual (historical) values over this period provides measures of forecast errors that were used to evaluate the forecast accuracy of the model. Nonetheless, we recognize that such a model might forecast the past well but not the future; hence, these measures of forecast accuracy are necessarily limited.

Using the forecast errors described above, we calculated several statistics to interpret forecasting accuracy of the model. One statistic is the RMS (root-mean-square) simulation error, which is presented here as a percentage of the actual value of the variable. The other statistic is the Theil-U, or inequality coefficient, which is the RMS but scaled in a different manner to lie between 0 and 1. For both statistics, values close to zero indicate that the model is able to forecast the past well. These statistics for the 'best' specification of the model are presented in table I.4.

Table I.4: Measures of Forecast Accuracy

Dependent (Endogenous) variable	RMS percent error	Theil-U
BQDC	1.40	.0069
QMD	1.37	.0068
QMS	1.24	.0061
COWS	.48	.0024
YIELD	.96	.0046
BNRMLK	79.36	.0982
RPMLK	1.77	.0090

As shown in the table, the Theil-U numbers are all very small, and similarly the RMS percent errors are all less than 2 percent, with one exception. That exception is BNRMLK, net removals, and its relatively high values in the table might be explained by recognizing that BNRMLK is a residual value, specifically the difference between QMS and QMD, and that a small change in QMS and or QMD could mean a rather large (percentage) change in BNRMLK. The fact that the forecast evaluation statistics for QMS and QMD are reasonably good suggests that poor numbers for BNRMLK do not indicate that the model fails to forecast well, although they suggest that forecasting a residual value is difficult. A decomposition of the Theil-U statistic does show that the forecast of BNRMLK is not biased. Furthermore, the decomposition of the Theil-U indicates that the forecast errors for all the variables are primarily random, and not the result of inadequacies or bias inherent in the model specification.

Sensitivity Analysis

Estimation results of the kind presented above are inherently uncertain, particularly with regard to coefficient estimates, model specifications, and data accuracy. Although it is not possible to account for all sources of uncertainty, such as that posed by measurement problems in data, some sources of uncertainty can be addressed through sensitivity analysis. We conducted such analysis to show how sensitive the estimation results presented earlier are to some of these uncertainties.

Uncertainty Associated With the Estimated DTP Coefficient

Our estimate of the direct effect of the DTP on (the number of) COWS, B2, is -1.02. This can be interpreted as a best estimate of this effect. The standard error of this estimate serves to account for the associated uncertainty. Using the estimated standard error of the point estimate of B2, a 95-percent confidence interval around the -1.02 estimate can be constructed, indicating 95-percent confidence that the interval brackets the true value of B2. For B2, the estimated 95-percent confidence interval is -.87 to -1.17. Using both -.87 and -1.17 as alternative possible values for B2 in a sensitivity analysis, a range of possible savings to the government was estimated.[7] This sensitivity analysis indicates that the DTP could result in federal savings ranging from about $1.85 billion to $2.90 billion for fiscal years 1986 through 1990. Since this range indicates considerable evidence that the DTP provides the government with substantial savings, accounting for uncertainty associated with the estimate of B2 provides additional support for our principal finding that the DTP resulted in a net savings to the federal government.

Uncertainty in Model Specification

The estimates presented earlier are from the specification of the model that we consider best. However, selecting a best specification of the model is, in part, a subjective process. We tried numerous alternative model specifications.[8] Three of the more important ones involved adding variables to the model's existing equations, while a fourth involved adding an entirely new equation to the model. With regard to the former, we added (1) an advertising variable to the demand equation to reflect the extent to which milk demand is affected by advertising, (2) an interest-rate variable to the cows equation to reflect alternative investment opportunities, and (3) an intercept term or constant to the cows equation.

We also tried adding an eighth equation to the model, which was intended to represent the number of replacement heifers. By adding this equation, we hoped to determine whether or not the DTP had disrupted the age composition of herds, implying that the program might have affected milk yields.

Variations of Demand and Cow Equations

Table I.5 summarizes the different specifications tried and the results. As seen in table I.5, the estimate of B2, the coefficient of the DTP variable in the COWS equation, does not differ significantly from our best

[7]These different values of B2 are used in simulations of the model to estimate reductions in government net removals because of the DTP. These reductions are then used to estimate government savings. The methodology for estimating government savings is described earlier in this report.

[8]Results are not presented for all specifications tried. One example of an alternative specification tried in the early stages of our research was to include several lagged price terms in lieu of the lagged dependent variable in both the COWS and YIELD equation. The results showed no improvement in explaining what happened, and the creation of a strong bias in the forecast errors for the COWS equation over the historical period of the sample.

specification. This coefficient captures much of the effect of the DTP on production, net removals, and government savings from the DTP.

Table I.5: Sensitivity Analysis Involving Alternative Specifications

	Equation.	R-Bar Sq.[a]	Est. B2
'Best' or base case	Demand COWS	.9025 .9773	−1.02 −1.02
Variable added			
Advertising (generic) -a (1,0) dummy for the Dairy Promotion Board starting in May 1984.	Demand	.9021	−1.02
Constant term	COWS	.9767	−1.01
Prime interest rate in constant dollar or real terms.	COWS	.9768	−1.02

[a]The R-Bar Square is a better measure of the explanatory power of an equation than R-Square when comparing equations that differ in the number of coefficients estimated.

We tried including an advertising variable in the demand equation because the literature suggests that milk-product advertising may be an important factor affecting milk demand. The specific variable added measures a change in the level of generic milk-product advertising coinciding with the establishment of the National Dairy Promotion and Research Board. Including this variable did not improve the explanatory power of the equation, and the t-statistic for the estimated coefficient for the advertising variable proved not significant at the 90-percent level for a one-tailed test.

We also examined consequences of adding an intercept to the COWS equation. The intercept term was statistically significant at the 90-percent level, but the R-Bar Square was lower with the intercept term. This occurs because the intercept term causes collinearity problems that make it difficult to measure the effects of other variables in the equation.

Specifically, including this intercept term not only reduces the explanatory power of the equation but also lessens the contributions (and significance levels) of several other variables in the equation. In any event, including the intercept term in the COWS equation did not appreciably alter the estimate of B2.

We also tried adding an interest-rate variable to the COWS equation because it might reflect alternative investment opportunities and financial constraints. We did not have a clear expectation for the sign of this variable since some investment opportunities in dairying may suggest a positive sign while other nondairying opportunities and financial constraints may imply a negative sign. The sign of the estimated coefficient for this variable was positive, but the coefficient was not significant at the 90-percent level for a two-tailed test.

In summary, the specifications shown in table I.5 and several others not presented (because their results were considered less plausible) resulted in estimates of government savings from the DTP. Furthermore, in each of these alternative specifications, the R-Bar Square statistic was less than in the corresponding 'best' case results.

Use of an Eighth Equation

We estimated one other specification that involved adding another behavioral equation to the model. The dependent variable of the new equation is RHEFX, the number of replacement heifers. RHEFX is the numerator of the variable REPHEF, replacement heifers as a percentage of the dairy cow herd, which appears in both the COWS and YIELD equations.

Our primary purpose in trying this new equation was to address concerns that the DTP may have disrupted the age composition of the herd, which would then imply that the DTP might affect YIELD in addition to affecting herd size. Without this additional equation, DTP cannot directly affect YIELD because there is no mechanism to separate out the possible effects of the DTP on RHEFX.

In table I.6 we present results obtained from estimating the RHEFX equation simultaneously with the other equations in the model. This simultaneous estimation did not produce results for any of the other equations in the model that differed appreciably from the 'best' results presented in table I.1. The one exception is that, the estimated coefficient for DTPSL in the COWS equation equals -.90 in the eighth equation version, which is significantly less than the anticipated -1.00 at the 90-percent level for a one-tailed test. This result suggests the possibility that there was some slippage in the DTP.

Table I.6: RHEFX Equation Estimation Results

Variable	Coefficient estimate	t-statistic
COWS (t-7)	.03	2.85
RHEFX (t-7)	.52	14.09
RPUTIL (t-7)	.61	5.52
DTPCM (t) - DTPCM(t-7)	−1.25	−12.69
MDPMX (t-1)	.001	3.83
MDPMX (t-3)	.001	3.58
RPSMLK/RPFEED (t-7)	14.58	7.94
RPSMLK/RPFEED (t-3)	8.04	3.79
	R-Square	.961

Two new variables, DTPCM, which measures the cumulative number of heifers only that were slaughtered or exported under the DTP, and MDPMX, which measures the total dollar government payouts under the MDP, are introduced in this equation. Many of the variables are lagged seven quarters in the equation, which may approximate the average biological time lag between the decision to create a heifer and when the resulting new calf becomes a heifer. The three quarter lag on the support-price feed-cost ratio is included because a second decision is made once the calf is born whether to sell the calf or raise it to become a heifer. The dairy support price rather than the all-milk price is used in the milk-price feed-cost ratios because milk production is several years beyond the decision to raise a new heifer and the current support price is a better reflection of future milk prices than the current all-milk price, which is more influenced by short-run factors. The MDP variables are included because dairy experts told us that the MDP caused farmers to delay breeding of heifers, thereby stockpiling heifers, and thus affecting the age composition of the herd at a time just prior to the DTP.

The results presented in table I.6 suggest that the DTP has reduced the number of heifers. However, because we are uncertain of the proper specification of the RHEFX equation, in comparison to the level of confidence we have concerning the specification of the other equations in the model, the RHEFX equation is not included in the 'best' specification of the model.

In any event, including the RHEFX equation in the model simulations permits the DTP to affect YIELD in a direct manner. Results of simulations of the model while including the RHEFX equation indicate that the DTP would result in slightly less financial benefits to the government over the 1986-90 time period than shown using the 'best' specification—about $2.1 billion compared with $2.4 billion.

Sensitivity of Results to Outside Influences

In our discussion of the model, we recognize that feed prices and utility cow prices, in particular, could be considered endogenous in the model. Although we do not believe that the DTP appreciably affected the levels of these two variables (in part because of the legislatively stipulated government red meat purchase provision of the DTP), it may be useful to examine how sensitive our results might be to our assumption that these two variables were not affected by the DTP.

In order to examine this question, we conducted a simulation using the 'best' specification results and under the assumptions that the DTP did not occur, and consequently both the feed and utility cow prices were higher because there would have been more cows to feed and less cows slaughtered. In this simulation, we adjusted both feed costs and utility cow prices upward by 5 percent beginning in 1986. The choice of 5 percent was somewhat arbitrary, but in our judgment more than sufficient to capture any possible effects of the DTP on these two variables. The results, compared with the simulation with the DTP (and with no adjustments to feed or beef prices), show that if utility cow price and feed costs were higher without the DTP, then milk production and net removals would have been less than in our earlier simulations. Specifically, with these 5-percent price adjustments, the DTP would have reduced net removals by only about 32.4 billion pounds through 1990, versus 38.1 billion pounds when utility cow prices and feed costs are not adjusted. As a result, the estimated savings to the government from the DTP are only about $1.9 billion when the 5-percent adjustments are made to the feed costs and utility cow prices, versus $2.4 billion when feed costs and utility cow prices are not adjusted.

Comments From the U.S. Department of Agriculture

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

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Mr. John W. Harman
Director, Food and Agriculture Issues
Resources, Community, and
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United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Harman:

Thank you for the opportunity to review a draft of the General Accounting Office (GAO) report, "DAIRY TERMINATION PROGRAM, An Estimate of its Impact and Cost-Effectiveness." We share GAO's interest in resolving the dairy surplus problem and lessening Government influence on milk prices, while preserving dairy policy goals.

The referenced study and the model used by GAO in conducting the study appear to be reasonable tools and methods for measuring the impact and effectiveness of the Dairy Termination Program (DTP) which operated from April 1, 1986 through September 30, 1987.

See comment 1.

The draft manuscript has been reviewed by dairy analysts in both the Economic Research Service (ERS) and Agricultural Stabilization and Conservation Service (ASCS). Specific suggestions are provided in the enclosed comments from those agencies.

The basic issues noted by the analysts is in the interpretation of the results. The criteria against which the success or failure of the DTP is measured is not necessarily the criteria about which the DTP was constructed.

The DTP was not designed to, in and of itself, eliminate future dairy surpluses. It was designed to temporarily reduce surpluses followed by support price adjustments which would help retain the supply-demand balance.

The study conclusions (and possibly the analysis) seem to overlook the fact that a reduction in the effective milk price (i.e., lower support prices and producer assessments) was an integral part of the DTP package.

ASCS

Mr. John W. Harman 2

USDA also believes that the report should emphasize that the cost effectiveness of the DTP as analyzed in the report may not provide a good basis for estimating future cost effectiveness of such programs.

Sincerely,

Vern Neppl
Acting Administrator

Enclosures

GAO Comments

1. The referenced comments are not included in this appendix. They reinforced many of the comments in the Service's May 8, 1989, letter. We have incorporated them into our final report, as appropriate.

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Related GAO Products

Dairy Termination Program: A Perspective on Its Participants and Milk Production. (GAO/RCED-88-157, May 31, 1988)

Milk Marketing Orders: Options for Change. (GAO/RCED-88-9, Mar. 21, 1988)

Federally Owned Dairy Products: Inventories and Distributions, Fiscal Years 1982-1988. (GAO/RCED-88-108FS, Feb. 23, 1988)

Overview Of The Dairy Surplus Issue—Policy Options For Congressional Consideration. (GAO/RCED-85-132, Sept. 18, 1985)

Effects And Administration Of The 1984 Milk Diversion Program. (GAO/RCED-85-126, July 29, 1985)

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