Novakovic, Andrew M.; Babb, Emerson M.

Working Paper

An analysis of U.S. Dairy Price Supports Based on Parity Versus Cost of Production

Staff Paper, No. SP 79-06

Provided in Cooperation with:
Charles H. Dyson School of Applied Economics and Management, Cornell University

Suggested Citation: Novakovic, Andrew M.; Babb, Emerson M. (1979) : An analysis of U.S. Dairy Price Supports Based on Parity Versus Cost of Production, Staff Paper, No. SP 79-06, Cornell University, Charles H. Dyson School of Applied Economics and Management, Ithaca, NY,
https://doi.org/10.22004/ag.econ.183688

This Version is available at:
https://hdl.handle.net/10419/276557

An Analysis of U. S. Dairy Price Supports Based on Parity Versus Cost of Production

by

Andrew Novakovic

and

Emerson Babb*/

April, 1979 No. 79-6

*/ Andrew Novakovic is an Assistant Professor in the Department of Agricultural Economics at Cornell Universtiy. Emerson Babb is a Professor in the Department of Agricultural Economics at Purdue University.

Abstract

Analyses based on a spatial model of the U. S. dairy sector indicate that the current parity based price supports could lead to large and increasing federal expenditures on dairy products over a five year period, whereas support prices based on the full cost of production would imply much lower expenditures.

Introduction

In the fall of 1977, the support floor for manufacturing grade milk prices was raised from 75 percent to 80 percent of parity. Representing a substantial increase in dairy prices, this action led to concern that U. S. Department of Agriculture (USDA) dairy product expenditures would soar to unacceptable levels. Dairy stocks did build for a while. In the fiscal year ending September 30, 1977, net government expenditures on dairy products reached $711.5 million. This was not a record, but it was higher than the sum of net expenditures in the three previous years. In 1978, unexpectedly brisk consumption led to expenditures one-third lower than the previous year, accompanied by a decline in concern for the level of support. In early 1979, legislation has been proposed to continue supporting prices at 80 percent of parity. One proposal in Congress calls for an extension through September 30, 1981.

Although the experience with supports at 80 percent of parity has not been as bad as expected in the past year, it seems desirable to consider the potential impacts of continuing supports at that level for the next several years. In this paper, the impacts of such a policy and alternate policies, in particular support prices based on cost of production, are compared.

Methodology

Impacts of the various support policies are estimated with a spatial model of the U.S. dairy sector, referred to as the Dairy Market Policy Simulator or DAMPS.[1/] Model components include:

1/ DAMPS evolved from a model of the Federal Order system, known as the Federal Milk Marketing Order Policy Simulator or FMMOPS. Details on FMMOPS are available in Banker, et. al. (1, 2).

- supplies of Grade A milk
- supplies of Grade B milk
- processing activities
- demands for fluid (Class I) products, soft (Class II) manufactured products, cheese, butter, nonfat dry milk, and miscellaneous hard (Class III) manufactured products
- imports of cheese, butter, nonfat dry milk, and miscellaneous Class III products
- commercial stocks of cheese, butter and nonfat dry milk
- government stocks of cheese, butter and nonfat dry milk.

The dairy sector is split geographically into Federal Order areas, state regulated areas, unregulated Grade A regions, and Grade B or manufacturing milk regions. Each regulated area has a production center, a processing center, and a consumption center. Unregulated regions have production centers and consumption centers. Grade B regions have production-manufacturing, import, stocks, and consumption centers.

DAMPS is a quarterly model and can simulate from one to five years of dairy sector activity. Dynamic elements of the dairy sector are represented in DAMPS by the carryover of dairy stocks between quarters and by supply and demand being a function of lagged prices. Projected Grade B prices (M-W prices) are the basic model input. The Class III price in regulated areas is equal to the Grade B price. Class I and II prices in regulated areas are based on Class I and II differentials added to the Class III price. Differentials default to values in the base year, 1976, but can be set at any level. Retail prices are based on farm level prices and marketing costs or margins. Other model data include exogenously specified import levels, desired stock levels, the level of exogenous

factors affecting supply and demand, and restrictions and pricing mechanisms used in regulated markets.

Given a matrix of prices and exogenous factors, quarterly production and consumption can be computed in each area or region. DAMPS determines the spatial allocation that minimizes marketing costs, using a capacitated network algorithm to solve the transshipment problem.

Further details on DAMPS can be obtained from Novakovic (3).

Results and Analysis

A number of changes in dairy support policy have been considered. These range from adjustments in the level of parity to which supports are tied under the current program to entirely new programs, such as a direct payments plan. Other alternatives include support prices based on cost of production, support prices with supply controls, support prices with reduced Class I differentials, cow culling incentives, and base-excess pricing plans.

Three sets of experiments with DAMPS are reported here.[2/] In the first set, support prices are set at 75 and 80 percent of parity (SUP75 and SUP80, respectively). The basic legislation authorizing price supports, requires prices to be supported between 75 and 90 percent of parity. Currently, legislation exists which moves the support floor up to 80 percent. Although higher levels have been called for, the 75 and 80 percent levels seem the more politically likely alternatives, under the current program.

2/ Other experiments were also performed, the results of which are reported elsewhere by Novakovic (3). These experiments involve policies of support prices set at 90 and 100 percent of parity, support prices with reduced Class I differentials, and increasing dairy imports.

The second experiment, referred to as BASE, approximates a minimum support or equilibrium scenario. A set of prices are found which limit government purchases to one percent of production. The one percent level is chosen to reflect the need for stocks to satisfy military and welfare requirements and the speculative component of commercial stocks that is held by the government.

In the third set of experiments, support prices are tied to the cost of production. In one experiment (COST2), changes in the direct cost of production are matched in the support price. In the second experiment (COST4), changes in the full cost of production are matched in the support price. In both experiments, it is postulated that the average price of all milk is supported to the full cost of production, beginning in 1977. Changes in costs are added to the Grade B support price.

All other conditions, restrictions, and exogenous factors are treated the same across all experiments. Exogenous factors are permitted to vary, as specified in the base data (see Novakovic (3)), and imports are held constant.

The prices projected as Grade B or Class III prices and selected results under these five experiments are listed in Table 1. The reader is reminded that DAMPS allows no deviation from these prices, regardless of how realistic or reasonable the situation they imply. For this reason, the price used in 1977 under SUP75 is not 75 percent of parity for that year. The true 75 percent price of $8.20 led to an infeasible solution, such that it could not be assumed that it was an effective support price. That is, the market price would exceed $8.20 under the SUP75 scenario in 1977. The actual 1977 market price was about 30 cents higher than the

75 percent support price; this led to the use of $8.55 as a 1977 market price in SUP75. In addition, the prices in COST2 led to an infeasible solution starting in 1979, again implying that market prices would exceed the COST2 level. Production and consumption under COST2 prices are mentioned below only for comparison. Otherwise, the COST2 experiment is not discussed.

This should not be construed as implying that a policy leading to an infeasible solution in DAMPS is a bad or undesirable policy. DAMPS gives a feasible solution only when prices are such that quantity supplied equals or exceeds quantity demanded for all products. An infeasible solution means that the prices submitted to the model are less than equilibrium prices. The purpose of BASE is to help identify where equilibrium might be in the dairy sector over the next five years.

Raw milk production[3/] and total returns over direct cost are affected under the five experiments as shown in Table 1. There is a high correlation between farm prices and production and returns over direct cost. Production, farm prices, and returns are initially lower with price supports based on 75 or 80 percent of parity than under the BASE or COST plans. By 1978 or 1979, the situation is reversed. In 1981, production, farm prices, and returns are lower in the BASE and COST experiments. Compared to BASE results in 1981, production is 2.5 percent higher with price supported at 80 percent of parity, 1.3 percent higher with price supported at 75 percent of parity, and 0.7 percent lower with price supported at the

---

3/ What is called production in this paper is actually milk sold to plants and dealers, which excludes milk consumed on the farm and producer-dealer milk sales. Although the conceptual distinction is significant, the numerical difference between milk sold to plants and dealers and production is slight.

full cost of production (COST4). Total returns over direct cost vary more. Compared to BASE results in 1981, returns are 35 percent higher at 80 percent of parity, 18 percent higher at 75 percent of parity and 10 percent lower at the full cost of production.

The impact of the various support policies on consumers is also listed in Table 1. As would be expected, experiments having higher prices have lower consumption. Compared to BASE results in 1981, fluid products consumption is 0.9 percent lower and manufactured products consumption is 4.7 percent lower with price supports at 80 percent of parity. When price supports are set at 75 percent of parity, consumption of fluid products is 0.5 percent lower and manufactured products consumption is 2.6 percent lower, than 1981 BASE results. Support prices equal to the full cost of production result in fluid products consumption that is 0.3 percent higher and manufactured products consumption is 1.5 percent higher than corresponding figures in the BASE experiment.

Retail prices increase somewhat faster than consumption, in all experiments. Fluid products consumption is fairly stable across all experiments and manufactured products consumption even declines with parity based supports; yet consumer expenditures increase over time in all experiments and are higher under experiments with higher prices.

The impact of the various support policies in the government sector are measured in terms of two variables - net government expenditure and net government purchases as a percent of total raw milk produced (called percent net purchases, for brevity). Net government expenditure is the cost of new stocks purchased less the value of old stocks sold by the USDA; it is measured in dollars. The difference between the quantity of

new stocks purchased and the quantity of old stocks sold is net government purchases; purchases are measured in pounds on a raw milk equivalent (M.E.) basis.

Both measures reveal distinct differences between the policies examined. Net expenditure expands rapidly under the parity based support policies. By 1981, net expenditure reaches $670 million when prices are set at 80 percent of parity and $364 million when prices are set at 75 percent of parity. Although less than actual expenditures in 1977, these expenditures are much greater than net expenditures in 1974 through 1976. Expenditures under the BASE experiment, designed to be low, are held to the low level achieved in 1976. At this level, expenditures would scarcely be noticed by those concerned with fiscal outlays. Net expenditures are even lower when prices are supported to the full cost of production. In fact, by 1980, government sales exceed purchases. The same overall picture is seen when looking at percent net purchase. By 1981, net purchases could be as high as 5.9 percent of total production with prices at 80 percent of parity, and are 4.0 percent of total milk production at 75 percent of parity.

Implications

First, it should be recalled that DAMPS is not designed to answer the question: What will prices be?; rather it answers the question: What would happen if prices are at a certain level? Accepting that the BASE experiment is a plausible equilibrium pricing scenario, it can be assumed that support prices set at 75 percent of parity or higher will be effective in supporting the price of milk above what the price of milk would be in the absence of supports. This might not be the case only in

1977. The BASE price in 1977 is about 81 percent of parity. Prices set at 75 percent of parity are still below the BASE price in 1978, but diverge fairly rapidly afterwards. In 1981, the BASE Grade B price is 69 percent of parity. Based on this it may be concluded that prices at 80 percent of parity may have been appropriate in the last two years, but could lead to large government expenditures if they are extended. Even at 75 percent of parity, expenditures could exceed acceptable levels.

The cost of production experiment offers even greater insights. As would be expected of a policy that increases prices rapidly to meet the full cost of production in 1977, expenditures begin at a higher level under this plan. However, by 1979 prices under COST4 are slightly lower than under BASE. The COST4 plan comes very close to approximating an equilibrium scenario, but, with USDA sales exceeding purchases by 1980, under the COST4 policy, it must be concluded the support prices based on full cost of production would not be effective for long. That is, the results indicate that it is likely that market prices would exceed a support price based on the full cost of production by 1980, given the assumptions in COST4.

The key to this rather startling difference between parity based supports and supports based on the cost of production seems to lie in the growing divergence between parity prices and the cost of production. If parity continues to be used as a base for support prices, the evidence provided by this research strongly suggests that this divergence be investigated. It is possible that an alteration in the parity formula could reduce its declining relevance to dairy prices. Nevertheless, it also seems that cost of production should be further reviewed as a base for price supports.

One must, however, be careful not to interpret the results as giving a sure sign that the full cost of production can be supported with no exposure by the USDA. There are several ways that cost of production could be computed and tied to price supports. The particular methods chosen could make a significant difference. If the results reported here are indicative of what would happen with full cost supports, it seems that there is a high probability that farmers would protest against the method used to compute costs of production, when the full cost falls short of the market price.

Despite the necessary qualifications noted above, the results lead to the following conclusions. Prices supported at 80 percent of parity should be expected to lead to large government expenditures within five years. Supporting prices at 75 percent would cut those expenditures almost in half. Even at 75 percent of parity, the support price would diverge from prices likely to occur in the absence of supports or under a minimum support plan. It is possible that the full cost of production could be supported at no appreciable expense to the USDA.

Table 1. Support Prices and Selected Results From Experiments with No Supports, Supports Based on 75 and 80 Percent of Parity, and Supports Based on the Full Cost of Production

	BASE	SUP75	SUP80	COST4
1977				
Support Price 1/	8.90	8.55	8.74	8.93
Milk Production 2/	118,552	117,900	118,256	118,583
Returns Over Direct Cost 3/	3,675.1	3,313.0	3,500.4	3,699.8
Fluid Consumption 2/	42,709	42,799	42,750	42,706
Manufactured Consumption 2/	78,181	79,330	78,699	78,086
Consumer Expenditures 3/	22,186	21,799	22,010	22,221
Net Government Expenditures 3/	98.3	-20.2	43.6	107.1
Net Government Purchases as a Percent of Production	1.0	-0.2	0.5	1.1
1978				
Support Price	9.30	9.20	9.81	9.34
Milk Production	119,327	118,996	120,159	119,418
Returns Over Direct Cost	3,985.5	3,879.3	4,530.0	4,024.4
Fluid Consumption	42,836	42,894	42,730	42,821
Manufactured Consumption	78,936	79,240	77,438	78,821
Consumer Expenditures	23,233	23,129	23,811	23,274
Net Government Expenditures	55.4	14.5	228.5	69.2
Net Government Purchases as a Percent of Production	1.0	0.4	2.6	1.2

1/ dollars per hundredweight

2/ thousand pounds

3/ million dollars

Table 1. (continued)

	BASE	SUP75	SUP80	COST4
1979				
Support Price	9.77	9.95	10.61	9.66
Milk Production	120,177	120,448	121,815	119,990
Returns Over Direct Cost	4,386.5	4,577.0	5,286.8	4,271.6
Fluid Consumption	43,023	42,991	42,787	43,046
Manufactured Consumption	79,554	79,046	77,277	79,870
Consumer Expenditures	24,411	24,623	25,365	24,283
Net Government Expenditures	51.8	110.8	356.8	15.1
Net Government Purchases as a Percent of Production	1.0	1.7	3.7	0.4
1980				
Support Price	10.27	10.78	11.50	10.00
Milk Production	121,045	121,972	123,396	120,546
Returns Over Direct Cost	4,696.5	5,257.0	6,046.4	4,412.0
Fluid Consumption	43,205	43,079	42,871	43,273
Manufactured Consumption	80,171	78,844	77,100	80,895
Consumer Expenditures	25,667	26,266	27,093	25,353
Net Government Expenditures	49.0	228.1	503.4	-41.6
Net Government Purchases as a Percent of Production	1.0	2.9	4.8	-0.4
1981				
Support Price	10.80	11.67	12.45	10.33
Milk Production	121,972	123,578	125,056	121,076
Returns Over Direct Cost	5,269.2	6,228.3	7,115.7	4,758.3
Fluid Consumption	43,391	43,170	42,959	43,513
Manufactured Consumption	80,795	78,710	76,998	82,019
Consumer Expenditures	26,992	28,033	28,947	26,420
Net Government Expenditures	49.7	364.1	670.5	-111.7
Net Government Purchases as a Percent of Production	1.0	4.0	5.9	-1.4

References

1. E. M. Babb, D. E. Banker, O. Goldman, D. R. Martella, and J. E. Pratt, Economic Model of Federal Milk Marketing Policy Simulator - Model A, Station Bulletin No. 158, Agricultural Experiment Station, Purdue University, April 1977.

2. David E. Banker, A Model for the Analysis of Alternative Pricing Policies in Federal Milk Marketing Orders, unpublished Ph.D. thesis, Purdue University, August, 1977.

3. Andrew M. Novakovic, An Economic Analysis of the U. S. Dairy Price Support Program and Alternate Policies, unpublished Ph.D. thesis, Purdue Univeristy, May 1979.