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David R. Krog and Satheesh V. Aradhyula

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An econometrically estimated model is used to project the impact of the 1985 dairy program on the dairy industry and government costs. Projections indicate that a whole-herd buyout program could be an effective way of reducing the excess supply of milk while maintaining dairy income and reducing government costs.

On December 23, 1985, a four-year farm bill was signed into law by the President. A key focus in the new farm legislation was the dairy program. The primary aim was to create dairy legislation which allows for an eventual realignment of the supply of dairy products with commercial demand for them. The current state of the dairy industry is one of overproduction and escalating government costs. In 1983, the nation's dairy farms produced nearly 139 billion pounds of milk, of which only about 122 billion pounds found its way into commercial channels. The 17 billion pounds of excess production (over 12 percent of the total) was purchased by the government in order to support the price of milk received by farmers. The resulting 1983 cost to the government was over $2.6 billion. This unprecedented figure compares with annual costs of between $100 million and $750 million during the 1960's and 1970's. This excess supply problem is a result of a milk price support program which had set the support level price significantly above the current market-clearing price. In order to correct this problem, the new 1985 farm legislation calls for lower milk support prices and a whole-herd buyout program.

Objective

The objective of this analysis is to evaluate the impact on the dairy industry of the new dairy program. In particular, we wish to use an econometrically estimated model of the U.S. dairy industry to project program impacts on dairy cow numbers, total milk production, gross returns to milk producers, government purchases of milk products, and government costs. The sections which follow describe the U.S. dairy model used in the analysis, summarize provisions of the 1985 dairy program, and report the results of the analysis.

The U.S. Dairy Model

Modeling the U.S. dairy industry is especially difficult. For many years, the dairy industry has been highly influenced by dairy programs designed to support and stabilize milk prices and ensure adequate supplies of milk. Because of these programs, conventional approaches for estimating supply and demand relationships for milk and milk products are inadequate. The reason for this is that prices, especially those in the product markets, are influenced to a significant degree by price targets fixed by the government through the milk price support program. Our aim, therefore, in designing a U.S. dairy model is to directly account for the influence of the price support program. But before describing the model, it may be useful to review the program's basic operation.

The intent of the milk price support program is to support the price of milk received by farmers. This is done through Commodity Credit Corporation (CCC) purchases of butter, nonfat dry milk, and cheese which, in effect, support the price of Grade B (manufacturing grade) milk. The principal events involved in supporting milk prices are as follows:

- The government decides on a target level at which it wants to support the price of Grade B milk. Until 1981, the support price was tied directly to parity but since the passage of the Agriculture and Food Act of 1981, these price supports depend upon the expected size of CCC purchases.

- Based on the support price, the CCC sets the prices it will pay for butter, cheese, and nonfat dry milk. The purchase prices announced by the CCC for these products include margins to cover costs of processing milk into these products. These margins are administratively set at levels which enable the processors to pay farmers the announced support for Grade B milk during periods of surplus production.

- The CCC then purchases all butter, cheese, and nonfat dry milk offered by the processors at the announced prices.

The U.S. dairy model that has been developed is relatively simple. The primary components and their interrelationships are shown in Figure 1. Total milk supply is determined by the number of milk cows and average milk productivity, which are both influenced in part by the blend price of milk received by farmers. Subtracting on-farm use and fluid milk demand from total milk supply gives the supply of milk to the manufacturing milk market. The determination of the supply of manufacturing milk is depicted graphically in Figure 2. Total milk supply (S^{TM}), demand for fluid milk (D^{FL}), on-farm use (D^{OF}), and the excess supply of nonmanufacturing milk (XS^{TM}) are shown in retail fluid milk price (RFLUID) and quantity (Q) space. The supply of manufacturing milk (S^{MM}) is shown in Grade B milk price (MFDP) space. The retail price of fluid milk is equal to the Grade B milk price plus a price margin (MARGINF) between the retail fluid price and the Grade A milk price plus the Class 1 differential (CLS1DIFF) between the Grade A and Grade B prices.

Total demand for manufacturing milk is composed of the demand for domestic consumption, net exports, commercial stocks, military consumption, and purchases by the CCC. As depicted graphically in Figure 3, the model determines the summation of the milk equivalent non-CCC demand. The difference between the supply of manufacturing milk and the non-CCC demand at the support price is equal to total government purchases of manufacturing milk (TGP).

In the model, only the butter, cheese, and nonfat dry milk markets have been endogenized. All other milk product markets are left exogenous. Figure 4 shows graphically the three endogenous markets. Prices in each market are determined through price linkage equations which relate product prices to Grade B price. Prices, along with other factors, such as income and population, determine the level of non-CCC demand for butter, cheese, and nonfat dry milk. Average, historical shares of total government purchases are used to determine the CCC purchases of cheese and nonfat dry

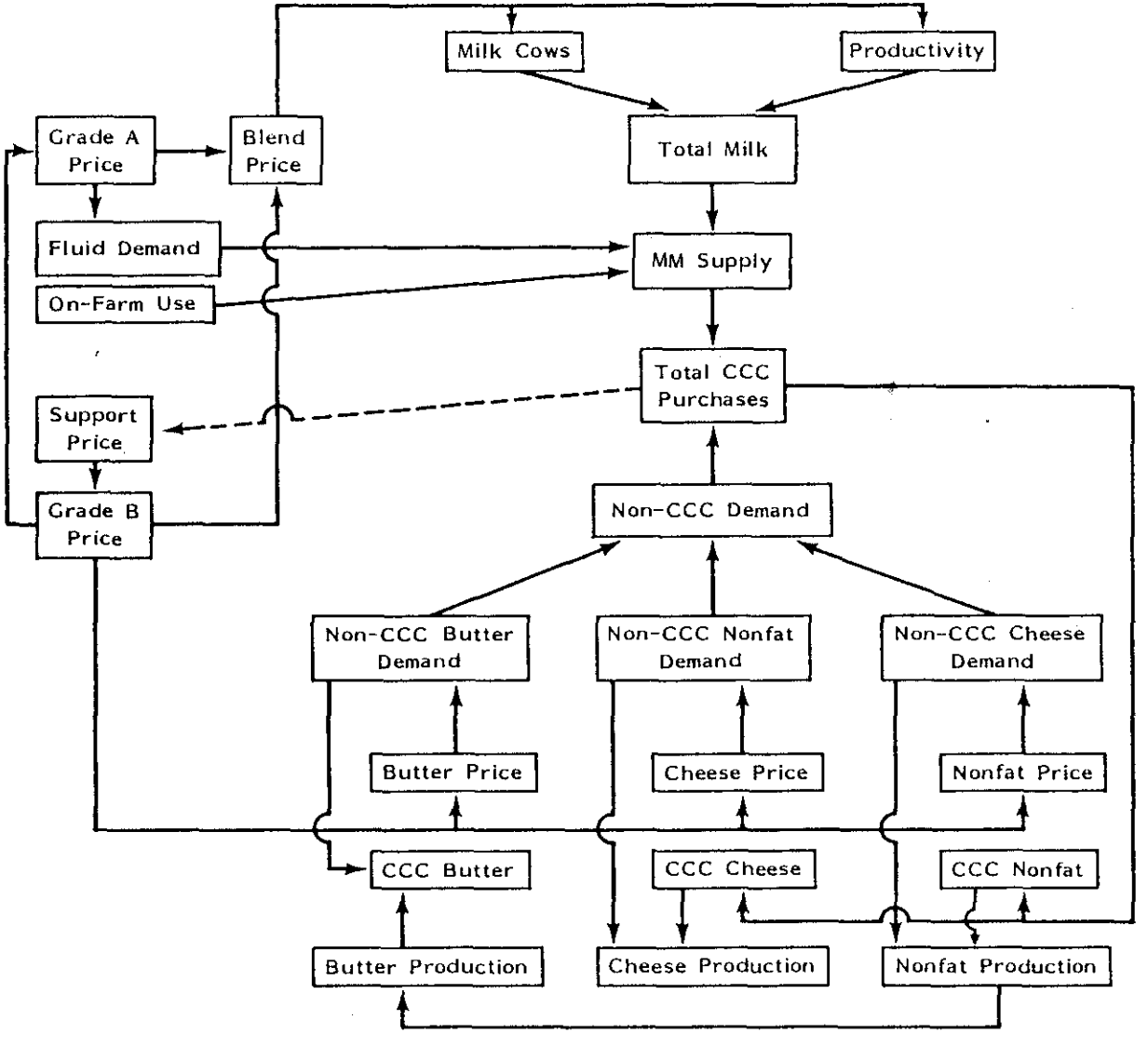

Figure 1. Flow Diagram of the U.S. dairy model

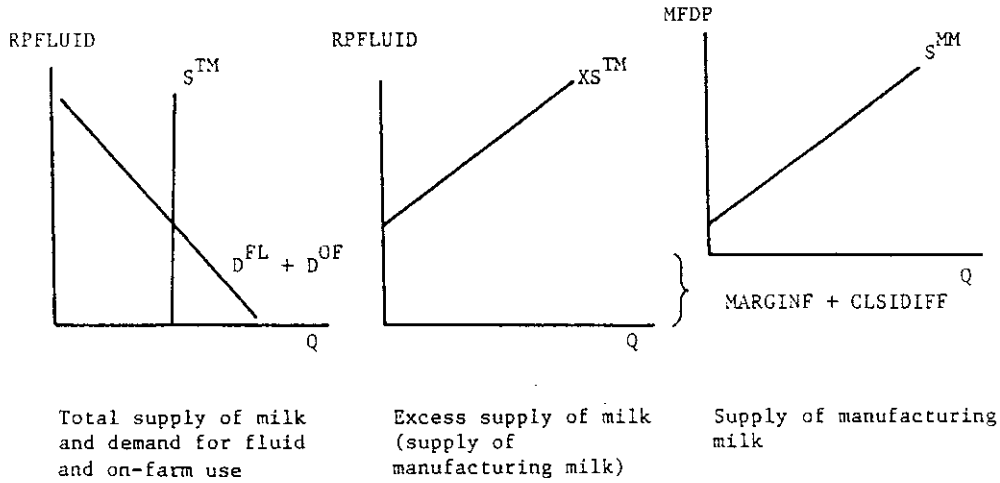

Figure 2. Graphical representation of determination of the supply of manufacturing milk

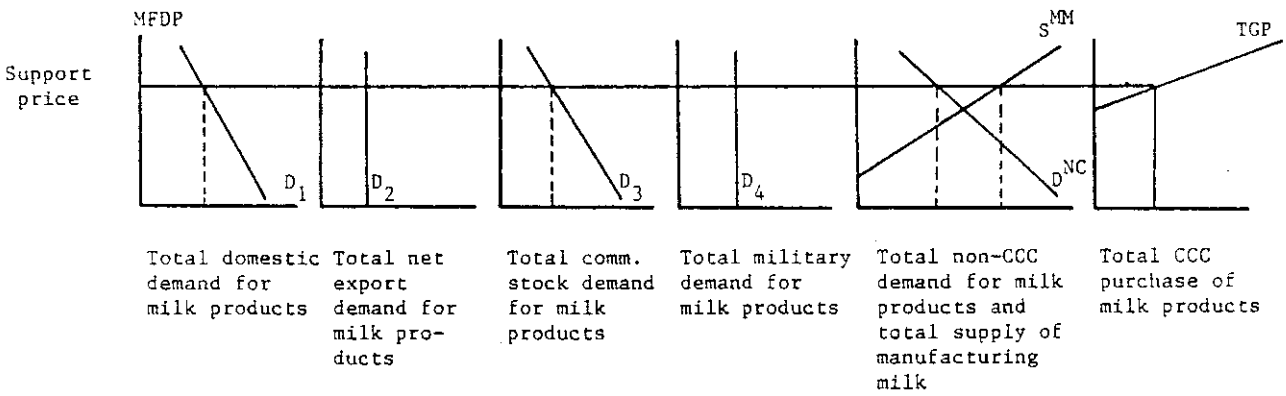

Figure 3. Graphical representation of the determination of total government purchases of milk products

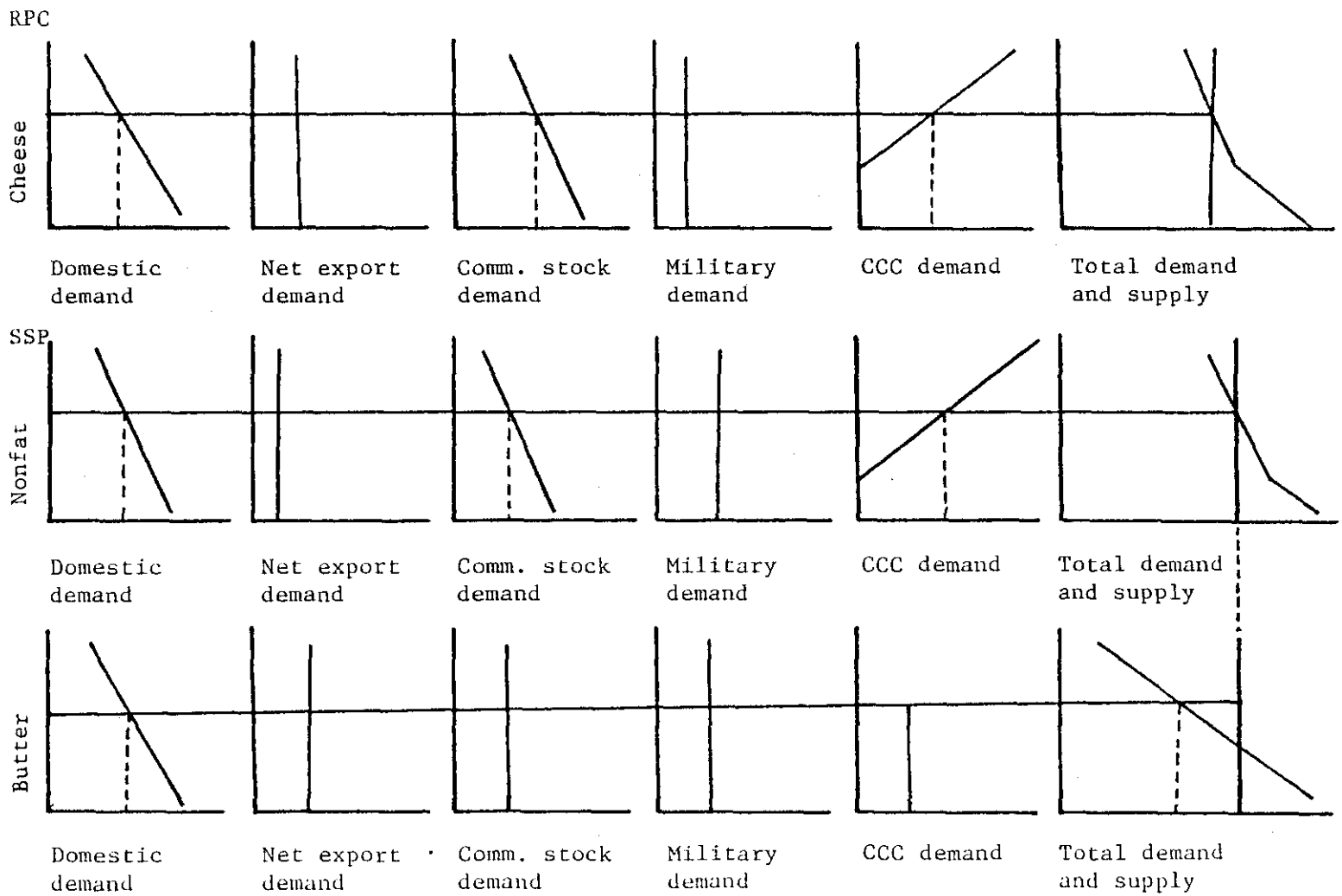

Figure 4. Supply and demand components of the cheese, nonfat dry milk, and butter markets

milk. Production of cheese and nonfat dry milk is found by summing all of the demands for each commodity at respective prices. Since nonfat dry milk and butter are co-products in processing, butter production is set equal to nonfat dry milk production in terms of milk equivalents. The CCC purchases of butter are found by subtracting non-CCC demand from production.

The model is estimated using three-stage least-squares techniques. In estimation, the Grade B price of milk is made exogenous. In the forecast period, however, the Grade B price is set equal to the support price which depends on the level of CCC purchases. (The next section discusses these trigger levels.) All estimated coefficients have expected signs and most are highly significant. The model simulates well over the historical period as evidenced by low Root-Mean Square percent error statistics. Selected elasticity estimates are shown in Table 1. Further documentation and description of the model can be found in Krog, Aradhyula, Johnson, and Meyers (1986).

Table 1. Short-run supply and demand elasticities

Variable	Elasticity With Respect To	Short-run Elasticity
Total milk production	Blend price	0.1169
Manufacturing milk supply	Grade B price	0.1897
Manufacturing milk demand	Grade B price	0.0590

The 1985 Dairy Program

The key features of the 1985 dairy program relate to the milk support price, producer assessments, and a whole-herd buyout program. The support price is set at $11.60 per hundredweight of milk for calendar year 1986, lowered by $0.25 on January 1, 1987, and lowered an additional $0.25 on October 1, 1987. Beginning on January 1, 1988, the support price is cut $0.50 per hundredweight in each year that CCC purchases of milk products is expected to exceed five billion pounds of milk equivalent. The support price is increased $0.50 per hundredweight in years in which purchases are expected to fall below 2.5 billion pounds, and support prices are not changed if purchases are expected to lie between 2.5 and 5 billion pounds. Table 2 summarizes support prices through 1990.

Producer assessments will be required in only two of the next five years. An assessment of $0.40 per hundredweight of milk begins on April 1, 1986, drops to $0.25 on January 1, 1987, and is discontinued after October 1, 1987. The assessment schedule is also shown in Table 2.

The whole-herd buyout is a new feature of the dairy program intended to reduce the number of milk cows in a relatively short period of time. The buyout program begins on April 1, 1986, and lasts for 18 months. Farmers

submit bids to the government to retire their whole herds from production for at least five years. Herds with accepted bids must go directly to slaughter and can not be sold to other milk producers. No more than 7 percent of the total dairy herd can be retired in each of the two years covered by the program. In order to buffer the impact on meat prices, the government will purchase an additional 400 million pounds of red meat during the buyout period. The program will be partially financed using revenue generated from producer assessments.

Table 2. Dairy support prices and assessments specified by the 1985 dairy program

	1/1/86	4/1/86	1/1/87	10/1/87	1/1/88	1/1/89	1/1/90
Support Price ($/cwt)	11.60	11.60	11.35	11.10 (based on CCC trigger levels)			
Assessment ($/cwt)	-	0.40	0.25	0.00	0.00	0.00	0.00

Results of the Analysis

The objective of the analysis is to project the impact of the 1985 dairy legislation on the dairy industry and on the cost of the U.S. dairy program. The whole-herd buyout program is a significant component of the dairy program, but it is unclear how many milk cows will be taken out of production. The number of cows retired could range from zero to as much as seven percent of the total herd in each of 1986 and 1987. The final number will depend upon the farmers' bids and the government's acceptance criteria. In this analysis, we examine the two extreme cases. Sets of projections are made with and without a whole-herd buyout program. Projections made with the buyout assume that the full 7 percent herd retirement is made in each of the next two years. Projections are made for the years 1985 through 1995. Of particular interest are projections for milk cow numbers, milk production, gross revenue of milk producers, government purchases, and government costs.

Without Whole-herd Buyout

Projections reported here are made using the dairy program provisions outlined in the previous section. However, we assume that the government does not accept any bids for whole-herd retirement. It is unlikely that this will be the case, but these results can be used as a basis for comparison with the full-scale retirement case. Projections are shown in Table 3.

The Grade B price is set equal to the support price in the projection period and after 1987, the support price is annually adjusted depending upon expected government purchases. The support price begins to fall in 1988 in

response to expected government purchases of greater than five billion pounds of milk products in that year. The support price falls every year until 1993 when it reaches a low of $8.10 per hundredweight. The support price begins to rise in 1994 as purchases fall below the 2.5 billion pound trigger level. From the 1985 level, a 30.2 percent drop in the support price occurs before government purchases drop into the target range of 2.5 to 5 billion pounds.

The drop in the support price and, therefore, a drop in the blend price of milk causes the number of milk cows to fall over the projection period. Cow numbers drop a projected 19.8 percent from the 1985 level to about 8.9 million cows in 1995. Milk productivity over the same period increases 12 percent. Consequently, total milk production is projected to decline by 10 percent to about 127 billion pounds in 1995. The combination of a falling blend price and declining production results in a drop in gross milk returns to farmers of 28.3 percent between 1985 and 1995.

While the new dairy program with no herd buyout reduces milk returns to farmers significantly, it also eventually reduces the government cost of the dairy program to near zero. In 1985, the projected cost is nearly $2.5 billion. By 1995, this cost is reduced to about $6.9 million. These costs represent only those incurred in the CCC purchases.

With Full-scale, Whole-herd Buyout

Projections reported in this section are also made using the program provisions discussed above. Now, however, we assume that the government accepts the maximum number of retirement bids, and 7 percent of the dairy herd is bought out in each of the years 1986 and 1987. Projections are shown in Table 4.

Unlike the case without a herd buyout, the support price for milk does not start falling in 1988. This is because the full-scale herd buyout reduces government purchases of milk products to under five billion pounds by 1988. After an initial decrease of 50 cents per hundredweight, support prices begin to rise in 1989 due to purchases dropping below the minimum trigger level. By 1995, the support prices are projected to increase to $13.10 per hundredweight.

The full-scale, whole-herd buyout reduces the number of milk cows by is 1.52 million the end of 1987. By 1995, cow numbers are slightly over 9 million head. Milk productivity increases 14 percent between 1985 and 1995 which is slightly higher than under the no-herd buyout case. Total milk production over the same period falls 2.9 percent to about 131 billion pounds in 1995. Because of the higher blend price, gross returns to milk producers increase nearly 9 percent between 1985 and 1995. This is quite a contrast to the 28.3 percent reduced returns without the whole-herd buyout.

Cost of the dairy price support program falls sharply with the full-scale buyout and the savings is realized in just two years. Since the eventual bid prices of farmers is unknown, the whole-herd buyout costs are

Table 3. Selected projections under the 1985 dairy program without a whole

Year	Grade B Milk Price ($/cwt)	Milk Cow Numbers (thousands)	Milk Productivity (lbs/cow/yr)	Total Milk Production (billion lbs)	Milk Gross Returns (million $)	Total Government Purchases (billion lbs)	Total Government Cost[a] (million $)	Assessment Revenue (million $)
1985	11.60	11,127	12,729	141.6	17,456	23.0	2,482.3	278.5
1986	11.41	11,070	12,883	142.6	17,314	23.3	2,625.2	403.1
1987	10.73	10,991	13,006	142.9	16,398	22.5	2,555.1	0.0
1988	10.10	10,854	13,141	142.6	15,478	20.9	2,375.4	0.0
1989	9.60	10,663	13,274	141.5	14,661	18.7	2,102.0	0.0
1990	9.10	10,432	13,410	139.9	13,800	15.9	1,739.3	0.0
1991	8.60	10,164	13,544	137.7	12,900	12.4	1,274.3	0.0
1992	8.10	9,862	13,675	134.9	11,972	8.4	709.0	0.0
1993	8.10	9,531	13,846	132.0	11,709	4.4	273.4	0.0
1994	8.60	9,205	14,051	129.3	12,107	0.8	53.8	0.0
1995	9.10	8,920	14,255	127.2	12,522	0.1	6.9	0.0

[a] Cost of CCC purchases valued at wholesale prices

Table 4. Selected projections under the 1985 dairy program with a full-scale, whole-herd buyout program

Year	Grade B Milk Price ($/cwt)	Milk Cow Numbers (thousands)	Milk Productivity (lbs/cow/yr)	Total Milk Production (billion lbs)	Milk Gross Returns (million $)	Total Government Purchases (billion lbs)	Total Government Cost[a] (million $)	Assessment Revenue (million $)
1985	11.60	10,628	12,729	135.3	16,659.1	16.7	1,589.6	278.5
1986	11.41	9,671	12,883	124.6	15,088.1	5.3	359.3	403.1
1987	10.73	9,592	13,006	124.8	14,275.4	4.3	286.1	0.0
1988	10.60	9,455	13,180	124.6	14,100.3	3.1	209.4	0.0
1989	11.10	9,302	13,387	124.5	14,701.4	2.2	154.2	0.0
1990	11.60	9,184	13,593	124.8	15,351.0	1.7	121.3	0.0
1991	12.10	9,099	13,795	125.5	16,051.9	1.5	116.3	0.0
1992	12.60	9,047	13,990	126.6	16,809.1	1.7	138.8	0.0
1993	13.10	9,029	14,187	128.1	17,642.6	2.4	201.5	0.0
1994	13.10	9,042	14,350	129.8	17,877.3	3.1	261.5	0.0
1995	13.10	9,055	14,515	131.4	18,111.8	3.6	306.4	0.0

[a] Cost of CCC purchases valued at wholesale prices

not projected. Of course, these costs would be high and may offset a large part of the savings made in the price support operations. Part of the cost, however, will be covered by the producer assessment revenue. Assessments for 1985 and 1986 are projected at $279 million and $403 million, respectively.

Another cost to the government will be for the purchase of red meat to help buffer the price effects of massive milk cow slaughter. The USDA currently predicts that the government will need to buy 400 million pounds of red meat. However, given a full-scale buyout and assuming 550 pounds of carcass weight per slaughtered cow, projections here indicate over 480 million pounds of additional red meat will be put on the market. No cost estimates have been made here for the purchase of the meat.

Conclusions

A whole-herd buyout program appears to have potential as an effective means of reducing the excess supply of milk while maintaining milk producer income and reducing government costs. With no herd buyout, a significantly lower support price for milk is needed in order to bring milk supply in line with commercial demand. The result is a dramatic reduction in producer income. It appears as though a full-scale buyout may not be needed. A herd reduction of 3 to 4 percent in each of the next two years may be sufficient to eliminate surpluses without significant reductions in the support price. A further examination is currently underway.

References

Economic Research Service. 1984. "Dairy: Background for 1985 Farm Legislation." Agriculture Information Bulletin Number 474. USDA. Washington, D.C.

Krog, David R., Satheesh V. Aradhyula, Stanley R. Johnson, and William H. Meyers. 1986. "Description and Documentation of the U.S. Dairy Model." Forthcoming CARD Staff Report. Center for Agriculture and Rural Development. Iowa State University. Ames, Iowa.