SOCIAL COSTS OF THE DAIRY PRICE SUPPORT PROGRAM

By Glen D. Whipple*

*Assistant Professor, Department of Agricultural Economics and Rural Sociology, University of Tennessee

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Over the previous two years there has been considerable discussion of the dairy price support program. The program has undergone more change during this period than in its previous history. For the first time ever, Congress intervened to eliminate a price support adjustment (April 1981 Adjustment). The 1981 farm bill, signed into law in December 1981, set the support price at the previous year's level until September of 1982 and related the support price to the level of price support purchases rather than strictly to parity. These changes have been made against a backdrop of nearly three years of monthly milk production increases, increasing cow numbers and production per cow and increasing commodity credit corporation (CCC) net price support purchases (9.8 percent of production in fiscal year 1981).

Virtually all fluid grade milk marketed in the U.S. is sold under a federal or state market order. Under the federal market orders, milk is priced according to its use. The price mover or pricing base is the Minnesota-Wisconsin manufacturing (M-W) milk price. Class I milk (milk consumed as fluid milk) is paid the M-W price plus a Class I differential. Classes II and III milk (milk used in soft and hard products, respectively) are paid the M-W price or slightly more. All of the milk shipped into an order market is pooled and the producer is paid the average price (blend price) of all milk sold from the pool.[1]

The federal government supports the price of manufacturing milk through the purchase of manufactured products (nonfat dried milk, butter and cheese) at prices established under the support program. The

1949 legislation set the price support level at between 75 and 90 percent of parity. From 1977 until April 1981 the price support level was set at between 80 and 90 percent of parity.

Decisions to alter the dairy price support program should consider not only the government costs of the program,but also the associated net cost to society. It is the objective of this paper to formulate a model to estimate the impact of the price support program on the net social welfare of participants in the U.S. milk markets and to estimate the net social cost of the dairy price support program.

Theoretical Model

The concept of economic surplus has been used frequently to measure welfare shifts enduced by policy changes. Blakely and Riley, Buxton and Hammond, Johnson, and Dahlgran, among others, have used market supply and demand schedules to define areas of economic surplus and show net social welfare effects. Although the market demand schedule does not provide an accurate measure of economic surplus unless income elasticity of demand for the commodity within the market is zero, the error in measurement would be small if the elasticity were small [Currie, Murphy and Schmitz, 753]. Hallberg and Fallert estimated the income elasticity of demand for fluid milk to be 0.11. This suggests that the error in measurement induced by using uncompensated market demand curves for such an analysis would be small.

It can be shown that the conditions necessary for a perfectly competitive market ensure a pareto optimal welfare distribution in that market [Intrilligator]. Although the appropriateness of the pareto optimum as a social goal is questionable, Wallace, Johnson, and

Dahlgran have used it as a standard by which to measure nonoptimal market conditions and assess resource misallocation resulting from actual or potential agricultural policies. The theoretical model of the dairy industry used in this analysis utilizes measures of economic surplus resulting from deviations from the competitive optimum to assess the welfare impacts of the price support program. This model is an adaptation of models developed by Dahlgran, Buxton and Hammond, and Ippolitto and Masson.

Figure 1 represents a single market with a farm level derived demand for fluid milk (D_f), a farm level derived demand for manufacturing milk (D_m) and a farm level supply of milk (S_b).[2] The average revenue, or blend price function due to classified pricing and pooling, inclusion of Grade B milk, and price supports is represented by AR^S. It is assumed that Grade B milk is paid the same price as Grade A milk used in manufactured products. PM^S is the price floor for manufacturing milk representing the support level. In the absence of classified pricing, pooling, and the price support program, the demand for milk equals $D_f + D_m$ and competitive equilibrium is at the price-quantity vector (P_b^c, P_f^c, P_m^c, Q_b^c, Q_f^c, Q_m^c). With classified pricing, pooling, and the price support program, the price of manufacturing milk moves to the price floor P_m^s which results in a fluid milk price of P_f^s. The equilibrium price-quantity vector is (P_b^s, P_f^s, P_m^s, Q_b^s, Q_f^s, Q_m^s). Price support purchases within the market equal $Q_b^s - Q_b^{ss}$. The welfare costs and transfers resulting from classified pricing, pooling, and price supports are graphically illustrated in Figure 1. Area A^S represents the economic surplus loss due to under consumption of fluid milk; Area B^S is the resource loss

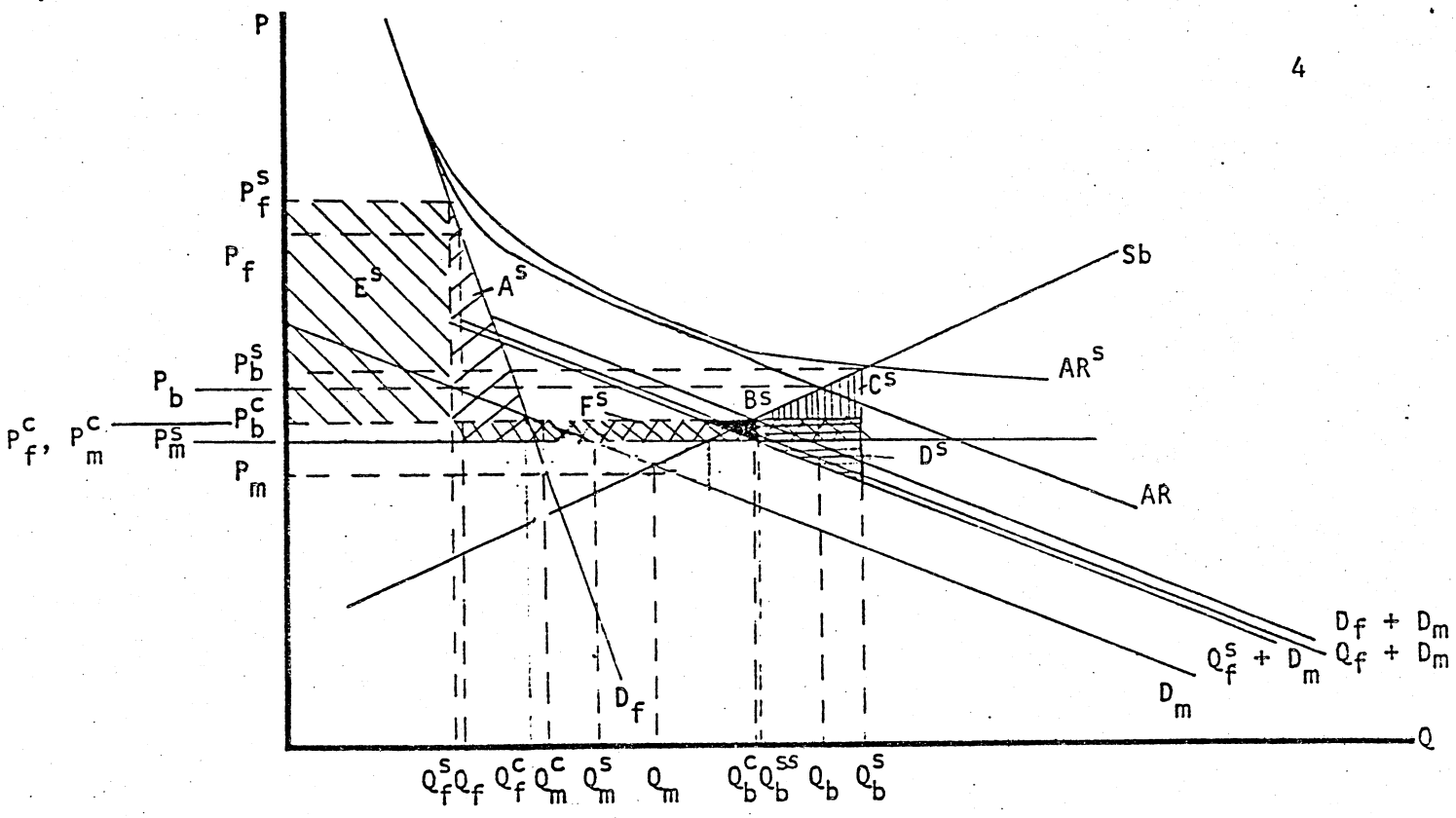

Figure 1. Competitive and Regulated Equilibrium with and without Price Support in a Local Milk Market. Welfare Losses and Transfers Associated with Classified Pricing Pooling and Price Supports.

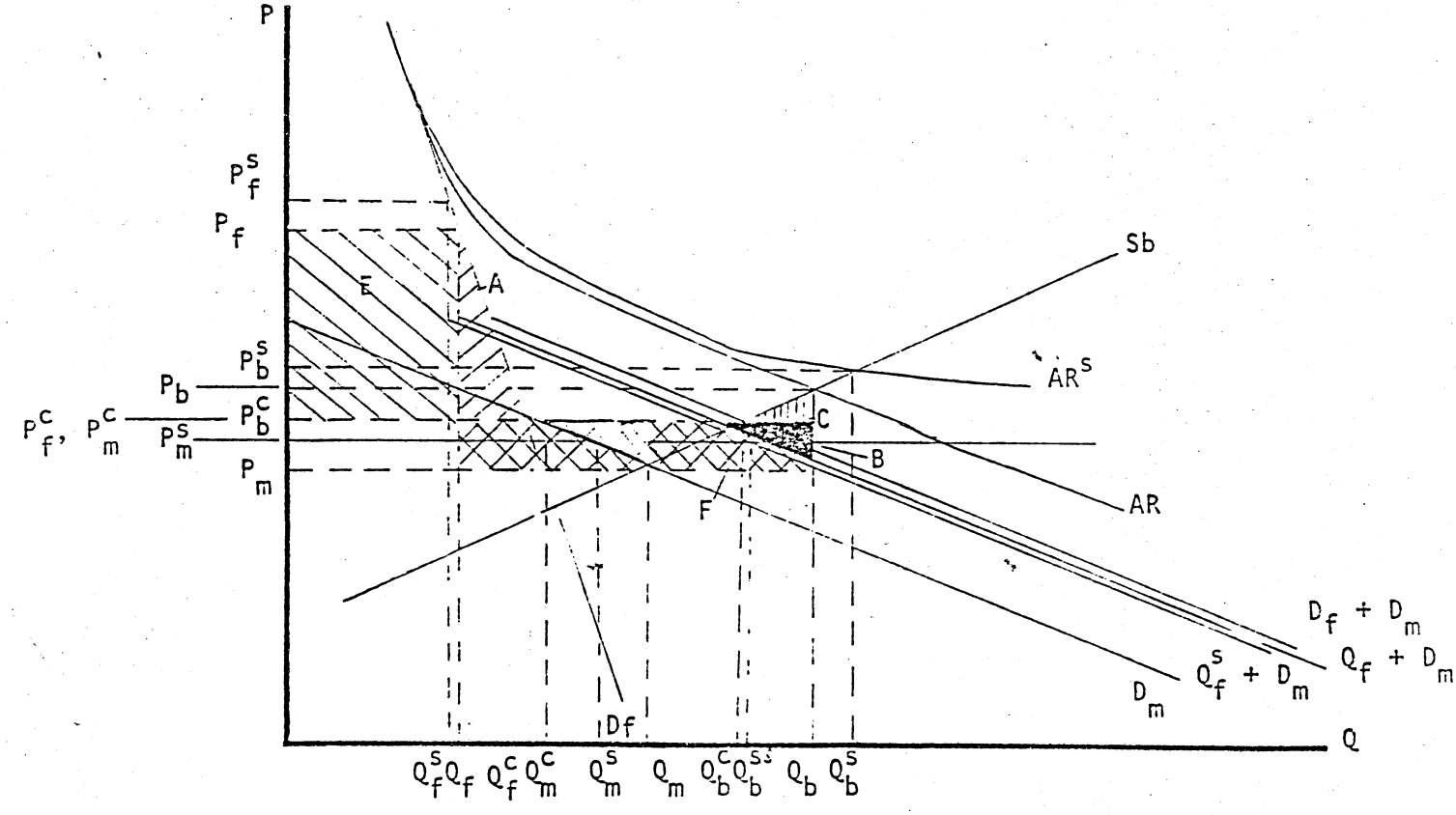

Figure 2. Competitive and Regulated Equilibrium With and Without Price Support Purchases in a Local Milk Market. Welfare Losses and Transfers Associated with Classified Pricing and Pooling.

due to over consumption of manufactured products by the private sector. Area C is the resource loss due to over production of milk; Area D is the resource loss due to over consumption of manufactured products as a result of price support acquisitions.[3] The transfers in the model are represented by Area E -- the transfer from fluid milk consumers to milk producers and Area F -- the transfer from milk producers to manufactured product consumers.

A graphic model of a market with classified pricing and pooling but without the price support program is represented by Figure 2. The average revenue or blend price function is represented by AR and the demand for milk is $Q_f + D_m$. The absence of price support purchases would result in a lower price for manufacturing milk, thus a lower fluid milk price. The equilibrium price-quantity vector is $(P_b, P_f, P_m, Q_b, Q_f, Q_m)$. The welfare costs and transfers are defined as in Figure 1, except Area D, a resource cost directly attributable to the price support program, which would not exist. An aggregation across all markets in the U.S. constitutes a model of the U.S. dairy industry.

Comparison of equilibrium price-quantity vectors for the price support and nonprice support models suggests market and welfare impacts of the price support program. These are: 1) The price of manufacturing milk is higher along with the fluid milk price and the blend price. 2) Economic surplus loss for over production of milk and under consumption of fluid milk is larger, but the surplus loss for the over consumption of manufacturing milk is lower 3) The total deadweight loss due to dairy market regulation is larger.

The size and direction of these a priori expectations will be evaluated with the simulation model developed in the following section.

Simulation Model

The simulation model developed in order to evaluate the market and welfare impacts of the price support program uses the reactive programming technique developed by T. E. Tramel and A. D. Seale.[4] The reactive algorithm allocates supplies (based on a fixed supply or supply function) from the various suppliers among the various demanders (based on a demand function) so that no reallocation of supplies will increase the gross returns, net of transfer costs, of any supplier.

The interregional model encompasses the continental U.S. which was divided into 21 fluid and manufacturing milk consumption and 21 milk production areas. Price and quantity data for the calendar year 1980 were collected from various sources[5] and combined by area to establish base 1980 production and consumption data for each area. The prices, quantities, and geographic center were weighted by locations of quantities of milk within areas. Transfer costs were based on supply to demand point distances and linear transportation cost functions.

Supply and demand functions used in the model were log linear and price dependent. They were calculated using 1978 price and quantity data for each region and supply and demand elasticity estimates provided by Dahlgran. The elasticity of demand for fluid milk and manufacturing milk were set at -.112 and -.352, respectively. The elasticity of supply for milk was set at 1.19.

Two variations of the simulation model were formulated to measure the market and welfare impacts of the price support program.[6] Model I

simulates the market as if it were perfectly competitive, i.e., no market orders, no price supports and competition within and between markets. It was assumed in Model I that all milk used in manufactured products was manufacturing grade and that the cost of production difference between fluid grade and manufacturing grade milk was $.15 per hundred pounds. Model I provides an efficiency baseline against which to measure the regional welfare impacts of other model simulations. The assumptions of Model I are similar to those of the Dahlgran competitive model. Model II simulates the market with classified pricing and pooling, but without the price support program. In Model II, the price mover or base is assumed to be the manufacturing milk price since it is the closest internal model approximation to the M-W price. The fluid milk price is assumed to be the manufacturing milk price plus the Class I differential. The producer blend price is the total revenue from the sale of milk to fluid and manufacturing uses divided by total quantity sold.

A three-step analysis was used to measure the welfare effects of the price support program: 1) The welfare losses and transfers resulting from classified pricing, pooling, and the price support program were estimated from actual 1980 market data and the Model I competitive market simulation estimates. 2) The welfare losses and transfers resulting from classified pricing and pooling but without the price support program, were estimated from the Model II market simulation estimates (no price supports) and the Model I competitive market simulation estimates. 3) Finally, the welfare loss and transfer estimates from the first two steps were compared. The differences between these two estimates provides an estimate of the welfare effects of the price support program.

To aid discussion, the estimates from the 21 region simulation models were aggregated into 8 regions.

Results

The price support induced effects on welfare losses and transfers, taxation and subsidy rates, and the net welfare position of producers and consumers in the U.S. diary industry are listed in Table 1. The analysis indicates that the price support program resulted in an increase in surplus loss due to under consumption of fluid milk (Area A) and an increase in the surplus loss due to the over production of milk (Area C). The surplus loss due to over purchase of manufactured dairy products (Area D) stems directly from the price support program. The price support program resulted in a reduction in the resource loss due to the private sector over consumption of manufactured milk products (Area B).

The analysis indicates that milk producers received an $534.818 million increase in net welfare as a result of the price support program, while fluid and manufacturing milk consumers received a $188.564 and $399.917 million loss in net surplus, respectively. The analysis indicates that total net surplus was reduced $53.964 million by the price support program in 1980. Taxation and subsidy rates, which indicate percentage changes in price induced by the government programs suggest effects similar to those of the economic surplus data.

These estimates of the social cost of the price support program indicate only the losses and transfers of economic surplus. The direct costs of the program administration and commodity acquisition have not as of yet been mentioned. Net expenditures for the dairy price support program were $1279.8 million in fiscal year 1980. The costs of storage,

Table 1. The Net Welfare Effects Associated with the Price Support Program Assuming the Existence of the Federal and State Market Orders (Classified Pricing and Pooling).

Region	Change in Economic Surplus[e/]						Change in Net Surplus				Change in Taxation (t) and Subsidy (s) Percentage Rates		
	Economic Surplus Losses				Economic Surplus Transfers		Milk Producer[a/]	Fluid Milk Consumer[b/]	Manufacturing Milk Consumer[c/]	Net Total Surplus[d/]	Milk Producer	Fluid Milk Consumer	Manufacturing Milk Consumer
	A	B	C	D	E	F	Millions of Dollars				Percentage Rates		
Northeast	0.696	-0.113	5.962		39.374	-76.833	110.245	-40.100	-76.720	-6.645	-2.60(s)	1.04(t)	-5.73(s)
Southeast	0.182	-0.181	5.348		15.203	-13.220	23.075	-15.384	-13.039	-5.350	4.48(s)	1.36(t)	-4.59(s)
Lake States	0.267	-1.388	7.448	25.520	30.950	-82.685	106.187	-31.216	-106.817	-31.846	9.67(s)	4.16(t)	-6.57(s)
Upper Midwest	0.097	-1.360	-1.996		17.178	-111.481	129.778	-17.275	-109.821	+3.259	8.28(s)	4.39(t)	-6.64(s)
South Central	0.374	-0.312	8.579		27.326	-21.495	40.222	-27.700	-21.183	-8.660	8.84(s)	4.70(t)	-6.71(s)
Mountain	0.140	-0.193	1.401		10.308	-14.062	22.968	-10.448	-13.869	-1.349	3.41(s)	-0.65(t)	-5.48(s)
Calif.-Nevada	0.737	-0.617	2.875		39.607	-43.018	79.750	-40.344	-42.401	-2.995	3.25(s)	5.04(t)	-5.05(s)
Northwest	0.059	-0.203	0.623		6.680	-16.270	22.327	-6.127	-16.067	-0.479	6.13(s)	1.27(t)	-6.04(s)
Total	2.552	-4.367	30.240	25.520	186.014	-379.064	534.818	-188.564	-399.917	-53.964	5.83(s)	3.14(t)	-5.93(s)

[a/] Equals the change in areas [E - (F + C)].

[b/] Equals the change in areas [-(E + A)].

[c/] Equals the change in areas [F - (B + D)].

[d/] Equals producers' plus fluid and manufactured product consumers' net welfare for each region and the total U.S.

[e/] Economic surplus areas correspond to like-labeled areas in Figure 1 and Figure 2.

transportation, and processing totaled $62.8 million for fiscal year 1980 which represents a lower bound on the direct cost of the price support program. The remaining $217.0 million may or may not represent a direct cost depending on its disposal. If it were sold at a price equal to the acquisition cost, only the transport and processing costs would be lost. If sold of at a price lower than the acquisition cost, the direct cost would include the difference between the CCC acquisition cost and the sales price. If sold in a domestic market, the domestic consumers surplus would offset a portion of the cost incurred with sale at a price below acquisition cost. If the CCC acquisitions were sold in a foreign market, the acquisition cost net of sales price would represent the cost of disposal of CCC acquisitions.

Assuming the welfare effects estimated for the calendar year 1980 are satisfactory estimates of the fiscal year 1980 effects, the estimated upper limit for total costs of the price support program was $1,333.96 million (total net surplus plus CCC net expenditures). The estimated lower limit was $116.76 million (total net surplus plus CCC storage, transport, and processing costs). The actual social cost of the dairy price support program would be between these two limits, its level depending upon disposal prices, methods of disposal, and who ultimately consumed the CCC acquisitions.

Conclusions

The empirical model estimated total net economic surplus loss due to the price support program at $53.964 million for the U.S. during 1980. The estimated total benefit to milk producers was $534.818 million. Consideration of the direct costs of the price support program

resulted in an estimated lower limit to total program costs of $116.76 million and an estimated upper limit of $1,333.96 million. Some current factors which would contribute to the determination of the actual level of cost are: 1) The world price for manufactured dairy products is substantially below U.S. support prices, which would suggest a substantial cost for disposal of CCC acquisitions in foreign markets. Trade barriers would also make such disposal more difficult. 2) There are programs in place to dispose of CCC acquisitions domestically, e.g., school lunch and welfare programs. Even though the acquisitions are generally given away, the consumers' surplus from such disposal may substantially reduce the disposal cost. 3) There are programs in place to dispose of acquisitions abroad, e.g., PL 480, but the lack of a consumer's surplus capture makes the cost of such disposal high. 4) The dairy market situation in the U.S. and the world is one of over supply at support levels making an imminent increase in the world price unlikely. 5) The agricultural market situation would not suggest a rapid turn around in U.S. milk production making continued substantial support purchases probable unless changes were made in the price support program.

These factors suggest that the total cost of the price support program in 1980 is substantially above the estimated lower limit as prospects have not been and are not good to dispose of the CCC acquisition at prices near the acquisition cost.

FOOTNOTES

1. For an explanation of the workings of the classified pricing and pooling provisions of the federal market orders see Hallberg and King.
2. The supply of milk includes Grade A and Grade B milk.
3. Assumed for Area D is that price support acquisitions are consumed domestically. If some or all of the acquisitions were consumed in foreign markets and sales price exceeded acquisition cost, Area D would be larger.
4. The reactive programming algorithm and certain model components were obtained from Richard King and Roger Dahlgran at North Carolina State University.
5. Production and consumption data were collected from Milk Production, Disposition and Income, 1980, USDA, Ag Prices, 1980 USDA and Summary of Market Orders Statistics, 1980 USDA.
6. A third model (Model III) was used to simulate the market characteristics of the actual policy situation, i.e., market orders, pooling and price supports. Results from the Model III were compared with the actual market characteristics to validate the basic simulation model. Although space limitations do not allow presentation of the validation results, Model III simulated the actual market situation satisfactorily in the author's opinion. This suggests that Models I and II would accurately estimate the characteristics if the market situations which they simulate.

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