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by Glen D. Whipple*

The pricing of milk and milk products is a major agricultural policy issue. In late 1979, the Community Nutrition Institute (C.N.I.) petitioned the United States Department of Agriculture (USDA) for a hearing to review the federal order pricing of reconstituted fluid milk. Even though the USDA turned down the hearing request, the pricing of reconstituted fluid milk is still an important issue. At the crux of the issue is the classified pricing system and the down allocation and compensatory payment provisions of the federal market orders [Hammond, Buxton, and Thraen].

Under classified pricing, milk is priced according to its use. Milk used for fluid purposes (Class I) is priced at a fixed differential above the Minnesota-Wisconsin manufacturing (hereafter M-W) milk price (the differential varies with order and is based on distance from Eau Claire, Wisconsin). Milk used for manufacturing purposes (Classes II and III) is priced at the M-W milk price or slightly above. Under pooling, the total revenue from the sales of milk from the order pool are divided so that each producer shipping milk into the pool receives the same price.

The down allocation and compensatory payment provisions of the federal orders effectively prohibit the sale of reconstituted fluid milk products. The down allocation provision ensures that within the

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order market all local producer fresh milk is assigned to Class I utilization, while to the extent possible all reconstituted milk or components are down allocated to a manufacturing classification. Any milk components reconstituted and sold within the market would be allocated to Class II or III uses until all fresh, local producer milk was allocated to Class I use. Any reconstituted milk used as Class I is subject to the compensatory payment charge. This charge is computed as the difference between the market order Class I use price and the manufacturing milk price, and is paid by the processor into the producer pool for each unit of milk reconstituted and allocated to Class I use. These provisions ensure that reconstituted fluid milk products are priced at the Class I price plus the additional costs of processing and transportation and thus, would be more costly than fluid milk products made from fresh milk bought from producers who are regulated in that order or another order, or who are unregulated [Hammond, Buxton, and Thraen].

The intent of the C.N.I. petition was to relax the down allocation and compensatory payment provisions so as to allow milk components used in reconstituted fluid products to be priced at manufacturing use prices. This would make it possible for reconstituted fluid milk to be sold at prices competitive with fresh milk in some federal order markets.

Slightly more than 75 percent of all milk marketed in the Southeastern and Southcentral U.S. is delivered to federal order plants, while over 80 percent of all fluid grade milk is delivered to federal order plants. Thus, adoption of the C.N.I. proposal could have a significant impact on the marketing of a major portion of the milk produced in the Southern region. It is the purpose of this paper to investigate the

potential price relationships between fresh fluid and reconstituted fluid milk products in the Southeast and Southcentral United States.

Pricing and Transportation Cost Relationships

Reconstituted milk products are made by combining milk components (non-fat solids and milkfat) with potable water. The technology to commercially reconstitute milk has been available for a number of years, and reconstitution can be accomplished with the equipment found in most modern bottling plants. Reconstituted milk has been used in Alaska and foreign military bases. Reconstituted milk can be used to reduce milk costs if local milk production is less than consumption, and transportation or storage for fresh fluid milk is expensive or unavailable. Reconstituted fluid milk products would be less expensive than fresh fluid products in any market importing fluid milk for which the cost of importing fresh fluid milk was higher than the cost of importing and processing the components for reconstituted milk.

The relationship between fluid milk transport costs and the processing and transport costs for milk components is expressed graphically in Figure 1. The fluid milk transport function used was estimated by Lough (p.18). Adjusted to 1978 prices by the consumer price index for transportation service, the cost function is: Fluid Milk Transport Cost Per Cwt. = .08516 + .00140 (distance in miles).

The cost of processing the milk into components and recombining and handling the components, as indicated by the intercept of the line AB, is $1.10 per cwt. This was approximated by subtracting the 1978 average USDA support level from the value of the components (powder and butter)

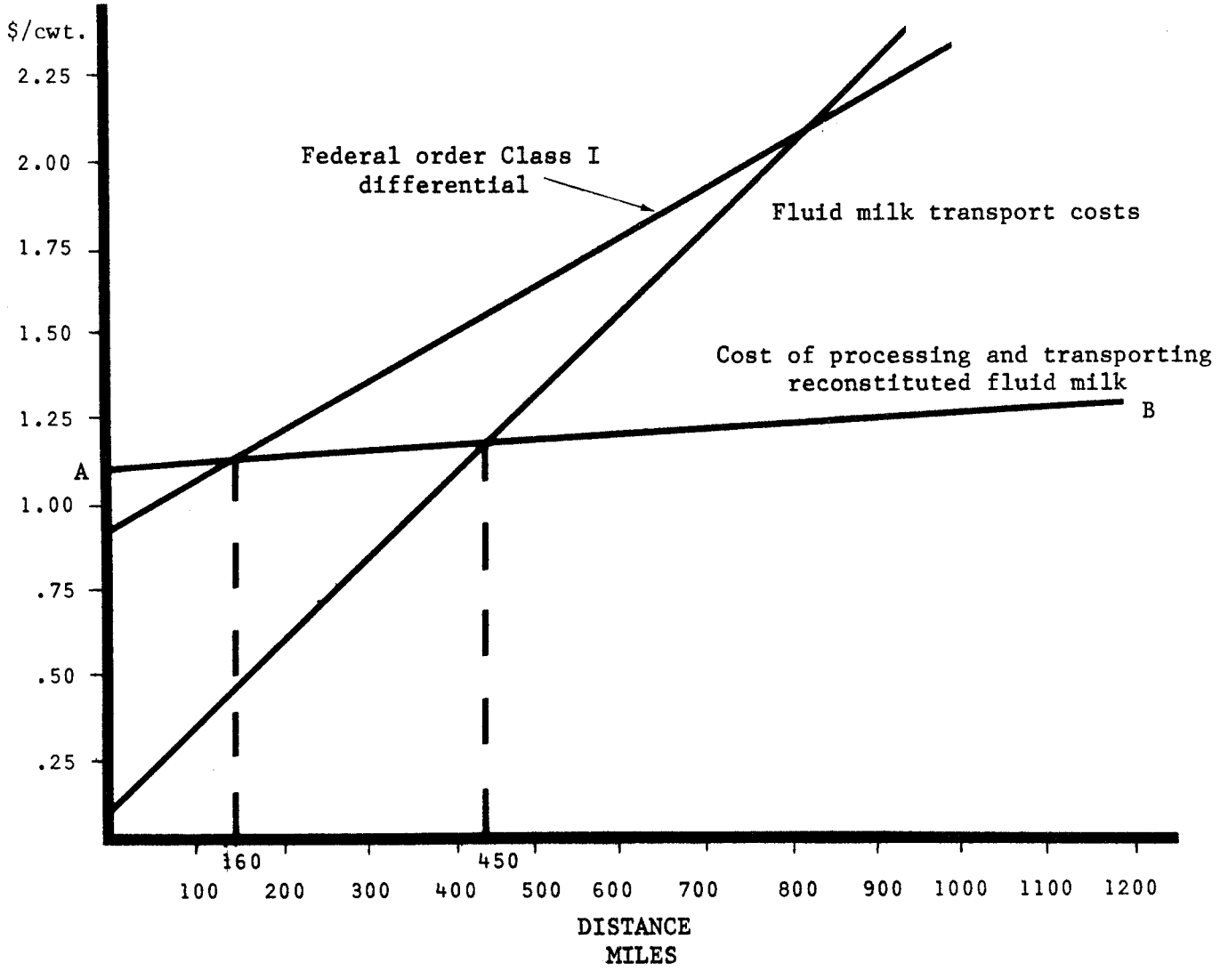

Figure 1. Graphic representation of the relative costs of transporting fresh fluid milk, the cost of processing, transporting, and recombining the components, and the federal marketing order minimum Class I differential.

in 100 lbs. of milk priced at the Commodity Credit Corporation (C.C.C.) product support purchases prices. This is an approximation of the USDA estimate of processing cost for butter and milk powder. An additional $.06 per cwt. was included to cover the cost of handling and recombining the milk components [Hammond, Buxton and Thraen]. There may be some question as to the accuracy of this cost estimate since it depends on the USDA's estimate of processing costs. That estimate has been questioned because actual manufacturing milk prices have lagged behind the support level in recent years. Even so, it is perceived by the author to be the best available estimate of the costs of reconstituting fluid milk. The cost of transporting the milk components is indicated by the slope of line AB. This function was estimated by Hallberg et al. and is in terms of the 1978 costs of transporting the manufactured products obtained from 100 lbs. of fluid milk. Manufactured Product Transport Cost Per Cwt. = .005160 + .000145 (distance in miles).

Combining these estimated costs suggests that,in a perfectly competitive market,it would be economically feasible to process milk into components and transport and recombine the components if the milk importing market were located over 450 miles from the exporting market.

With non-competitive restraints that exist in the U.S. milk markets, the price relationships are slightly different. Under classified pricing, the minimum Class I differential (difference between the M-W price and the minimum Class I milk price) is set based on the market's distance from Eau Claire, Wisconsin. In most federal market orders the minimum Class I differential equals approximately $.90 plus $.15 per 100 miles from Eau Claire [Fallert and Buxton]. Without the down allocation and

compensatory payment provisions (components used in reconstituted fluid products would be priced at the manufacturing price), milk could be profitably reconstituted if the cost of processing, transporting, and recombining were less than the Class I differential in the order market. A market located 160 miles from Eau Claire would satisfy such a criterion (Figure 1). Under a federal market order without compensatory payments and down allocation, local producer milk could be processed into components and recombined for sale at a lower price than that of fresh fluid milk, even though such action would not necessarily minimize resource use (additional processing costs would be incurred over those used for fresh milk) if that order were located over 160 miles from Eau Claire, Wisconsin. Only in the case where fresh milk was being transported over 450 miles into the order market would the reconstitution alternative result in reduced resource use.

Price Relationships in the Southern Federal Order Markets

The data in Table 1 indicate the potential prices which could have been offered for various fluid milk products in the Southern federal order markets if the down allocation and compensatory payment provisions had been removed in 1978. Two methods of obtaining milk for reconstitution were considered: Milk components could be imported into the order market and recombined, or local producer milk could be processed and recombined within the market. Reconstituted milk made from imported components is more expensive in every case than reconstituted milk made from local producer milk (Table 1). The additional transfer cost associated with imported components accounts for a small portion of this margin, but the major portion is due to a difference in the level of the

Table 1. The Farm Level Production Price of Reconstituted Fluid Milk Made From Imported and Locally Produced Components Compared to the Federal Market Order Class I Milk Prices[a/c/]

Federal Market Order	Distance from Eau Claire, Wisconsin	Minimum Federal Order Class I Milk Price	Milk Components Imported from the Upper Midwest		Local Producer Milk	
			Cost of Reconstituted Fluid Milk Made From Imported Components[b/]	Potential Price Break in 1978	Cost of Reconstituted Fluid Milk Made From Local Components	Potential Price Break in 1978
	(miles)	($/cwt.)	($/cwt.)	($/cwt.)	($/cwt.)	($/cwt.)
Louisville-Lexington	596	10.99	11.15	-.16	10.77	.22
Paducah	527	10.99	11.14	-.15	10.77	.22
Memphis	660	11.14	11.16	-.02	10.77	.37
Nashville	606	11.23	11.15	.08	10.77	.46
Tennessee Valley	671	11.39	11.16	.23	10.77	.62
Tampa Bay	1220	12.23	11.24	.99	10.82	1.41
Southwest Florida	1407	12.44	11.27	1.17	10.82	1.62
Upper Florida	1110	12.14	11.23	.91	10.82	1.32
Georgia	877	11.60	11.19	.41	10.77	.83
New Orleans-Mississippi	959	12.14	11.20	.94	10.77	1.37
Greater Louisiana	936	11.75	11.20	.55	10.77	.98
Central Arkansas	700	11.23	11.17	.06	10.77	.46
Oklahoma Metropolitan	761	11.27	11.18	.09	10.77	.50
Red River Valley	850	11.46	11.20	.26	10.77	.69
Texas Panhandle	923	11.54	11.19	.35	10.77	.77
Lubbock-Plainview	1010	11.72	11.21	.51	10.77	.95
Texas	909	11.61	11.20	.41	10.77	.84

[a/] All milk is standardized at 3.5 percent butterfat.

[b/] The cost of reconstituted fluid milk made from imported components is $11.06 plus transportation costs.

[c/] All prices are at 1978 farm level.

[d/] Assuming the removal of the down allocation and compensatory payment provisions from the Federal market orders.

two prices. In 1978 the components contained in 100 lbs. of 3.5 percent butterfat and 8.5 percent non-fat solids milk would have cost $11.00 at the F.O.B.Chicago butterfat and non-fat solids prices. At minimum federal order prices and estimated processing costs, equivalent components made from milk produced in the Chicago federal order would have cost $10.71. This margin has two potential origins: Either the milk used to produce the imported components is priced above the minimum federal order price (M-W milk price), or the approximation of the USDA processing cost estimate does not accurately reflect actual processing costs. Although brevity does not allow a complete discussion of this problem, it is probable that both factors contribute to the price inconsistency. Even so, the estimate of the cost of reconstituted fluid milk made from imported components includes transportation and recombining costs and as such is an upper limit estimate of the cost of reconstituted fluid milk in the order markets.

In those markets most distant from Wisconsin, reconstituted fluid milk could be sold for significantly lower prices in 1978 than local or imported fresh milk; $1.17 less in Southeast Florida (approximately $.10 per gallon). In fact, these data (Table 1) suggest reconstituted fluid milk could be sold at a lower price than fresh fluid milk in fourteen of the seventeen federal order markets of the Southeast and Southcentral States, and thus could displace some portion of the fresh fluid milk sales. This would not necessarily lower resource use since it could occur due only to the classified pricing structure of the federal market orders.

Competitive Simulation

The neoclassical theory of markets suggests that costs or resource use will be minimized, subject to demand at the competitive spatial equilibrium of the market. Prices in the markets may differ only by the cost of transporting product between them. Assuming equal product quality, at a competitive spatial equilibrium, milk would be shipped as components and recombined if doing so would lower the price in the importing market, and it was less costly than importing fresh fluid milk.

The data in Table 1 indicate that under the market orders, substantial potential exists for reconstitution of fluid milk if the down allocation and compensatory payments were removed. Some of this potential may be due to the classified pricing system, in which case the proposed alteration of the federal market orders which would allow consumption of reconstituted fluid milk would not necessarily result in reduced total resource use. A model was developed to simulate the competitive equilibrium of the milk market to assess the potential usefulness of reconstituted fluid (hereafter RF) milk in the Southeastern U.S. if the markets were perfectly competitive.

The model developed to simulate the competitive market equilibrium uses the reactive programming technique developed by T. E. Tramel and A. D. Seal. The reactive algorithm allocates supplies (based on fixed supplies or supply functions) among various markets (based on demand functions) such 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 47 milk consumption regions and 35 milk production regions.

Production and consumption data for the calendar year 1978 were collected for each area from milk marketing and utilization data [USDA, 1978]. Transfer costs were based on supply to demand point distances and the previously listed linear transportation cost functions.

The supply and demand functions used in the model are log linear and price dependent. They were calculated using 1978 farm level price and quantity data for each area, and supply and demand elasticity parameters estimated by Dahlgran [1980]. Variation in elasticities among regions was not considered,as it was shown by Dahlgran that such variation was not significant. The elasticities of demand for fluid and manufactured products were assumed to be -.112 and -.352, respectively. The price elasticity of milk supply was assumed to be 1.19.

The competitive farm level prices for the Southern fluid milk markets, as simulated by the competitive milk market model, are listed in Table II. Comparison of the competitive fluid milk price with the potential minimum reconstituted fluid milk price suggests the market potential for RF milk in the individual market. Those markets with a competitive milk price higher than the minimum competitive reconstituted fluid milk price would have a market potential for reconstituted fluid milk. The competitive market simulation model indicates that in the three Florida market areas, RF milk could be sold at a lower price than fresh fluid milk, ($.24, $.54, and $.23 less per cwt. in Tampa Bay, Southeast Florida and Upper Florida, respectively), if the fluid milk market was competitive. In each of the other markets listed, fresh fluid milk would maintain a lower price than RF milk. Thus, only in the Florida markets would the competitive pricing structure warrant the production of reconstituted milk for fluid use.

Table 2. The Competitive Equilibrium Milk Price Compared to the Price of Reconstituted Fluid Milk in the Simulated Competitive Markets[a/]

Market Area	Simulated Competitive Fluid Milk Price	Simulated Competitive Reconstituted Fluid Milk Price	Positive Differential
	($/cwt.)	($/cwt.)	($/cwt.)
Louisville-Lexington	10.57	11.29	--
Paducah	10.69	11.29	--
Memphis	10.70	11.29	--
Nashville	10.40	11.29	--
Tennessee Valley	10.75	11.31	--
Tampa Bay	11.61	11.37	+.24
Southeast Florida	11.92	11.38	+.54
Upper Florida	11.65	11.42	+.23
Georgia	11.10	11.34	--
New Orleans-Mississippi	10.75	11.34	--
Greater Louisiana	10.37	11.33	--
Central Arkansas	10.39	11.28	--
Oklahoma Metropolitan	10.39	11.28	--
Red River Valley	10.55	11.30	--
Texas Panhandle	10.98	11.31	--
Lubbock-Plainview	11.02	11.33	--
Texas	10.44	11.31	--
Virginia	10.38	11.32	--
North Carolina	10.51	11.32	--
South Carolina	10.91	11.32	--
Alabama	10.75	11.30	--

[a/] All prices are at 1978 farm level.

Conclusion

If the down allocation and compensatory payment provisions were removed from the federal market orders as proposed by the C.N.I. petition, reconstituted milk could have substantial potential for use in the South. In fourteen of the seventeen federal order markets listed in Table 1, reconstituted fluid milk could be sold at a lower price than fresh fluid milk, that is, the minimum federal order Class I price would be higher than the cost of importing from the Upper Midwest and reblending those components. Even so, only in those markets where milk was being transported over 450 miles would the consumption of reconstituted fluid milk rather than fresh fluid milk result in a reduction in resource use. In order to assess the potential of reconstituted fluid milk to reduce resource use in the Southeast, a model was developed to simulate the competitive market spatial equilibrium in the U.S. The simulated solution indicated that only in the three Florida milk consumption areas would the competitive price relationships encourage the consumption of reconstituted fluid milk. Thus, the potential for the RF products to reduce resource use across the South is limited. The potential appears even more limited when one considers that the estimated farm level price difference in the Florida markets is only $.02 to $.04 per gallon of milk.

The results indicate that reconstituted fluid milk would have a substantial market potential in the Southeast and Southcentral States if it were priced according to the C.N.I. petition under the federal market orders. Much of that potential is due to the price discrimination conducted in the fluid milk markets under the federal market orders, rather

than competitive price relationships. Even though the price relationships indicate a potential market for reconstituted fluid milk, the analysis considers only the production side of the market. The consumer acceptability of reconstituted fluid products would determine the impact of an altered pricing structure on the consumption, production, prices, and market shares of fresh fluid and reconstituted fluid milk products. Investigation of the consumer acceptability of reconstituted products is needed so as to indicate the potential response of the consumption side of the fluid milk market to a change in the pricing structure of reconstituted fluid milk.

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