POTENTIAL IMPACTS OF RECONSTITUTED MILK ON REGIONAL PRICES, UTILIZATION, AND PRODUCTION

Jerome W. HAMMOND
Boyd M. BUXTON
Cameron S. THRAEN

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Introduction

Commercial reconstitution of nonfat dry milk and milk fat (in the form of either butter or anhydrous milk fat) and water into fluid beverage milk has been technically feasible for a number of years. This technique has been used to meet fluid use needs of markets that are distant from milk supply areas, e.g., Alaska and our military bases in foreign countries. It is used currently in several countries in Southeast Asia and Africa. It appears to have potential to meet some fluid demands in the continental U.S., but regulations on its use have eliminated economic incentives to use it commercially. Therefore, it has not been widely marketed.

Eliminating restrictions on using reconstituted milk as a commercial source of fluid milk would affect the structure and level of fluid milk prices across the United States. This study makes an initial estimate of the likely impact on the relationship between fluid and manufacturing milk prices, then traces impacts on prices, regional milk production, and use.

The technology required to recombine nonfat, low-heat spray powder with water and milk fat to produce fluid milk products would present few problems for existing fluid milk plants. In the 1950's, the Foreign Agricultural Service in the U.S. Department of Agriculture published a series of four reports on the technological and plant requirements of recombination to process fluid milk.[1] The reports are aimed primarily at establishing plants to reconstitute milk in foreign countries. The lack of adequate transportation and refrigeration facilities in many undeveloped areas made recombination an intriguing possibility. Recombining does not require a significantly different investment in plant and equipment or processing steps than already exist for a raw milk processor. In addition to the normal processing equipment, an additional set of mixing tanks and blender pumps would be required. The process is essentially one of mixing the nonfat dry milk and water at specified temperatures and then reblending in the desired amount of milk fat to achieve the proper fat test fluid milk.[2] Many different products could be processed, e.g., fluid milk, buttermilk, chocolate milk, milk drinks, sour cream, ice cream and sherbet, and yogurt and cottage cheese.

Much of the discussion relating to use of reconstituted milk has considered it as a totally recombined product distinct from traditional fluid milk products. However, the possibility being examined here is the use of reconstituted milk for blending with locally produced fresh whole milk when local supplies are short. A market that must import fluid milk seasonally or occasionally could use nonfat dry milk and anhydrous milk fat or butter to blend with available fresh fluid milk to fill the shortage. The technique is really an extension of the current common practice of fortification of fluid milk products with nonfat dry solids.

To understand the blending potential, suppose that a processor mixes 100 pounds of fresh whole milk testing 3.7 percent fat with 2.1 pounds of nonfat dry milk and 21.2 pounds of water. The resulting mixture weighs 123.3 pounds with a fat test of 3.0 percent the approximate average fat test of all fluid milk products sold in the U.S. in 1976. Thus, fluid milk handlers could increase their fluid milk supply by almost 25 percent by blending reconstituted skim milk with their supply of fresh whole milk.

If commercially reconstituted milk became an alternative or supplement to locally produced milk in some markets, the geographic milk price differences that now exist among regions of the U.S. would decline because

Jerome W. Hammond is a professor and Cameron S. Thraen is a research assistant in the Department of Agricultural and Applied Economics, University of Minnesota. Boyd M. Buxton is an agricultural economist with the Economics, Statistics, and Cooperatives Service, USDA, stationed at the University of Minnesota.

[1]"Recombined Milk," Ag. Report No. 84, 1955; "How to Use Recombined Milk Ingredients in Manufactured Dairy Products," FAS-M-21, 1957; "Recombined Condensed Milk, Recombined Sterilized Milk, Toned Milk," FAS-M-66, 1954; "Planning and Equipping the Milk Recombination Plant," FAS-M-117, 1961.

[2]Water and nonfat dry milk could be blended into fresh whole milk to obtain a low fat fluid milk with a desired fat test. For example, about 77.6 pounds of water and 7.4 pounds of nonfat dry milk blended into 100 pounds of whole milk with a 3.7 percent fat test will yield 185 pounds of fluid milk with a 2 percent fat test.

transportation costs for whole milk, which are the basis of the differences between regions, would be reduced. This assumes that the use of recombined milk is not restricted through outright prohibition or pricing provisions of federal and state milk marketing orders. As a consequence of the changing geographic price differences, the price, supply, and use structure of the U.S. dairy industry would adjust. Some areas with high fluid milk prices would see reduced prices, decreased local production, and increased fluid milk consumption. Areas with lower fluid milk prices could see increased producer prices and increased local production.

The purpose of this study is to analyze the economic impacts of commercially reconstituted fluid milk from storable nonfat dry milk and milkfat to fill fresh fluid milk shortages in importing fluid milk markets. For this analysis, we assume no restrictions on use of the process or acceptance of the product by consumers. We will however examine the existing restrictions on production and sale of reconstituted milk.

The study should have several practical uses. It will provide a perspective on the restrictions on production and sale of reconstituted milk. It will provide estimates of the economic gains and losses of various participants in milk markets resulting from adoption of a lower cost method of milk handling. The study should also indicate the potential pressures on pricing regulations and on the amount of excess Grade A milk needed (reserve) to meet fluid demand year-round.

Factors Influencing Acceptance and Use of Reconstituted Milk

The use of reconstituted fluid beverage milk in the U.S. is very small. Reconstituted fluid milk is used for production of cultured buttermilk and flavored milk drink in a few states. A North Carolina processor markets a product that is a blend of fresh whole milk, water, and nonfat milk powder. In Alaska reconstituted milk accounts for about one third of all beverage milk sales.

The level of use of reconstituted milk is probably influenced by three factors: (1) whether it is viewed as an inferior product compared to fresh milk products, (2) its cost relative to fresh fluid milk products, and (3) legal restrictions on its use.

Some evidence of the potential acceptability of using a blend of locally produced fresh milk and reconstituted milk is the use of nonfat milk solids to fortify fluid milk products. According to Herreid and Wilson, strong evidence exists that consumers prefer regular or low fat milk that is fortified with solids-no-fat (SNF) to the same unfortified products.[3] They also indicate, "Beverage milk of acceptable palatability can be prepared from sterilized cream, low-heat powder of good quality, and potable water...without the use of any expensive equipment." They conclude that if "properly used, SNF fortification and reconstitution could play a vital role in improving the nutrition of the world."

Current marketing of the product is under labels and definitions that distinguish it from fresh fluid beverage products (except in North Carolina) so that it is viewed as somewhat different from fresh products. If blended products of fresh milk and recombined milk (whole or skim) were used, taste differences from fresh fluid products probably would be indistinguishable. Dairy technologists whom we consulted stated that a blended fluid whole milk or low fat product with up to 50 percent reconstituted milk would be indistinguishable in taste from a totally fresh milk product.[4] The fact that we fortify many fluid products to improve flavor as well as nutritional levels supports these statements.

The recommended Grade "A" Pasteurized Milk Ordinance of the U.S. Public Health Service, a guide adopted by many states, defines reconstituted or recombined milk and milk products as "...milk products...which result from the recombining of milk constituents with potable water."[5] It also requires that the product be labelled with the words "reconstituted" or "recombined" if the product is made by recombining or reconstituting. It makes no reference to any blended products. Thus, even with no restrictions or limits on production and sale of recombined milk products when properly labelled, most states would have difficulty interpreting their present regulations for blended products. To the extent that it is permitted, any blended product probably would have to be labelled as recombined milk whether it contained 1 percent or 99 percent reconstituted milk.

Outright restrictions on marketing of reconstituted milk and mandatory pricing provisions for ingredients under state and federal marketing orders are common in most U.S. milk markets. The nature and extent of these provisions are described in the "Regulatory Considerations" section of this report. For the purpose of the following economic analysis, we will assume elimination of legal restrictions.

[3]E.D. Herreid and H.K. Wilson, "Milk Fortification and Reconstitution with Solids-Not-Fat" in The Industrial Revolution in the Dairy Industry. Bulletin 14. Department of Agricultural Economics, University of Illinois. September 1967, pp. 24-28.

[4]Food technologists at the University of Minnesota and in dairy processing plants.

[5]"Grade 'A' Pasteurized Milk Ordinance," 1965 Recommendations of the U.S. Public Health Service, USPHS Publication No. 229, Washington, D.C., 1965, p. 2.

Regional Impacts of Reconstituted Milk

Our procedure for estimating the economic impacts of reconstituted milk involves two steps. First, we estimate the changes in regional and use price differentials that would result from the ability to use reconstituted milk to meet occasional and temporary milk shortages in deficit milk markets. Second, we use a regional supply-demand model that yields prices, production, and milk use for the new regional and use price differentials. We estimate regional price differential changes based on standard location theory of prices. The rationale for the changes is developed as our analysis of these differentials proceeds. The model for estimating other impacts represents multiple price plans currently administered by federal and state government.

Impacts on Use and Location Differentials

CURRENT USE AND LOCATION PRICE DIFFERENTIALS FOR MILK: RATIONALE

The impact of reconstituted milk would occur through its impact on fluid and manufacturing milk price differentials that could exist in each region of the U.S. The differentials are determined primarily by the transportation costs between markets, certain cost differences between fluid and manufacturing milk markets, and a price discrimination component. Regardless of what constitutes the existing differentials, allowing use of reconstituted milk would redefine the maximum differential that could exist in any particular area.

The theory of price relationships for a given product among different geographic consuming and supply areas where trade can occur is well-developed. This spatial theory of prices shows that (in the absence of administered pricing or monopoly that set an alternative price structure) the price differences that can exist between geographic areas are limited to the cost of moving that product between areas. For example, the U.S. dairy industry for both consumption and production is dispersed throughout the nation in every state. Some states produce more milk than they consume. Others produce less. With no trade barriers, one of two relationships will exist among markets:

(1) Milk will move from surplus to deficit areas, and the price of milk in the deficit area will exceed the price of milk in the surplus area by the least cost method of transporting the milk between the two areas.

(2) If the supply and demand situation in the two areas is such that their equilibrium price differences are less than transport costs, then no product will move between the areas.

Thus, in either case, the maximum price difference between areas is the cost of transportation between them, though in the latter case price differences between areas are likely to be less than in the first case.

The theoretical geographic milk price structure is somewhat more complicated because the cost of moving fluid milk product per hundredweight of raw whole milk is much greater than the cost of moving the manufactured dairy products produced from a hundredweight of whole milk. If Region A imports fluid milk to supplement local supplies, its price is the fluid price of the exporting region plus the cost of transporting the fluid milk. If Region B is deficient only in manufactured dairy products, its milk price should exceed that of the exporting region only by the cost of transporting the manufactured dairy products produced from a hundredweight of milk. The latter is a much lower rate on a hundredweight basis.

Most regions of the U.S. produce enough milk to meet most local fluid milk requirements at current prices. Fluid milk for some regions is imported occasionally to meet shortages during the seasonal lows in milk production and temporary imbalances between supply and demand. The basis for the administered geographic price structures under federal milk market orders reflects rather closely the cost of moving milk from the Upper Midwest to most other regions of the U.S. except the West Coast. Figure 1 shows by the isoprice lines the actual fluid use (Class I) prices in federal order markets throughout the U.S. Note how the prices increase with distance from Eau Claire, Wisconsin. The rationale given for this administratively set price structure is that the Upper Midwest is the residual supplier for fluid use needs in all other regions east of the Rocky Mountains. It is interesting that the price administering agencies for fluid milk set minimum Class I price differentials as though all regions east of the Rocky Mountains, except the Upper Midwest, are deficient in fluid milk supplies when, in fact, most regions are deficient only in manufactured dairy products.[6]

Geographic price differences for fluid milk, as administered by pricing agencies, are essentially limited because of the inability of the pricing agency to absolutely restrict movements of fluid milk between fluid markets.[7] Differentials between fluid prices in excess of

[6]Minimum Class I differentials are those set under federal milk marketing order pricing policies. Actual Class I differentials also reflect "over order payments" and exceed the minimum Class I differentials set under orders.

[7]The allocation and compensatory payment provisions described later in this paper provide some short-term impediments.

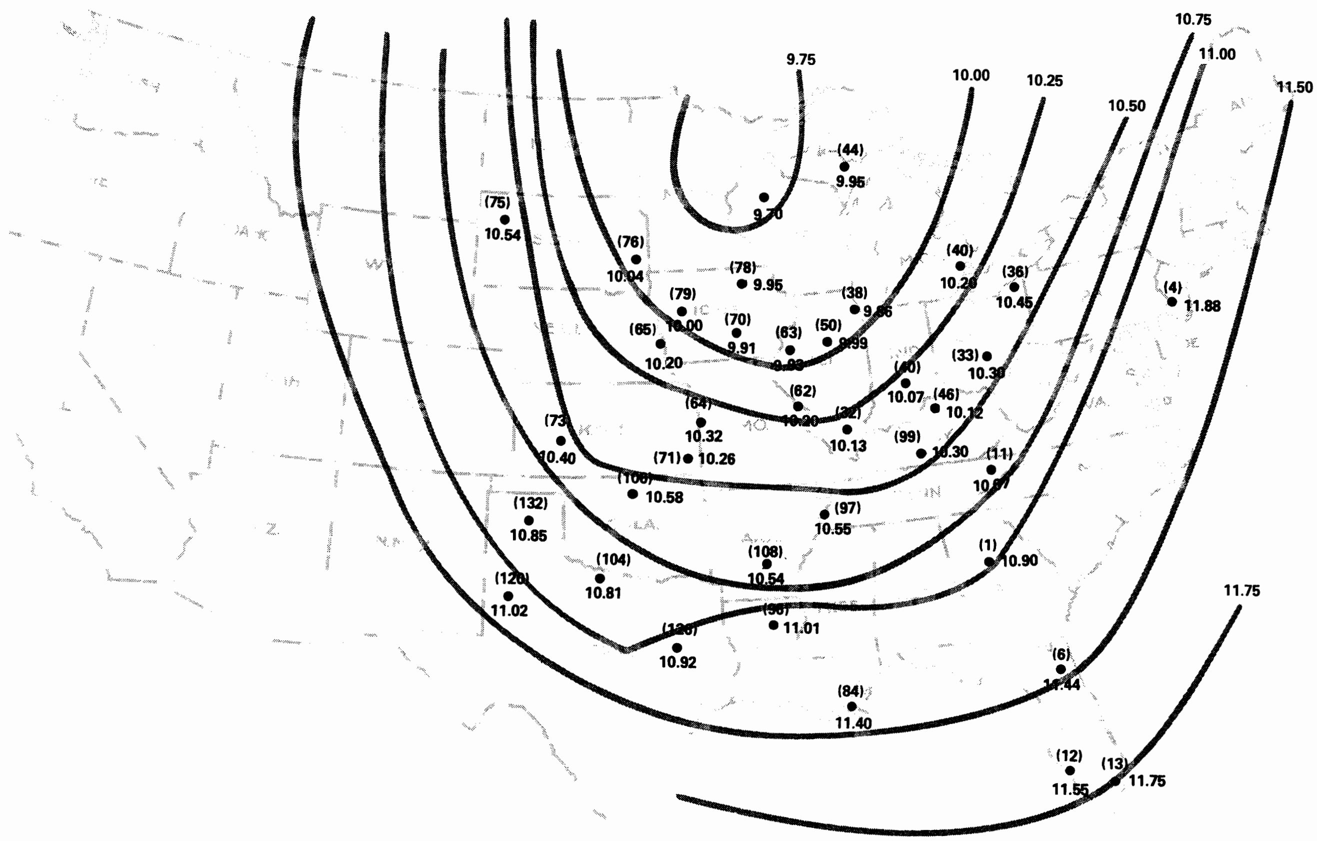

Figure 1. Actual minimum Federal Order Class I price zones for 1976
(Numbers in parentheses are identification numbers for each federal order market. Others are prices.)

SOURCE: Summary of Federal Milk Order Statistics, 1976, Statistical Bulletin No. 575, AMS, USDA, Washington, D.C. June 1977.

transport costs cannot persist without attracting fluid supplies from other markets. The consequence of regional differentials greater than transport costs is falling fluid use in the importing markets as more milk is attracted to that market with falling producer blend prices. The recent request by producers in the New England federal order market to reduce Class I prices is an example of producers recognizing the need to align prices with the nearby New York-New Jersey market according to transport costs.

To analyze the potential regional impact of reconstituted milk, we first must determine the impact on the effective Class I price differentials in various regions of the United States. For the analysis of milk price differentials, prices, and quantity adjustments, we have divided the U.S. into nine regions. The prices used or estimated will be averages for these regions. The distance used will be from Eau Claire, Wisconsin, to the population-weighted center of each region. These regions and the states included in each are:

(1) Northeast—Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Ohio, West Virginia, Maryland, Delaware, and Virginia;
(2) Corn belt—Indiana, Illinois, Iowa, Missouri, Kentucky, and Michigan;
(3) Lake states—Minnesota and Wisconsin;
(4) South central—Alabama, Mississippi, Louisiana, Arkansas, Tennessee, Texas, and Oklahoma;
(5) Plains—North Dakota, South Dakota, Nebraska, and Kansas;
(6) Southeast—Florida, Georgia, North Carolina, and South Carolina;
(7) Mountain—Utah, Colorado, New Mexico, Nevada, Wyoming, and Montana;
(8) Southwest—Arizona and California;
(9) Northwest—Washington, Oregon, and Idaho.

In 1976, the actual Class I differential in each of these regions was calculated. These estimates are shown with an "x" in figure 2. Except for the three western regions, the maximum differentials are approximately $1.34 plus 18 cents per hundredweight of milk per 100 miles from Eau Claire, Wisconsin (line AA′A in figure 2). The actual Class I differential for Chicago, slightly more than 300 miles from Eau Claire, was about $1.80 in 1976 (figure 2).

COMPONENTS OF DIFFERENTIALS FOR RECONSTITUTED FLUID MILK

The use and location differentials for reconstituted milk would be substantially different than for milk from fresh fluid sources. As long as Grade A standards differentiate milk for fluid use, there would be the added cost of producing it, a 45 cent Class I differential is assumed to cover the added costs of producing Grade A milk. This would return about 15 cents per hundredweight to farmers in the 33 percent fluid utilization of the upper Midwest. This is equivalent to ab in Figure 2. In place of the transportation cost for fresh whole milk, there would be the costs of processing milk into the concentrates, recombining and blending with fresh fluid supplies, and transporting the ingredients to the fluid market. The following describes these latter three components.

Processing costs. The location differentials necessary to encourage movement of milk ingredients to make reconstituted fluid products must cover the cost of processing whole milk into butter and nonfat dry milk. Estimates of these can be obtained in a number of ways. We considered three methods: (1) analysis of operating records for dairy plants, (2) derived margins between average wholesale product prices and producer prices using product yield data, and (3) USDA processing allowances used for the milk price support program.

In a study of surplus milk pricing, Jacobson, Hammond, and Graf calculated 1974 processing costs for a sample of Minnesota and Wisconsin butter-powder plants.[8] These costs, adjusted to 1976 by the wholesale price index, ranged from 35 cents to 75 cents per hundredweight of whole milk.

Another method of estimating processing costs is to compute the difference between gross value of product produced from a hundredweight of whole milk and the average price paid to farmers for manufacturing grade milk. We computed the monthly difference for 1974 through 1976 and then computed 12-month moving averages of the margin (table 1). This value varies considerably over time, from a low of 62.2 cents per hundredweight for 1/74 through 12/74 to 95.5 cents per hundredweight for 5/74 through 4/75. It generally trended downward through 1976 and reached a low of 69.2 cents for 1/76 through 12/76. This represents an average of what plants receive to cover their costs of processing, not what the costs actually are. Over the long run, they should, however, approximate actual average costs.

The ASCS of the U.S. Department of Agriculture sets a processing margin each year for use in its price support operations. It is calculated from examination of plant records with adjustments for price changes. This value is added to the announced support price for manufacturing milk to determine the gross value of butter and nonfat dry milk that plants must receive to pay the support price. For all of 1976, the processing allowance was 92 cents per hundredweight, substantially above the estimates from the other two methods.

There is obviously no single cost of processing milk. For the analysis that follows, which uses 1976 data, the 92 cents-per-hundredweight estimate of the USDA was used. This will yield smaller impacts of reconstituted milk than the lower estimates of the alternatives discussed above. This component of the differential is illustrated by bc in figure 2.

Recombining costs. There undoubtedly would be some additional costs to fluid processing plants that would use reconstituted milk rather than all fresh milk. Our contacts with dairy processing technologists in industry and at the University of Minnesota indicate that total additional costs to the processing plant to use reconstituted milk are not likely to be more than a few cents per hundredweight of whole milk equivalent. They would be small because no significant increase in equipment or labor is needed in existing fluid milk plants to use reconstituted milk. There are, however, the costs of receiving and storage of the ingredients. Existing dry storage and cold storage may be adequate. A blending tank, pumps, and a vat pasteurizer would be necessary. This equipment is already available in most bottling plants for fortification of skim products and for blending of ingredients for flavored milk products. To obtain an estimate of additional warehousing costs, we used estimates from a study of butter-powder plants done by Hanlon and Koller.[9] We adjusted these for price

[8]R.E. Jacobson, J.W. Hammond, and T.F. Graf, "Pricing Grade A Milk Used in Manufactured Dairy Products," Research Bulletin 1105, Ohio State University, Columbus, Ohio, 1978.

[9]J.W. Hanlon and E.F. Koller, "Processing Costs in Butter Nonfat Dry Milk Plants," Station Bulletin No. 491. University of Minnesota Agricultural Experiment Station. St. Paul. 1969.

Table 1. Twelve-month moving average butter-powder processing margin, 1974-1976

12-month period	12-month moving average		12-month period	12-month moving average	
	Butter-powder margin (cents)	Butter-powder gross value as % of milk price		Butter-powder margin (cents)	Butter-powder gross value as % of milk price
1/74 - 12/74	62.2	109.96	1/75 - 12/75	87.7	111.37
2/74 - 1/75	75.1	111.29	2/75 - 1/76	84.3	110.83
3/74 - 2/75	86.5	112.85	3/75 - 2/76	81.4	110.31
4/74 - 3/75	95.0	114.06	4/75 - 3/76	76.6	109.50
5/74 - 4/75	95.5	114.21	5/75 - 4/76	73.9	109.00
6/74 - 5/75	91.9	113.62	6/75 - 5/76	72.5	108.72
7/74 - 6/75	89.9	113.19	7/75 - 6/76	72.9	108.64
8/74 - 7/75	89.4	112.94	8/75 - 7/76	73.8	108.60
9/74 - 8/75	87.2	112.41	9/75 - 8/76	73.1	108.40
10/74 - 9/75	85.9	111.93	10/75 - 9/76	72.8	108.35
11/74 - 10/75	86.0	111.81	11/75 - 10/76	72.2	108.34
12/74 - 11/75	86.5	111.62	12/75 - 11/76	71.4	108.31
			1/76 - 12/76	69.2	108.17

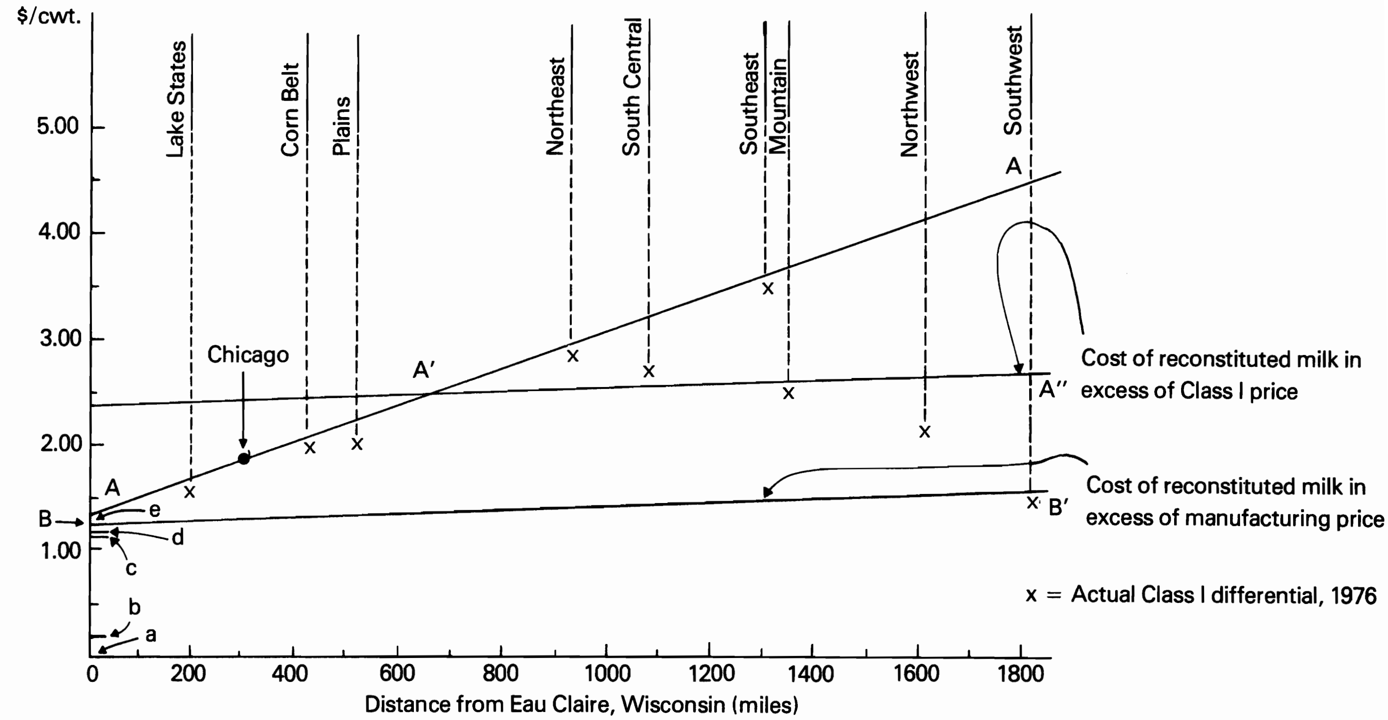

Figure 2. 1976 Class I differentials and cost in excess of manufacturing price for reconstituted milk for fluid use.

changes since the study. This indicates a handling and warehouse cost of 1.5 cents per hundredweight equivalent of whole milk. Our estimate of processing costs for reconstituting the ingredients for a large bottling plant was 3 cents per hundredweight. These costs undoubtedly vary with changes in plant size. For the analysis that follows, we include an allowance of 5 cents per hundredweight for all additional plant costs for use of reconstituted milk (indicated by line cd in figure 2). The component would be invariable with distance from the alternative supply area.

Transportation costs of milk ingredients. The transportation costs of ingredients in hundredweight equivalent were calculated from transportation cost data supplied by the USDA Agricultural Stabilization and Conservation Service. These were cost data for 80,000-pound car lot shipments of butter and shipments of nonfat dry milk for several lengths of haul. These data were used to estimate equations relating cost per hundredweight of product to distance.

For nonfat dry milk, the equation is (1) $Y_{NF} = 30.0 + 12.0(D)$,

where

Y_{NF} = transportation cost in cents per 100 pounds of nonfat dry milk and

D = distance in 100-mile units.

For butter, the equation, excluding refrigeration charge, is

(2) $Y_B = 24.0 + 13.5(D)$,

where

Y_B = transportation cost in cents per 100 pounds of butter and

D = distance in 100-mile units.

A refrigeration charge for butter is also based on mileage. The estimated equation for this is

(3) $Y_{BR} = 14.0 + 1.5(D)$,

where

Y_{BF} = refrigeration cost in cents per 100 pounds of butter and

D = distance in 100-mile units.

Each equation was converted from units of products to units of milk equivalent necessary to produce the products[10] and summed to obtain

(4) $Y_{TC} = 5.242 + 1.689(D)$,

where

Y_{TC} = total transportation cost in cents per 100 pounds of fluid milk equivalents of butter and nonfat dry milk and

D = distance in 100-mile units.

The fixed component, 5.242, and those in the component equations above represent principally a fixed charge of loading and unloading that is independent of distance. The equation yields the transportation cost for any distance from Eau Claire, Wisconsin, for shipping the butter and nonfat dry milk for a hundredweight equivalent of regular whole milk. Thus, transportation costs from Eau Claire to the center of the South Atlantic region, a distance of 1,296 miles, would be

$Y_{TC} = 5.242 - 1.689\ (12.96) = 27.13$ cents for each hundredweight of milk.

Transportation costs for a hundredweight equivalent of ingredients from Eau Claire, Wisconsin, are illustrated by the slope of line BB′ in figure 2. The fixed transportation charge for ingredients is shown by de in figure 2.

[10]One hundred pounds of milk is equivalent to 4.375 pounds of butter and 8.6 pounds of nonfat dry milk. The U.S. Public Health Service standard for solids-not-fat (snf) in fluid milk is 8.25 pounds per hundredweight of fluid milk. However, we are assuming the average snf to be approximately the national average for raw milk from the farm.

Table 2. 1976 regional actual Class I price differentials, cost of milk ingredients in excess of manufacturing milk prices, and upper limit on the Class I differentials that could prevail if reconstituted milk is an alternative to fresh fluid milk

Region	Distance from Eau Claire, Wisconsin	Actual 1976 differential	Cost of ingredients in excess of manufacturing milk prices: With continued Class I differential for both fresh fluid milk or milk for reconstitution	Cost of ingredients in excess of manufacturing milk prices: With continued Class I differential only on fresh fluid milk	Upper limit Class I differentials that could prevail if reconstituted milk is an alternative to locally produced fresh milk: With continued Class I differential for both fresh fluid milk or milk for reconstitution	Upper limit Class I differentials that could prevail if reconstituted milk is an alternative to locally produced fresh milk: With continued Class I differential only on fresh fluid milk
	miles	$/cwt.				
Column number	(1)	(2)	(3)	(4)	(5)	(6)
Northeast	941	2.95	2.64	1.63	2.64	1.63
Corn belt	441	2.05	2.56	1.55	2.05	1.55
Lake states	175	1.60	2.51	1.50	1.60	1.50
Southeast	1,296	3.50	2.70	1.69	2.70	1.69
South central	1,076	2.72	2.66	1.65	2.66	1.65
Great plains	534	2.02	2.57	1.56	2.02	1.56
Moutain	1,350	2.53	2.71	1.70	2.53	1.70
Southwest	1,810	1.35	2.79	1.78	1.35	1.35
Northwest	1,608	2.17	2.75	1.74	2.17	1.74

Information obtained from a railroad company indicates that transportation costs for 1 pound of anhydrous milk fat would be approximately 84 percent of the cost of transporting 1 pound of butter. For the remainder of our analysis, however, we will assume that all butterfat is moved in the form of butter.

IMPACT ON ACTUAL CLASS I DIFFERENTIALS

Estimates of the potential impacts of reconstituted milk on use and location differentials are made for two possible scenarios. For scenario 1, we assume that the current level of Class I prices in Eau Claire, Wisconsin is maintained for milk supplied as ingredients. That is, processors who use nonfat dry milk must pay the Class I price for that milk. This implies the maintenance of identity of source for any milk solids used for reconstitution so that proper accounting to appropriate milk orders can be made. This may be difficult if not impossible to administer. However, for our analysis, we will assume that it can be accomplished. The relevant upper limit in actual Class I differentials in the various regions under this scenario is represented by AA′A″ in figure 2.

For scenario 2, we assume that maintenance of the Class I price in Eau Claire, Wisconsin for milk used in reconstituted fluid products is not possible, but it is maintained on the fresh fluid milk. Here, there is no need to maintain the identity of source for milk solids used to reconstitute fluid milk. The relevant upper limit actual Class I differential is represented by line BB′ in figure 2. Comparing this upper limit in the actual Class I differentials with the prevailing differentials (x's) indicates that the differentials would be expected to fall in all regions, except the Southwest.

The data developed in the preceding section provide the basis for the estimation of adjustments for each of these situations. The first step is to compute the upper limit for the actual Class I price differentials that could exist in any region if fluid milk products are produced from milk ingredients. The distance for these calculations is a weighted average distance of the federal order fluid milk markets in each region from Eau Claire, Wisconsin. The distance of each market in the region is weighted by its proportion of total fluid use in the region. These distances are listed in column 1 of table 2. The costs of obtaining milk ingredients in each region are listed in columns 3 (scenario 1) and 4 (scenario 2) of table 2. These differentials reflect the extra cost of Grade A production, processing of milk into ingredients, transport of ingredients, and the $.05 "other" costs.

To determine the upper limit Class I differentials that could occur if reconstituted fluid products could be used in fluid markets, we compared the cost estimates of columns 3 and 4 of table 2 with the actual 1976 Class I differentials, which reflect prices in excess of manufacturing milk prices, column 2 of table 2. For the specified scenario, the resulting 1976 differentials would have been the lower of the actual differentials or the Class I differential needed for obtaining milk supplies in ingredient form. In figure 2, for any market, it is the lower of the values on the indicated line or the actual Class I differential (x's). For scenario 1, the upper line (AA′A″) represents the maximum possible Class I differential of fluid milk prices above Eau Claire, Wisconsin manufacturing milk prices if milk can move in ingredient form. Average differentials in three regions (the Northeast, South central, and Southeast) lie above this line. Differentials should fall to the value on the line. All other regional actual Class I differentials are less than the maximum differential for reconstituted milk. We assume, therefore, that they would remain the same. These Class I differentials for each scenario are presented in columns 5 and 6 of table 2. With continuation of Class I prices for both fluid and manufacturing milk used for ingredients, only three regions, the Northeast, Southeast, and South central, would experience declining Class I differentials, column 5 of table 2. If the Class I price is continued on milk in fresh fluid form but it is not applied to milk in ingredient form, differentials decline in all regions but the Southwest, column 6 of table 2.

MILK MOVEMENTS IN INGREDIENT FORM

The change in geographic price relationships because of the potential to use recombined fluid milk components to meet fluid needs does not mean that all markets will shift to 100 percent reconstituted milk. In fact, its actual use may be rather limited. Local supplies of fluid milk within about 500 miles of any market would be used rather than importing ingredients because milk costs to processors will be lowest and prices to producers highest. Figure 3 illustrates this. The processors' cost above the base manufacturing milk price for using nonfat dry milk and milk fat is indicated by line A″A″ (the same as in figure 2). However, the net producer returns for milk in this form are indicated by line CC, which is less than line A″A″ by the cost of making nonfat dry milk and butter from whole milk and using it for reconstituted fluid milk. The meaning of this is that producers located near any fluid market can receive a higher net price by shipping milk in fluid form rather than by processing it into butter and nonfat dry milk to be recombined into fluid milk. This results regardless of the actual level of the new "at market" price. Any milk within 500 miles of a market for fluid use would be shipped in fluid form rather than as ingredients because it would cost less than importing ingredients and making reconstituted milk. The net return to producers shipping to any fluid market will be greater and processors' costs will be lower for shipment of milk in fluid form as long as the cost of fluid transport is less than the cost of processing milk into butter and nonfat dry milk, transporting, and reconstituting it. Because transportation costs for fluid milk increase more rapidly with distance from the assembly area than do transportation costs for ingredients, at some point they will equal and then exceed the milk ingredients' costs. The net producer price structure for each market for fluid shipments is indicated partially by the dashed lines in figure 3. Their intersection with A″A″ represents the "at market" fluid milk price. Their intersection with the lower line CC indicates the distance from the receiving market beyond which additional supplies will move in ingredient forms of butter and nonfat dry milk. As long as the prices are high enough to maintain sufficient supply in an area of that radius to meet all fluid demand, the milk will be shipped in fluid form.[11] If insufficient supplies are forthcoming at any equilibrium price from a supply area of this size, then part of the supply will enter the market in the form of ingredients. Without limitations on blending, fluid beverage milk could be a blend of regular fluid milk and some reconstituted milk, probably with a relatively small proportion of the blend being reconstituted.

[11] Also, the Class I prices would be expected to fall below line A″A″ (figure 3) in that market if local supply exceeded local demand.

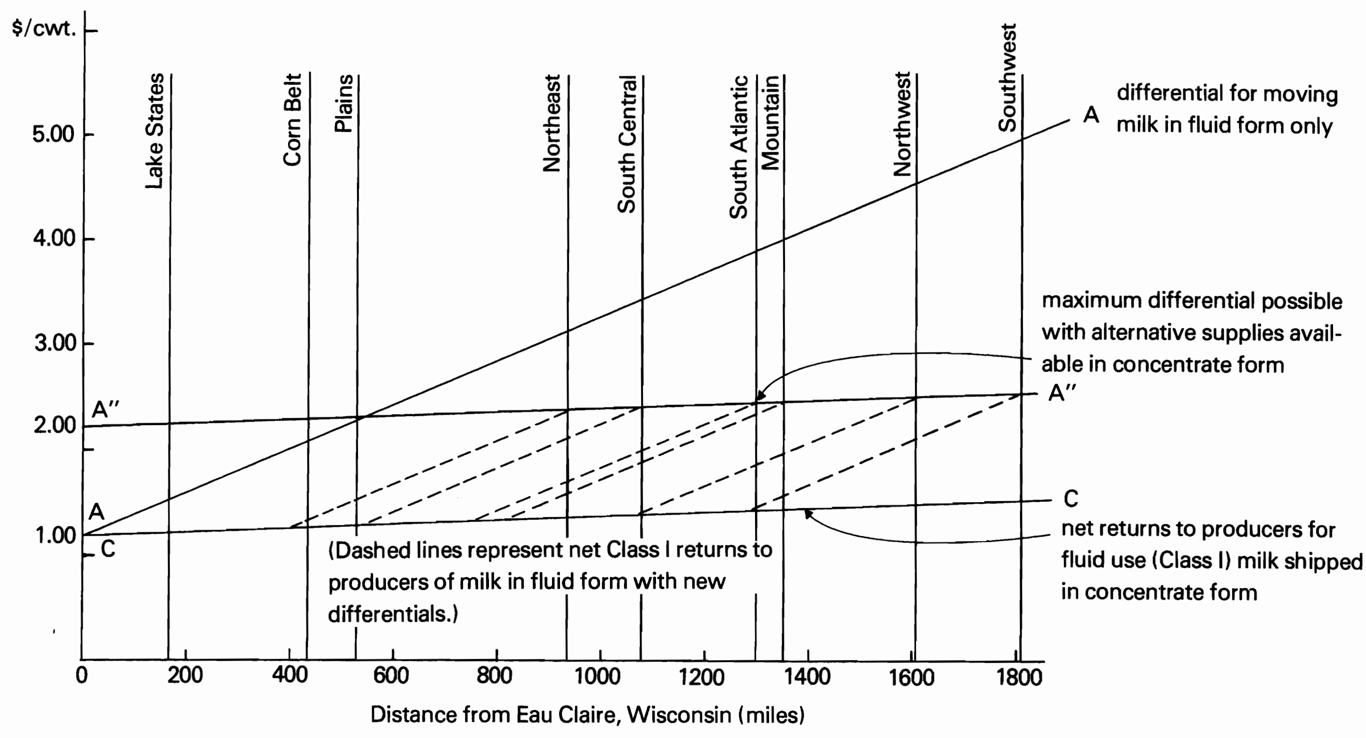

Figure 3. Differential of processor costs and net producer returns above Eau Claire manufacturing milk price for milk supplied in fluid form only and with potential to import in concentrate form.

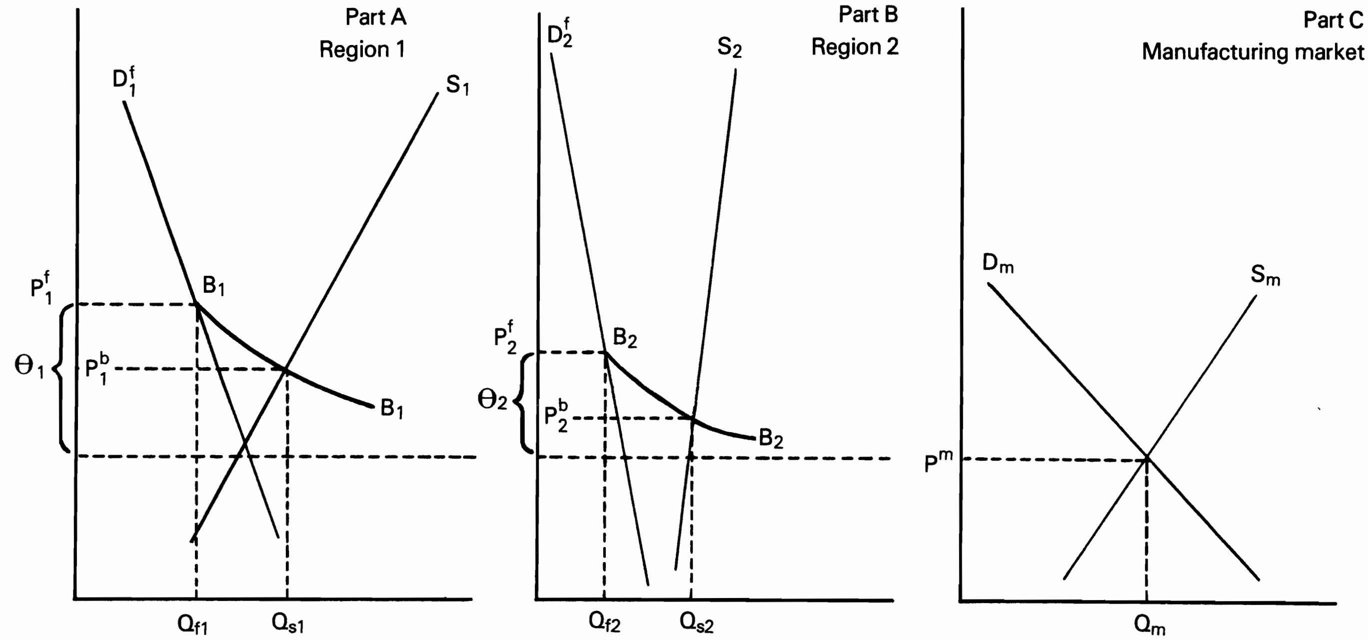

Figure 4. Intermarket supply and demand relationships in a two-region dairy model.

Price, Quantity, and Income Adjustments

A MODEL FOR REGIONAL AND NATIONAL PRICE AND QUANTITY DETERMINATION

The changing differentials because of reconstituted milk cause changes not only in milk prices. Milk production, consumption in the various uses and income from milk production also are changed. Our model for estimating these consequences represents the classified price plans for milk that significantly determine prices in each region of the U.S. The model does not distinguish between but incorporates both Grade A and Grade B milk supplies so it differs slightly from the pure federal order price model. Figure 4 shows the essential features of the model. For this figure, we have assumed that the U.S. is divided into two fluid milk markets. The demands for fluid milk are represented by D_1^f and D_2^f for regions 1 and 2, respectively and depend on the respective class I prices. Milk supplies in the respective regions are represented by S_1 and S_2 and depend on the respective all wholesale milk prices. The market for manufactured dairy products is a national market with demand represented by D_m. The prices in each market for fluid use milk (P_1^f and P_2^f) are fixed administratively at a differential, Θ_1 and Θ_2, over the national average manufacturing milk price (P^m). The average all wholesale milk price received by all producers in each region is a weighted average which is calculated from the prices and quantities of milk allocated to each use. The all wholesale milk prices that producers would receive for each possible quantity of milk marketed in each region are illustrated by curves B_1B_1 and B_2B_2 given the U.S. manufacturing price (P^m) and the Class I differentials (Θ_1 and Θ_2). Intersection of these curves with the respective supply curves determines the quantities produced in each region as well as the equilibrium all wholesale milk prices, in this situation P_1^b and P_2^b.[12]

The difference between the quantity supplied in each region and the amount demanded for fluid use at the fluid price is allocated to manufactured dairy products at whatever price will clear the market.[13] The total of these quantities from both regions is the amount of milk available for manufacturing uses and is indicated by S_m in figure 4, part C. This illustrates, for a given set of Class I differentials, the quantity supplied at all possible manufacturing milk prices. It intersects with the manufacturing milk demand curve to determine the U.S. manufacturing milk price.

The model depicted in figure 4 is at an equilibrium. If the technology for reconstituted milk reduces the Class I use differentials (Θ's), the following adjustments would be expected. The quantities of fluid milk demanded in each region would increase because Class I prices would decline. In some regions, the all wholesale price curves would fall, thus intersecting at a lower price on the supply curve. This means smaller supplies of milk. More fluid use and less supply would reduce the supply of milk available for manufacturing uses at each manufacturing milk price. This would be equivalent to shifting the S_m curve to the left. Given the manufacturing milk demand, the manufacturing milk price

[12]For our analysis, Grade A and Grade B milk are combined. The blend price is an average price for milk from both sources and, therefore, is somewhat different than that commonly reported for federal milk market orders only.

[13]For our analysis, the government support price is included. Wherever necessary, the price support determines market price in all markets and the model can be solved easily for all quantities and government purchases.

would rise. Thus, if the manufacturing milk price rises, fluid milk prices will not fall by the full amount of the reduced differentials because the fluid differentials, Θ's, are added to the manufacturing price to fix fluid prices. The net final impact on the blend prices in each region depends upon the relative slopes of the manufacturing and fluid milk demands and on the proportion of milk in each use in each region. The final all wholesale price in each region could fall, remain the same, or increase. In general, if fluid milk demand is more inelastic than manufacturing milk demand, reduced differentials will cause blend prices to decline in markets with high fluid use and to rise in markets with low fluid use.

The essential feature of the estimating model is that the fluid-manufacturing use differentials are determined exogenously by the administrative agency on the basis of transportation costs and other components described in the preceding sections. Thus, if we formulate our model in terms of price differentials with given supply and demand relationships, we can calculate the price and quantity impacts on each region caused by changing differentials. In this case, differentials are reduced because of reconstituting milk.

The structure of the demand-supply model can be stated formally for multi-supply-demand regions. The demand and supply relationships for a given year may be stated as

(1) $D_i^f = a_i + b_i P_i^f$, fluid demand in region i = 1 to n,

(2) $S_i = c_i + d_i P_i^b$, supply in region i = 1 to n, and

(3) $D_m = e + fP^m$, national demand for manufacturing use milk,

and the identities in the model are

(4) $P_i^f = P^m + \Theta_i$, fluid milk price in region i = 1 to n,

(5) $P_i^b = P_m + r_i\Theta_i$, blend price in region i = 1 to n, and

(6) $S_m = \sum_{i=1}^{n} (S_i - D_i^f)$, milk available for manufacturing use,

with an equilibrium condition

(7) $D_m = S_m$,

where

D_i^f = fluid milk consumption,

S_i = total milk production,

D_m = total U.S. manufacturing milk demand,

P^m = U.S. average manufacturing milk price,

P_i^f = fluid use milk price,

P_i^b = all wholesale milk price,

S_m = total milk available for manufacturing, after the fluid demand is met,

Θ_i = Class I milk price differentials,

r_i = percentage of milk used in fluid uses, and

a_i, b_i, c_i, d_i, e, and f are the intercept and slope coefficients for the supply and demand equations.

Equation (5) is a restatement of the more common blend price calculation

$$(8)\quad P^b = \frac{P_i^f D_i^f + P^m(S_i - D_i^f)}{S_i}.$$

This equation reflects the average price for all milk, including Grade B. Equation (5) is identical to Equation (8) if $r_i = \frac{D_i^f}{S_i}$. By assuming $\frac{D_i^f}{S_i} = r_i$ = a constant, Equation (8), which is a nonlinear function of S_i, can be made linear. With this modification and given the fluid differentials, Θ_i (which are determined by the minimum Class I differentials set by an administrative agency), initial utilization rates, r_i, and the parameters of the model, the equilibrium U.S. manufacturing milk price in any year can be determined from the above equations as follows:

$$(9)\quad P^m = \frac{e + \sum_{i=1}^{n}(a_i - c_i - d_i r_i \Theta_i - b_i \Theta_i).}{\sum_{i=1}^{n}(d_i - b_i - f)}.$$

All other prices and quantities can be calculated from the equilibrium manufacturing milk price.[14] Equation (9) provides the basis for an iterative solution process, i.e., an initial value of P^m is obtained by assuming initial values for all r_i. Given P^m and the initial set of r_i, equations (1) through (5) can be solved to obtain regional quantities and prices which, in turn, yield a new set of r_i's. If the new r_i's differ from the initial values by less than some predetermined value, then an equilibrium solution is assumed to have been obtained in which P_i^b is consistent with r_i. If not, the iterative procedure continues using the new set of r_i until a solution is obtained where r_i is very close to or equals the D_i^f/S_i ratio of that solution.

The model takes into account that some regions can be deficit in milk for fluid use. The model calculates the amount of milk that must be shipped from surplus region(s) so that all deficit regions will have enough milk to meet their fluid consumption needs. This total amount of milk to be imported into deficit regions is allocated to likely surplus regions which in turn affects each exporting region's fluid utilization rates and all wholesale milk prices.

Actually, these shipments should originate from the locations that could provide them at lowest cost (including transportation) to the importing regions. A spatial equilibrium model would provide this information. Since the model is not a spatial equilibrium one, we simply used the prior allocation to those regions from which fluid milk currently moves.

EMPIRICAL RESULTS

These potential impacts were estimated for the nine geographic regions of the U.S. for 1976, using the model described above. The supply coefficients used for the model are based on estimates by Hammond.[15] The demand elasticities were those developed and used by Fallert and Buxton.[16] The implied short run supply elas-

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[14]The model was developed by Boyd M. Buxton in "A Framework for Evaluating the Economic Impact of Classified Pricing of Milk," Staff Paper P77-24, Department of Agricultural and Applied Economics, University of Minnesota, November 1977.

[15]Jerome W. Hammond, "Regional Milk Supply Analysis," Department of Agricultural and Applied Economics Staff Paper 74-12, University of Minnesota, July 1974, p. 2.

[16]Richard F. Fallert and Boyd M. Buxton, Alternative Pricing Policies for Class I Milk under Federal Marketing Orders—Their Economic Impact, Economics, Statistics, and Cooperatives Service, USDA, Ag. Econ. Report No. 401, May 1978, p. 55.

ticities from these coefficients range from .03 to .37 for the nine regions. The demand elasticities for fluid milk range from −.123 to −.244, and the manufacturing milk demand elasticity was −.45. (For coefficients and elasticities, see appendix table 1.) All are farm level elasticities.

We estimated the impacts for the two scenarios presented above representing the fluid-manufacturing differentials presented in columns 5 and 6 of table 2.

Scenario 1—Changed differentials but continued Class I price for fluid and reconstiuted milk. With continued Class I prices on both locally produced fresh milk for fluid use or on reconstituted milk, there would be a relatively small impact on the U.S. manufactured milk price, about a 5 cent per hundredweight increase. Furthermore, Class I prices would decline in only three of the regions (the Northeast, Southeast, and South central regions). The largest decline would be 75 cents per hundredweight (about 6 cents per gallon retail) in the Southeast and 26 cents per hundredweight (about 2 cents per gallon retail) in the Northeast. For all other regions, because fluid-manufacturing differentials are unchanged, fluid milk prices increase by the same 5 cents as the increase in the U.S. manufacturing milk price (table 3).

Producer blend prices are changed in all regions because of the changing Class I price differentials. Changes are small in all regions, except the Southeast, which would experience a 58 cent per hundredweight blend price decline. The blend price would decline by 10 cents in the Northeast. The South central region blend price increases slightly even though its Class I price declines. This occurs because the U.S. manufacturing price increases more than the decline in the fluid milk price, thereby increasing the price received by farmers. In the other six regions, blend prices for milk increase by about the amount of increase in the base manufacturing price since Class I-manufacturing differentials are unchanged.

Milk utilization is altered because of changes in the use prices (table 3). The increased manufacturing milk price would reduce the amount of milk used for manufacturing by 152 million pounds, or less than 0.1 percent. The change is small because of the relatively small manufacturing milk price increase and a very low elasticity of manufacturing milk demand. Fluid utilization would increase in those regions (the Northeast, South Atlantic, and South central regions) with declining fluid prices, and fluid use would decline in all other regions because of the increased fluid price. For the Southeast, fluid product consumption would increase 74 million pounds, or 1.5 percent. In total, for all regions, fluid consumption increases by 151 million pounds, or 0.27 percent.

For those regions with declining blend prices (the Northeast and Southeast) milk production declines. The largest decline is in the Northeast with a 70 million pound decline, about 0.23 percent. All other regions increase milk production but not sufficiently to offset the decline in the Northeast and Southeast. Total U.S. milk production declines by .06 percent.

The supply decrease and fluid use increase under this scenario would have been sufficient, even with a slight decline in total milk use in manufactured products, to have eliminated all government price support purchases in 1976. The actual purchases were relatively small in that year (49 million pounds milk equivalent on a fat solids basis).

Total U.S. producer income would decline by $46 million in this stiuation, or 0.4 percent. However, the impacts are different for each region. Producer income from milk declines by 6.2 percent in the Southeast and 1.5 percent in the Northeast. The Lake states gain $16 million, about 0.6 percent.

Several significant conclusions can be drawn from this scenario. First, the alternative of reconstituted milk with the associated changes in fluid milk differentials in only a few regions of the United States has price, supply, and demand impacts for every other region as well as for government price support activities. It also shows that a decline in fluid price for a region does not necessarily mean a decline in producer blend prices. Another important result is that all or almost all fluid use milk would be produced within the region where used. Imports for all regions are about 0.01 percent of total fluid use. Unless milk moved more than 500 miles, it would not move in ingredient form.

Scenario 2—Regional fluid-manufacturing price differentials with continued Class I price on fresh fluid supplies but not for milk used in ingredients for reconstitution. This scenario assumes that fluid-manufacturing differentials would continue to reflect actual Class I prices on fresh milk used in fluid milk products in the Upper Midwest. However, raw milk used to make ingredients for reconstituting would not include the Class I differential. This scenario reduces the Class I differentials that are possible for fresh fluid milk in other regions in that it reduces the maximum amount that prices can exceed those in the Upper Midwest (figure 2). The cost of using reconstituted milk would include the allowance for Grade A production, processing costs for making butter and nonfat dry milk from whole milk, and the additional cost for the fluid processors to reconstitute fluid milk. With this alternative, fluid-manufacturing price differentials would be reduced for eight of the nine regions. The Class I price differential is limited in this case to the amount of the processing cost per hundredweight of 92 cents for ingredients plus extra fluid handler costs of 5 cents for a total of 97 cents, plus transportation costs. If Class I prices exceed this, even fluid handlers in Eau Claire would prefer the alternative of using milk ingredients to reconstitute fluid products. Column 6 of table 2 shows the maximum possible differentials. As with scenario 1, all regions' prices, supplies, and use would change.

The U.S. manufacturing milk price for 1976 would have been increased by 24 cents per hundredweight with this scenario (table 4). Fluid milk prices decline in all but two regions, the Lake States and the Southwest. The fluid price decline in the other regions varies from 19 cents per hundredweight in the Northwest to $1.57 per hundredweight in the Southeast. Implied changes in retail milk prices are about 1 cent per gallon increases in the Lake States and 2 cents in the Southwest. Retail

Table 3. Regional impacts of reconstituted milk on prices and quantities with continued Class I price for both fresh fluid use milk and milk used for reconstitution

	Regions									
	1 North-east	2 Corn Belt	3 Lake States	4 South-east	5 South Central	6 Plains	7 Mountain	8 South-west	9 North-west	United States
Fluid milk price ($/cwt.)										
Actual 1976	11.63	10.73	10.28	12.18	11.40	10.70	11.21	10.03	10.85	
With new differentials	11.37	10.78	10.33	11.43	11.39	10.75	11.26	10.08	10.90	
Change	−.26	.05	.05	−.75	−.01	.05	.05	.05	.05	
Mfg. milk price ($/cwt.)										
Actual 1976										8.68
With new differentials										8.73
Change										.05
Blend price ($/cwt.)										
Actual 1976	10.19	9.48	9.01	11.15	10.34	9.10	9.97	9.30	9.54	
With new differentials	10.09	9.53	9.06	10.57	10.35	9.15	10.01	9.34	9.58	
Change	−.10	.05	.05	−.58	.01	.05	.04	.04	.04	
Fluid milk use (million lbs.)										
Actual 1976	19,377	10,075	2,731	4,823	7,413	1,271	1,872	6,045	1,804	55,411
With new differentials	19,451	10,068	2,729	4,896	7,415	1,270	1,871	6,041	1,803	55,562
Change	74	+11	−2	73	2	−1	−1	−4	−1	151
Mfg. milk demand (million lbs.)										
Actual 1976										63,906
With new differentials										63,754
Change										−152
Exports to deficit regions (million lbs.)										
Actual 1976	.40	1.10	1.10	0	0	0	0	0	0	
With new differentials	3.00	7.50	19.60	0	0	0	0	0	0	
Change	2.60	6.40	18.50	0	0	0	0	0	0	
Total milk supply (million lbs.)										
Actual 1976	30,909	19,079	29,599	5,438	9,778	5,277	2,778	12,464	5,035	120,357
With new differentials	30,839	19,086	29,612	5,385	9,779	5,278	2,780	12,486	5,044	120,289
Change	−70	7	13	−53	1	1	2	22	9	−68
Government purchases (million lbs.)										
Actual 1976										49
With new differentials										0
Change										−49
Cash receipts from farm marketing (million $)										
Actual 1976	3,191	1,823	2,552	630	1,030	473	283	1,138	466	11,586
With new differentials	3,142	1,833	2,568	591	1,031	476	284	1,146	469	11,540
Change	−49	10	16	−39	1	3	1	8	3	−46

prices decline for other regions from 2 cents per gallon in the Northwest to 14 cents per gallon in the Southeast.

Producer blend prices under this alternative decline in four of the regions, the Northeast, Southeast, South central, and Mountain. These blend price declines range from 17 cents to $1.07 per hundredweight. Three regions, the Corn belt, Plains, and Northwest, which have declines in fluid use prices would have had an increase in producer blend prices. Those regions with both increased fluid and manufacturing prices would, of course, have increased blend prices. The largest blend price increases occur in the Lake States and Southwest, 22 and 23 cents per hundredweight, respectively.

The 24-cent increase in the U.S. manufacturing milk price causes a little more than a 1 percent decline in manufacturing milk use. Fluid milk use declines in two regions and increases in the remaining seven. The net change in fluid milk consumption in all regions—an increase in fluid use of 610 million pounds—is about 1 percent of 1976 fluid use. Again, the largest absolute increase occurs in the Northeast, 302 million pounds or about 1.6 percent, but the largest percentage increase, 3.2 percent (152 million pounds), occurs in the Southeast.

Milk supply responses to the blend price changes are quite varied. Milk production declines 278 million pounds (0.9 percent) in the Northeast and 87 million pounds (1.6 percent) in the Southeast. In total, U.S. milk production declines by only 231 million pounds (0.2 percent).

The net changes in supply and demand under the alternative are again sufficient to have eliminated the need for price support purchases for 1976 and raise the U.S. manufacturing milk price above the support level.

Interregional shipments of fluid milk increase, but they are still a minor part of any region's total use. Probably only part of these would be moved in the form of ingredients for reconstitution. It is unlikely that any

Table 4. Regional impacts of reconstituted milk on prices and quantities with continued Class I price for only fresh fluid use milk.

	Regions									
	1 North-east	2 Corn Belt	3 Lake States	4 South-east	5 South Central	6 Plains	7 Mountain	8 South-west	9 North-west	United States
Fluid milk price ($/cwt.):										
Actual 1976	11.63	10.73	10.28	12.18	11.40	10.70	11.21	10.03	10.85	
With new differentials	10.55	10.47	10.42	10.61	10.57	10.48	10.62	10.27	10.66	
Change	−1.08	−.26	.14	−1.57	−.83	−.22	−.59	.24	−.19	
Mfg. milk price ($/cwt.):										
Actual 1976										8.68
With new differentials										8.92
Change										.24
Blend price ($/cwt.):										
Actual 1976	10.19	9.48	9.01	11.15	10.34	9.10	9.97	9.30	9.54	
With new differentials	9.77	9.51	9.23	10.08	9.93	9.20	9.80	9.53	9.62	
Change	−.42	.03	.22	−1.07	−.41	.10	−.17	.23	.08	
Fluid milk use (million lbs.):										
Actual 1976	19,377	10,075	2,731	4,823	7,413	1,271	1,872	6,045	1,804	55,411
With new differentials	19,679	10,116	2,726	4,975	7,529	1,276	1,889	6,022	1,809	56,021
Change	302	41	−5	152	116	5	17	−23	5	610
Mfg. milk demand (million lbs.):										
Actual 1976										63,906
With new differentials										63,105
Change										−801
Exports to deficit regions (million lbs.):										
Actual 1976	.42	1.06	2.75	0	0	0	0	0	0	
With new differentials	7.44	18.61	48.38	0	0	0	0	0	0	
Change	7.02	17.55	45.63	0	0	0	0	0	0	
Total milk supply (million lbs.):										
Actual 1976	30,909	19,079	29,599	5,438	9,778	5,277	2,778	12,464	5,035	120,357
With new differentials	30,631	19,084	29,658	5,351	9,724	5,279	2,769	12,580	5,050	120,126
Change	−278	5	59	−87	−54	2	−9	116	15	−231
Government purchases (million lbs.):										
Actual 1976										49
With new differentials										0
Change										−49
Cash receipts from farm marketings (million $):										
Actual 1976	3,191	1,823	2,552	630	1,030	473	283	1,138	466	11,586
With new differentials	2,988	1,829	2,624	550	971	480	273	1,177	471	11,363
Change	−201	6	72	−80	−59	7	−10	39	5	−223

of the intraregional shipments of milk for fluid use would move in the form of ingredients.

Producer income changes are greater in this scenario than in the preceding one. Nationally, producer income declines about $223 million or 1.9 percent. The Northeast loses $201 million, about 6.3 per cent, while the decline in the Southeast, though less in dollars ($80 million) represents a decline of 12.7 percent. The Lake States and the Southwest gain about 3 percent in income.

The price, utilization and production adjustments are much greater with scenario 2 than scenario 1.

SENSITIVITY TO CHANGES IN SUPPLY ELASTICITIES

The preceding estimates were made with short-run supply elasticities. Over time, additional adjustments occur, especially on the supply side of the market because more than a year is required for producers to adjust to price changes. To determine the magnitude of these longer run adjustments, we recalculated adjustments with long-run supply elasticities from a study by Hammond.[17] These elasticities are approximately double the short-run elasticities (see appendix table 1). The impacts were calculated for scenario 2 only.

The industry adjustments, for the most part, do not differ substantially from the short-run adjustments (compare tables 4 and 5). Fluid milk price declines range from 18 cents to $1.56 instead of 19 cents to $1.57 per hundredweight. The manufacturing milk price rises

[17]Jerome W. Hammond. "Regional Milk Supply Analysis." Department of Agricultural and Applied Economics Staff Paper 74-12. University of Minnesota. July 1974.

Table 5. Regional impacts of reconstituted milk on prices and quantities with Class I prices continued only on fresh fluid use milk.*

	Regions									
	1 North-east	2 Corn Belt	3 Lake States	4 South-east	5 South Central	6 Plains	7 Mountain	8 South-west	9 North-west	United States
Fluid milk price ($/cwt.):										
Actual 1976	11.63	10.73	10.28	12.18	11.40	10.70	11.21	10.03	10.85	
With new differentials	10.56	10.48	10.43	10.62	10.58	10.49	10.63	10.28	10.67	
Change	−1.07	−.25	.15	−1.56	−.83	−.21	−.58	.25	−.18	
Mfg. milk price ($/cwt.):										
Actual 1976										8.68
With new differentials										8.93
Change										.25
Blend price ($/cwt.):										
Actual 1976	10.19	9.48	9.01	11.15	10.34	9.10	9.97	9.30	9.54	
With new differentials	9.78	9.52	9.24	10.08	9.94	9.21	9.80	9.53	9.62	
Change	−.41	.04	.23	−1.07	−.40	.11	−.17	.23	.08	
Fluid milk use (million lbs.):										
Actual 1976	19,377	10,075	2,731	4,823	7,413	1,271	1,872	6,045	1,804	55,411
With new differentials	19,678	10,115	2,726	4,974	7,529	1,276	1,889	6,022	1,809	56,018
Change	301	40	−5	151	116	5	17	−23	5	607
Mfg. milk demand (million lbs.):										
Actual 1976										63,906
With new differentials										63,095
Change										−811
Exports to deficit regions (million lbs.):										
Actual 1976	.43	1.06	2.75	0	0	0	0	0	0	
With new differentials	11.40	28.42	73.90	0	0	0	0	0	0	
Change	10.97	27.36	71.15	0	0	0	0	0	0	
Total milk supply (million lbs.):										
Actual 1976	30,909	19,079	29,599	5,438	9,778	5,277	2,778	12,464	5,035	120,357
With new differentials	30,463	19,090	29,713	5,273	9,669	5,283	2,767	12,780	5,076	120,114
Change	−446	11	114	−165	−109	6	−11	316	41	−243
Government purchases (million lbs.):										
Actual 1976										49
With new differentials										0
Change										−49
Cash receipts from farm marketings (million $):										
Actual 1976	3,191	1,823	2,552	630	1,030	473	283	1,138	466	11,586
With new differentials	2,977	1,834	2,631	544	967	481	273	1,196	474	11,377
Change	−214	−11	79	−86	−63	8	−10	58	8	−209

*Calculated using long run elasticities of supply (see Appendix Table 1).

from 24 to 25 cents per hundredweight. Blend prices vary from a decline of $1.07 in the Southeast to an increase of 23 cents per hundredweight in the Lake States and Southwest.

Total milk production declines 243 million pounds compared to a short-run adjustment of 231 million pounds. Interregional milk shipments increase from 74 million pounds assuming short-run elasticities to 114 million pounds assuming long-run elasticities.

Implication for Public Welfare

Permitting reconstitution of fluid milk would change the relative prices of fluid and manufactured dairy products and the relative prices among regions of the United States. A relevant question might be, "Would these changes be in the public interest?" Clearly, Grade A dairy farmers would improve incomes in some regions but lose some income in others. Fluid milk consumers generally would pay lower prices, while consumers of manufactured products would generally pay higher prices. The government cost of supporting the manufacturing milk price at a specific level generally would be reduced.

Social welfare methodology that is well documented in economic literature[18] was employed to provide a

[18]Boyd M. Buxton and Jerome W. Hammond, "Social Cost of Alternative Dairy Price Support Levels," American Journal of Agricultural Economics, 56 (1974): 286-91; J.M. Currie, J.A. Murphy, and A. Schmitz, "The Concept of Economics Surplus and Its Use in Economic Analysis," Economics Journal, 81(1971): 741-99; Paul R. Johnson, "The Social Cost of the Tobacco Program," Journal of Farm Economics, 44(1965): 242-55; and T.D. Wallace, "Measures of Social Costs of Agricultural Programs," Journal of Farm Economics, 44(1962): 580-94.

rough estimate of whether the diverse changes brought about by permitting reconstitution of fluid milk would be in the general public interest. Results indicated that scenario 2, which assumed its Class I price would be charged for fluid milk and not for milk used in manufacturing ingredients, would improve general public welfare from $22 to $25 million annually. Scenario 1 which assumed that the Class I price would be charged for both fluid and for milk used in manufacturing ingredients would improve general public welfare from $11 to $15 million annually.

These estimated net benefits to the general public would be quite complete as long as the two scenarios analyzed did not result in a decrease in the amount of fluid eligible milk to an extent that there would be more unstable markets, insecure markets, and other "disorderly" marketing conditions. It is our conclusion that disorderly markets would not be a problem. To the contrary, the ability to use reconstituted milk under either of the scenarios analyzed may actually enhance market stability because:

(1) Permitting reconstitution would actually make it much easier for fluid bottling plants to coordinate variable supplies and demands. A reconstituted product could quickly expand the fluid milk supply if and when the fluid supply-demand situation became tight. Ingredients would be stored on the bottlers' premises; therefore, even the problem of locating a source of fresh fluid milk, bargaining for a price, and transporting it to the bottlers' plants would be reduced.

(2) Tight fluid markets and rising fluid prices usually could be avoided because the fluid milk supply could be expanded quickly by blending reconstituted ingredients with fresh whole milk. This would reduce the size of reserve of fresh whole Grade A milk needed to provide the needs of the fluid market and, thereby, enhance price stability.

(3) The level of prices calculated for both scenarios would still provide economic incentive for many dairy farmers to continue to produce Grade A milk.

In summary, permitting reconstitution as outlined in both scenarios would be in the general public interest when measured in terms of aggregate public welfare. Obviously, producers in some regions do not always gain from the adjustment.

Regulatory Considerations

The estimated economic impacts of reconstituted milk described in the preceding sections were made under the assumption of no government restrictions on its sale and use. However, regulatory restrictions are currently in effect which often eliminate any economic advantage of reconstituted fluid milk products. They are imposed by both the federal and state governments. They fall into two groups: (1) outright restriction by state governments on the sale and production of reconstituted milk and (2) the provisions of federal and state milk marketing orders that effectively raise the cost of reconstituted milk above the costs of existing fluid milk prices. Let's examine the nature and extent of these restrictions.

State Regulation of Reconstituted Milk

To determine the current state prohibitions on production and sale of reconstituted milk, we contacted all states during the summer of 1977. We asked for information on each state's statutes relating to production and sale of reconstituted milk. Responses were classified into three types of restrictions: (1) direct prohibition of manufacturing and selling reconstituted milk, (2) Grade A milk standards that prevent reconstituted milk from meeting acceptable product standards, and (3) price regulation that eliminates any economic incentive to reconstitute fluid milk.

DIRECT PROHIBITION

Seven states reported an outright prohibition of producing and/or selling reconstituted milk (table 6). All except one of these states (Idaho) are in the eastern or southern regions of the U.S. A number of the states prohibit reconstituted whole milk or low fat milk but permit other recombined milk products. Alabama, for example, restricts all reconstituted products except cultured buttermilk. Georgia prohibits sale of reconstituted milk except in the case of emergency, defined as a shortage of Grade A fluid milk. South Carolina prohibits recombined fluid beverage milk except flavored milk and buttermilk. Tennessee prohibits the sale and manufacture of reconstituted milk products except in an emergency declared by the Commissioner of Agriculture. The responses indicate that the condition of shortage refers to the national supply of fluid eligible milk. Currently, about 40 percent of all fluid eligible milk is in excess of fluid needs. Thus, an emergency situation is unlikely in the near future.

PROHIBITION THROUGH GRADE A STANDARDS

Nine states have Grade A standards for the products that may effectively prohibit sale or manufacture of most of these products (table 6). This is particularly true for any reconstituted milk product that uses butter as a source of fat. Currently, there are specifications for Grade A nonfat dry milk powder. This nonfat dry milk is produced under specified production standards and is produced from Grade A milk. However, no standards require that Grade AA or Grade A butter be made from Grade A milk. In fact, a large proportion of Grade AA and A butter currently is made from Grade B milk. If a state does not permit reconstituted fluid beverage milk from other than ingredients of Grade A farm milk, no reconstituted products with milk fat can be produced or sold. Colorado officials informed us that this type of prohibition is effective in that state. Other states, though they have not been confronted with the issue, believe that these Grade A standards for fluid beverage milk would prohibit reconstituted products with milk fat.

Table 6. State regulations applied to reconstituted fluid milk products, 1977*

State	Direct state prohibition on recombined milk	Grade A ordinance prohibition on recombined milk	State regulation of prices for recombined milk	Recombined milk product currently being offered for sale in state other than cultured buttermilk	Specific labeling requirements for recombined milk
Alabama	Yes+	No	N/A	No	N/A
Alaska	No	No	No	Yes	Yes
Arkansas	No	No	No	No	Yes
Arizona	No	No	No	No	Yes
California	No	No	Yes	No	Yes
Colorado	No	Yes	N/A	No	N/A
Connecticut	N/R	Yes	N/A	N/A	N/A
Delaware	No	No	No	N/R	Yes
Florida	No	Yes	No	No	Yes
Georgia	No	Yes‡	N/A	No	N/A
Hawaii	No	No	No	Yes	Yes
Idaho	Yes	No	N/A	No	N/A
Illinois	No	No	No	No	Yes
Indiana	No	No	No	No	Yes
Iowa	No	No	No	No	Yes
Kansas	No	No	No	N/R	Yes
Kentucky	No	No	No	No	Yes
Louisiana	No	Yes	N/A	No	N/A
Maine	No	No	No	No	Yes
Maryland	No	No	No	No	Yes
Massachusetts	Yes	No	No	No	N/A
Michigan	No	No	No	No	Yes
Minnesota	No	No	No	No	Yes
Mississippi	No	No	No	No	Yes
Missouri	No	No	No	Yes	Yes
Montana	No	No	Yes	No	Yes
Nebraska	No	No	No	N/R	Yes
Nevada	No	Yes	No	No	N/A
New Hampshire	Yes	No	No	No	N/A
New Jersey	No	No	Yes	Yes	Yes
New Mexico	No	No	No	N/R	Yes
New York	No	No§	Yes	Yes	Yes
North Carolina	No	No	Yes	Yes	Yes
North Dakota	No	No	Yes	N/R	Yes
Ohio	No	No	No	No	Yes
Oklahoma	No	No	No	Yes‖	No
Oregon	No	No	Yes	No	Yes
Pennsylvania	No	No	Yes	N/R	Yes
Rhode Island	No	Yes	No	No	N/A
South Carolina	Yes+	Yes	Yes	Yes‡	Yes
South Dakota	No	No	No	No	No
Tennessee	Yes‡	No	No	No	No
Texas	No	No	No	No	Yes
Utah	No	No	No	No	Yes
Vermont	No	Yes	N/R	No	N/A
Washington	No	No	No	No	Yes
Virginia	No	No	Yes	Yes	Yes
West Virginia	Yes	Yes	No	No	N/A
Wisconsin	No	No	No	Yes*	Yes

Table 6. State regulations applied to reconstituted fluid milk products, 1977*(continued)

State	Direct state prohibition on recombined milk	Grade A ordinance prohibition on recombined milk	State regulation of prices for recombined milk	Recombined milk product currently being offered for sale in state other than cultured buttermilk	Specific labeling Specific labeling requirements for recombined milk
Wyoming	No	No	Yes	No	Yes
Puerto Rico	No	No	No	Yes	No
Totals:					
Yes	7	9	11	11	35
No, not applicable, or no response	44	42	40	40	16

*Tabulations are based on responses from individuals in state departments of agriculture, milk control agencies, or health departments. Some indicated that as they had little or no experience with the product, they were somewhat unsure on how their regulations would apply.

+Except cultured buttermilk.

‡Fluid milk (3.25 percent fat and 7.75 percent solids not fat) cannot be modified in any manner. All other fat content milk products can be recombined.

§May be set aside in the event of a milk shortage.

‖A small number of processors are using nonfat powder to extend whole milk supplies to produce lower fat, 2 percent, milk.

**Some processors are marketing a recombined chocolate milk drink.

Federal and State Milk Order Pricing Provisions

Federal and state milk orders do not, nor cannot, prohibit the sale or manufacture of reconstituted milk. Their provisions do, however, impose conditions that effectively prohibit use of such milk. These provisions are:

(1) the allocation provision of milk orders which specifies the way in which an importing handler in an order must deduct milk from other sources and milk components for reconstitution or fortification from the various use classifications. How this milk is allocated determines what the handler must pay local producers for milk (his or her obligation to the pool), and/or

(2) a compensatory payment or charge that is imposed on the buyer for some of the imported milk that is allocated to Class I uses in the importing market.

Both the allocation provision and compensatory payment affect the cost to handlers for fresh and reconstituted milk from other sources outside the handler's particular federal milk marketing order.

Eleven states have milk pricing programs for their milk industries that would apply to the ingredients used in reconstituted milk (table 6). These pricing provisions require that any handler who produces recombined fluid beverage products must pay as much or more for the ingredients as he or she is required to pay for regular fluid milk from local producers. The application of the pricing provisions and the method of assuring this cost relationship is similar to that of federal orders described below.

To describe how the federal order provisions affect the handler's costs, three situations using hypothetical numbers are examined to illustrate how they affect a handler's cost of milk other than fresh whole milk from locally regulated producers. These situations are

(1) use of fluid milk from other federal order markets,

(2) use of fluid milk from a nonregulated supply area, and

(3) use of nonfat dry milk and butterfat for reconstitution into fluid products.

Assumed characteristics of the markets for the analysis are that there are only two use classes in the regulated markets, Class I (fluid) and Class II (manufacturing). The Class II price is set at the same level in all regulated markets and is fixed at the level of average prices in nonregulated manufacturing milk areas, $8.00 per hundredweight. The Class I price in the importing market is $10.00 per hundredweight. Assume also that the nonregulated exporting handler and the regulated exporting handler are the same distance from the importing market and that the transport cost for fluid milk between markets is $1.00 per hundredweight. Remember that the Class II price is the same in all markets and that the Class I prices are aligned in all markets so that each exceeds fluid use milk price in the exporting markets by the cost of transportation. For comparison, let us first examine the milk costs for a regulated handler who buys 2,000 hundredweight of milk from local producers and uses 1,400 hundredweight in Class I products and 600 hundredweight in Class II products. The handler's total cost for milk in both uses would be (shown in column 1 of table 7):

In order Class I milk, 1,400 cwt. × $10.00 =	$14,000.00
In order Class II milk, 600 cwt. × $8.00 =	4,800.00
Total cost	$18,800.00

The following shows the impacts of the allocation and compensatory payment requirements on the handler's costs when some milk is obtained from other than local producers.

IMPORTED MILK FROM ANOTHER FEDERAL ORDER MARKET

If fresh whole milk is received in a federal order market from a source not regularly associated with the

Table 7. Allocations and costs for a federal order milk processor according to source of milk and allocation alternatives

	All milk from local producers (1)	Some from other order (with Class I price of $9.00/cwt.): Handler determined allocation (2)	Some from other order: Required allocation (3)	Milk from nonregulated source, Market utilization: 80%, Blend price: $9.60: Handler determined allocation (4)	Market utilization 80%: Required allocation (5)	Milk from nonregulated source, Market utilization: 50%, Blend price: $9.00: Handler determined allocation (6)	Market utilization 50%: Required allocation (7)	Milk in form of ingredients: Handler determined allocation (8)	Milk in form of ingredients: Required allocation (9)
	cwt.								
Total milk purchases	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Used in Class I	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Used in Class II	600	600	600	600	600	600	600	600	600
Source of milk									
Local producers	2,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Other	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Allocations									
Class I: local	1,400	400	700	400	800	400	800	400	1,000
Class I: other	0	1,000	700	1,000	600	1,000	600	1,000	400
Class II: local	600	600	300	600	200	600	200	600	0
Class II: other	0	0	300	0	400	0	400	0	600
	dollars								
Milk cost									
Class I: local ($10/cwt.)	14,000	4,000	7,000	4,000	8,000	4,000	8,000	4,000	10,000
Class I: other	0	9,000	6,300	8,600	5,160	8,000	4,800	8,000	3,200
Class II: local ($8/cwt.)	4,800	4,800	2,400	4,800	1,600	4,800	1,600	4,800	0
Class II: other	0	0	2,400	0	3,400	0	3,200	0	4,800
Transportation	0	1,000	1,000	1,000	1,000	1,000	1,000	130	130
Processing	0	0	0	0	0	0	0	920	920
Total without compensatory	18,800	18,800	19,100	18,400	19,200	17,800	18,600	17,850	19,050
Compensatory payments	0	0	0	0	240	0	600	0	800
Total	18,800	18,800	19,100	18,400	19,440	17,800	19,200	17,850	19,850

market and, therefore, not priced by that market order, this milk must be deducted from the handler's total receipts of milk to calculate his or her price obligation to local producers. The allocation provision requires that "other order milk" be deducted from each use class in the same proportion as the receiving market's utilization or the handler's utilization, whichever has the lowest Class I utilization rate. Consider a handler in a market with 80 percent Class I utilization who uses a total of 2,000 hundredweight of milk of which 1,000 pounds is imported. If the handler uses 70 percent of all purchases for Class I uses, he or she must, in computing the pool obligation, deduct 700 hundredweight from Class I use (70 percent of the imported milk) and 300 from Class II use (30 percent of the imported milk). In this example, the handler's Class I utilization percentage (70 percent) is less than the market utilization rate (80 percent). The total cost of all milk used by the importer will include the locally produced milk at the local order price plus the price of the imported milk and the cost of transporting it. Because orders require that milk shipped to another order be priced at the exporting order prices and on the utilization rate assigned in the importing market, the importing handler must pay at least $9.00 per hundredweight for the remainder of the imported milk. In all likelihood, the handler will pay more to cover the shipper's handling costs. Furthermore, transport costs of $1.00 per hundredweight must be added for all imported milk. The total costs to the importing handler for all milk purchased locally and imported are (also listed in column 3 of table 7):

In order Class I milk, 700 cwt. × $10.00=	$7,000.00
In order Class II milk, 300 cwt. × $8.00=	2,400.00
Other order Class I milk, 700 cwt. × $9.00=	6,300.00
Other order Class II milk, 300 cwt. × $8.00=	2,400.00
Transport of other order milk, 1,000 cwt. × $1.00=	1,000.00
Total cost	$19,100.00

Now, how would this cost of milk compare to the cost if the handler could allocate the imported milk between uses as he or she chooses? In this case, regardless of the use made of the imported milk, the handler can minimize total milk costs by deducting other source milk from the Class I uses to the extent possible as follows (shown in column 2 of table 7):

In order Class I milk, 400 cwt. × $10.00=	$4,000.00
In order Class II milk, 600 cwt. × $8.00=	4,800.00
Other order Class I milk, 1,000 cwt. × $9.00=	9,000.00
Transport of other order milk, 1,000 cwt. × $1.00	=1,000.00
Total cost	$18,800.00

With the assumption about price alignment between order markets, unspecified allocation of other source milk permits the handler to purchase milk from distant order markets at the same cost as local supplies ($18,800.00). The required down allocation to Class II use for some of this milk increases the total milk cost to the handler. It occurs because of the additional cost of acquiring Class II milk from another source. The other order milk allocated to Class II is paid for at the same Class II price as local milk ($8.00), but $1.00 per hundredweight transportation must also be paid.

If the importing handler has a higher Class I utilization than the market utilization, the allocation is based on the market utilization. The effect of the allocation, however, increases the cost of other order milk, compared to local supplies, even more than if the handler's utilization rates are used.

IMPORTED MILK FROM A NONREGULATED HANDLER

Nonregulated milk purchased by a federal order handler is allocated somewhat differently than other order milk, plus a compensatory payment may be assessed. The allocation provision requires that any amount of milk from unregulated sources which exceeds the difference between Class I needs, plus a necessary operating reserve,[19] and local supplies be allocated to Class II uses. If any other milk remains after computation, it is prorated according to the pounds of milk remaining in each class. We look at two variations of this situation—(1) where the importing handler's Class I utilization rate is less than the market utilization rate (70 percent for the handler and 80 percent for the market) and (2) where the importing handler's utilization rate is greater than the market utilization rate (50 percent for the market and 70 percent for the handler). Again, suppose that the receiving handler uses 2,000 hundredweight of milk in all uses, as described above. If 1,000 hundredweight is purchased from a nonregulated handler, the allocation is as follows. The total Class I use of 1,400 hundredweight is multiplied by 1.25 to determine necessary supplies for the market. This yields 1,750 from which producer receipts of 1,000 hundredweight are subtracted to yield 750. The nonregulated milk, 1,000 hundredweight, exceeds this by 250. This amount of the other source milk is down allocated to Class II. The remaining 750 hundredweight of other source milk is prorated according to the percentage of milk remaining in each class, 80 percent in Class I (1400 ÷ 1750 × 100) and 20 percent in Class II (350 ÷ 1750) × 100.

We can again show impact on handler cost of milk by comparing the handler's cost with the required allocation to that if the milk could be allocated as to minimize cost. Nonregulated milk is not subject to minimum Class I pricing in the exporting market, but the importing handler must be forced by competition to pay, at a minimum, the receiving order blend prices for milk ($9.60 per hundredweight in this example).[20] If the handler pays less than the receiving order blend price, producers in the exporting market would find it profitable to pay the transportation costs and ship directly to the importing market to receive the blend price of $9.60. This means that the seller in the exporting market would be receiving $9.60 less transportation costs of $1.00 per hundredweight to the receiving market. However, the importing handler must allocate (for purposes of determining order allocations) 400 hundredweight of this milk to Class II uses. Remember that Class II milk from in-order producers can be purchased at $8.00 per hundredweight.

The handler must also pay a compensatory payment. This is a payment on each hundredweight of nonregulated milk imported into a federal order market that is allocated to Class I uses. It is assessed against the importing handler. The charge is the difference between the order Class I price and the blend price in the importing market. In this case, it is 40 cents per hundredweight ($10.00 minus $9.60). It is paid into the pool (producer settlement fund) for payment to local producers. It is paid on the 600 hundredweight of other source milk allocated to Class I.

Total costs of milk to the importing handler would be at least as follows:

In order Class I milk, 800 cwt. × $10.00=	$8,000.00
In order Class II milk, 200 cwt. × $8.00=	$1,600.00
Nonregulated Class I milk, 600 cwt. × $9.60=	5,760.00
Nonregulated Class II milk, 400 cwt. × $9.60=	3,840.00
Compensatory payment of 40 cents per cwt. on nonregulated milk allocated to Class I=	240.00
Total cost	$19,440.00

These allocations or costs are also shown in column 5 of table 7. Without the down allocation requirement and compensatory payment requirement, the importing handler would deduct all the nonregulated milk from Class I use. The total cost of milk would be $18,400 (column 4 of table 7). This allocation, if allowed, would permit the handler to reduce milk costs below costs of using all locally produced, regulated milk.

One might ask why the compensatory payment is necessary since the down allocations alone increase the cost above that of obtaining milk from local producers ($19,200 versus $18,800), or, in this example, above costs of obtaining some milk from other order markets ($19,200 versus $19,100). The compensatory payment is necessary to maintain the cost advantages for local milk

[19]This has normally been estimated at 25 percent of Class I use.

[20]$9.60 =$10.00 (.8M) + 8.00 (.2M)

when the importing handler has a utilization rate higher than the market utilization rate. In this case, down allocation does not raise the handler's cost above that of the locally produced milk. To illustrate, let's alter the situations described above so that the market Class I utilization is 50 percent rather than 80 percent. With class prices the same, this now means that the order blend price is now $9.00 per hundredweight. The required allocations (column 7 of table 7) are the same as in the preceding example, but nonregulated milk may now be available at $9.00 per hundredweight or $8.00 to the exporting handler if its blend price is in alignment with non-order milk prices. The importing handler cost of milk with only down allocation is

In order Class I milk, 800 cwt. × $10.00=	$8,000.00
In order Class II milk, 200 cwt. × $8.00=	1,600.00
Nonregulated Class I milk, 600 cwt. × $9.00=	5,400.00
Nonregulated Class II milk, 400 cwt. × $9.00=	3,600.00
Total cost without compensatory payment	$18,600.00

The handler's cost would be less than if buying only from local producers, $18,600 versus $18,800. The compensatory payment is the second line of defense against nonregulated milk when down allocation is insufficient to raise costs above cost of local source milk. In this case, the charge is $1.00 per hundredweight (the difference between the Class I price of $10.00 and the blend price of $9.00). This raises the total handler's cost to $19,200 (column 7 of table 7).

APPLICATION TO INGREDIENTS FOR RECONSTITUTED MILK

The application of the down allocation and compensatory payment provisions to milk-derived ingredients that are used in reconstituted milk or for fortification of the traditional fluid products is even more costly to the receiving processor. The provisions are applied in essentially the same manner whether the ingredients are (1) produced in a plant of the regulated handler, (2) purchased from another handler in the same order, (3) purchased from a handler in another federal order market, or (4) purchased from a nonregulated handler. The allocation provisions require complete down allocation of these ingredients to the extent possible, i.e., there is no pro rata allocation according to the market's or handler's current utilization. The compensatory payment charge is computed as the difference between the order Class I and manufacturing use price. Thus, there is no possibility that a handler who considers producing reconstituted milk products can do so at a lower cost than by buying whole milk from producers regulated in that order, another order, or from a nonregulated handler even though classified pricing without down allocation or compensatory payments would give the advantage to the reconstituted products.

To illustrate the impacts, assume a handler uses 2,000 hundredweight with the same 70 percent utilization as described above. If the handler purchased nonfat dry milk and anhydrous milk fat from another plant for recombining into 1,000 hundredweight of fluid products, the purchase cost for recombined milk would be:

Ingredients for 1,000 hundredweight of reconstituted milk:

Manufacturing milk at $8.00 per cwt.	= $8,000.00
Processing costs at 92 cents per cwt.[21]	= 920.00
Transport cost for ingredients at 13 cents per cwt.[22]	= 130.00
Total cost	$9,050.00

Though used for reconstituting into fluid products, the ingredients must be deducted from Class II uses to the extent possible in determining the handler's order obligations. Thus, the handler is paying $9.05[23] per hundredweight for 600 pounds of milk and allocating it to a use that would cost only $8.00 per hundredweight if purchased from producers in the handler's own market. In this situation, all local producer milk is assigned to Class I utilization. The reconstituted milk is assigned 400 hundredweight to Class I and 600 hundredweight to Class II (column 9 of table 7).

To the extent that the ingredients are allocated to Class I use, a compensatory charge, computed at the difference between the Class I and manufacturing milk prices, is assessed regardless of the source of the ingredient. Any handler who uses ingredients for reconstituted milk must necessarily incur a minimum cost on each hundredweight equivalent. That minimum cost for milk equivalent allocated to Class I includes the manufacturing milk price, the ingredient processing and transport costs, and a compensatory payment that equals the difference between the Class I and Class II prices. For the examples cited previously, this would be $8.00 plus 92 cents plus 13 cents plus $2.00 for a total of $11.05 per hundredweight in the importing market. In this situation where the handler purchased ingredients to reconstitute 1,000 hundredweight of whole milk, the allocation requirements and compensatory payments would result in a total cost of all milk of $19,850 (column 9 of table 7). This includes

Cost of local producer milk allocated to Class I (1,000 cwt. at $10.00)	= $10,000
Cost of ingredients for 400 cwt. of milk allocated to Class I ($9.05 per cwt.)	= 3,620
Cost of ingredients for 600 cwt. allocated to Class II ($9.05 per cwt.)	= 5,430
Compensatory payment of $2.00 per cwt. on 400 cwt.	= 800
Total cost	$19,850

It appears from the examples that order regulation reserves the local market, first for locally regulated producers, then other order producers and nonregulated producer plants that ship milk in fluid form. If supplies from these sources are inadequate, then ingredients might be used. As long as the market is able to maintain a price that generates enough local milk supply, it is

[21]See page 8 for source of processing cost estimates.

[21]See page 9 for source of transportation costs.

[23]This does not include the extra costs that would be incurred for recombining into fluid milk.

largely protected from outside competition. Even if the technology and acceptability of reconstituted milk could substantially reduce costs of providing milk to some sections of U.S., it would be prevented by the above provisions.

One can conclude that market order allocations and compensatory provisions currently eliminate any economic advantages that recombined milk may have. They would have to be changed or eliminated for the kinds of adjustments described in the previous section to occur.

In the early 1960's, it appeared that compensatory payments would be eliminated from orders. They were challenged and found unconstitutional as then administered in Lehigh Valley v. the United States. The USDA then revised the way that the compensatory payment was computed. Previously, it had been calculated at the difference between Class I and Class II prices and applied to all other source milk, including other orders. The revision eliminated compensatory payments on milk from other orders and changed to a pro rata allocation with any pool milk that the handler receives. The provisions have not been changed since then.

Summary and Conclusions

The purpose of this study was to analyze the impact of permitting use of reconstituted milk to meet occasional and seasonal shortages of fresh fluid milk. We assumed in our analysis that reconstituted milk from nonfat dry milk and butterfat or anhydrous milk fat could be blended with locally produced fresh milk for any market in the U.S. and that the resulting product would be indistinguishable in terms of taste and quality from standard fluid milk products. Our discussion with dairy technicians indicates that blending up to about 50 percent reconstituted milk could pass this test.

Current regulation of milk and milk products by the state and federal governments effectively prevents reconstituted milk production or sales. Eleven states prohibit the sale or manufacture of reconstituted milk products. In some states, a few products can be produced (usually flavored milk drinks and cultured buttermilk).

Seven states restrict reconstituted milk through their Grade A milk ordinances which require the use of Grade A milk for fluid milk products. Because there are no Grade A standards, federal or state, for butter or anhydrous milk fat, they cannot be used for reconstitution into a Grade A product. This would limit reconstitution to skim products made from Grade A nonfat dry milk.

Even in states that permit production and sale of reconstituted milk, pricing provisions in state and federal milk marketing orders impose penalities on use of the ingredients. These penalities mandate prices or charges on ingredients that make it more costly than locally produced fresh milk regardless of the prices that exist for fresh fluid milk in the local market. The specific order provisions are sometimes called "allocation requirements" and "compensatory payments." The compensatory payment is a charge on milk equal to the difference between the fluid use and manufacturing use price in the receiving processor's market. This assures that the processor will always incur a higher cost for using reconstituted milk than for using locally produced fresh milk for fluid milk products.

Removing all restrictions on the use of reconstituted milk to supplement local supplies of fresh milk and acceptance of the product by consumers would have price, utilization, and production consequences for milk throughout the U.S. The economic adjustments by regions would occur because reconstituted milk would alter the fluid-manufacturing price differentials that are now based, in part, on transport cost for fluid milk. We estimated the impacts and compared them to actual 1976 milk prices, supply, and use. The estimates were made for two different sets of assumptions: First, the processors of nonfat dry milk and butter must pay to the market pool the fluid price for that proportion of their milk whose final use is in reconstituted fluid milk. Second, we assumed that these processors do not have to pay the fluid price for the milk ingredients used in reconstituted fluid milk.

The smallest regional impacts would occur in the first scenario and the largest regional adjustments with the second scenario. Fluid-manufacturing differentials decline in only three regions (essentially no change in one) with the first assumption, but this brings about price and quantity adjustments in all regions. The national average manufacturing milk price rises by 5 cents. Fluid price declines in three regions, by 75 cents per hundredweight in the Southeast region, 26 cents in the Northeast region and 1 cent in the South Central region, and rises moderately in all other regions. Total U.S. fluid use increases just slightly. Blend prices fall in the Northeast and Southeast regions and rise by 4 to 5 cents in all other regions. Total national milk supply would have declined just slightly.

Under the second scenario the fluid-manufacturing price differentials and fluid milk prices would decline in all except one region (table 4). The change in fluid price would range from plus 24 cents to minus $1.57 per hundredweight. Total U.S. fluid milk use would increase by 1.2 percent. Blend price declines, however, would be moderate except for in the Southeast region where it would decline by $1.07 per hundredweight.

And blend prices actually would increase significantly in the Southwest, Lake States and Plains regions. This occurs for two reasons: (1) because manufacturing milk prices increase as fluid-manufacturing differentials decline and (2) because the proportion of milk used and priced in manufactured products in these regions is much smaller than that used in manufactured products. Thus, a 1 cent manufacturing price increase can more than offset a larger fluid price decline. Manufacturing demand decreases by 1.3 percent. Nationally, milk production declines less than 1 percent.

A major implication of permitting reconstitution of fluid milk is, as outlined above, on the geographical Class I price structure throughout the United States.

Both of our estimates resulted in the elimination of the need for government price support for 1976 . However, this was a year of low price support activity.

It is our conclusion that relaxing all restrictions on use of reconstituted milk would not lead to its being a significant part of total fluid milk supply for any region of the U.S. (2.2 percent for the Southeast region)[24]. That is, if reconstituted milk would be freely traded and used and accepted by consumers in the U.S., very little would be used to supply fluid milk needs. Nevertheless, it is a technology that can enable some consumers to obtain milk at lower costs, and it does not have economic consequences. As our analysis shows, it increases production and producer prices in some regions and has the opposite impact in others.

Permitting reconstitution of milk greatly influences the amount of excess Grade A milk reserve needed to meet seasonal and day-to-day variations in Grade A supply and fluid demand. Reconstituted fluid milk is really fluid milk that has been stored to be used when tight markets for fluid milk appear. The possible disorderly market conditions characterized by unstable fluid milk prices and insecure markets for some Grade A farmers may be of much less concern than under the present pricing policy. The needed reserve of Grade A milk would be reduced greatly if reconstitution were permitted than if it were not permitted.

We did not analyze the effect of transporting only nonfat dry milk which could be blended with water and whole milk at 3.7 percent fat test to make a fluid product with a 3 percent fat test. By doing so, a fluid handler could obtain about 123 pounds of fluid milk with only 100 pounds of fresh whole milk. This situation is very short run and would tend to decrease Class I differentials even more than if both milkfat and nonfat dry milk ingredients are used as assumed in this study.

Further, we did not consider economies of condensing (taking the water out) whole milk in order to lower transportation costs. Also, we assumed that ingredients would originate in the Upper Midwest. This probably would not be the case in regions like the Northeast and Southwest where substantial quantities of ingredients are now manufactured.

Additional research is needed to take these other factors fully into account. However, we believe the most significant impacts of reconstitution are reflected in the results of the analysis.

[24]This conclusion is based on relatively inelastic supply curves in those regions where prices would fall dramatically. This means that total milk production would not decline in the same proportion as the all wholesale milk price.

Appendix

Appendix Table 1. Elasticity of supply and demand used in study

Region	Demand (fluid milk)	Supply* (all milk) Short run	Long run
Northeast	−.168	.22	.36
Corn belt	−.168	.08	.15
Lake states	−.123	.08	.15
Southeast	−.244	.14	.29
South central	−.216	.14	.29
Plains	−.197	.03	.10
Mountain	−.173	.18	.24
Southwest	−.158	.37	1.04
Northwest	−.173	.37	1.04
U.S. manufacturing demand	−.450		

*Developed for assumed regions from Jerome W. Hammond, Regional Milk Supply Analysis, Department of Agricultural and Applied Economics, Staff Paper 74-12. University of Minnesota, July 1974, p. 21.