EFFICIENCIES IN MILK ASSEMBLY AND MANUFACTURING THROUGH COOPERATIVE MERGERS IN THE SOUTHWEST

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TABLE OF CONTENTS

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Efficiencies In Milk Assembly And Manufacturing Through Cooperative Mergers In The Southwest

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Milk is a unique agricultural commodity distinguished by its perishability and the wide variety of product forms it can assume. A high degree of coordination is necessary to efficiently integrate the production, assembly, processing and distribution functions to guarantee the product mix marketed is what consumers demand. Coordination is required with respect to space, time, type and quality of product, and quantities.

Technological developments in the dairy industry since World War II made available large potential economics of size in fluid milk processing. Such innovations along with reciprocity of inspection among milk market areas tended to increase the volume and geographic coverage of individual processing firms. Many firms accomplished this through merger activity; while other firms, lacking the financial resources to adopt new technology, saw their ability to compete against large, more efficient processors erode and ultimately disappear. As a result, the number of fluid milk processors in the United States decreased from 16,000 in 1950 to 3,000 in 1971.

During this period fluid handlers in each major city or market area were served by a single milk producers' cooperative. Due to the large decrease in the number of fluid processors, local cooperatives came to depend on fewer customers, mainly large national or regional proprietary firms with processing and distribution activities in many markets. Thus a cooperative often found itself competing with cooperatives in other milksheds that supplied a common processing firm that operated in many markets. Producer cooperatives retained little market power vis-a-vis the regional or national processing firms. Low returns to producers characterized the period.

In an attempt to offset fluid processors' market power, milk cooperatives formed federations, or marketing agencies-in-common. By doing so, competition between producers' cooperatives was legally eliminated. One primary objective of federations was to increase the market power of member cooperatives through coordination of their marketing activities.

A final organizational change in establishing a countervailing power to the regional and national fluid processors was the creation of large regional cooperatives. To perpetuate and expand the gains due to federation, many of the federations' member

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cooperatives pursued merger. The number of dairy cooperatives has decreased from 36 to 15 over the period 1964 to 1973 in the south central United States. [Tucker, Monroe and Roof]

Over time, cooperatives have assumed a vastly expanded role in the coordination of the milk marketing system, especially at the first handler level. In years past, each milk processing firm used its own resources to develop a dependable supply of milk for plant needs. But over time, cooperatives assumed the responsibility for raw product assembly for three basic reasons. First, improved roads and trucks, on-farm bulk tanks, and bulk hauling meant many apparent economies of size could be achieved to decrease hauling costs paid by producers. Cooperatives performing procurement and coordinating functions more efficiently grew in size and importance. Second, cooperatives were the only type of firm in the fluid milk market willing to market all milk of its members at all times and take on new producers. Third, classified pricing and market wide pooling eliminated differentiation of producers selling to individual plants. In view of the foregoing, regional cooperatives could provide procurement services more economically than several firms, reducing plant resources used for assembly.

Cooperatives also undertook increased responsibility for marketing their members milk. An important role in milk marketing is the allocation function. Cooperatives coordinate supplies to meet the quality and quantity specifications of fluid handlers on a daily and long-run basis. Only those quantities needed for Class I and Class II uses are delivered to handlers, with the surplus diverted to cooperative-owned facilities for manufacturing. Actual milk movements are such that the total transportation cost for all classes of milk is minimized.

With respect to the agribusiness sector, some marketing functions have shifted to cooperatives from proprietary firms. This is especially true with respect to manufactured dairy products. In 1957, cooperatives manufactured 58 percent of the total butter production in the United States, 57 percent of the dry powder and 18 percent of the cheese. Comparable figures for 1973 are 66 percent, 85 percent, and 35 percent for butter, dry powder and cheese, respectively. [Tucker, Monroe and Roof, pp. 35-38]

The overall objective of this study was to determine the effects of milk cooperative mergers on the capacity, efficiency, and location of hard-product processing facilities for reserve and Class III milk and on the cost of assembling all classes of milk. Specific objectives include:

1. To estimate the number, size, and location of cooperative firms that would exist in selected years 1968-1978 in the absence of cooperative mergers that led to the creation of one regional cooperative in the southwest region of the U.S. Most of the basic data were obtained from AMPI and apply to the Southern Region of AMPI, which for this study encompasses primarily areas within the states of Oklahoma, Texas, Arkansas, Kansas, New Mexico, and Tennessee.
2. To estimate changes in assembly and transportation costs for all classes of milk under market structures with and without cooperative mergers.
3. To estimate changes in manufacturing costs for Class III milk supplies under market structures with and without cooperative mergers.

Manufacturing Plant Numbers, Locations, and Volumes Under Alternative Market Structures

With the creation of Associated Milk Producers, Incorporated (AMPI), many of the processing plants acquired through merger were shut down to achieve economies of size in the total operation of surplus milk handling. [Cook, Blakley and Berry, p.7]. In the absence of AMPI, many of those plants closed might be in operation today. Thus to compare assembly and processing costs under a with merger and without merger situation, one needs to know the number, locations and volumes under the alternative market structure.

Actual AMPI Plant Locations

Milk Producers, Incorporated (MPI) of San Antonio, Texas merged with 11 northern states cooperatives to form AMPI in 1969. Prior to that MPI was created by consolidation of many cooperatives in the Southwestern United States, primarily in Texas, Oklahoma, and Kansas.

The series of mergers establishing the AMPI Southern Region involved 16 processing plants to handle surplus milk (Table 1). In 1968, MPI operated 13 plants in the Southwest. By 1978, the cooperative had trimmed the number of operating plants to six. In the premerger situation, many plants possessed equipment for manufacturing one or more products but at low volumes and, for cheese, with high labor requirements. With merger the firm had the financial capability to introduce new equipment and technology for specialized, high butter-powder and cheese production, often in dual-purpose plants. The effect of such actions should lead to economies of size with respect to assembly and processing costs of surplus milk and to flexibility in product mix in response to tilts in prices favoring cheese production relative to butter-powder production or vice versa. Also, excess processing capacity could be reduced by closing the smaller, inefficient plants.

Table 1. MPI and AMPI Southern Region Processing Plant Locations in Selected Years.

Pre-1968	1968	1971	1978
		Kansas	
Hillsboro	Hillsboro	Hillsboro	Hillsboro
Arkansas City	Arkansas City	Linn	
		Oklahoma	
Tulsa	Tulsa	Tulsa	Tulsa
Enid	Enid	Oklahoma City	Oklahoma City
Oklahoma City	Oklahoma City		
Mangum	Mangum		
		Texas	
Wichita Falls	Sulphur Springs	Muenster	Muenster
Sulphur Springs	Muenster	Sulphur Springs	Sulphur Springs
Muenster	Fort Worth	Rusk	El Paso
Fort Worth	Round Rock	San Antonio	
Jacksonville	La Grange		
Ballinger	Rusk		
Round Rock	San Antonio		
La Grange			
Rusk			
San Antonio			

SOURCE: Data furnished by Associated Milk Producers, Inc. San Antonio, Texas

Pre-Merger Market Structure

The first step in determining the number and location of manufacturing plants that would be operative without the series of mergers is to specify a premerger configuration of butter-powder and cheese plants in what is now the AMPI Southern Region.[1] For butter-powder, ten plants are assumed to operate in 1968. Six actually manufactured butter and powder in 1968: Arkansas City, Kansas; Hillsboro, Kansas; Tulsa, Oklahoma; Oklahoma City, Oklahoma; Enid, Oklahoma; and Muenster, Texas. The Sulphur Springs, Texas plant produced only nonfat dry milk, but for this study was assumed to be a joint butter-powder plant. Three plants closed down just prior to 1968. This study includes them in the premerger market structure on the assumption some of the older, smaller plants would have operated in 1968 in the absence of the formation of MPI.The Jacksonville and Wichita Falls plants are designated as butter-powder plants given the fact most of the smaller cooperative-owned dairy processing plants in Southwest United States produced butter and/or powder. The La Grange plant, last used during the flush season of 1968, acutally possessed a batch churn and printing equipment.

Estimating Without Merger Market Structures

Number of Plants

Data to predict the number of butter-powder and cheese plants that would exist without the creation of AMPI came from July 1974 *Dairy Situation.* [USDA, 1974] That publication presents the number of butter and cheese plants operating in various production-size catagories for the years 1957, 1963, and 1972 in the United States.

The distribution of butter plants is divided into ten size groups based on the plants' annual output. The smallest production-size category includes plants producing less than 100,000 pounds of butter per year, while the largest size category encompasses plants manufacturing greater than 4.0 million pounds annually. This study combines the five smallest size groupings, covering volumes up to 1.0 million pounds, into one production-size group to more realistically predict the size of distributions of the plants considered in this study. For the same reason, the two next-to-largest size categories are consolidated into one category; volumes range from 2.0 million to 4.0 million pounds. Thus, this study utilizes only five categories of butter plants.

This study assumes that without the merger some plants not operative in 1968 would have actually processed milk into hard products that year. These include the Wichita Falls, Jacksonville, and La Grange butter-powder plants. To place them in a production-size group, it is assumed their production equals 500,000 pounds per year, the mid-point of the smallest size category.

The Sulphur Springs facility produced only powder in 1968. It's nonfat dry milk output, 9.98 million pounds, was multiplied by 8.13 pounds of whole milk per pound of powder, to obtain a whole milk equivalent of 81.16 million pounds. That value was divided by 22.22 pounds of whole milk per pound of butter to yield a value of 3.652 million pounds of butter, the assumed butter output of the Sulphur Springs plant in 1968. Table 2 lists each plant's 1968 output and associated production-size group.

For American Cheese, nine size categories of plants are set forth. The smallest size grouping covers plants with cheese production of less than 50,000 pounds per year, and the largest category includes plants with annual volumes in excess of 2.0 million pounds

[1]This study assumes butter and nonfat dry milk are joint products produced in a single plant.

Six cheese manufacturing facilities are assumed to operate during 1968. Four plants in reality produced cheese in 1968: Linn, Kansas; Mangum, Oklahoma; Fort Worth, Texas; and San Antonio, Texas. Two plants, at Ballinger and Round Rock, both in Texas, were also included on the assumption some of the older, smaller plants were operative in 1968 as part of the premerger configuration. Infact, MPI closed the Ballinger plant in October, 1968, and also shut down the Round Rock facility prior to 1968. Both plants had cheese manufacturing equipment.

Table 2. Output and Production-Size Category for Plants in 1968, Predicted Annual Change in Plant Numbers by Category and Assumed Plant Numbers for Production-Size Categories in 1971 and 1978 for the Without Merger Market Structure

	1968 Output Per Plant	Production-Size Category	Predicted Change Per Year	Assumed 1968 Plant Numbers	Predicted 1971 Plant Numbers	Predicted 1978 Plant Numbers	Assumed 1971 Plant Numbers	Assumed 1978 Plant Numbers
	(Thousand lbs. of Product)	(Thousand lbs. of Butter	(Percent)					
Wichita Falls	500*							
Jacksonville	500*	<1000	−11.45066	3	2.0829	.8891	2.0	1.0
La Grange	500*							
Muenster	1477	1000-1499	−9.95248	1	.7302	.3505	1.0	0.0
Enid	1500	1500-1999	−10.37086	1	.7201	.3346	1.0	1.0
Tulsa	2225							
Arkansas City	2754							
Hillsboro	2751	2000-3999	−8.15009	4	3.0995	1.7094	3.0	2.0
Sulphur Springs	3652							
Oklahoma City	4750	>4000	3.34096	1	1.1036	1.3891	1.0	1.0
TOTAL	NA	NA	NA	10	7.7363	4.6727	8.0	5.0
				Cheese				
Round Rock	250*							
Ballinger	250*	<500	−9.95902	3	2.2170	1.0946	2.0	1.0
Fort Worth	490							
Mangum	3291							
San Antonio	4433	>2000	5.34317	3	3.5070	5.0488	3.0	5.0
Linn	3317*							
TOTAL	NA	NA	NA	6	5.7240	6.1434	5.0	6.0

*Estimated Output
NA: Not Applicable

of cheese per year. For the same reasons stated above, the four smallest size categories are aggregated into one with volumes ranging up to 500,000 pounds annually.

Two plants that produced cheese in earlier years but none during 1968, Round Rock and Ballinger, were assumed to manufacture 250,000 pounds of cheese, which is the mid-point of the smallest size cheese category. AMPI Southern Region data show the Linn plant processed 33.51 million pounds of whole milk in 1969, the first year any volume data were available for that plant. Dividing 33.51 million pounds by 101.1 pounds of whole milk per pound of cheese produced an estimate of 3.32 million pounds of cheese manufactured at Linn.

The six 1968 cheese plants fall into two categories: the lowest, covering volumes up to 500,000 pounds, and the largest, including plants with production greater than 2.0 million pounds per year.

The number of butter and cheese plants in the U.S. decreased dramatically after 1957 (*Dairy Situation*). The number of U.S. butter plants fell from 2062 in 1957 to 475 in 1972. Cheese plant numbers declined to 613 from 1194 over the same period. Most of decline occurred in the small output categories, with butter plants having output less than 1.0 million pounds annually dropping from 1665 to 303. Cheese plants producing less than 500,000 pounds declined from 534 to 127. Conversely, plant numbers in the largest size categories for both butter and cheese have increased; butter from 48 to 81, and cheese from 98 to 215 over the period 1957 to 1972. This implies that the minimum efficient size operation has increased considerably since 1957.

Regression analysis provides quantitive predictions of the relationships between time and the number of butter or cheese plants of each size operating in the United States. The specified model is:

$$\ln Y_{tc} = A + B_1 X_t + u_{tc} \qquad (4)$$

where in Y_{tc} is the natural logarithm of the number of butter or cheese plants operating in year t in category c; A is the intercept; X_t is the year for which a prediction of plant numbers is desired (last two digits only); and u_{tc} is an error term.

There are two major reasons for specification of a semilog function. First, specifying a semilog relationship prevents negative estimates for total plant numbers. Second, by stating the dependent variable as a natural logarithm, the estimate obtained for the parameter B_1 is the average annual percentage change in the total number of plants of a given production-size group. For example, regression results for the largest butter production-size group (greater than 4.0 million pounds annually) yield the following equation:

$$\ln Y_{t5} = 2.0332 + 0.0334X_t$$

Thus, the average annual increase in the number of butter plants of this size in the United States over the period 1957 to 1972 was 3.34 percent. A negative B_1coefficient implies a decrease in plant numbers over time.

The estimates for the B_1parameter are used to predict the number of AMPI plants that would exist in the years 1971 and 1978 if AMPI had not been created, given the assumed premerger market structure of ten butter-powder plants and six cheese plants. The B_1parameter resembles in principle a compound interest rate. To determine the predictied plant numbers for any one production-size category for a given year, the estimated coefficient for B_1, is added to one. The resulting value is then raised to a power equal to the number of years from 1968 for which an estimate of plant numbers is desired. In turn, that value is then multiplied by the number of plants actually in that size category in 1968 to get an estimate of plant numbers in the given year. Estimated coefficients for B_1 are listed in the column labeled "Predicted Change Per Year" in Table 2.

For cheese, the 1971 estimate of 3.5070 plants operating in the largest production-size group is rounded downward. Since the assumed market structure of cheese plants includes only the two extremes of production-size groups, it would have been unlikely for one of the smaller plants to increase its production enough over the period 1968 to 1971 so as to move into the largest category. This study supposes the smaller, independent cooperatives lacked financial resources to increase output by such a quantity.

For 1971, two small-size and three large-size cheese plants were assumed to exist in the without merger situation. In 1978, one small-size and five large-size plants were assumed to exist (Table 2).

Plant Locations

After estimating how many plants would exist without the emergence of AMPI, the specific plant locations which would and would not be operative in the years 1971 and 1978 is needed. For example, in 1968, three of the plants have annual butter output less than 1.0 million pounds; Wichita Falls, Jacksonville, and La Grange. Two of the plants remain in that category in 1971, and only one plant exists in 1978. For lack of any other grounds to determine which specific plants exit, the plants assumed to close down were randomly selected. On that basis, the La Grange plant was assumed to exit between 1968 and 1971, the Jacksonville facility was assumed closed between 1971 and 1978, and the Wichita Falls plant remained operative in 1978 in the smallest size category.

Random selection was also employed for the butter-production-size category for 2.0-4.0 million pounds and for the small-size cheese grouping. The Arkansas City butter-powder plant and the Round Rock cheese facility were selected to exit between 1968 and 1971 from their respective categories. The Fort Worth cheese plant was eliminated between 1971 and 1978.

For 1978, the large production-size group for cheese was predicted to have five plants. As stated above, it is improbable the Fort Worth or Round Rock plants (from the small-size category) would have the capacity to move into the large-size group. At the same time, random selection procedures eliminated the Tulsa plant and Muenster plant from the butter-powder structure for 1978. This study assumes the Tulsa and Muenster plants convert to cheese production in the large-size cheese category. Converting those plants' 1968 butter production to whole milk equivalents, and then dividing by 10.1 pounds of whole milk per pound of cheese, places the Tulsa and Muenster plants in the large-size cheese category. Tulsa and Muenster equivalent cheese production equals 4.895 million and 3.429 million pounds respectively. Table 3 shows the without merger structure of processing facilities for the years 1968, 1971, and 1978.

Plant Volumes

The final step in determining a without merger market structure estimates whole milk volumes processed by each plant in the years 1968, 1971, and 1978. Because of the seasonality of milk production and Class III milk supply, plant volumes are determined for the months of May and October.

In the without-merger structure, it was necessary to estimate the volume of milk processed in individual plants in each of the years 1968, 1971, and 1978. The total volume of milk processed by AMPI for non-fluid milk markets was approximately 90 million pounds in May, 1969.[2] An additional 10.2317 million pounds was estimated as the volumes processed in Arkansas City, La Grange, and Round Rock plants to

[2]Data furnished by AMPI Southern Region, San Antonio, Texas. 1969 is the earliest year for which plant volumes are available.

Table 3 Location of Plants Assumed Operating in the Without Merger Structure for 1968, 1971, and 1978

1968	1971	1978
	BUTTER	
Hillsboro	Hillsboro	Hillsboro
Arkansas City	Tulsa	Enid
Tulsa	Enic	Oklahoma City
Enid	Oklahoma City	Wichita Falls
Oklahoma City	Wichita Falls	Sulphur Springs
Wichita Falls	Sulphur Springs	
Sulphur Springs	Muenster	
Muenster	Jacksonville	
Jacksonville		
La Grange		
	CHEESE	
Linn	Linn	Linn
Mangum	Mangum	Tulsa
Fort Worth	Fort Worth	Mangum
Ballinger	Ballinger	Muenster
Round Rock	San Antonio	Ballinger
San Antonio		San Antonio

account for a total surplus milk supply of 100.137 million pounds in May, 1969. The volume for 1968 was assumed to be the same as for 1969. The closing of the Arkansas City, La Grange, and Round Rock plants would account for 89,9053 million pounds of processing in May, 1971. The closing of the Jacksonville and Ft. Worth plants (with a combined volume of 2.1956 million pounds) would account for 87.7097 million pounds for the May, 1978 processing volume.

Actual surplus milk handled by the AMPI Southern Region was variable but exhibited no trend over the decade 1969 to 1978. Therefore, this study considers the total supply of milk in May as constant for each of the three years 1968, 1971, and 1978. The supply in October also was considered constant over the years, though at a much lower level.

To determine individual plant volumes, data on each individual plant for each year was expressed as a share of the total volume accounted for by all plants in that year. (For plant shares see Stellmacher, Table 12). The share for each plant was then applied to the total volume assumed used for that month to obtain the estimated average monthly volume for the plant. Since plant numbers have decreased since 1968, the effect is to permit each plant remaining in operation to have a larger volume over time.

The same procedures used to determine May plant shares and volumes are applied to October data. Contrasting the two months, one sees volumes in general are much larger in May, the flush production season. Specifically, the Oklahoma City, Tulsa, and Sulphur Springs plants combined handle 50 percent of the supply during May, but only 10 percent during October. Conversely, the Muenster and Hillsboro plants process 25 percent of the AMPI Southern Region Class III milk in May, and 53 percent in October.

Processing and Assembly Costs

Two important facets of marketing efficiency associated with surplus milk are processing costs and assembly costs.

Processing Costs

Processing costs involve primarily two product groups: a) butter-powder and b) cheese. Detailed steps and procedures for estimating total and average costs for processing butter-powder and for processing cheese under alternative market structures are included in Agricultural Economics Paper No 8107. In general, the costs for butter-powder manufacturing are updated from a 1972 study by Nolte and Koller for Minnesota area plants. The costs for cheese manufacturing are updated from a 1975 study by Boehm and Conner for the Southeastern United States.

Both sets of costs are adjusted to represent the seasonality of milk supplies which are available for manufacturing in the study area. The concept of effective capacity for the plants was developed for estimating costs. Effective capacity is related to the average capacity at which a plant could expect to operate through out the year, based on the seasonality of those supplies along with the presumption that the plant would operate at capacity during June or the flush period. The effective capacity is about 57 percent of June capacity for the Southern Region of AMPI.

The cost relationships are shown graphically in Figure 1. The curves show high costs for small volumes. Most of the economies of size are realized at volumes near 300 million pounds per year. For cheese cost declined at a rate of about seven cents per hundredweight as volume increases from 300 to 500 million pounds. The rate of decline is similar for butter-powder production.

Assembly Costs

The creation of AMPI permits substantial savings in assembly costs through elimination of cross-hauling and through policies to direct milk flows to markets in need. A linear programming algorithm, the transportation model, is used to determine flows that minimize the cost of assembling all classes of milk. The specific objective of the transportation model used in this study is to minimize the cost of assembling AMPI Southern Region Grade A milk to fluid and hard-product processing plants under alternative market structures. Data furnished by AMPI provide volumes to apply to the model. Total milk supply is the sum of producers' deliveries by AMPI Southern Region members. Total fluid milk demand equals the sum of each handler's fluid milk purchased from AMPI. The surplus milk available for cheese and butter-powder manufacturing at AMPI plants is the difference between total supply and total fluid demand.

Because of the seasonality in milk production, assembly costs are estimated for the months of May and October, for both the with and without merger situations. This study considers the total supply, total fluid demand (and each handler's demand), and the surplus milk supply fixed for all years. From AMPI data, the total milk supply for May 1978 was 397.07 million pounds; that value is considered the May supply for all years. Total fluid demand equals 319.61 million pounds, and the surplus equals 77.46 million pounds for May 1978.

Total supply, total fluid demand, and total class III supply are also assumed fixed for October (based on AMPI October 1977 data). Those volumes equal 363.37 million pounds, 344.54 million pounds, and 18.83 million pounds, respectively.

Supply and demand areas are designated on a county basis. Any county that had

AMPI-member production in May 1978 or October 1977 is a separate supply area. Summing all members' production in one county yields the total supply in that county. For May, there are 390 supply areas, and for October, 388 areas.

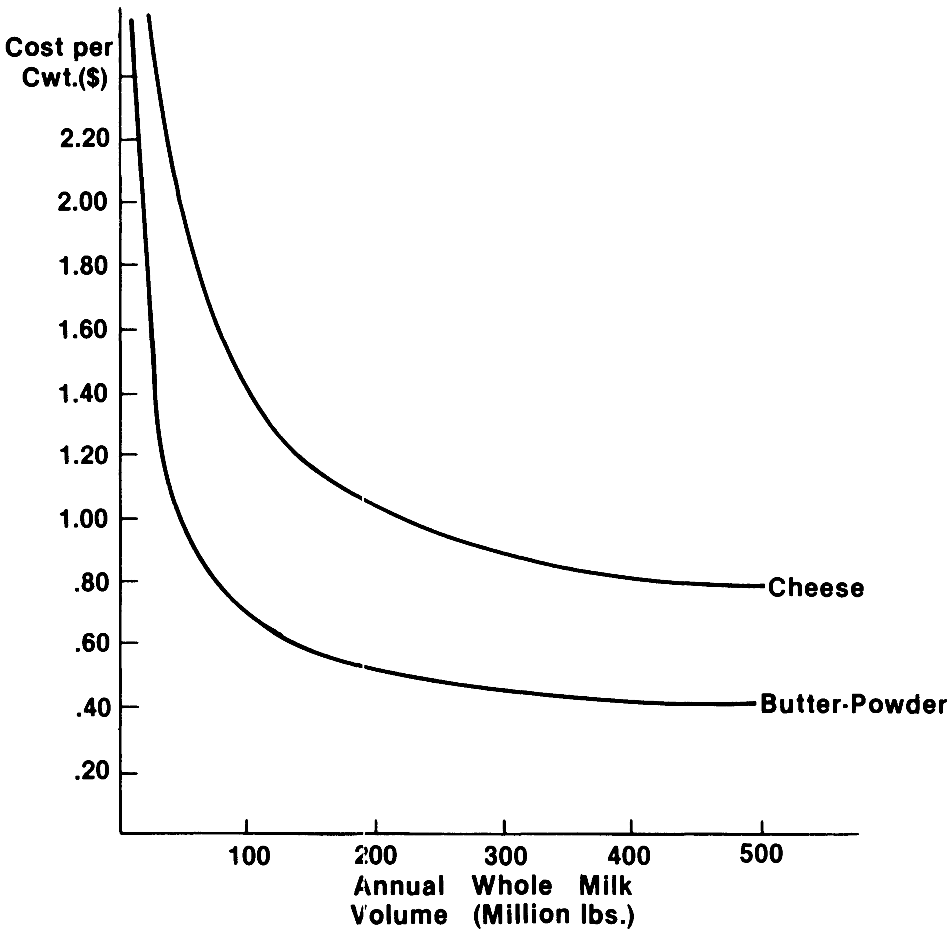

Figure 1. Long-Run Average Cost Curves for Butter-Powder and Cheese Manufacturing, AMPI Southern Region

Demand areas are of two types, fluid and manufacturing. A fluid demand area is any county in which exists a fluid milk processor who purchased Grade A milk from AMPI in May 1978 or October 1977. If there are more than one handler in a county, the sum of the individual handler volumes gives the total fluid demand for that demand area. For May, there are 66 fluid demand areas, and 65 for October.

Manufacturing demand areas are counties in which AMPI plants are located. Depending upon year and market structure under consideration, the number of manufacturing demand areas varies. There is no more than one AMPI plant in any one county, and 17 in total.

This study supposes transportation costs are a linear function of mileages involved in moving milk from the county seat of a supply area to the county seat of a demand area. AMPI data furnished included the distances based on arc length. Those mileage estimates multiplied by 1.21 approximate road distances. A flat rate of $ .0025 per cwt./mile is assumed, based on the average costs incurred by AMPI in the intermarket transport of milk. The rate has been adjusted for 1978 cost conditions.

Only intermarket shipping costs are considered; costs incurred in farm-to-county seat assembly are excluded. Thus, costs estimated here understate actual farm-to-plant costs. Assembly costs in this study reflect the marginal cost of shipping milk some extra distance between markets.

Transport costs are minimized under two sets of conditions. One set minimizes the total transportation costs for both fluid and manufacturing milk. This situation reflects the with merger situation where a large regional cooperative can better coordinate intermarket milk movements.

The second set initially minimizes the transport costs that satisfy only the fluid demands. The shipping costs of the surplus milk to the manufacturing plants is then minimized separately. The second set of conditions represents a without merger situation, where an independent cooperative typically satisfies the fluid demands first, and then assembles and processes the surplus.

Results and Analysis

Three important functions performed by producers' cooperatives include (1) transporting Grade A milk from farms to firms processing milk for Class I and Class II uses by consumers, (2) transporting surplus Grade A milk from farms to private and cooperative-owned processing plants, and (3) processing the excess milk into manufactured milk products such as butter, nonfat dry milk powder and cheese.[3] It is in the performances of these functions that important economies might be achieved through coordination of transportation and manufacturing activities.

There are several approaches to measuring the savings that might be achieved due to coordination. This study selects an approach that first determines the costs of assembly and processing under the market structure designated as "without merger". These costs become the base situation and represent the number and size of firms at or just before the major merger activities in the study area. Next, the costs of assembly and processing are estimated for a "with merger" market structure under two different assumptions concerning coordination. One assumption is that the coordination is centralized with costs minimized for the transportation of all classes of milk. The other assumption is that coordination is decentralized to the division (state) level with costs minimized for milk needed by fluid handlers. The excess milk, wherever located, is then transported to the closest cooperative-owned processing facility. Under both types of

[3]Processing and manufacturing are synonymous terms in this study.

market structures, some plants were actually closed in 1968 as a result of the merger into MPI and were considered operating at 1967 levels for the with merger and without merger situations.

Data for the study includes monthly quantities for May and October. Two approaches for computing annual costs include (1) estimating per unit costs for each of the two months, averaging the estimates and applying the average to annual quantities, and (2) estimating the factor which each month's quantity represents of the annual quantity and use this factor to expand the monthly cost to an estimated annual cost. Both types of cost estimates are made, but the final conclusions emphasize the first set of estimates.

Without Merger Market Structure Costs

The without merger market structure reflects a scenario where each local independent cooperative serves the major markets in its service area. Under this situation, the cooperative is assumed to minimize the transportation costs of milk to meet fluid handlers' demands and divert the surplus to cooperative-owned manufacturing plants, either its own plants or the nearest competitor's plants.

To simulate the flows of milk to fluid plants and manufacturing facilities, the transportation model first minimizes the cost of assembling milk to fluid handlers, and separately minimizes the cost of moving surplus milk to cooperative butter-powder or cheese plants. Volumes flowing to manufacturing plants are assumed to be some share of the Class III milk supply. As some facilities exit from the industry, the shares for remaining plants increase. Processing costs are estimated using the cost functions previously derived and applied to each plant's effective annual volume.

Assembly Activities-Since total milk supply and fluid demands are assumed the same for all years, the fluid milk shipping costs are constant on an annual basis for May of each year (Table 4). The May fluid costs of 7.173 million dollars converted to annual costs by dividing the monthly cost by 0.083 (the May percentage of the total annual fluid milk demand) were $.1859 per cwt. Annual fluid milk assembly costs based on October data of 7.994 million dollars and the factor 0.086 are $.202 per cwt.

Minimum transportation costs for surplus milk decrease little from May 1968 to May 1978, falling from 2.836 million dollars ($.500 per cwt.) to 2.826 million dollars ($.497 per cwt.) on an annual basis. For October, cost declines from 5.536 million dollars ($.900 per cwt.) in 1968 to 5.530 million dollars ($.899 per cwt.) in 1978.

The high cost of shipping surplus milk in the without merger situation can be attributed to two factors. First, minimization of fluid costs separately generally leaves the surplus milk farther away from manufacturing plants as illustrated in Figure 2 for 1978. This increases the distance and cost of moving the surplus milk. Second, in the without merger situation each butter-powder or cheese plant has a volume equality constraint. This means some milk that might have been shipped to other facilities at a lesser cost must be diverted to plants with available capacity to meet the restrictions.

Manufacturing Activities-Total annual processing costs based on May and October annualized volumes are higher in 1978 than in 1968 (Table 4). Annualized volumes are based on expansions from the May volume equal to .137 of the annual manufacturing milk volume and the October volume equal to .031 of the annual volume. The results imply that processing costs increase as fewer plants take on larger volumes, contrary to long-run cost theory. However, the increase is attributable to a doubling of cheese volume with cheese more expensive than butter-powder to manufacture. The percentage of the surplus milk supply going into cheese production during

Table 4. Projected Annual Manufacturing And Assembly Costs For The Without-Merger Market Structure, AMPI Southern Region, Selected Years 1968-78

	Total Costs			Per Unit Costs		
	1968	1971 (mil dol)	1978	1968	1971 ($/cwt)	1978
Projections from May Data						
Manufacturing Costs						
Butter-Powder	5.080	4.389	2.817	1.062	.933	.897
Cheese	2.259	2.354	4.735	2.548	2.438	1.873
Assembly Costs						
Fluid	7.173	7.173	7.173	.186	.186	.186
Surplus	2.836	2.834	2.826	.500	.500	.500
Combined	10.009	10.007	9.999	.247	.247	.247
Total	17.348	16.750	17.551	1.924	1.858	1.958
Projections from October Data						
Manufacturing Costs						
Butter-Powder	4.916	4.200	2.439	1.132	1.001	1.152
Cheese	3.471	3.562	6.188	1.919	1.821	1.534
Assembly Costs						
Fluid	7.994	7.994	7.994	.202	.202	.202
Surplus	5.536	5.576	5.530	.900	.907	.899
Combined	13.530	13.570	13.574	.238	.239	.238
Total	21.917	21.332	22.151	2.331	2.267	2.352

May increases from less than 20 percent in 1968 and 1971 to 45 percent in 1978. For October, that percentage rises from 30 percent in 1968 to about 66 percent during 1978.

Economies of size in processing are evident, based on the per unit costs of butter-powder manufacturing and cheese processing. Unit costs for butter-powder manufacturing based on May volumes decline continuously between 1968 and 1978. For cheese production, costs decline continuously over the period for both May volumes and October volumes.

Unit costs based on May volumes reflect conditions where quantities of surplus milk are at or near a maximum; October costs represent a case where quantities of surplus milk are at or near a minimum. Thus actual annual average manufacturing costs probably lie in the range between May and October estimates of $2.548 per cwt., and $1.919 per cwt. respectively.

Combined Activities-Combined costs for the three marketing functions performed by cooperatives are also shown in Table 4. The May estimates suggest 1971 as the least cost organization. The larger percentage of milk going into the more expensive cheese production causes the 1978 organization to show larger total processing costs. October annualized costs, show modest decreases in costs from 1968 through 1978. These decreases occur even with the larger quantities of milk being used for cheese.

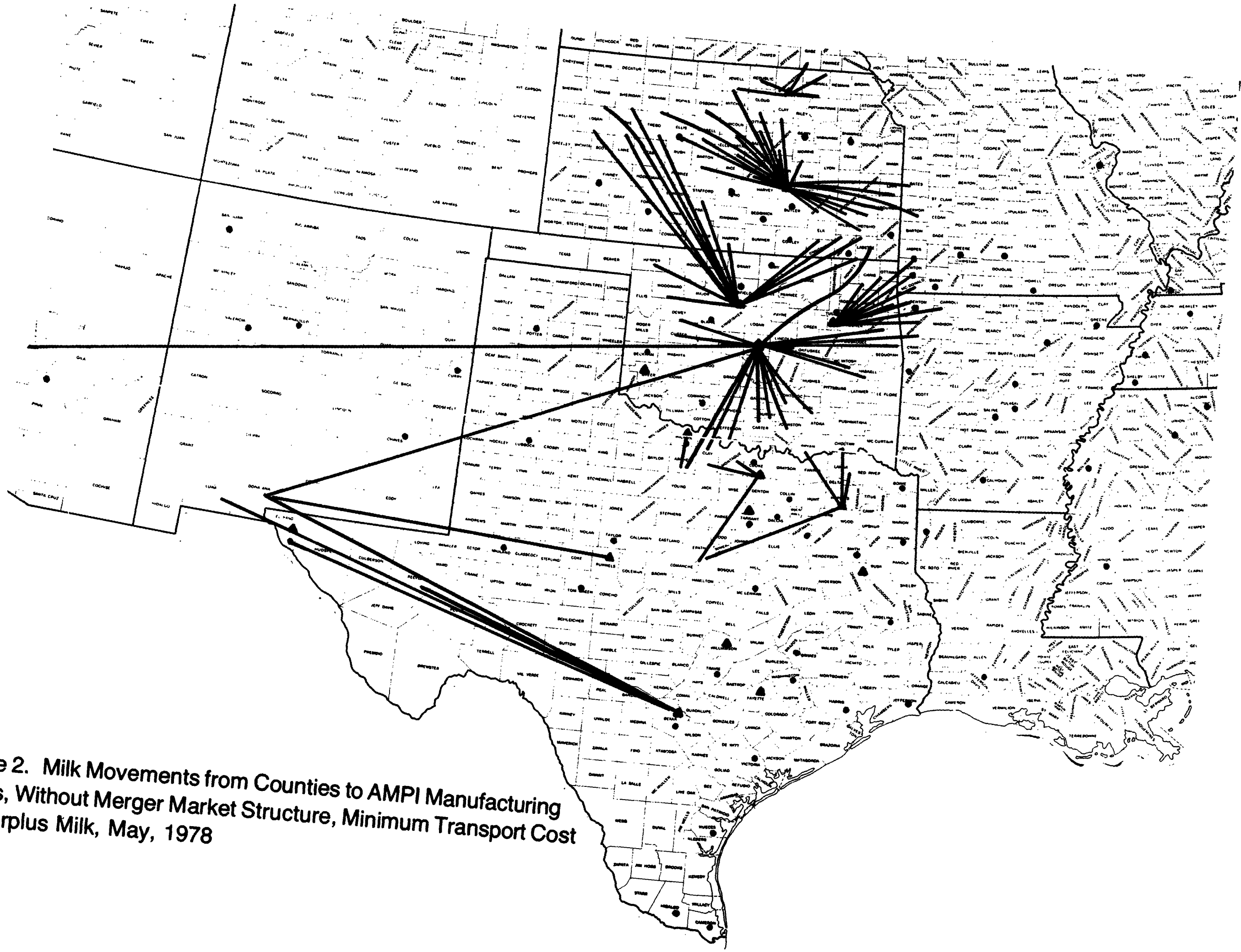

Figure 2. Milk Movements from Counties to AMPI Manufacturing Plants, Without Merger Market Structure, Minimum Transport Cost for Surplus Milk, May, 1978

With Merger Market Structure Costs
Central Coordination

The with merger market structure includes the same sixteen plants in 1968 as included in the without merger structure. In subsequent years only those plants actually operating are included. In the case where a cooperative controls a large part of the supply over a region, it coordinates movements of milk to both fluid plants and cooperative facilities so as to minimize total transportation cost. Volumes flowing to butter-powder or cheese plants are given by the transportation model when assembly costs are minimized. An upper restriction is placed on each plant's volume processed in one month. This restriction equals the maximum volume of whole milk processed in any one month for a year or group of years. For example, the Oklahoma City plant has an upper limit (or capacity) of 16.0 million pounds per month in 1978. That volume equals the largest quantity processed in any one month during the period 1976 to 1978 at the Oklahoma City plant. Processing costs, as in the without merger structure, are computed on the basis of annual effective volumes using the previously derived cost functions.

Assembly Activities-Fluid milk assembly costs under the with merger situation based on May volumes decrease between 1968 and 1978 (Table 5). Surplus milk assembly costs also decrease over the decade. Hence, total assembly costs decrease from 9.35 million dollars in 1968 to 8.19 million dollars in 1978. Surplus milk movements to plants are illustrated in Figure 3.

Table 5. Projected Annual Manufacturing And Assembly Costs For The With-Merger Market Structure, Central Coordination, AMPI Southern Region, Selected Years 1968-78

	Total Costs			Per Unit Costs		
	1968	1971 (mill dol)	1978	1968	1971 ($/cwt)	1978
Projections from May Data						
Manufacturing Costs						
Butter-Powder	4.836	2.141	2.509	.964	.690	.784
Cheese	1.784	3.712	3.125	2.739	1.446	1.267
Assembly Costs						
Fluid	8.596	8.648	7.468	.223	.224	.194
Surplus	.751	.751	.723	.132	.132	.128
Combined	9.347	9.399	8.191	.205	.206	.181
Total Costs	15.967	15.252	13.825			
Projections from October Data						
Manufacturing Costs						
Butter-Powder	3.503	1.919	2.166	.702	.563	.533
Cheese	1.959	3.363	2.212	1.690	1.221	1.059
Assembly Costs						
Fluid	8.502	8.525	8.129	.215	.216	.206
Surplus	.591	.577	.728	.096	.094	.118
Combined	9.093	9.102	8.857	.209	.209	.201
Total Costs	14.555	14.384	13.235			

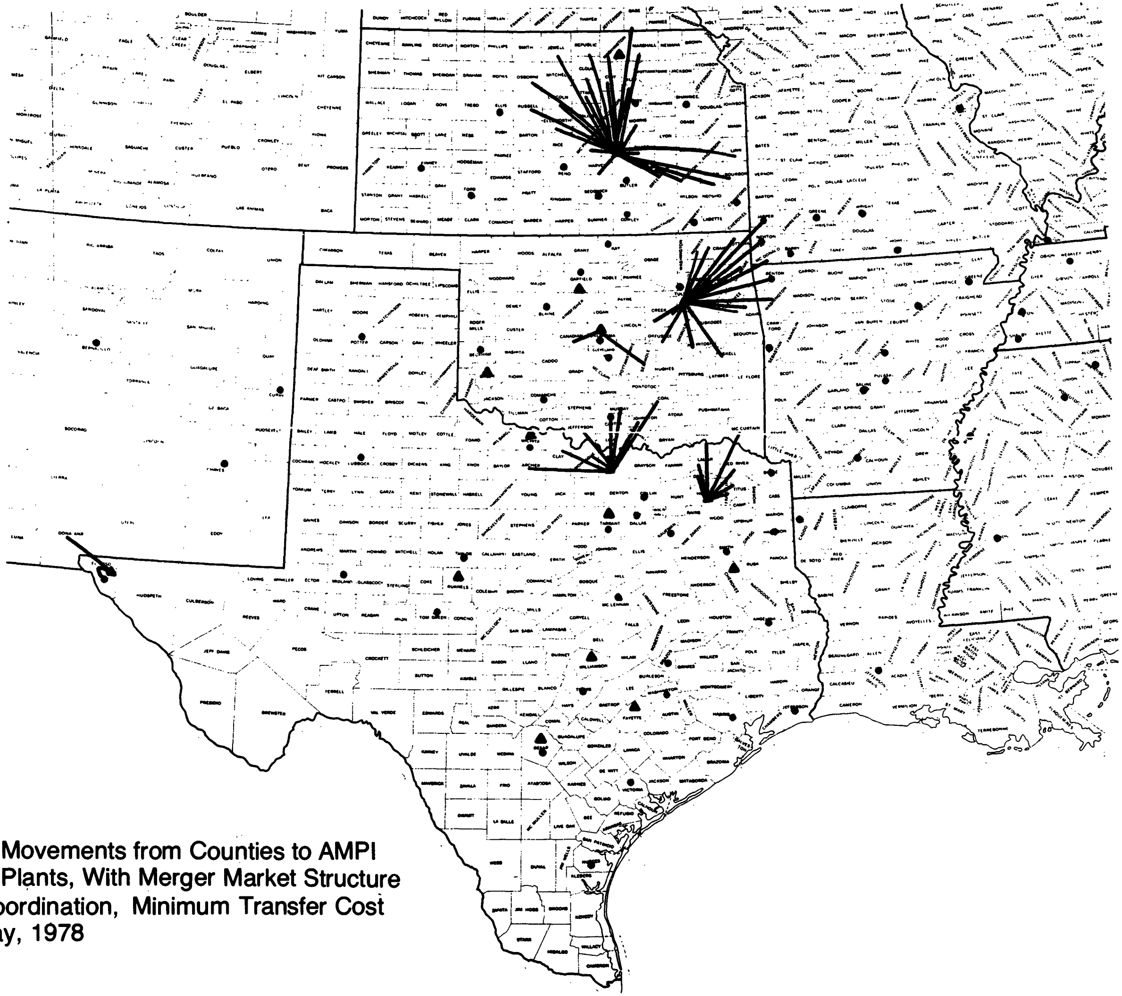

Figure 3. Milk Movements from Counties to AMPI Manufacturing Plants, With Merger Market Structure and Central Coordination, Minimum Transfer Cost for all Milk, May, 1978

A priori, one would assume total transportation costs to increase with time as surplus plants are closed down, and distances to operating plants increase, rather than decrease as they do in the with merger situation. But in reality, AMPI added a condensing plant at El Paso, Texas between 1971 and 1977. This plant handles primarily surplus milk from nearby Dona Ana County, New Mexico, and El Paso County, Texas. In prior years, that milk has been moved much greater distances to such points as Muenster, Texas, or Oklahoma City, Oklahoma. This is the major reason for the large decrease in shipping costs for 1978.

For volumes based on October data, fluid assembly costs fall over the period 1968 to 1978, while surplus assembly costs increase. Total transportation costs decline over the period 1968 to 1978 from 9.09 million dollars to 8.86 million dollars. Presumably, coordination allows significant reductions in the cost of assembling fluid milk. Those savings more than offset the increase in moving the surplus milk longer distances to fewer manufacturing plants.

Manufacturing Activities-Annual combined costs of manufacturing butter-powder and cheese under May supply conditions and October conditions (Table 5) decrease continually from 1968 to 1978. From the results, it appears AMPI realizes economies of size in processing operations, but the higher cost of cheese manufacturing versus butter-powder manufacturing has affected the results. For May, the average cost of butter-powder processing declines in 1971 but rises in 1978. For cheese, average cost decreases steadily over the period considered. This indicates most economies of size in manufacturing butter came early (within three years) after establishment of AMPI. The $.094 per cwt. higher average cost for butter-powder manufacturing in 1978 versus 1971 is more than offset by a decrease in the cheese unit cost of $.179 per cwt. This represents a net saving of 219.2 thousand dollars in manufacturing costs.

Average annual butter-powder and cheese manufacturing costs using October data decline over time. Thus, both total processing costs and average costs for October volumes for manufacturing butter-powder and cheese decline from 1968 to 1971 to 1978. The creation of AMPI apparently allows these economies to be realized by concentrating larger volumes in fewer plants.

Combined Activities-Based on May volumes, total marketing costs equal 15.97 million dollars in 1968, 15.25 million dallars in 1971, and 13.83 million dollars in 1978. Total marketing costs using October volumes are 14.56 million dollars, 14.38 million dollars, and 13.24 million dollars in 1968, 1971, and 1978 respectively.

The 2.14 million dollar saving between 1968 and 1978 based on May supply conditions results largely from elimination of excess capacity by closing smaller, less efficient plants. That annual savings equals .986 million dollars. The rest of the saving comes from a decrease in total transportation cost of 1.156 million dollars. That decrease results mainly from location of a manufacturing plant at El Paso. For October supply conditions, a 1.32 million dollar savings between 1968 and 1978 can be attributed to 1.084 million dollar decline in manufacturing cost and a .235 million dollar savings in total assembly costs. October's total marketing cost declines because of the same reasons cited for May.

Division Decentralized Coordination

The market structure under division decentralized coordination is the same as under regional coordination for the with merger situation. The major difference is the coordination of milk flows on a division or statewide basis. It is assumed that transportation costs are first minimized for meeting Class I and II fluid milk demands then transportation costs are minimized for moving the remainder of the milk from county centers to surplus processing facilities.

Assembly Activities-With the fixed supply and fluid demands for all years, the fluid assembly cost is the same for all years under May supply conditions and totals 7.173 million dollars, or $.1859 per cwt. (Table 6). Surplus milk costs decrease substantially from 1968 to 1978. The large decrease in surplus milk assembly costs is due to the larger volume restrictions put on AMPI plants from 1978 versus 1971. In 1971, three plants take on capacity volumes whereas only one does in 1978. These larger restrictions allow some surplus milk to flow to plants closer to the supply than in 1971.

Based on October supply conditions, fluid milk transport cost equals 7.994 million dollars, or $.2022 per cwt. Surplus milk assembly cost increases in 1971 but decreases dramatically in 1978. The large decrease in transportation cost of surplus milk in 1978 comes from the establishment of a plant at El Paso. In October 1978, El Paso accepts surplus milk from Pima County, Arizona and Dona Ana County, New Mexico. In October 1971, the same volumes of milk from those two counties are transported to the San Antonio manufacturing facility, an extra distance of 600 miles.

Manufacturing Activities-Manufacturing costs based on May volumes decrease steadily from 1968 to 1978, as do costs based on October volumes.

Total costs decrease continuously from 1968 to 1978 under both May and October supply conditions. This reflects in part economies of sizes as plant numbers decrease.

Table 6. Projected Annual Manufacturing And Assembly Costs For The With-Merger Market Structure, Division Coordination, AMPI Southern Region, Selected Years 1968-78

	Total Costs			Per Unit Costs		
	1968	1971 (mil dol)	1978	1968	1971 ($/cwt)	1978
Projections From May Data						
Manufacturing Costs						
Butter-Powder	4.318	1.968	2.302	.957	.748	.871
Cheese	2.799	4.730	3.559	2.420	1.557	1.176
Assembly Costs						
Fluid	7.173	7.173	7.173	.186	.186	.186
Surplus	2.671	2.788	1.491	.471	.492	.263
Combined	9.844	9.961	8.664	.242	.246	.201
Total Costs	16.961	16.659	14.525	-	-	-
Projections From October Data						
Manufacturing Costs						
Butter Powder	2.453	.924	2.194	.805	.577	.530
Cheese	4.555	5.253	2.159	1.467	1.154	1.073
Assembly Costs						
Fluid	7.994	7.994	7.994	.202	.202	.202
Surplus	4.542	4.947	1.430	.738	.804	.232
Combined	12.536	12.941	9.424	.230	.233	.204
Total Costs	19.544	19.118	13.777	-	-	-

Since May volumes reflect a maximum surplus milk supply condition and October volumes a minimum surplus milk condition, actual average cost probably lies between the two estimates in the range of five to seven million dollars per month.

Combined Activities-Total marketing costs under May supply conditions, decrease from 16.961 million dollars in 1968 to 16.659 million dollars in 1971, and further decrease to 14.524 million dollars in 1978. Of the 2.437 million dollar saving under the 1978 organization versus the 1968, 1.257 million dollars is due to economies in manufacturing hard dairy products from concentrating greater volumes in fewer plants. The remainder, 1.180 million dollars, accrues from savings in the assembly of surplus milk. Once again, the addition of the El Paso plant reduces substantially assembly costs because it is closer to the source of surplus milk.

For October, total marketing costs equal 19.544 million dollars in 1968, 19.118 million dollars in 1971, and 13.777 million dollars in 1978. A saving of 2.655 million dollars occurs because of manufacturing economies. Over 67 percent of the surplus milk supply goes into butter-powder production in 1978, versus only 50 percent in 1968, which biases total costs downward. Also, 1978 manufacturing activities take place in three plants, while in 1968 there were eight operating plants. With respect to assembly activities, there is a saving of 3.112 million dollars annually under the 1978 structure; the El Paso plant's handling of surplus milk is again the reason.

Savings From Coordination

Direct Approach

One procedure for measuring savings would be to compare total costs as given in Tables 4, 5, and 6 under the various market structures. Annual savings based on May data and October data give estimates of annual rates of savings. For 1978, the average annual savings of the with merger structure and central coordination compared with the without merger situation are 3.726 to 8.916 million dollars with the average equal to 6.321 million dollars (Table 7).

Because of the differing product mix for all years under the three types of market structures, manufacturing costs differ greatly and also affect the savings estimates. Generally, savings are projected for central coordination in each year and appear to have increased over the 10-year period. Savings under division coordination were much smaller in 1968 but increased a more rapid rate to approach savings under central coordination by 1978. One reason for this is the decrease in the number of outlets for surplus milk.

An Alternative Approach

An additional approach that may be used to estimate savings from coordination is to multiply the per hundredweight savings in performing the assembly and manufacturing functions by the respective volumes involved in each function. Because of the disparate product mixes between butter-powder and cheese among the various years and market structures, the per hundredweight savings for manufacturing are based on the per hundredweight cost for the average annual volume per plant. For example, in the with merger/central coordination scenario, total whole milk volume processed in May 1968 equals 501.77 million pounds. Dividing that number by nine, the number of plants manufacturing butter-powder, yields an average plant volume of 55.75 million pounds (Table 8). The per hundredweight savings are applied to the volumes that actually went into AMPI (or MPI) butter-powder or cheese plants to determine total manufacturing cost savings. For example in 1969, 525.6 million pounds went to AMPI plants predominantly processing butter and/or powder. Multiplying 5.256 million

Table 7. Estimated Annual Savings Under Central And Division Coordination Of The With-Merger Market Structures, AMPI Southern Region, Selected Years Projected From Monthly Rates

	1968		1971		1978	
	May Data	Oct. Data	May Data	Oct. Data	May Data	Oct. Data
				(million dollars)		
Central Coordination						
Butter-Powder Manufacturing	.244	1.413	2.248	2.280	.308	.273
Cheese Manufacturing	.475	1.512	-1.358	.199	1.610	3.976
Transportation	.662	4.437	.608	4.468	1.808	4.717
Total	1.381	7.362	1.498	6.448	3.726	8.916
Division Coordination						
Butter-Powder Manufacturing	.762	2.463	2.421	3.276	.515	.245
Cheese Manufacturing	-.540	-1.084	-2.376	-1.691	1.176	4.029
Transportation	.165	.994	.046	.629	1.335	4.100
Total	.387	2.373	.091	2.214	3.026	8.374

hundredweight by the per hundredweight savings of $0.265 for the with merger/central coordination situation yields a total savings of 1.39 million dollars in butter-powder production costs. Volumes and per hundredweight costs for the average plant size, per hundredweight savings, and total savings for butter-powder manufacturing are shown in Table 8 and in Table 9 for cheese manufacturing.

With respect to assembly costs, the total savings are based on the combined assembly costs per hundredweight as shown previously and are applied to the combined fluid and surplus annual volumes. To obtain annualized fluid milk volumes, the May and October monthly fluid volumes (319.61 million pounds and 344.54 million pounds, respectively) are divided by their respective conversion factors of 0.083 and 0.087; the resulting values are averaged to determine annual fluid volume for all years; that value equals 39.06 million hundred-weight. The total pounds actually processed by AMPI plants are added to the fluid total to give the combined volume. The May and

Table 8. Average Annual Volume Per Plant, Average Cost And Savings For Butter-Powder Plants Under Three Market Structures, AMPI Southern Region, Selected Years Projected From Average Rates

	1968		1971		1978	
	Average Annual Volume Per Plant (million lbs.)	Cost Per Cwt. ($)	Average Annual Volume Per Plant (million lbs.)	Cost Per Cwt. ($)	Average Annual Volume Per Plant (million lbs.)	Cost Per Cwt. ($)
Without Merger						
May	47.83	1.062	58.79	.933	62.816	.897
October	43.43	1.132	52.44	1.001	42.35	1.152
Average	—	1.097	—	.967	—	1.024
With Merger						
Central Coordination						
May	55.75	.963	103.37	.696	80.04	.784
October	99.85	.702	169.32	.565	203.12	.533
Average	—	.832	—	.625	—	.659
Division Coordination						
May	56.40	.957	87.70	.748	66.08	.871
October	76.17	.805	160.11	.577	206.98	.530
Average	—	.881	—	.662	—	.700
Unit Savings From						
Division Coordination		.216		.300		.324
Central Coordination		.265		.342		.365
Total Savings From (million dollars)						
Division Coordination		1.14		1.47		1.08
Central Coordination		1.39		1.67		1.22

Table 9. Average Annual Volume Per Plant, Average Cost And Savings For Cheese Plants Under Three Market Structures, AMPI Southern Region, Selected Years Projected From Average Rates

	1968		1971		1978	
	Average Annual Volume Per Plant (million lbs.)	Cost Per Cwt. ($)	Average Annual Volume Per Plant (million lbs.)	Cost Per Cwt. ($)	Average Annual Volume Per Plant (million lbs.)	Cost Per Cwt. ($)
Without Merger						
May	14.78	3.017	19.31	2.851	42.18	2.189
October	30.15	2.504	39.14	2.263	67.23	1.726
Average	--	2.761	—	2.557	—	1.956
With Merger						
Central Coordination						
May	13.03	3.084	85.60	1.508	123.36	1.262
October	57.96	1.871	137.77	1.210	208.92	1.059
Average	—	2.478	—	1.359	—	1.161
Division Coordination						
May	19.28	2.852	75.95	1.612	151.30	1.173
October	77 62	1.592	151.69	1.172	201.25	1.073
Average	—	2.222	—	1.392	—	1.123
Unit Savings From						
Division Coordination		.539		1.165		.833
Central Coordination		.283		1.198		.795
Total Annual Savings (million dollars) From						
Division Coordination		0.56		3.35		2.78
Central Coordination		0.29		3.45		2.65

October combined costs per hundredweight are averaged; savings per hundredweight (based on that average) multiplied by the combined fluid and surplus milk volumes yields total transportation savings.

Following this approach, the annual savings are shown in Table 10. The results indicate that substantial economies of size have resulted from the merger with savings for manufacturing and transportation activities in excess of 5.5 million dollars annually under both division and central coordination. They also suggest the bulk of the savings occurred early after the merger, since 1971 savings are more than double those in 1968, but level off in 1978. It is noted the substantially larger volume of surplus milk processed in 1971 will increase savings due to manufacturing efficiencies relative to the 1978 manufacturing savings.

Summary And Conclusions

Large regional cooperatives have assumed the role of procuring producers' milk and allocating the specified quantities when and where fluid handlers want them. Milk

Table10. Estimated Annual Savings Under Central And Division Coordination Of The With Merger Structure, AMPI Southern Region, Selected Years Projected From Average Rates

	1968 (million $)	1971 (million $)	1978 (million $)
Central Coordination			
Butter-Powder Mfg.	1.39	1.67	1.22
Cheese Mfg.	.29	3.45	2.65
Transportation	1.62	2.23	2.36
Total	3.30	7.35	6.23
Division Coordination			
Butter-Powder Mfg.	1.14	1.47	1.08
Cheese Mfg.	.56	3.35	2.78
Transportation	.32	.65	1.84
Total	2.02	5.47	5.70

supplies over and above quantities demanded for fluid purposes are sold or processed at cooperative-owned manufacturing facilities. Actual milk movements minimize the total transportation cost for all milk. The overall effect of increased coordination is a stronger horizontal marketing base at the producer and first handler level and forward vertical integration by cooperatives.

The overall objective of this study is to determine marketing costs (assembly cost of Class I and Class II milk, assembly cost of Class III milk, and manufacturing cost of Class III milk) under the actual market structure of AMPI and an alternative structure where it is assumed AMPI was not created. Doing so permits the determination of changes in efficiency possible with the existence of a large regional milk cooperative.

To compare assembly costs under alternative market structures, a transportation model is employed. To reflect the without merger situation and the with merger case with division coordination, the model minimizes the transportation cost of first satisfying only the fluid demands. The cost of moving milk not needed for fluid demands to the manufacturing plants is then minimized. In the with merger case, with central coordination present, the transportation model determines the minimum total cost of shipping all classes of milk. AMPI manufacturing plants will take any volume up to certain capacity restrictions.

With respect to assembly activities, the with merger market structure under centralized coordination is the most efficient. The combined 1978 annual average cost of transportation for fluid and surplus milk under May supply conditions is $.18 per cwt., and is $.20 per cwt. for October condition. Estimated 1978 average transportation costs for the without merger structure equal $.25 and $.24 per cwt., respectively.

The with merger market structure for 1978 also provides for the most efficient manufacturing operations. The 1978 annual manufacturing costs under May supply conditions for the with merger and without merger structures range from 5.63 million dollars to 7.55 million dollars. For October conditions, 1978 total manufacturing costs range from 4.35 million dollars to 8.63 million dollars for those market structures.

Considering the combined costs of transportation and manufacturing, the with merger structure is the most efficient organization. Annual savings are estimated at 1.4 to 8.9 million dollars during 1968 through 1978 using one procedure and a range of 3.3 million to 6.2 million dollars using another procedure. Savings under division coordination are somewhat less.

Results obtained for the three market structures considered indicate organizational and technical efficiencies have accrued to the milk marketing system in the Southwest United States due to the creation of AMPI as a large regional cooperative. Both assembly and manufacturing costs are less. This implies a large regional cooperative such as AMPI can better coordinate the intermarket movements of milk and decrease assembly costs. Because a large regional cooperative can eliminate excess capacity, represented by smaller, inefficient plants, it can achieve economies in surplus milk handling. It also can add to capacity at optimum locations.

This study ignores the cost of assembling milk from the farm to the county seat. Therefore, it understates both fluid and surplus actual assembly costs and the savings that accrue from the elimination of duplicate hauling routes.

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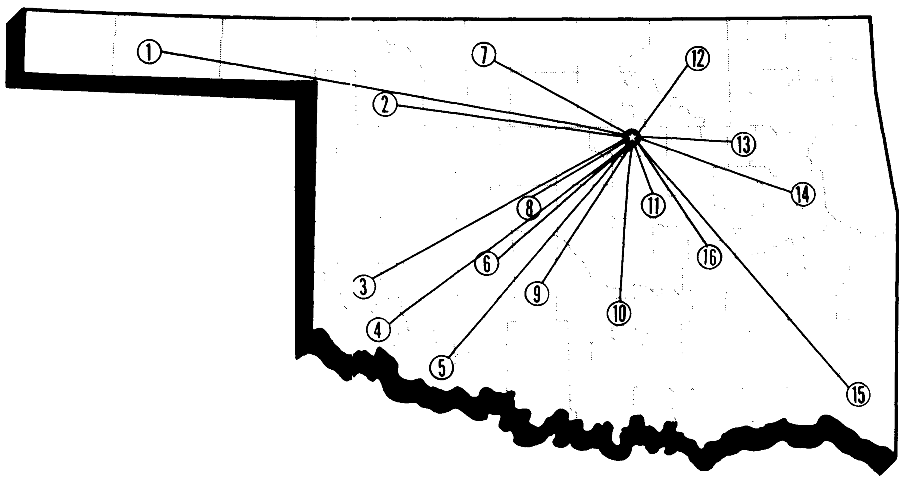

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