EQUILIBRIUM IN THE FLUID MILK INDUSTRY UNDER ALTERNATIVE PRICING POLICIES AND STRUCTURAL CHANGES, 1972-1976

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in partial fulfillment of the requirements
for the Degree of
DOCTOR OF PHILOSOPHY
May, 1974

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ACKNOWLEDGEMENTS

Many people have contributed to the completion of this study. Foremost among these was Dr. Leo V. Blakley, my major adviser. For his counsel, encouragement, patience, and understanding, my sincere appreciation is extended. Grateful acknowledgement is also due Drs. Paul D. Hummer, Wayne D. Purcell, P. Leo Strickland, and Michael R. Edgmand, members of my advisory committee, for their assistance during the various stages of the study.

Special thanks are given to the Department of Agricultural Economics at Oklahoma State University, Dr. James S. Plaxico, Head, for the financial assistance provided. Recognition is also deserved by the department's statistical, computer programming and secretarial staffs for their many services performed. The final draft of the manuscript was typed by Mrs. Suzanne Moon.

Finally, I gratefully acknowledge my family, Mr. and Mrs. J. W. Riley, Jr., Linda and Douglas. Their love, encouragement, and understanding were a constant source of inspiration.

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CHAPTER I

INTRODUCTION

The fluid milk industry, like most industries in the United States, can be characterized by rapid change during the past 20 years. Innovation and the advancement of technology have influenced the industry from the producer level to the consumer level. Examples include producers using automated bulk milk systems in their farming operations to reduce labor cost associated with increased production per cow and larger herd sizes, transporters moving milk in large bulk loads safely for long distances, processors automating more and more to process larger volumes in shorter times, and consumers demanding a fresh, wholesome product available on call in their nearby grocery store and packaged in convenient paper containers.

Pressure for changes to achieve greater technological efficiency continues to be important in the individual segments of the fluid milk industry, but changes in market structure and interdependence of sectors are becoming increasingly important. For example, large regional cooperatives have been formed which involve both producers and handlers on wide geographical bases. Integration of processing and retailing activities is expanding and consumers are demanding a different mix of fluid milk and manufactured milk products. In short, the economic environment of the industry is becoming more and more complex as it becomes more interdependent.

Adjustments to the ever-changing environment and the problems created by change may require modifications in pricing systems and institutional arrangements in approaching new equilibrium conditions in the industry. Associated with such potential modification is a growing concern about the equity relationships within the fluid milk industry. One aspect of the equity concern is at the sectorial level. For example, increased efficiency at the processor level could benefit either producers or consumers or neither depending upon the nature of the final market structure and performance. Another aspect of the equity concern is at the regional level. Frequent allegations are that southern producers benefit at the expense of northern producers. A corollary allegation could be that the northern consumers are subsidized by northern producers. Certainly, new equilibrium conditions will not affect all segments of the industry in the same way.

Industry Change

Market Structure

Some of the major changes in the structure of the fluid milk industry have been of recent importance. At the producer level, large regional cooperatives have gained producer support primarily during the past six years. One midwest cooperative claimed a membership in excess of 43,000 dairymen in 1972 [2]. About 86 percent of the producers in the Federal order milk marketing system were cooperative members in 1967 [14, p. 5].

One primary purpose of the large cooperatives formed in recent years is to bargain with processors for the sale of milk, although some cooperatives process fluid and manufactured products as well as negotiate with processors about price. A recent advisory report to Associated Dairymen, Inc. recommended a total marketing concept. Two elements in the total concept included "developing ability to negotiate equitable terms of trade and to establish prices on both product and geographic bases", and "developing effective programs for equitable sharing of costs and proceeds" [1, p. 9]. The latter problem, distribution of returns, is much greater for the organization covering widely different geographic regions.

Processing is also changing with fewer firms of larger size. In December, 1948, there were 8,525 commercial fluid milk bottling plants. By December, 1972, the number of commercial processors had declined to 1,930 plants in the U.S. [51, September, 1973, p. 13]. In Federal order markets, the average share of the four largest pool handlers in different market sizes increased as much as 34 percent during period 1950 to 1965 [31, pp. 33, 34].

Associated with the changes in processing structure is a change in the type of processor. Retail establishments are integrating backward into the processing function. Supermarkets, dairy, and convenience stores, both retailing and processing milk, accounted for 5.7 percent of the total sales by commercial processors in December, 1965. Supermarket chains and groups of supermarkets accounted for 4.2 percent alone [31, pp. 6-7]. The percentages undoubtedly would be greater in 1973 but do not reflect the full effects of supermarkets and other large retailing agencies on contracting arrangements for the processing of fluid milk [19]. Returns on equity suggest that the processors do not have the upper hand in negotiating terms of trade with retailers.

Retailers themselves have changed. No longer is milk sold predominately by home delivery. Only 22 percent of milk sales were handled through home delivery in 1969. The remainder was distributed through retail stores, and about 75 percent of the milk distributed by stores was handled by supermarkets. Dairy and convenience stores as a new method of distribution are obtaining larger shares of the retail market as time passes. Their share of the market increased almost 2 percent between 1967 and 1969. Nonfood retail outlets, such as gasoline service stations, are also of growing importance [30, pp. 8-13, and 53, pp. 26-34].

Economic Environment

The consumer demand for milk has been relatively stable since 1950 with decreasing per capita consumption offsetting the increasing numbers of consumers. The form of consumption, however, has been changing from emphasis on the fat content in fluid products to emphasis on the non-fat content. Whole milk usage per person decreased 44 pounds per person from 1965 to 1972 while the per capita consumption of low-fat milk doubled. In 1972, for the first time since 1955, total civilian per capita consumption of all milk increased. Based on product weight, fluid milk consumption alone increased from 291 pounds per person in 1971 to 294 pounds per person in 1972 [51, November, 1973, pp. 14-15]. Cheese and the lower-fat frozen manufactured products are also experiencing increased per capita demand.

The producer supply of milk also has been relatively stable but there has been a shift from production directly for the manufacturing product market to production directly for the fluid market. In the

1948-1949 period, 59 percent of the whole milk sold to plants and dealers was Grade A milk or milk eligible for the fluid milk market; by 1971, the percentage was 76. The percentage is projected to be about 81 percent in 1976 as manufacturing grade milk would be only 18.71 percent of the milk marketed in that year [3, p. 182].

Two major programs at the production level that affect the economic environment of the fluid milk industry are the Federal order milk marketing system, which determines the structure of milk prices, and the price support system, which influences the level of milk prices. Both programs are conducted under the auspices of the U.S. Department of Agriculture (USDA) as authorized in the Agricultural Marketing Agreement Act of 1937 and the Agricultural Act of 1938 as amended. About 80 percent of the milk produced in the U.S. that is eligible for the fluid milk market is marketed under the Federal order system [48]. Milk sold for fluid use purposes is sold for a price that is higher than the price paid for milk that is used in manufactured milk products. Producers receive a weighted average of these prices or a blend price. For example, estimated average price received by farmers in 1972 was $7.26 per cwt. for milk bottled for fluid use, $5.09 per cwt. for milk used in manufacturing milk products, and $6.40 per cwt. as a blend price for all milk eligible for fluid products [51, March, 1973, p. 11].

Class I or farm fluid milk prices under the Federal order system follow closely a basing point pricing structure. Near the center area of production in June, 1973, a Madison, Wisconsin dealer paid $6.81 per cwt. for Grade A milk. A Miami, Florida, dealer paid as much as

$9.05 per cwt. for the same quantity milk [55, June, 1973]. Blend prices, therefore, are also generally higher the further a producer is located from the major surplus production regions of the U.S.

The Problem

The general economic environment in which the fluid milk industry must operate has undergone drastic change during the early 1970's and the future course is extremely uncertain. Inflation at higher rates than in previous years in the domestic economy and at differential rates in the international sphere has added uncertainty to the expectations of the types of governmental programs likely to prevail. A switch from an emphasis on grants and gifts of surplus agricultural commodities to an emphasis on the use of the agricultural industry as a basis for generating trade balances will change the environment from a surplus to a deficit (or market) economy. This could result in some sacrifice of the dairy industry through relaxation of import controls on milk products in order to gain concessions which would support feed grain exports [46]. Such policies would affect both price levels and the structure of prices in the industry, which, in turn, would have differential regional impacts.

Possible alternatives in the pricing structure that could evolve in the industry include a structure in which no allowance is made in the minimum Federal order Class I price for different geographic locations, i.e., handlers in all Federal order markets would have a uniform minimum Class I price that must be paid for milk used in fluid products. Rather than the present system of having high prices in low income and high price elasticity of demand regions and low prices in the high income and low price elasticity of demand regions [7, p. 15], a pricing system to maximize returns under geographic price discrimination could be instigated. Equity concerns might force the Federal order pricing scheme to account more for differences in the cost of production that may exist in different areas of the U.S. As another alternative, the structure of fluid milk demand may change such that there is no longer the need for a regulated classified pricing system for milk although a single support price for the commodity could remain in effect. The strength of the dairy cooperatives could supercede the effects of marketing orders and price supports to make the pricing system rely solely on negotiated prices. Of course, it is also possible that changes in the industry may not affect the Federal order pricing structure at all. In that event, a minimum Class I, blend, and support price would continue to exist for every Federal order market in the U.S. even though this system distributes returns among dairy farmers in a regressive manner [18].

Competition for resources used in the dairy industry affects the market place. As other industries are able to capture resources away from the dairy industry, shortages in the supply of milk would exist. A shortage could also be created by increased consumer demand for the product. In a different spectrum the presence of excess milk in the market could affect the price levels to both producers and consumers and exert influence on the market structure of the industry.

Prices to the producer and consumer need not be the only prices experiencing direct change as a result of new conditions in the fluid milk industry. Given an energy shortage, the transportation sector of the industry could be materially affected. Higher transportation rates would likely affect the structure of the sector as well as the distribution pattern of raw milk. Undoubtedly, the environment in the transport sector would eventually also be reflected in farm and retail prices.

An increased competitive spirit at the retailing level might bring a change in the retailing cost structure existing within the industry. Less competition among processors may bring a new pricing environment to this sector also. Changing costs associated with transforming the raw milk product into a consumable item will affect the price level for the product. Who gains or loses from cost changes is still a question to be answered.

Objectives of the Study

Given the many changes in the fluid milk industry and the possible conditions change may dictate, it is important to know both the absolute and relative effects of the different types of changes that may occur or are presently occurring. The primary objective of this study was, therefore, to study the fluid milk industry under alternative pricing and structural conditions. More specifically, the objectives of the study were:

1. To develop a spatial equilibrium model of the fluid milk industry which would be versatile in use as well as descriptive of both sectors and markets comprising the industry.
2. To evaluate the effects on the fluid milk industry of selected changes in the pricing policy for milk.

3. To evaluate the effects on the fluid milk industry of selected changes in the market structure of the industry.
4. To evaluate the regional impacts of changes in pricing or structural conditions in the fluid milk industry on consumer expenditure for fluid milk products and producer revenue from all milk sales.
5. To test for the effects of alternative projections of demand or supply changes in the industry.

Having fulfilled the above objectives, the study will provide the fluid milk industry a rather simple predictive tool. More importantly, an insight can be gained into the sectorial and regional effects that can occur, given physical and policy changes that are present or anticipated for the industry.

CHAPTER II

SPATIAL EQUILIBRIUM MODELS AND EQUITY CONSIDERATIONS

Few economic units are completely isolated from all other similar units. The dimension of space is an important factor in achieving equilibrium as trade helps some units achieve comparative advantage or prevents a few units from establishing near monopoly conditions. Only recently, though, have economists had the mathematical tools to evaluate spatial equilibrium.

Models for Achieving Spatial Equilibrium

Model Development

Spatial problems were neglected in early economic theory [38, p. 284]. Economic theory centered on the self-sufficient unit in which all factors, producers, products, and consumers were, in effect, at one single point. Ricardo, in his theory of comparative advantage did recognize a spatial dimension in economic analysis but, like his peers, tended to neglect transportation cost. Weber, Ohlin, Losch, and other economists advanced spatial equilibrium theory over the years. Not until the late 1940's, however, did work by Koopmans, Dantzig, Enke and others make spatial considerations operational in economic analysis [25].

The Koopmans-Hitchcock[1] minimum transportation cost problem, as stated by Samuelson, was as follows:

> A specified total number of (empty or ballast) ships is to be sent out from each of a number of ports. They are to be allocated among a number of other receiving ports, with the total sent into each port being specified. If we are given the unit costs of shipments between every two ports, how can we minimize the total costs of the program? [38, p. 284].

Enke, incorporating the transportation minimization concept, stated the problem in a spatial framework that recognized the endogenous determination of trade quantities and prices in trading units.

> There are three (or more) regions trading a homogeneous good. Each region constitutes a single and distinct market. The regions of each possible pair of regions are separated -- but not isolated -- by a transportation cost per physical unit which is independent of volume. There are no legal restrictions to limit the actions of the profit-seeking traders in each region. For each region, the functions which relate local production and local use to local price are known, and, consequently, the magnitude of the difference which will be exported or imported at each local price is also known. Given these trade functions and transportation costs, we wish to ascertain: (1) the net price in each region; (2) the quantity of exports or imports for each region; (3) which regions import, export, or do neither; (4) the aggregate trade in each commodity; (5) the volume and direction of trade between each possible pair of regions... [15, p. 41].

Enke presented a machine method for minimizing transportation cost. Samuelson, however, using the Enke formulation, demonstrated that the spatial model could be transformed into a maximization problem and solved using simple linear programming. The objective of the model was to maximize net social payoff. Net social payoff was defined as the difference in area under the excess supply functions of the

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[1]Koopman independently dealt with the problem considered in 1941 by F. L. Hitchcock and in 1942 by a Russian mathematician, L. Kantorovitch [38, p. 284].

exporting and importing markets less transportation costs between the markets.[2]

Baumol and Beckman further modified the Samuelson model but maintained its basic approach and solution by systematic trial and error [25, p. 803]. Price analysis was an inherent characteristic of both models given a least cost, unrestricted movement of product between markets.

Models presently used to obtain a solution to spatial equilibrium problems include the Judge and Wallace model [25]. Developed in 1958, the model was originally applied to situations where demand quantities were a function of price but supply quantities were fixed. The solution procedure uses both the transportation model and the dual of the linear programming routine to give an exact final solution. The model suffers from the possibility of not reaching equilibrium if self-sufficient markets emerge in the model. All points of interest must be either definite surplus or deficit markets.

Reactive programming, a 1959 development by Tramel and Seale [44], is a gradient solution process. Equilibrium is not dependent on a specifically stated objective function but on a set of rules that

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[2]Net social payoff is an artificial, non-normative concept and should not be confused with net social gains or losses in a welfare sense. Mathematically:

$$\text{Net Social Payoff} = \int_0^{E_{ij}} S_i(X)dX - \int_0^{-E_{ij}} S_j(X)dX - t_{ij}(E_{ij})$$

where $S_i(X)$ = excess supply function of exporting market,
$S_j(X)$ = excess supply function of importing market,
E_{ij} = quantity exported from i to j, and
t_{ij} = transportation cost between i and j.

translate into a spatial equilibrium at a minimum of transportation cost. Linear formulations of both market supply and demand can be used. Equilibrium conditions for all markets, including those neither importing nor exporting the product of the model, are determined.

Quadratic programming applied to spatial equilibrium analysis brought with it the exactness of the Judge-Wallace model and the ability to incorporate the functional relationships of supply and demand found in the Tramel and Seale model. The Takayama and Judge model [42] is based on the Wolfe modified simplex procedure and provides a means of combining the primal and dual programming models into one formulation. Like its predecessors, this model also relies on a stated or implicit concave objective function with convex constraint sets.[3]

Theory of the Models

Objectives of the Models. Regardless of the procedural model selected, the theory for each remains the same. Basic is the concept that each supplier will sell to the market paying the highest net price per unit (sales price minus transportation cost) while those buying centers will seek to purchase at the lowest net price per unit (buying price plus transportation cost). The theory is based on the following three objectives of the models: (1) to determine optimum market prices, (2) to determine equilibrium consumption and production, and (3) to determine the minimum cost flows of product between surplus and

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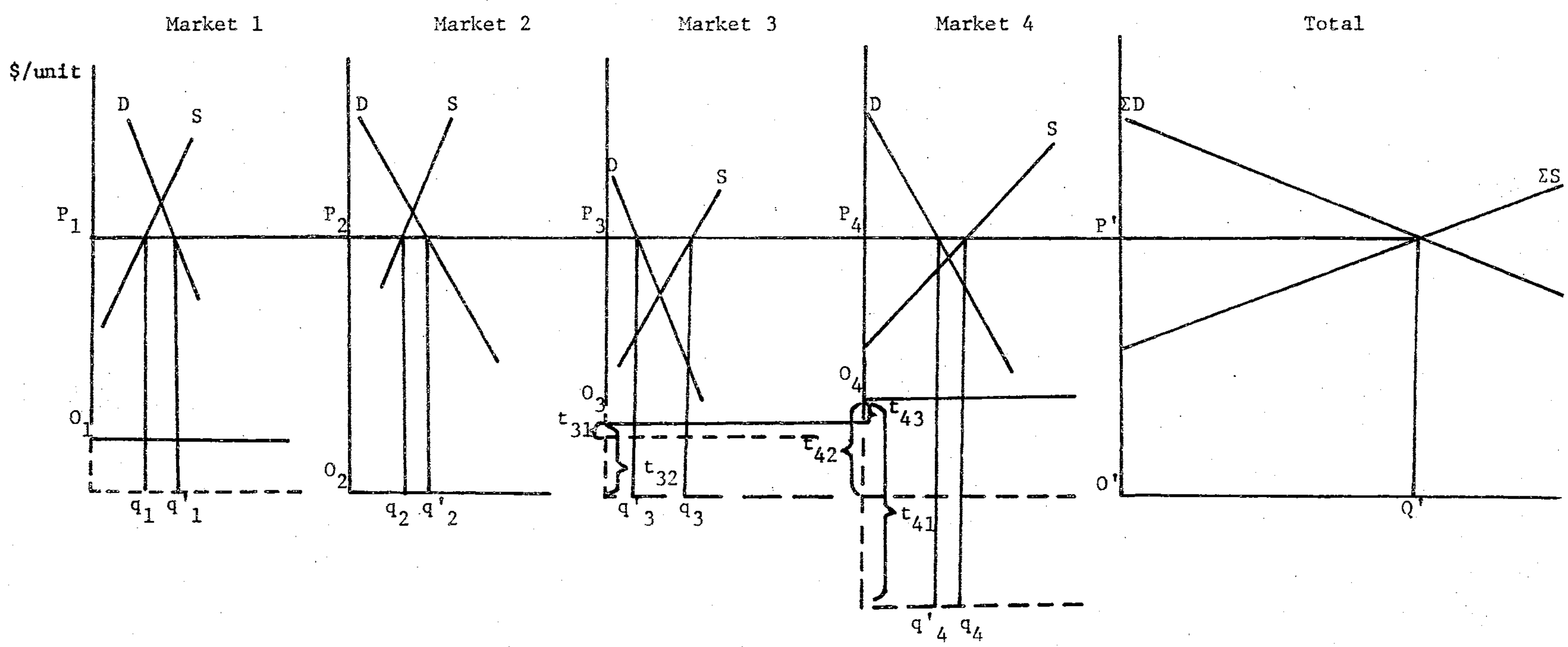
[3]A more detailed history of spatial equilibrium can be obtained from Samuelson [38], Judge and Wallace [25], and Takayama and Judge [42]. Takayama and Judge have also published a summary of the conditions and operation of the three primary models discussed above [41].

deficit markets. The equilibrium price for any one market must not differ from the price in any other market by more than the transportation cost between the centers. Achieving each objective is a mutually dependent process.

Assumptions of the Models. Each market center is assumed to be a production and/or consumption center. A perfectly competitive environment exists in as much as is possible. Unless specifically restricted, all markets are connected by a transportation system in which the transportation cost is independent of both directions of movement and volume of movement. Transported quantities must be positive. Surplus markets can only supply deficit markets. The product transported is homogeneous, i.e., consumers are indifferent as to the source of product to meet their needs. All production must be consumed or specifically designated as surplus.

Graphic Equilibrium of the Models. A graphical description of spatial equilibrium analysis is presented in Figure 1. Assume there are four consumption markets and four supply markets for a product. Based on individual market supply and demand equilibria, Markets 3 and 4 have a surplus quantity relative to Markets 1 and 2. Transportation charges between the surplus and deficit markets are indicated by the t_{ij} values in the figure.

In an equilibrium state, a total of Q' will be produced and consumed in the four markets. The quantity q_k, where k represents the market number, will be produced in each area. The quantity q'_k will be consumed in each market at a price of O_kP_k. Prevailing prices are such that $\Sigma q_k = \Sigma q'_k = Q'$ and market prices differ by no more than the transportation cost between the markets.



t_{ij} = transportation cost from excess supply area i to deficit demand area j.

Figure 1. Market Supply and Demand Relationships for Illustrating a Spatial Equilibrium

Excess product produced in Market 3 is delivered first to Market 1 with any additional surplus shipped to Market 2 at a price of $O_3P_3 + t_{31} = O_1P_1$ and $O_3P_3 + t_{32} = O_2P_2$ respectively. The quantities $q_1q'_1$ and $q_3q'_3 - q_1q'_1$ are shipped from Market 3 to Markets 1 and 2 respectively. Market 4 surplus $(q_4q'_4)$ fills the remaining deficit in Market 2 at a price of $O_4P_4 + t_{42} = O_2P_2 \cdot O_3P_3 - O_4P_4 = t_{43}$. The net price (demand price minus transportation cost) to Market 3, P_3O_3, is the same regardless of whether the product is shipped to Market 1 or Market 2. Otherwise, it would be more profitable to ship an increased quantity to the deficit area offering the greatest net price at the expense of a reduced quantity shipped to the market offering the lowest net price.

Net prices differ between the two surplus areas by an amount equal to the transportation cost between the two areas. Were the price difference greater, the market exporting the product at the lower net price would move some of its surplus into the markets supplied by the surplus area having the highest net price. The same price relationships, with regard to price differences and transportation costs, hold true within and between the two deficit markets.

The system diagrammed is not only in equilibrium but also moves the product from surplus to deficit markets at a minimum total cost. Market 4 could ship surplus milk to Market 1 at a transport cost of t_{41}. Cost, however, would increase and the system would not be in equilibrium. The net price to Market 4 from shipping to Market 1 would be less than the equilibrium price that could be achieved in Market 4 considering only the supply and the demand in that market.

Benefits of the Models

Spatial equilibrium models enable a multi-dimensional problem of price, quantity and flow of product to be handled simultaneously and efficiently. Even though analysis relies heavily on the accuracy of the parameters describing each area, the magnitude of a problem is placed in operational and manageable proportions. Furthermore, the models are adaptable to many situations.

Spatial models contribute much to comparative analysis. The effects of changing costs, such as transportation cost or processing cost, can be traced through the economic system represented in a model. Resulting equilibrium prices, geographic flows of the product, and supply and demand quantities for a firm compared with equilibrium conditions under alternative situations may serve as a basis for present or future firm action. Rather than using a spatial model in a predictive sense, management may also incorporate present conditions in the model as a means of determining the current operation of the business unit.

Sectors other than just the production and consumption sectors of an industry can benefit from spatial analysis. Processors may learn the comparative advantage of various markets or market areas. Such information aids in their decisions to either locate a new plant or relocate an existing plant. The transportation industry gains insight into the need for product movement as well as an indication of the distance of movement. Insight into those conditions that favor a particular activity or sector often results from spatial analysis models.

Finally, spatial equilibrium analysis, in a comparative static sense, assumes normative macroeconomic proportions. Alternative conditions evaluated can indicate what markets, geographic areas, or sectors gain at the expense of others. Deviations from the "ideal" are often easily identified. Do alternative pricing policies contribute to the competitive position of all markets equally or improve the efficiency of the entire market system?

Spatial Equilibrium Studies in the Dairy Industry

Of the reactive, linear, or quadratic programming routines for determining spatial equilibrium, versions of the reactive program appear to have been used most successfully in the dairy industry. A 1968 USDA study by Freeman used the reactive programming method of determining "what changes in Class I prices and marketings would have occurred on the assumption that milk flows freely from low-priced markets to any markets where prices are high enough to cover the costs of the additional transportation" [16, pp. 2-3]. The effect of increasing supplies in the Reserve Standby Pool area on blend prices in the middle and southeastern parts of the United States was determined with a reactive programming model in a 1973 special committee study for the Associated Reserve Standby Pool Cooperative [3]. In both studies, supply was treated as a fixed quantity for a given time period while farm price was a function of quantity of milk demanded.

Ruane and Hallberg [37], in studying the 1967 spatial equilibrium for fluid and manufacturing milk in the U.S., used an adaptation of the Judge and Wallace iterative procedure. The adaptation was necessary since both fluid and manufactured demand functions existed for each study region. The iteration procedure continued until the net social payoff was maximized. The model was used to analyze the impact of synthetic milk products on the milk industry.

One of the objectives of the 1960 West and Brandow [57] study was to indicate the impact of a fluid milk concentrate on the milk industry. The authors felt the Takayama and Judge approach for obtaining a spatial equilibrium solution, considering both fluid and manufactured milk products, would be most practical. Computer limitations, however, prevented them from successfully applying the procedure.

Kottke [29] has been extremely critical of the Takayama and Judge formulation and in particualr of quadratic programming as applied to spatial analysis. Quadratic programming, he contends, cannot accomodate the multidimensional nature of milk allocation or the diversity of competitive structure within the industry [29, p. 33]. Kottke proposed a spatial model that consisted of a set of recursive relationships which incorporated both linear and quadratic formulations to handle the temporal and product use dimension, as well as the spatial dimension in the milk industry. Again, both fluid and manufactured milk products were considered.

One of the first interregional studies using the transportation model of linear programming was conducted by Snodgrass and French [40] in 1953 and reported in their <u>Linear Programming Approach to the Study of Interregional Competition in Dairying</u>. The objective was to determine the optimum transportation pattern for fluid and manufactured milk products, in addition to the optimum location of processing plants and producing areas. Simultaneous determination of prices and quantities, however, was not a characteristic of this study or any of the other studies relying on the transportation model alone. Prices were either used to determine the limit supply and demand quantities for the transportation matrix or were calculated after the application of the model. Recent studies by Dobson and Babb [14] and by Babb and Minden [4] used this step by step approach in conjunction with the transportation or transshipment model.

Equity Considerations

Spatial equilibrium analysis not only describes an optimum situation under a given set of restrictions, but also can be used with normative connotations. Changes in pricing policies, new restrictions on product movements, changing supply response, movements of population, or any other factors subject to change in an economic system can have a marked effect on the equilibrium position of the economy. Changes may serve to benefit geographic areas or functional sectors of the economy. Likewise, change may completely eliminate a comparative advantage held by some group in the system. The system of distribution of benefits can be drastically altered or modified in direction. In an economy, such as the United States, where increased specialization emphasizes greater interdependence, the need to analyze change and the encompassing effects it may have at both the aggregate and sub-aggregate levels becomes more and more important.

Equity and Society

Society in general has made great strides in obtaining efficiency in the use of resources available. But efficiency and equity in the use and distribution of those resources are not synonymous.[4] Output per man-hour in the private economy has increased over 75 percent in the last 20 years [56, p. 224]. Income and leisure time have increased yet the disparity of educational opportunities among races, the lack of necessary income by segments of society, the regressiveness of some taxes, the use of resources without concern for all effects, and the different rates of return on invested capital in different but comparable enterprises at least suggest inequitable situations.

Many efforts today, based on a standard of equity, are increasingly directed toward allocating resources conditioned upon benefits and costs incurred. Recent Congressional legislation, national comittee reports, and government bureau standards for spending expose this equity emphasis. Federal revenue sharing, grants for rural development, minimum wage or income restraints, profit guidelines, merger guidelines, vocational training programs, education grants -- all have increased fairness as either a primary or secondary objective.

Measures of Equity

Given that equity is and should be receiving much attention, the central question remaining is: How is equity measured? How does one know when equity is achieved? By what criterion or criteria is the successor failure of the equity objective measured? Are equity measures different for each industry?

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[4]Efficiency refers to the real quantity of goods and services per unit of input. Equity relates to the distribution of gains and losses [45, p. 506]. The equity standard, not to be confused with a standard of equality, is grounded on "fairness".

Lack of an Equity Measure. Few people who speak or write of equity offer any standard means or criteria for evaluating a situation from an equitable viewpoint. There are those who say that to even consider a measurement of equity is ludicrous. Carl Kaysen, a Harvard scientist, is one such individual.

> Any discussion of equity moves rapidly from an economic to what is essentially a political view, since equity is ultimately a value problem whose social resolution is of the essence of politics. While the importance of equity in the sense of a fair distribution of the income of society as a goal is undeniable, equity itself is not measurable by any economic standard [26, p. 1689].

Proxy Measures of Equity. Kaysen admits, however, "certain specific judgments" about an equitable distribution are possible. Those judgments, by necessity, relate to some proxy measure of equity. Examples of such measures are parity price, parity income, and fair price. Quite frequently some rate of return, such as net income as a percentage of investment, is a gauge of equity. Rate of change or even absolute value measures may serve as the judgment factor. Consumer surplus, the value of a good to a consumer in excess of the value paid for the good, is often used as a measure of the welfare of the buying public. In comparison, producer surplus, the excess price of a product over the cost of production, is a frequent measure of the welfare of the producer.

Figure 2 illustrates the concept of consumer and producer surplus. D_m is the demand schedule for a good, while S_m represents the supply schedule for the product. The area beneath the supply curve is a measure of the loss or value foregone by sacrificing other commodities to consume the particular quantity. On the other hand, the area under the demand curve is a measure of the benefit derived by consuming

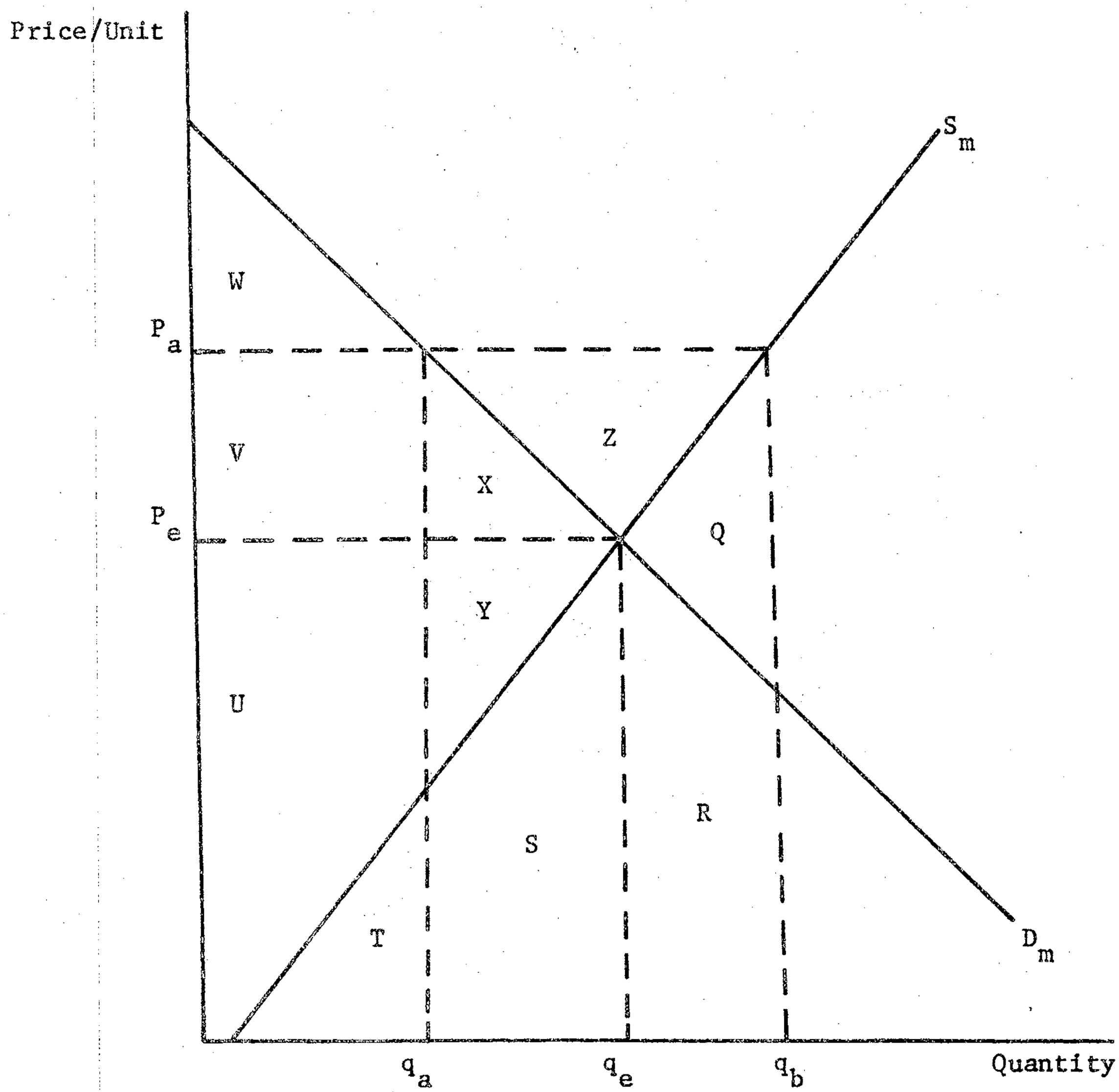

Figure 2. Demand and Supply Relationships for Illustrating Consumer and Producer Surplus

the product [45, pp. 512, 523-527]. A constant consumer value is assumed for each dollar.

Assume a competitive equilibrium where quantity q_e is both produced and consumed at price P_e. Consumers spend a total amount for the good equal to areas U, Y, T and S. Consumers, however, place a value in consumption on q_e of not only what they actually spend but also areas W, V, and X. This latter area is consumer surplus.

Producers receive for producing q_e an amount also equal to areas U, Y, T and S. But producers only used resources valued at prices equal to the area T plus S. Areas U and Y are producer surplus or value received in excess of value spent in the production of q_e. Note that both producers and consumers benefit by producing and consuming the commodity as determined under competitive equilibrium conditions.

Assume, however, that a minimum price per unit of P_a is established for the economic unit, i.e., no units of the product are sold for less than the minimum price. As a result of the restricted price, buyers purchase only quantity q_a at price P_a and spend in total an amount equal to area V plus U plus T. Consumers who obtained a surplus of W, V and X under competitive conditions obtain a surplus of only area W, given the minimum price. The change in the market pricing conditions brought a consumer surplus loss of area V plus X.

On the supply side, a price of P_a would induce producers to supply quantity q_b or a quantity q_aq_b more than is consumed. For this additional production, producer surplus increased by area V plus X plus Z, a net gain of area Z in comparing producer gain with consumer loss. A net gain of area Z implies that the consumer is not required to support the purchase of the excess supply at P_a and that the surplus is used in such a manner that its value in use is equal to the consumer value foregone in consuming $q_a q_e$ less of the good (areas Y and S) plus the consumer value foregone in committing resources to the additional $q_e q_b$ production (areas R and Q). In this latter case, if all production beyond consumption is of no value to consumers, total consumer loss by imposing a minimum price, as compared with an equilibrium solution under competitive conditions, becomes the sum of areas V, X, Y, S, R and Q.

With a loss in consumer surplus equal to area V plus X, and a producer gain of area V plus X plus Z, the value of the gain or loss to each can be calculated in Figure 2 by:

$$\text{Consumer Loss} = (P_a - P_e)\ (q_a) + \tfrac{1}{2}\ (P_a - P_e)\ (q_e - q_a) \qquad (2.1)$$

$$\text{Producer Gain} = (P_a - P_e)\ (q_e) + \tfrac{1}{2}\ (P_a - P_e)\ (q_b - q_e) \qquad (2.2)$$

Given supply and demand schedules that are highly inelastic, the triangular area of the gain or loss areas becomes relatively small. As a result, change in consumer or producer surplus or welfare can be approximated by the change in consumer expenditure or producer revenue. For example, if D_m were highly inelastic, areas X and Y plus S would be quite small relative to areas V and U plus T under the minimum price condition. Consumers' expenditures of U, Y, T and S under competitive conditions would compare with expenditures of V, U and T with the P_a minimum price. But with areas Y and S being small, the change in consumer surplus can be approximated by area V.

Equity and the Fluid Milk Industry

The principle of change in consumer surplus and change in producer surplus can be used to demonstrate the equity implications of change in the fluid milk industry. Relative changes in the surplus values for different regions of the country and/or different sectors of the industry will indicate the distribution of gains and losses in the industry given a change in conditions faced by the industry. Assume, for example, a situation where the price of fluid milk has increased relative to some general equilibrium position.

Consumer-Producer. Figure 3 shows a representative consumer-producer situation in a single market. D_r is the demand for fluid milk at the retail level and S_f is the farm supply of Grade A milk eligible for the fluid market. The derived demand for Class I milk at the farm level is shown as D_I. D_I would have the same slope as D_r under the assumption of a constant per unit marketing margin, but would have a smaller absolute value of the slope under the assumption of constant percentage marketing margin.

Given an increase in retail price from P_r to P'_r and the associated reduction in quantity consumer, the Class I price would increase from P_I to P'_I. The supply price would increase from P_b to P'_b if the price of surplus or Class II milk remained unchanged with the larger quantity diverted to this market from the fluid market (i.e., transfer from a more price-inelastic market).

The higher retail price of fluid milk would decrease consumer surplus by the area $P_rP'_rAC$. This area could be approximated by considering only area $P_rP'_rAB$ under a highly inelastic demand schedule. It could also be approximated by the comparable areas under the derived demand schedule D_I, but only if per unit marketing margins were constant. Technically the consumer surplus for milk consumption

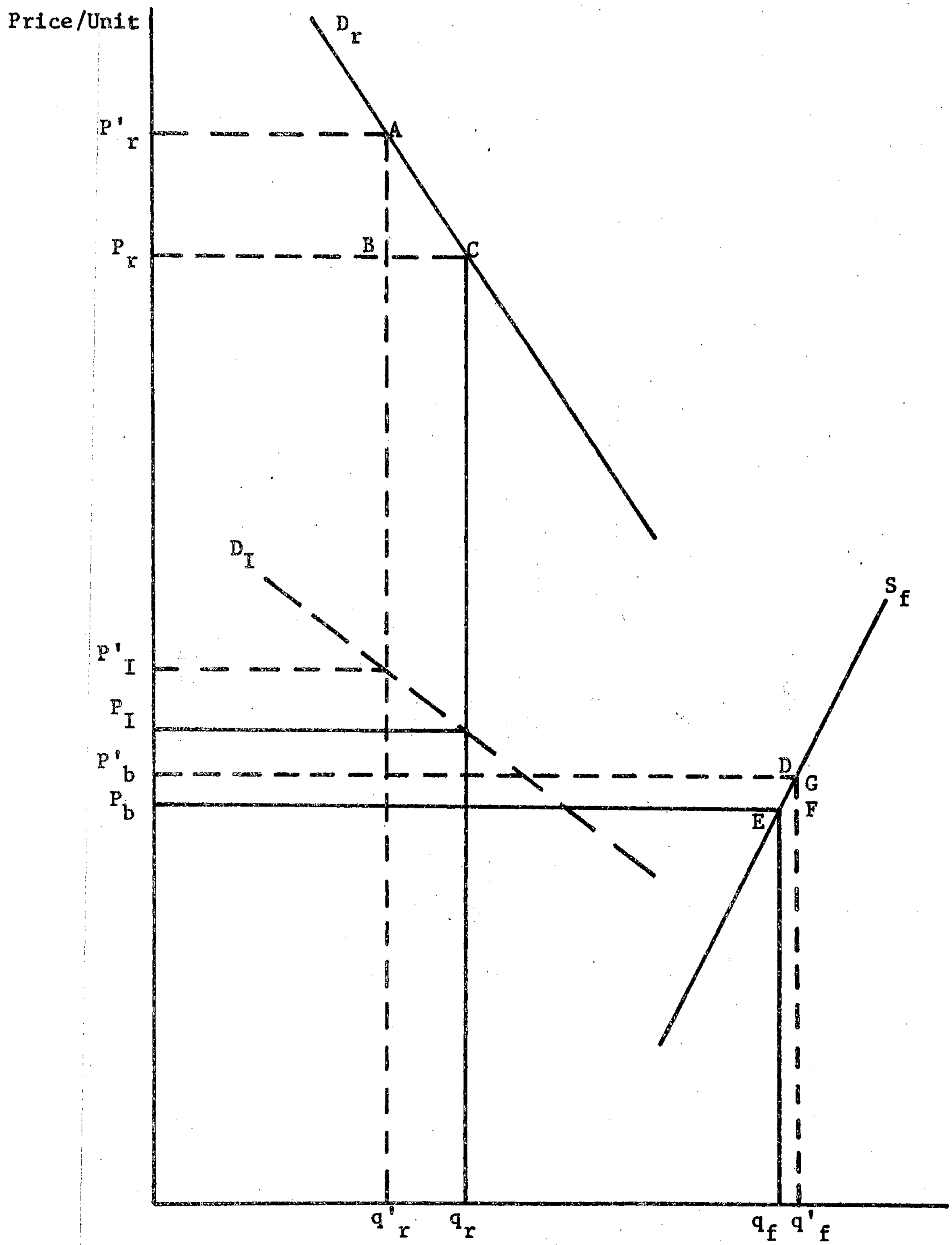

Figure 3. Supply and Demand Relationships in the Fluid Milk Industry for Illustrating the Changes in Producer and Consumer Surplus Given Increased Prices

should reflect not only the change in the fluid sector but also the changes in the manufactured milk product sector in which the milk was diverted. The latter is not measured in Figure 3.

The higher Class I price would result in an increase in blend price from P_b to P'_b and an increase in producer surplus of $P_bP'_bDGE$. With a highly inelastic supply schedule the area of the triangle DGE would be small. The triangular area would be zero in the short run with a fixed supply quantity. Consequently, the area $P_bP'_bDE$ would either be the change in producer surplus or an approximation of this change.

The ratio of change in producer revenue from all milk sales to the change in the farm equivalent value of consumer expenditure would always be less than 1.0 for quantity diversions of milk from a fluid market with an inelastic demand to a surplus market with a perfectly elastic demand. The ratio may not always be expected to be below 1.0 in comparing the change in producer revenue with the change in the actual value of the consumer expenditure because of the effects of changes in retailing and processing costs. Nevertheless, the ratio of change in producer value from all milk sales to change in consumer expenditure from fluid milk would be expected to be above 1.0 for markets with only moderate inelasticity of retail fluid demand and with no export potentials. While consumer loss may be larger than producer gain in one region of the U.S., just the opposite may hold true for another region of the country.

Processor. The effect of a decrease in fluid consumption on the processing sector of the fluid milk industry will depend upon the level of economics achieved by an individual plant. A plant producing at less than full capacity will likely face a higher per unit cost with the decreased demand for fluid milk resulting from the higher retail prices. Assuming that some of the increased consumer expenditure for fluid milk is passed to the processor, the change in net returns will depend on relative cost changes in comparison to revenue changes.

For a processor whose per unit cost changes little with the change in quantity processed, an increase in revenue would imply a comparable increase in net return to the operation and an increase in the percentage return on equity capital. Consequently, the distribution of gain to the processing sector is a function of the aggregate processing cost and the rate of change in processing cost in relation to the change in quantity processed.

<u>Retailer</u>. Retailing of fluid milk is likewise affected by decreased consumption. If retail demand is price inelastic and revenue per unit to the retail sector is considered a constant percentage of the per unit retail price, then total revenue to retailers will increase. But the increased revenue does not necessarily reflect the actual change in the cost associated with the change in quantity of fluid milk moved through the retailing system. If retailing cost is some combination of constant marginal costs and constant percentage markups, then cost would change less than revenue would change whenever volume was lower. Price changes and profit changes, therefore, would be positively correlated. Though net returns to equity capital should increase with decreasing volumes, it is unlikely that costs would be the same for retailers throughout the fluid milk industry.

Transporter. The transportation industry would benefit from increased quantities of milk moved between markets given a pricing structure for the transportation services. However, only small amounts of milk are moved among markets and even smaller quantities are indicated as needed to move among markets to achieve spatial equilibrium. Less of the consumer's dollar would be needed to support this service sector. For the producer the transporter's availability does little to improve farm revenue if there is no place to move fluid milk profitably.

Summary

Equity, as related to the distribution of gains and losses among participants, is receiving much public attention. There remains, however, the need for a universally acceptable means of measuring equity. One method that has been used to measure changes in equity is to measure changes in consumer and producer surplus and assume producers and consumers consider each dollar to have a constant use value. Given high inelasticity of demand and supply, the producer and consumer surplus can be approximated by the change in revenue received by the producer and the change in expenditure made by the consumer respectively.

Using the concept of surplus value, the equity implications of change in conditions within an industry can be analyzed. There are many factors affecting equity. However, it is clear that for an industry that serves a large area, lack of homogeneous conditions in all markets of the industry will affect the distribution of gains and losses among the markets. In a similar manner, conditions that characterize the various sectors of the industry will affect the distribution of gains and losses among those sectors.

CHAPTER III

THE MODEL

The model had to meet several criteria to fulfill the objectives of this study. First, it had to provide a fairly efficient means of describing spatial equilibrium conditions in the fluid milk industry. Second, the technique used in solving for spatial equilibrium had to be flexible enough to be adaptable to not only the classified pricing system used by the dairy industry but also to the use of a single product for two purposes. Third, the algorithm chosen needed to provide information concerning the effects that alternative conditions in the industry would have on various sectors of that industry as well as on areas of the country supplying and consuming the fluid product. The reactive programming formulation for spatial equilibrium satisfied these criteria.

As indicated in the previous chapter, the reactive programming algorithm is of recent origin and was developed by Thomas E. Tramel and A. D. Seale, Jr. at Mississippi State University.[1] Like other spatial models its objective is to simultaneously solve for the equilibrium prices, the equilibrium quantities, and the minimum cost flows of a product between markets that are spatially interdependent. In

[1]Reactive programming was originally used in determining Mississippi's competitive position in various vegetable industries. See King and Ho [28] for a bibliography of these studies.

this study the product is Grade A milk. Prices and quantities reflect values for the product in its use as either milk for fluid consumption or milk for manufactured milk products. Markets represent geographical areas of Federal order markets or groups of markets in the United States.[2]

Divisions of the Model

There are three basic divisions in the reactive program. The first division is the spatial iterative routine. Division two incorporates a modified transportation or minimum cost-flow model. The final portion of the model serves as a summary and presentation of results section. Each of the sections are discussed more fully below.

Spatial Equilibrium Analysis

Spatial equilibrium requires that the quantity of a product demanded in each market results in a price such that no market differs in price from another market by more than the cost of transportation between the markets. The spatial analysis section computes in an iterative manner the quantity in each market that satisfies this condition.[3]

Definitions and Mathematical Relationships. The computational process in this section relies on the following relationships and procedures. Let:

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[2]A complete description of the study area is given in Chapter IV.

[3]Convergence of the iterative process is assured based on (1) the similarity of reactive programming with the Hildreth gradient method of solution for non-linear programming problems and (2) the proof of convergence of the Hildreth method [41, pp. 12-13, and 43, p. 13].

$i = 1,2,\ldots, m$ = different producing or supply markets;

$j = 1,2,\ldots, n$ = different consuming or demand markets;

$n - 1 = m$. Each supply market is also assumed to be a demand market as well. Area n is designated as the demand area for all surplus or Class II milk from any of the supply areas;

Q_{ij} = fluid milk (cwt.) produced in area i and shipped to area j ($j = 1,\ldots,n - 1$) for fluid use. Q_{in} equals the milk (cwt.) produced in area i that is eligible for fluid use but classified as surplus production and used for manufactured milk products. $Q_{ij} \geq 0$;

X_j = fluid milk (cwt.) consumed in each j market ($j = 1,\ldots, n - 1$). X_n represents the sum of all surplus milk in the industry.

$$X_j = \sum_{i=1}^{m} Q_{ij} \qquad (j = 1,2,\ldots,n)\text{; and}$$

PT_i = Grade A milk (cwt.) supplied by each i producing area.

$$PT_i = \sum_{j=1}^{n} Q_{ij} \qquad (i = 1,2,\ldots,m).$$

The retail price equivalent for fluid milk is calculated according to the demand relationship in each market.

$$P_j = f(X_j) \qquad (j = 1,2,\ldots,n - 1) \qquad (3.1)$$

where:

P_j = retail fluid milk price (\$ per cwt.) in market j associated with a demand of X_j. P_n equals the price (\$ per cwt.) for surplus milk at the farm.

The Class I price, or price paid the farmer for milk used in fluid products, is derived by subtracting from the retail price the costs incurred in transforming the raw form fluid product into a packaged consumable product purchased at the retail grocery store.

$$CI_j = P_j - PM_j P_j - PE_j \qquad (j = 1,2,\ldots,n-1) \qquad (3.2)$$

where:

CI_j = Class I price ($ per cwt.) for fluid milk at the farm level in market j ($j = 1,2,\ldots,n-1$). $CI_n = P_n$;

PM_j = proxy value (percent) for the costs of selling fluid milk in the retail outlet in each j area ($j = 1,2,\ldots,n-1$). $PM_n = 0$; and

$PE_j = f(X_j)$ = processing cost ($ per cwt.) for fluid milk in market j ($j = 1,2,\ldots,n-1$). $PE_n = 0$.

The farm blend price in market j is a composite of the price paid for milk in the market that is used for fluid products and the price paid for milk in the market that is used for surplus products.

$$BPJ_j = \frac{(CI_j X_j + P_n Q_{jn})}{(X_j + Q_{jn})} \qquad (j = 1,2,\ldots,n-1) \qquad (3.3)$$

where:

BPJ_j = blend price ($ per cwt.) for all milk in market j. $BPJ_n = P_n$.

The price the farmer recieves for the milk sold is the blend price in the demand market to which he delivers his milk, less the cost of transporting the milk to market.

$$BPJ_{ij} = BPJ_j - T_{ij} \qquad (j = 1,2,\ldots,n,\ i = 1,2,\ldots,m) \qquad (3.4)$$

where:

BPJ_{ij} = blend price ($ per cwt.) for milk in market i delivered to area j; and

T_{ij} = transportation cost ($ per cwt.) for milk moved from market i to market j.

A weighted average of the blend prices received for the milk in a supply market is given by:

$$WBPJ_i = \frac{(\sum_{j=1}^{n-1} BPJ_{ij}\ Q_{ij} + BPJ_{ii}\ Q_{in})}{PT_i} \qquad (i = 1,2,\ldots,m) \qquad (3.5)$$

where:

$WBPJ_i$ = weighted average blend price ($ per cwt.) for all milk sold from supply area i.

Having made the base calculations, the reactive programming algorithm makes any needed adjustments in the Q_{ij} values for each i. A supply area will supply the j market offering the highest BPJ_{ij} or net blend price. To determine whether a Q_{ij} value should be changed, the difference between the BPJ_{ij} from a j market and the weighted average price received in the i market is calculated.

$$DIFF_{ij} = BPJ_{ij} - WBPJ_i \qquad (j = 1,2,\ldots,n - 1,\ i = 1,2,\ldots,m) \qquad (3.6)$$

where:

$DIFF_{ij}$ = difference ($ per cwt.) in net blend price received in i from shipping milk to j and the weighted average price received in i.

If $DIFF_{in} < 0$ and $Q_{ij} = 0$, there would be no incentive to ship to a market offering a lower net blend price than is already being received. $DIFF_{ij} < 0$ but $Q_{ij} > 0$ implies a higher net price can be obtained by reducing the quantity shipped to j and shipping more units to another j market offering a higher net price. If $DIFF_{ij} > 0$ and $Q_{ij} \geq 0$, the supplier would benefit by increasing the Q_{ij} to the market offering the net price higher than the average price presently received. If an increase or decrease in Q_{ij} is indicated, a new Q_{ij} is calculated by the Newton method as follows:

$$Q'_{ij} = Q_{ij} - \frac{DIFF_{ij}}{F_j} \qquad (j = 1,2,\ldots,n - 1,\ i = 1,2,\ldots,m) \quad (3.7)$$

where:

Q'_{ij} = new quantity (cwt.) of fluid milk shipped from i to j; and

F_j = slope of demand function in market j.

Having made new allocations of the supply in the i market, a check is made to assure that the sum of the shipments from i equals the supply available in i, i.e.,

$$\sum_{j=1}^{n} Q_{ij} = PT_i.$$

If not, the Q_{ij}'s are adjusted again by a Newton method.

$$Q''_{ij} = Q'_{ij} - \frac{\frac{1}{F_j}}{\frac{1}{\sum_{j=1}^{n} F_j}} \left(\sum_{j=1}^{n} Q_{ij} - PT_i\right) \qquad (3.8)$$

$$(j = 1,2,\ldots,n - 1,\ i = 1,2,\ldots,m)$$

where:

Q''_{ij} = adjusted quantity (cwt.) of fluid product shipped from market i to market j.

$$Q''_{in} = PT_i - \sum_{j=1}^{n-1} Q''_{ij}.$$

Each supply area is in turn considered during the iterative operation of this spatial analysis section of the model. A supply area may be temporarily ignored during an iteration if it is in equilibrium, i.e., no changes need be made in the Q_{ij} values from that supply area. To account for changes occurring in other markets, however, all i areas are checked for equilibrium after each 20 iterations and as a final check before declaring the total system to be in equilibrium. Prices are updated with any quantity change in a market.

<u>System Equilibrium Conditions</u>. Final system spatial equilibrium can be stated in terms of the above definitions and relationships.

$$Q_{ij} \geq 0 \quad (i = 1,2,\ldots,m,\ j = 1,2,\ldots,n) \tag{3.9}$$

i.e., negative shipments are not allowed. $Q_{ij} > 0$ is an active route.

$$Q_{ij} \neq 0 \rightarrow BPJ_{ij} = WBPJ_i \geq 0$$

and (3.10)

$$Q_{ij} = 0 \rightarrow BPJ_{ij} \leq WBPJ_i \quad (i = 1,2,\ldots,m,\ j = 1,2,\ldots,n - 1)$$

i.e., all net prices corresponding to shipping routes used must be non-negative and equal to each other, and, in turn, not less to those corresponding to non-active routes. Blend prices in the j markets receiving milk from an i market must not differ by more than the difference in transportation costs from the i market to each j market.

From this last equilibrium condition, an implied condition is:

$$DIFF_{ij} \leq 0 \qquad (i = 1,2,\ldots,m,\ j = 1,2,\ldots,n-1).^{4} \qquad (3.11)$$

Finally:

$$WBPJ_i \geq 0 \rightarrow \sum_{j=1}^{n} Q_{ij} = PT_i \qquad (i = 1,2,\ldots,m)^{4} \qquad (3.12)$$

insures that all of the available fixed supply in supply area i is allocated to either Class I fluid or Class II surplus use.

Minimum Cost Flow Analysis

A least cost flow model paralleling a transportation model is employed in the system procedure to determine that movement of milk from the supply areas to the consuming areas which will yield the least cost to the total system. Mathematically, the objective of the model and restraints imposed on the model may be stated as follows:

Minimize

$$Z = \sum_{i=j}^{m} \sum_{j=1}^{n} TT_{ij}\ Q_{ij}$$

subject to

$$\sum_{j=1}^{n} = Q_{ij} = PT_i \qquad (i = 1,2,\ldots,m) \qquad (3.13)$$

[4]An accuracy level approaching zero is specified by the researcher for this equilibrium condition. The iterative process continues until the specified accuracy level is not exceeded.

$$\sum_{i=1}^{m} Q_{ij} = X_j \qquad (j = 1,2,\ldots,n)$$

$$Q_{ij} \geq 0 \qquad (i = 1,2,\ldots,m,\ j = 1,2,\ldots,n)$$

where:

$TT_{ij} = PM_j\ P_j + PE_j + T_{ij}$ = sum of retailing cost plus processing cost plus transportation cost in getting milk from the producer in market i to the consumer in market j.

Although all costs incurred in transforming milk from the raw to the consumable product are included in TT_{ij}, the deficit demand areas seeking other supplies of milk need only consider differences in T_{ij}. Regardless of the source of milk for j, TT_{ij} for $i = 1,2,\ldots,m$ differs only by differences in T_{ij}. The least cost model becomes, essentially, a minimum cost transportation model.

The least cost model obtains its data from the spatial analysis division. Supply and demand for each market area are entered as fixed quantities in this section. The prices and costs associated with those quantities are used in determining the TT_{ij} value. Given this data, the Q_{ij} values that minimize cost are determined.

The initial least cost determination of the Q_{ij} values is derived by the inspection method [22, pp. 360-362]. The first feasible transportation plan is computed by filling successively the least cost routes available. The route offering the smallest TT_{ij} is filled first according to the supply in i and demand in j. The next largest TT_{ij} is chosen as the next active route. The process continues until all supply has been allocated and all demand fulfilled.

After the initial allocation, a check is made for least cost. The method used to check for least cost and make any adjustments in the Q_{ij}'s necessary to further reduce cost was developed by Dantzig and is presented in Gass [17, pp. 145-152]. The procedure (1) obtains basic feasible solutions without setting up the usual simplex tableau and (2) tests for optimality without explicit representation of the vectors not in the basis in terms of the basis vectors.

For each i, the proportion of milk used for fluid purposes is reflected in the Q_{ij} ($j = 1,2,\ldots,n - 1$) values. Q_{in} equals the surplus in the i market. The Q_{ij}'s generated are returned to the spatial analysis section for further adjustment as needed for spatial equilibrium.

The least cost analysis section is activated with the initial iteration of the spatial analysis section. It is executed thereafter with each twentieth iteration for the system. It is also executed whenever a check is made for total system equilibrium.

Summary and Regional Analysis

The third major section of the model presents the results from the two previous sections. Only simple arithmetic calculations on previously derived values are performed. Equilibrium results are presented for each market area as well as for combined groupings of areas. A group or regional average is based on the weighted values for the markets comprising the group. From this section comparative equilibrium analysis of results under alternative conditions can be made for the aggregate industry, for geographical regions, or for industry sectors.

Options of the Model

The versatility of reactive programming, as modified to conform to the dairy industry, is demonstrated in the model options available to the researcher. Options include restrictions on prices or quantities or costs or structure that may be used in the model. Variations can be made in the model to make it conform to the conditions at hand.

Limited Utilization of Milk Supplied

Milk production is seasonally greater than average during the months of March through June. Consumption, however, is greater than the yearly average from September to the following April. On a daily basis little buying of milk is done Sunday, while Friday and Saturday are large sales days [10]. To account for this daily and/or seasonal variation in the consumption of milk, it may be desirable to maintain production at some percentage above the average amount of milk used for Class I purposes. For example, to maintain an average 25 percent reserve, only 80 percent of the milk supplied is considered available for consumption. The utilization limitation in the model applies uniformly to all supply markets.

Retail Markup Margin

There are profits as well as variable and fixed expenses incurred in the retailing function for fluid milk. To account for retailing costs and all other charges not encompassed by processing or transportation costs, a percentage of the retail price is deducted. This price spread or margin for retailing costs and profits can be unique for each demand market or entered as a uniform value for all markets.

Processing Cost Function

Processing costs are associated with preparing and packaging the consumer product, and there are economies of size in processing. It is possible to enter such economic relationships in the model or, if desired, a processing cost not functionally related to volume can be entered. Either cost value would be an average for all milk processed in the market.

Sizes of plants in an area would not be expected to be uniform. With larger market size there also tends to be larger firms that process a greater volume of the milk, but control a smaller portion of the market [31, p. 19]. It is also possible to enter a processing cost relationship that reflects the changing structure of processing facilities in a market in relation to the size of the market. Processing cost would reflect the average cost per hundredweight of milk processed based on the plant-size mix in the market.

Minimum Class I Prices

A minimum Class I price acceptable at the farm level can be specified for each supply market. This minimum price may be a Federal order minimum price or a price to reflect a minimum difference in Class I and Class II prices. If specified, the minimum Class I price is used to calculate, in conjunction with the Class I usage in the supply market, the minimum acceptable blend price for milk in the supply area. This minimum blend price is treated as a deduction from the net blend prices actually received by the supply market for milk shipped to demand areas. BPJ_{ij} in Equation 3.4 becomes:

$$BPJ_{ij} = BPJ_j - T_{ij} - \left(\frac{(MCI_i\ X_i + P_n\ Q_{in})}{(X_i + Q_{in})}\right) \tag{3.14}$$

$$(j = 1,2,\ldots,n - 1,\ i = 1,2,\ldots,m)$$

where:

MCI_i = minimum Class I price ($ per cwt.) specified for market i.

Adjustments in shipments, Q_{ij}'s in Equation 3.7, will be made until the blend price received in a market equals or exceeds the minimum calculated blend price.

Under the minimum Class I price restriction option, the adjustment of quantities to balance shipments with supply may be accomplished under a different procedure than as given in Equation 3.8. If a minimum Class I price is specified and the weighted average "blend price" value is zero or less than zero, i.e., $WBPJ_i \leq 0$ in Equation 3.5, the Q''_{ij} values for each i become:

$$Q''_{ij} = Q'_{ij} \qquad (j = 1,2,\ldots,n - 1,\ i - 1,2,\ldots,m)$$

and (3.15)

$$Q''_{in} = PT_i - \sum_{j=1}^{n-1} Q'_{ij}.$$

If $WBPJ_i > 0$ with a minimum Class I price given, then Equation 3.8 is still used in adjusting milk shipments to equal supply available for fluid use.

It is quite possible that establishing a minimum Class I price and seeking minimum total costs will be conflicting goals in the model.

To establish minimum Class I prices may mean some markets cannot adjust quantities and accompanying prices to facilitate a least cost system equilibrium defined in terms of the blend price structure. Other markets will have more profitable shipping alternatives but at an increased cost to the entire market system. If the price restrictions prevent an equilibrium, one of two changes can be made. Either a solution that maintains the price restrictions but not the least cost transportation flow can be specified or the limiting price restrictions can be removed.

Uniform Minimum Blend Price

A uniform minimum blend price for all markets can also be incorporated into the model. Both a minimum Class I price and minimum blend price cannot, however, be specified simultaneously for a market. The model automatically prohibits blend prices received in a market from declining to values below the surplus milk price.

Regional Aggregation

A comparison of equilibrium conditions among geographic regions can be accomplished by aggregating markets based on market location. Markets may also be combined based on cost structure or size of production. In fact, the researcher has the option of aggregating markets by most any criteria desired.

Normal Options Available

The model is designed for a market system in which each market has a fixed supply quantity but a functional price-quantity relationship at the retail demand level. Only one product, milk, is produced. Within this fixed supply, variable demand framework, all options common to reactive programming still apply. For example, the model may incorporate a time framework or prohibit transportation of the product into certain markets. Tramel's 1965 publication [43] is most descriptive of the other options available.

Limitations of the Model

Although the total supply of milk produced in each market is a fixed quantity in this model, the multiple use characteristic leads to at least two problems not normally associated with spatial equilibrium models. For a given time period milk can be used for the fluid consumption market, according to prevailing demand, or simply allowed to go into surplus use. Surplus milk is treated as a residual. Consequently, the demand and actual supply functions for fluid milk are identical as long as demand is less than the total fixed quantity of milk available in the market.

In Figure 4, let OA represent the total quantity of Grade A milk available in the market, all of which could be used for fluid milk. Further, assume that a linear demand relationship is representative of the retail demand for fluid milk products. OB equals the price for surplus milk, i.e., the surplus milk price is not a function of quantity.

Given, for example, a fluid demand of OC, the fluid Class I price at the farm level can be derived as shown earlier in Equation 3.2. Applying the Class I price to quantity OC and the Class II price to

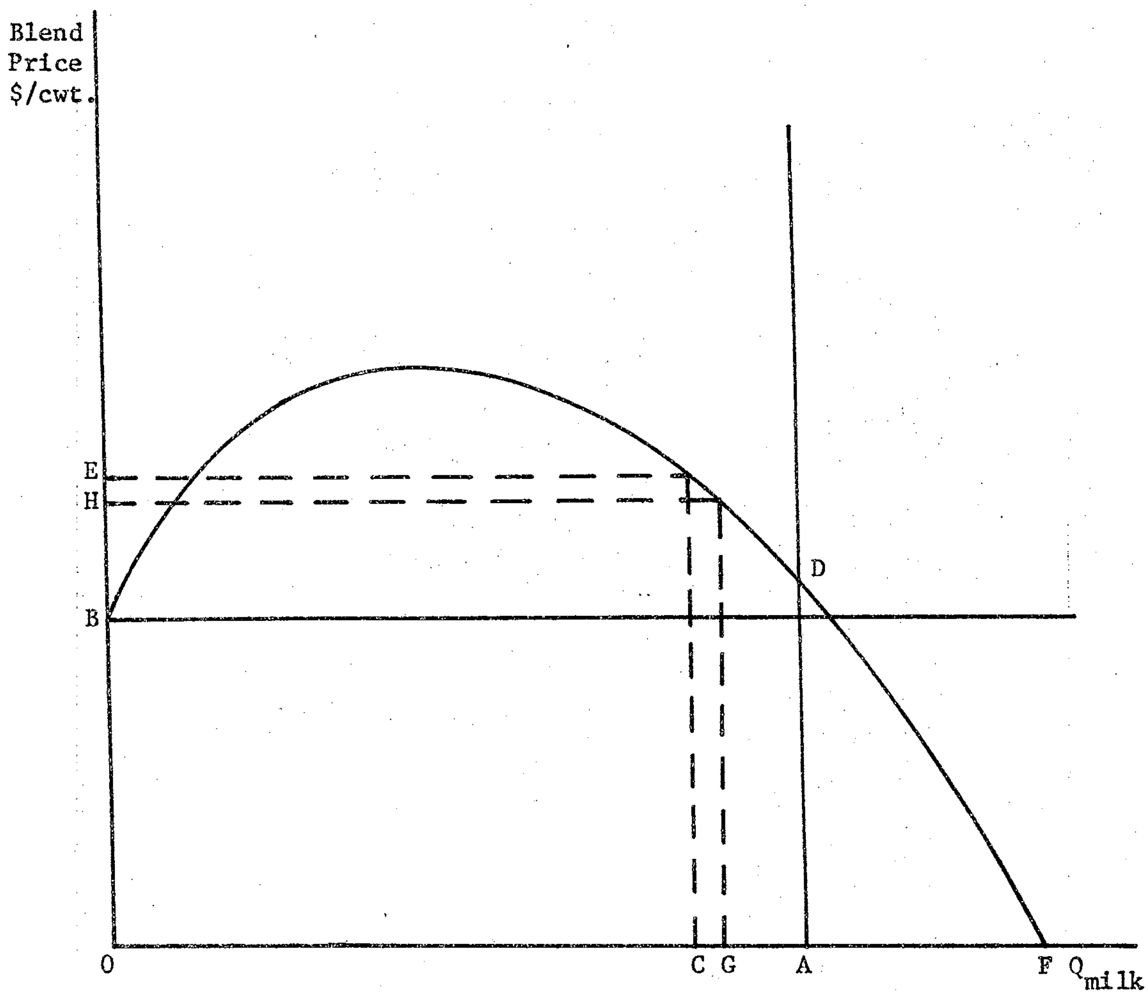


Figure 4. Demand and Supply Relationships for Milk in Each Market of the Spatial Equilibrium Model

the CA surplus quantity in the market results in a blend price of OE. The market supply at that same blend price is also OC fluid milk and CA surplus milk. By similar computation for other points, it can be seen that BD represents both the demand and supply functions for fluid milk. Beyond OA any additional fluid milk sold in the market is imported. With no surplus milk in the market the fluid demand farm price and the blend price are equal. DF is the demand relationship beyond OA. Of course, no other market would desire to export additional fluid milk to this market if Class I price falls below OB.

With Figure 4 in mind, the two major limitations of the model can be demonstrated. First, the model requires an initial set of fluid demand quantities for each market. Given this quantity a blend price is determined for each of the markets. If this price is no less than the price in any other market less transportation costs to that market or no greater than the price in any other market plus transportation cost from that market, there is no incentive for the initial price to change. There may be, however, several such demand quantities and resulting prices that are in equilibrium with the other markets. Consequently, spatial equilibrium prices are often a function of the initial data entered into the model.

As an example, assume OC is the initial demand quantity in Figure 4. The resulting blend price per hundredweight of milk in the market is OE. OE may well be an equilibrium price for that market. If OG had been given as the initial demand quantity in the market, it is also quite possible that the associated price of OH provides no incentive for imports or exports of fluid milk into or from the market. Either price would be acceptable in the total system spatial equilibrium.

The second problem with the model involves those markets that are potential export markets. A deficit market under the least cost section of the model imports milk from the surplus market that can ship at the least cost per hundredweight of milk shipped. The price structure in the markets, however, may not be conducive to such shipments. The net price to the export market from the import market may be less than the prevailing net price in the export market given that the export market supplies milk to meet only its own demand. To encourage shipment to deficit markets, the model increases the amount of milk in the export market that is used for fluid purposes, i.e., the surplus quantity is decreased and the fluid milk price depressed. At the same time, the quantity of fluid milk offered consumers in the deficit market is decreased. Price in the importing market is subsequently increased. As consumption decreases and price increases in the import market, a point may be reached where the importing of milk is no longer needed. In the iterative process, however, the price of the export market has been artificially pulled lower. The model does not restore price in the potential export market to a price in line with the initial fluid demand for the market. The lower price, though, still fulfills all the system's equilibrium conditions.

In general, the modified reactive program as described above provides the researcher a versatile means of determining spatial equilibrium under many alternative conditions. But, like most other models, the validity of the results depends upon the accuracy of the data entered into the model.

CHAPTER IV

MARKET DEMARCATION, BASIC DATA, AND MODEL ALTERNATIVES

A spatial equilibrium analysis for the fluid milk industry requires data from many sources as well as on many aspects of the total industry. Data are needed about fluid milk demand and total supply in each market. Transportation costs among markets as well as processing and retailing costs must be determined for each market. In a time framework, data are needed on expected future prices, changes in demand, and levels of governmental support. Procedures for obtaining or generating the necessary data for the model are outlined in this chapter.

Market and Region Demarcation

A major portion of the milk industry in the United States was serviced by 62 Federal milk marketing orders as of January 1, 1972, (see Figure 5). Milk handled in these orders accounted for approximately 60 percent of the total U.S. milk production in 1971, and 80 percent of the milk eligible for fluid markets [48, 1972, p. 9]. Although located in the more concentrated milk production areas of the U.S., the orders are representative of the entire industry. Order data on production, consumption and prices are readily available, and it is through the order structure that much of the Federal milk price

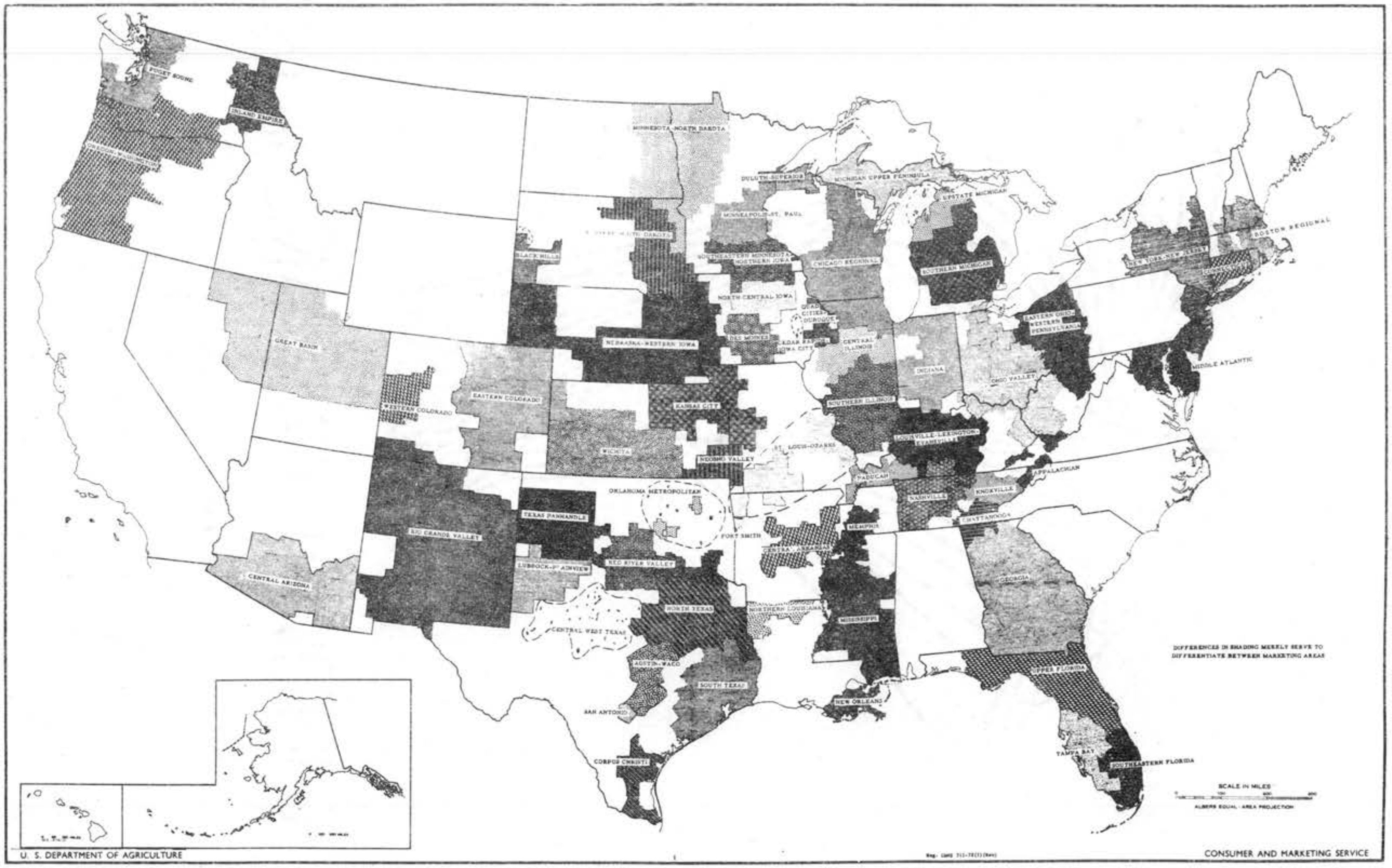


Figure 5. Milk Marketing Areas Under Federal Orders as of January 1, 1972

support program is facilitated. For these reasons, the 1972 Federal order milk market system served as a basis for the spatial analysis.

In some cases several orders represented similar area conditions and were grouped into a single market area for analysis. Similarity, for purposes of analysis, was based primarily on production and marketing conditions for the geographic area. In cases where similarity or differences in orders were not as apparent, Class I utilization and order price structure were also considered. The resulting 31 areas or markets that served as both production and consumption centers in the model are illustrated in Figure 6. Federal milk order markets included in each study market are given in Table XLII, Appendix A.

Within each study market a central major or key city was selected as a reference point for the market. All milk produced or consumed in the market was assumed to have taken place in the key city. This reference city also served as an origin or destination for the imports or exports of the market. Key cities are given in Table I.

For regional analysis purposes, markets were further grouped on the basis of similarity of market conditions and geographic location. Region boundaries are indicated in Figure 7. Region 1, the North-central U.S., is the major surplus production region while the Southeast, Region 4, is a major deficit production area in relation to the fluid milk demand of the region. With the exception of Region 4, the defined regions are basically self sufficient, i.e., produce enough milk to meet their own demand and import little milk for fluid use from other regions. Markets included in each region are also indicated in Table I.

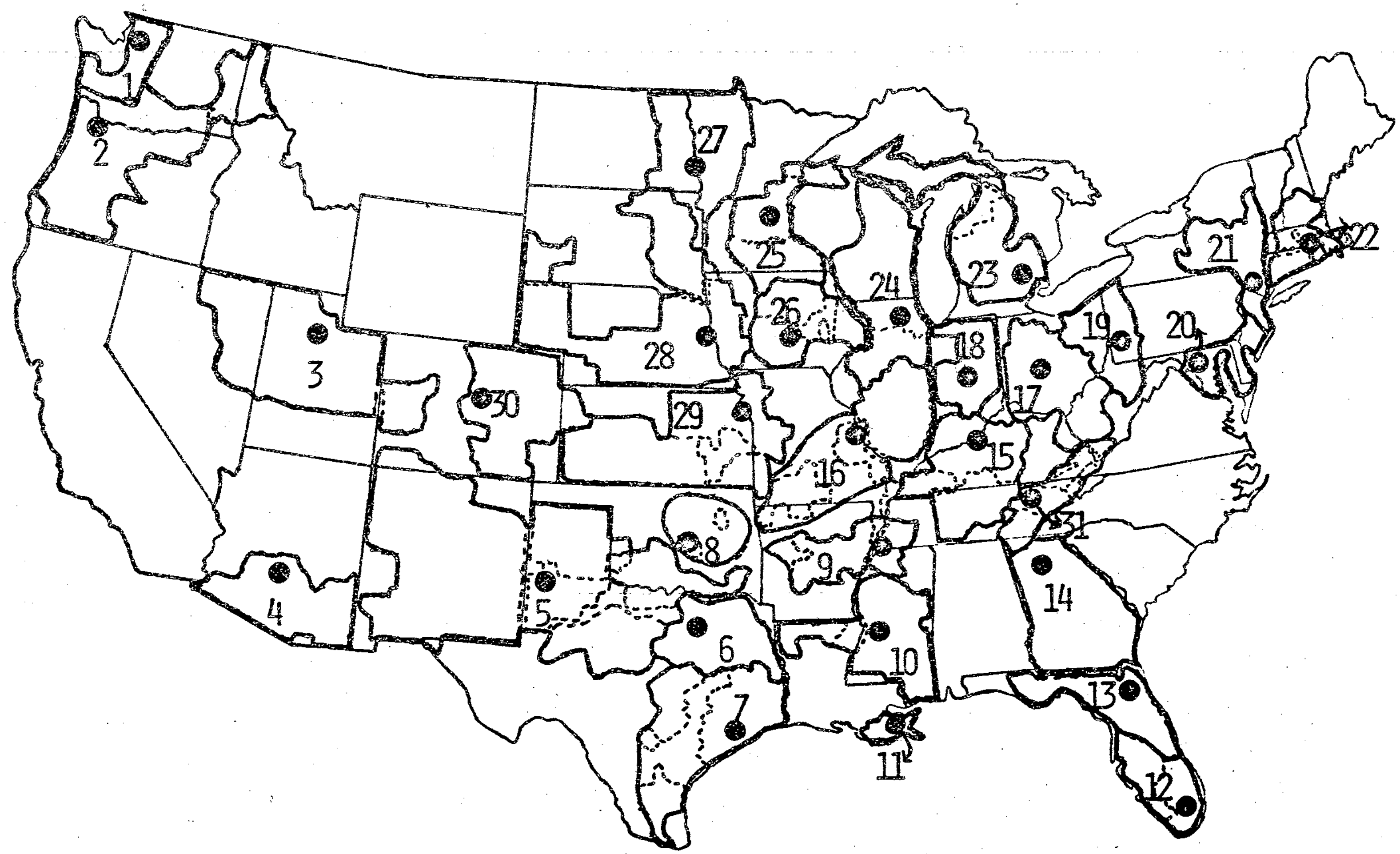
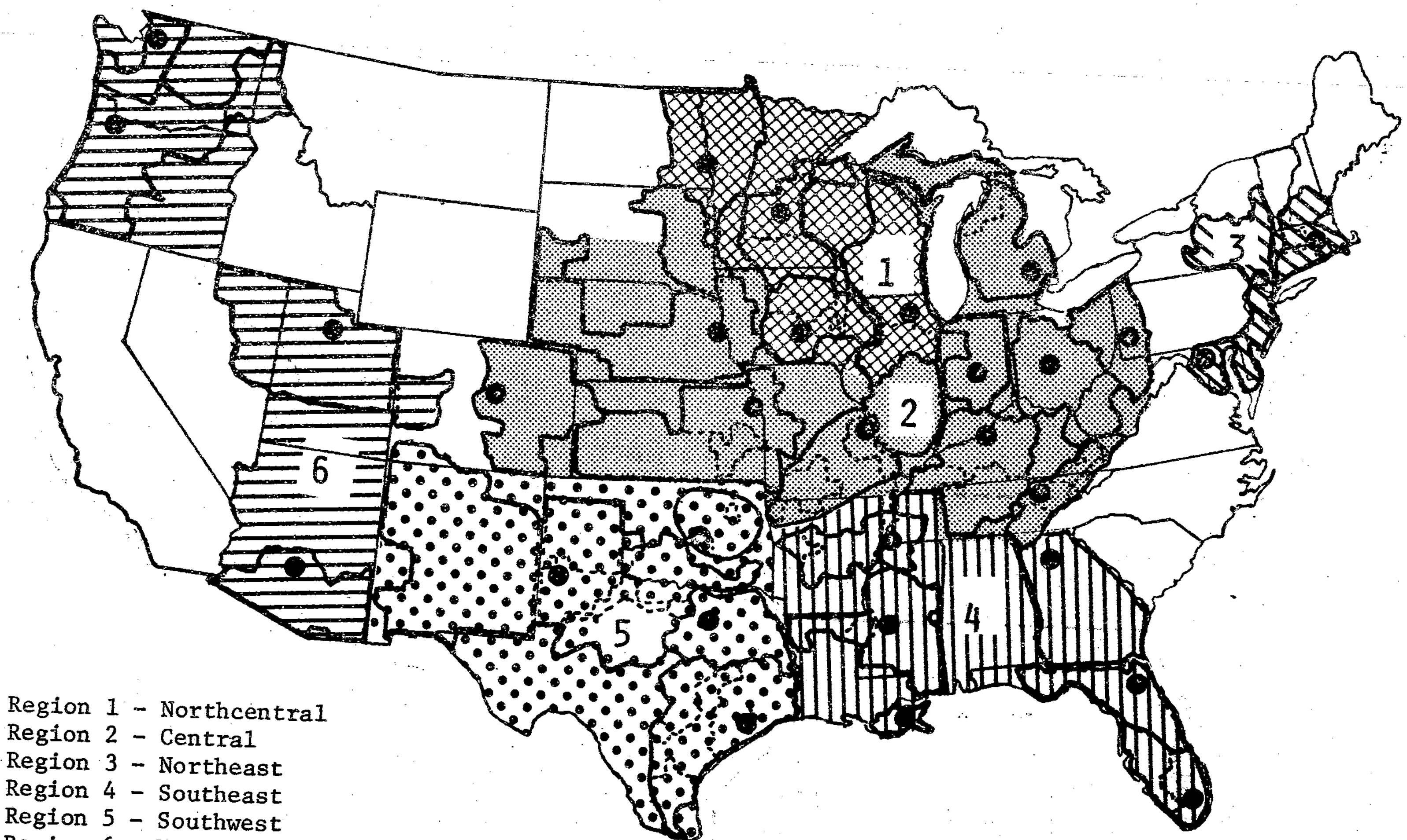


Figure 6. Markets Used in Study

TABLE I

REGION AND KEY CITY FOR EACH STUDY MARKET

Market	Region	Key City	Market	Region	Key City
1	6	Seattle	16	2	St. Louis
2	6	Portland	17	2	Columbus
3	6	Salt Lake City	18	2	Indianapolis
4	6	Phoenix	19	2	Pittsburgh
5	5	Lubbock	20	3	Baltimore
6	5	Dallas	21	3	New York
7	5	Houston	22	3	Boston
8	5	Oklahoma City	23	2	Detroit
9	4	Memphis	24	1	Chicago
10	4	Jackson	25	1	Minneapolis
11	4	New Orleans	26	1	Des Moines
12	4	Miami	27	1	Fargo
13	4	Jacksonville	28	2	Omaha
14	4	Atlanta	29	2	Kansas City, Missouri
15	2	Louisville	30	6	Denver
16	2	St. Louis	31	2	Knoxville



Region 1 - Northcentral
Region 2 - Central
Region 3 - Northeast
Region 4 - Southeast
Region 5 - Southwest
Region 6 - West

Figure 7. Regions Used in Study

Market Demand Relationships

Demand Functions

As additional quantities of fluid milk are placed on the market, retail, and resulting farm Class I prices, would be expected to decrease. In a 1969 study by Bullion [9], the response of retail price to changes in the quantity of fluid milk was estimated. Estimates were for areas of the U.S., but were adapted to the markets of this study. Demand was most inelastic in the western U.S., Region 6. Although generally more elastic in Regions 4 and 5 than in all other regions, retail fluid milk demand in the United States was everywhere price inelastic (Table XLIII, Appendix A).

Gross Class I sales by Federal milk orders and the retail equivalent price for fluid milk sold in Federal orders in 1972, as reported in Table XLIII, Appendix A, were used in conjunction with the elasticities to estimate the retail demand equations for each market. The retail price for an area was based on USDA reported prices from cities within Federal milk orders. Prices were weighted by population to obtain a representative Federal order price. Order prices were then weighted by Class I sales in an order to obtain the representative study market retail equivalent price for a hundredweight of fluid milk.

Functions were of the linear form:

$$P_j = a_j + b_jX_j \qquad (j = 1,2,\ldots,n) \qquad (4.1)$$

where:

P_j = retail price ($ per cwt.) of fluid milk in market j;

X_j = fluid milk (cwt.) consumed in market j;

a_j = price intercept coefficient for market j; and

b_j = slope coefficient for market j.

Estimated coefficients of the 1972 retail demand equations for each market are presented in Table XLIV, Appendix A.

Projected Demand Changes

A study by Raunikar, Purcell and Elrod [36] estimated both per capita and aggregate consumption of fluid milk for 1980. Projections were percentage changes from 1965 and were made for 14 major regions, 79 primary markets and 204 secondary markets in the contiguous United States. Factors affecting the estimates included number of households, the age and racial composition of the households, and an income variable. Census data were used to determine expected change in these factors during the projection period.

A later study by Raunikar and Purcell [35] using the same methods updated the 1980 projections for the major and primary markets in the southeastern part of the United States.[1] For the remainder of the United States only the major markets projections were updated. Projections were expressed as percentage increases from 1970. Generally, the updated projections to 1980 for all the major markets were about 95 percent of the projections from the earlier study.

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[1]The area updated by Raunikar and Purcell study roughly corresponds to Regions 4 and 5 of the present study.

Having adjusted these two studies to a comparable basis, estimates of fluid milk demand in 1980 were made for each of the 31 areas of this study. Each market estimate was placed on an annual basis assuming a compound rate of change for the projection interval. Yearly projected percentage changes to 1980 are presented by market as a part of Table XLV, Appendix A. In each area, fluid milk demand is expected to increase. The percent increase per year ranges from a low of 0.2 percent in the Pittsburgh market to a high of 3.7 and 3.8 percent in the Phoenix and Miami markets, respectively.

Using the yearly projected rates of change, 1972 area fluid milk sales were projected to 1976. These yearly projections served as the initial demand quantities entered into the model for each market for the given year under consideration. These projections are also shown in Table XLV, Appendix A. In total, fluid milk demand increased from 422,740,440 cwt. in 1972 to 443,509,831 cwt. in 1976.

Demand functions to reflect the market increases in demand were constructed for the years 1973-1976 and the coefficients are shown with those for 1972 in Table XLIV, Appendix A. The estimated 1972 functions served as a basis for the new functions. Market demand function slope coefficients for each year were assumed to be the same as for the market in 1972. New price intercepts for years beyond 1972 were estimated by assuming that the reported 1972 retail price was also the price each year at which the projected market demand quantities would be consumed. The resulting estimated functions represented parallel shifts in the demand functions over time.

Market Supply Relationships

Producers, like consumers, adjust to price changes. Though the response may be immediate to decrease production, as a biologically based industry, it takes time to increase production. Greater production occurs by increasing either the number of producing units or the output per producing unit. Given the lag in production response, supply is considered fixed in the model for each yearly time period.

The fixed quantity of Grade A milk produced in an area for a given year is a function of the previous year's average price for all milk in the area (farm blend price) and the previous year's total production. Market supply functions may take the form of a Koyck distribution:

$$PT_{it} = a_i + b_i\ PT_{i,t-1} + c_i\ BPJ_{i,t-1} \quad (i = 1,2,\ldots,m) \qquad (4.2)$$

where:

PT_{it} = Grade A milk (million lbs.) produced in supply market i in time period t;

$PT_{i,t-1}$ = Grade A milk (million lbs.) produced in market area i in the previous time period, t-1;

$BPJ_{i,t-1}$ = blend price ($ per cwt.) of milk produced in market i in the previous time period, t-1;

a_i = intercept constant for supply market i;

b_i = lagged production coefficient for supply market i; and

c_i = lagged blend price coefficient for supply market i.

The coefficient of the lagged production variable would reflect the influence of all other factors affecting supply such as feed costs, prices of other farm produced goods, and the general price level. Consequently, if $b_i < 1$, price in a market could remain unchanged over time but production decline.

Data provided from a recent study by Harrington [20, 21] facilitated the estimation of area supply function coefficients. The study estimated regional[2] supply functions for milk in either the Koyck distribution or Fisher lagged price forms. Other variables considered included the price of a 16 percent dairy ration, the price of beef, and the farm wage rate. Coefficients were estimated from data for the years 1953 through 1971. From the price elasticities of supply derived in the Harrington study, equations of the Koyck form described above were developed for each market area in this study. The long and short run price elasticities are shown in Table XLVI, Appendix A. Price and quantity data for area supply equations represented Federal order production quantities and minimum Federal order blend prices and are shown in Table XLVII, Appendix A. The resulting supply equation coefficients are given in Table XLVIII.

Utilization Percentage

Data for estimating needed reserves in a market to cover seasonal and daily fluctuations in supply and demand were obtained from the material developed by Paul Christ [10]. For his study period, indices of producer deliveries and sales by month showed heavier sales than deliveries of fluid milk in the fall and winter months (Table XLIX,

[2]Regions in the Harrington work are not the same as those used in this study. See Appendix Table XLVI.

Appendix A). For the month of October the dispersion was the greatest. The index of sales was 110.5 percent of the deliveries for the month.

Daily variation in sales, tends to be even more dramatic as confirmed by the Christ data (Table L, Appendix A). Based on six days of major sales and assuming a two-day plant storage capacity, it would have been necessary to maintain an average reserve of 12.6 percent of fluid milk sales to handle daily variation alone. Such would enable satisfying the two consecutive high volume sales days of Friday and Saturday.

The Christ data, as averages for several years, were assumed to represent present conditions in each market area. To account for both seasonal and daily fluctuations, the reserve requirement in the model would be 23 percent. The requirement would be 12.6 percent in accounting only for daily variation. Translated into utilization rates, or percentages of milk supplied available for fluid use, these limitations are 81.3 percent and 88.8 percent, respectively.

Class II Support Price

Market Class I prices are endogenously determined in the model. Although possible to treat the Class II or surplus milk price as an endogenous variable, it, as a fixed value, provides a means of indicating the governmental price support level for any one time period. Any milk not used in either fluid or manufacturing milk products for sale in the marketplace can be sold as a manufactured product to the government at prices consistent with the support price level. The price for the surplus product varies from market to market, but the variations usually are relatively small.

A January, 1973, report to the Agricultural Stabilization and Conservation Service by the Economic Research Service of USDA [52], evaluated, over time, the impact of alternative dairy price support levels. Assuming a 75 percent parity level, support prices increased approximately 4 percent for each additional marketing year from 1973 to 1978 in the study.

The announced support price in 1972 was $4.93 per cwt. In 1973, it jumped first to $5.29 then to $5.63. For the present study, a 1973 support price at $5.29 was used with the support price increasing each year thereafter by 4 percent. Estimated prices are shown in Table LI, Appendix A, and were entered as fixed values in the model.

Transportation Cost

Moede [33] estimated the 1969 costs of transporting bulk milk for distances up to 750 miles. He included both fixed and variable costs in his estimates on the basis of a 43,700 lb. payload and an empty backhaul. Labor involved conformed to Department of Transportation Safety Regulations. Estimates were made for 5, 6 and 7-day week operations. For a 5 week operation, cost per hundredweight per 100 miles ranged from 32 cents for a 25 mile one-way haul to slightly less than 14 cents for a 750 mile one-way haul. The cost tended to be less for shorter distance but higher for the longer hauls as compared with a 1966 study by Kerchner [27].

The Moede data were not considered representative of present day transportation costs in view of the general rise in costs associated with the transportation sector. To adjust costs to reflect changes in conditions, coefficients from a functional relationship of distance on cost, fit to the 5-day week cost estimations of Moede, were increased 20 percent. In addition, a 20 cents per cwt. handling charge, normally included by haulers, was also added. This handling charge covered any reloading of trucks that occurred and any overhead that could not be specifically assigned in budgeted costs. The resulting transportation cost function developed was as follows:

$$T_{ij} = .248950 + .001583M_{ij} \quad (i = 1,2,\ldots,m,\ j = 1,2,\ldots,n) \qquad (4.3)$$

where:

T_{ij} = transport cost ($ per cwt.) of bulk milk moved from supply market i to demand market j; and

M_{ij} = one way mileage between supply market i and demand market j.

Mileages represented distances between market key cities and were obtained from the Mileage Guide No. 9 of the Household Goods Carrier's Bureau [23]. No transportation cost was assumed for transporting fluid milk within the same market, i.e., $T_{ij} = 0$ for i = j. Implicitly such costs were included in the farm-retail price spread, discussed later. Surplus milk was also assumed to stay in the market area with no cost of transporting to manufactured product processing facilities ($T_{in} = 0$).

Processing Cost

Processing of raw milk into a packaged fluid milk product is subject to economies of size as was reported in a 1961 summary study by Cobia and Babb [11] and in a 1967 budget study by Devine et.al. [13]. Regardless of whether statistical or synthetic studies were used as a measure, there were large economies to be gained by processing at least 50,000 quarts of milk a day. Beyond this volume, economies still occurred, but declined rapidly.

Cobia and Babb combined three synthetic studies to develop a processing cost function representative of the industry. The equation:

$$PC = 11.763\ V^{-.11507} \qquad (4.4)$$

where:

PC = average packaged fluid milk processing cost (cents per quart); and

V = volume of milk processed (quarts per day);

was based on data adjusted to a 1961 price level for processing and packaging half-gallon paper containers of milk. Although they estimated several other functions, the above function was considered most representative of present conditions in the processing sector.[3]

In any one market it is not likely that there would be only one processing facility. Neither would several processing facilities in a market be expected to hold equal shares of the market. A USDA study by Manchester [31] showed the market shares for each of the four largest firms and for the fifth through eighth largest firms in markets of

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[3]The Devins et.al. study estimated costs from budget data for 3 sizes of New Jersey area processing plants. A 6-day week operation was assumed. Processing cost estimates were 3.4, 2.6, and 2.4 cents per quart for plants processing, 1, 4, and 8 thousand quarts of fluid milk per day respectively. Estimated costs using the Cobia and Babb equation (Equation 4.4) were 3.1, 2.7, and 2.5 cents per quart respectively for the same size plants.

different sizes in December, 1965. Markets were basically equivalent to Federal orders and ranged in size from very small to very large. For use in this study, several of the USDA regions were combined. The concentration data are presented in Table LII, Appendix A. As market size increased, share of the market decreased for the largest two firms. Plants smaller in size than the eight largest gained considerably in market share for the very large markets.

The average size of an order in each market size classification was also derived from the data in the USDA study (Table LIII, Appendix A). Ranges on each size grouping were set as a means of classifying the market sizes represented by each area in the present study. Study market fluid milk sales were divided by the number of Federal order markets per area. Based on the average sales per order, a study market area was classified as either medium small, medium, large, or very large. Study market orders and study areas in each market size classification are shown in Table LIII, Appendix A.

Using the average sales per order for each market classification derived from the USDA data, sales for individual plants were determined on the basis of the percentage of the market held by each size plant for that market size. Average processing cost per plant was calculated according to the Cobia and Babb function. For the fifth through eighth largest plants, each plant received equal shares of the market for that group of plants. Based on a Lorenz curve estimation, costs for all plants smaller than the eight largest were assumed to have a cost 10 percent greater than for the fifth through eighth largest plants. For the market as a whole, processing cost equaled the weighted average of individual plant costs.

For example, average order sales for a market classified as large size were approximately 575,000,000 lbs. (Table LIII, Appendix A). In this size market, the second largest plant held 15.7 percent of the market (Table LII, Appendix A) and would therefore process about 90,275,000 lbs. of fluid milk a year. According to the Cobia and Babb function, the average processing cost would be $1.377 per cwt. Each of the fifth through eighth largest plants processed 33,493,700 lbs. per year or one-fourth of the 23.3 percent of the processing done by the 4 firms in total. Cost per plant was calculated to be $1.543 per cwt. Plants smaller than the eighth largest plant had costs 10 percent higher than the $1.543 per cwt. for the fifth through eighth largest plants or $1.70 per cwt. Costs for each size plant were weighted by the percentage of the processing done to obtain the $1.459 per cwt. average processing cost for the order processing the 575,000,000 lbs. of fluid milk.

The maximum feasible size of plant based on current technology appears to be one processing about 465,000 quarts per day or approximately 1 million pounds per day operating under a 5-day week. Thus, in view of USDA concentration estimates, any market order processing more than 1,452.5 million pounds a year would result in the largest plant in the market processing more milk than could be handled efficiently under present day circumstances. Costs for markets very large in size were based on this maximum size market as representative of average sales per order.

All markets in this study had average order sales in excess of average Federal order sales for the small market classification in the USDA study. To place in a single functional form both economies and differences in market structure for different market sizes, a single regression was fit to the average costs calculated for the medium-small, medium, large, and maximum-size markets. The result was an equation of the form:

$$PE_j = 1.3926 + \frac{.3884}{PX_j} \qquad (j = 1,2,\ldots,n)^4 \qquad (4.5)$$

where:

PE_j = processing cost ($ per cwt.) in market j; and

PX_j = milk processed (million cwt.) per Federal order within market area j.

This function was used in the model to calculate the processing cost for a market area. For a market with per order sales averaging 14.525 million cwt. costs were $1.423 per cwt. or slightly more than 6 cents per packaged half-gallon of milk. Costs for study markets with larger per order sales were also calculated by the above function. With increased size, cost approached $1.39 per cwt.[5]

Retailing Cost

Only transportation and processing costs were specifically treated separately in the model. There were, however, costs of moving the fluid product from the processor through the remainder of the marketing channel to the consumer. These costs have been collectively classified as retailing cost. Included in this classification were

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[4]Both coefficients were significant at the .01 level.

[5]The $1.39 per cwt. cost for markets larger than 14.525 million cwt. was considered not significantly different from the $1.42 per cwt. cost for the defined maximum size market.

the costs associated with retail outlets, the costs of jobbers in wholesaling milk to retail outlets, and the costs of the processor in distributing the packaged product from the processing facility.

The retailing cost was calculated as a percentage of the retail price for fluid milk in the model and was based on 1972 USDA data. From the prevailing average retail price of milk in each area was subtracted the prevailing Class I price for milk in the area to give the farm-retail price spread subsequently referred to as the marketing margin. Based on area sales per order, a processing cost was subtracted from the marketing margin in each area to give a retailing and distribution margin. This margin, expressed as a percentage of the retail equivalent price, gave the markup percentage to account for retailing and distribution costs in the model, subsequently referred to as retailing percentage markup. Markup percentages ranged from a low of 26.82 in Arizona to 44.55 in Georgia and averaged for the U.S. 36.69 percent of the retail price.[6,7] Summary data for calculating the retailing percentage markup and the markup percentages for each study market are presented in Table LIV, Appendix A.

Alternative Models

Alternative models analyzed, using the above data in various combinations, were grouped into four classifications. The models were not meant to be fully descriptive of all conditions that could

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[6]The U.S. average is a simple average.

[7]A study of 46 markets with a population of 500,000 or over in September, 1972, indicated an average retail store markup of 41 percent over the store wholesale price [5].

exist in the fluid milk industry. Neither did the models belong exlcusively to the one category under which the model results are discussed.

The first model to be discussed was classified as the general equilibrium model (Model A-1) and is presented in Chapter V. It is from this base model that the remaining models were generated. Results of all other alternatives are compared with this base model.

Chapter VI presents three models classified as alternative pricing models. Model B-1 established a minimum Class I price for each market based on Federal order Class I-Class II price differentials. Models B-2 and B-3 also established minimum Class I prices. For Model B-2, prices were restricted by a uniform minimum Class I price. Minimum Class I prices in Model B-3 were based on feed cost differentials among markets.

Models in Chapter VII were characterized by changes in industry structure. Structural changes for purposes of this study were defined as those changes in the fluid milk industry not directly related to the pricing of milk. Model C-1 examined equilibrium conditions given a lower industry reserve milk requirement. In Model C-2, a uniform markup for retailing cost was entered for each market. The transportation sector with given cost changes was the structural change considered in Models C-3 and C-4.

The sensitivity of the industry was the question to be answered in Chapter VIII. Changes in supply were considered in Models D-1 through D-4. Each was compared to the projected fluid milk industry equilibrium developed in Model A-1.

CHAPTER V

AN EQUILIBRIUM PRICE STRUCTURE IN THE FLUID MILK INDUSTRY

A general equilibrium model was constructed on the basis of historical trends in the fluid milk industry. Data described in the previous chapter were entered into the model. A minimum of 20 cents per cwt. Class I-Class II price differential was maintained. Although all milk supplied was considered eligible for fluid consumption, all markets were required to hold milk in reserve to meet both seasonal and daily demand and supply fluctuations. A study period of 1972 through 1976 was assumed. Limitations or conditions imposed on the model were held constant throughout the study period. This model also served as a reference point for all other models considered in the following chapters.

General Equilibrium - Model A-1

The spatial equilibrium results for Model A-1 were obtained for each of the 31 study markets for each of the 5 study years, 1972 through 1976. The results were then aggregated for the 6 study regions previously shown in Figure 7. The regional analysis is given the major emphasis in comparing changes which occurred during the study period. The individual study market results are included in Appendix B. Regional information presented includes supply and demand quantities;

transportation patterns; retail, Class I, and blend prices; retail and farm revenues; and transportation, processing, and retailing costs.

Supply and Demand Quantities

Supply Quantities. The 1972 supply in Model A-1 was equal to the Federal order reported deliveries.[1] Supply for each year thereafter was calculated according to the supply functions discussed in Chapter IV. Supply for the U.S. increased each year an average of slightly more than 10 million cwt. and measured 728.3 million cwt. in 1976 (Table II). Increases were, however, proportionately greater in the earlier years as compared with the changes after 1974.

On a regional basis, the Northeast region (Region 3) had a 3.5 percent decline in production. Over half of the decline came in 1973 and 1974. By far the largest decline in milk production occurred in the New York market where supply decreased from 100.7 million cwt. to 96.1 million cwt. from 1972 to 1976 (Table LVI, Appendix B). All other regions indicated a production increase with Region 4 experiencing an 18 percent rise followed by Region 5 with a 12 percent increase.

Demand Quantities. Demand for fluid milk in Model A-1 increased from 423.4 million cwt. in 1972 to 442.9 million cwt. in 1976 (Table II). The increase, however, was not as great as was projected from data in the Raunikar, et.al. study [36]. The largest change in U.S. consumption occurred between 1973 and 1974. The smallest change came

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[1] Supply in Region 5 was adjusted downward to account for temporary excess supplies of milk in the Oklahoma Metropolitan and Red River Valley marketing orders in 1972.

TABLE II

SUPPLY AND DEMAND QUANTITIES OF MILK, U.S. AND REGIONAL TOTALS - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(million cwt.)		
			Supply		
1	135.9	140.7	144.3	146.8	149.0
2	207.8	213.3	217.9	221.7	225.1
3	194.2	191.7	189.8	188.4	187.5
4	50.9	53.8	56.3	58.3	60.1
5	46.6	48.3	49.9	51.2	52.4
6	49.8	51.1	52.4	53.4	54.3
U.S.	685.2	699.0	710.6	719.8	728.3
			Demand		
1	57.5	58.4	59.3	59.9	60.9
2	140.2	141.1	142.6	142.9	144.0
3	114.0	115.3	116.6	117.8	119.1
4	45.8	46.5	47.7	48.2	49.3
5	36.4	36.7	37.1	37.4	38.0
6	29.6	30.1	30.6	31.1	31.6
U.S.	423.4	428.1	433.8	437.4	442.9

between 1974 and 1975 but was followed by an increase the following year almost comparable with the 5.7 million cwt. increase in consumption for 1974.

Demand as a percent of supply declined slightly from 61.8 percent in 1972 to 60.8 percent in 1976. Consequently, increased amounts of milk were made available for consumption in the form of manufactured dairy products or were placed in government stockpiles.

All regions had an increase in demand with the Southeast having the largest percentage increase. Region 3, which was faced with declining production, increased consumption by 5.1 million cwt. over the 5 year period. The Central region had the smallest percentage gain in consumption. In Region 5, where supply increased 5.8 million cwt., demand increased 1.6 million cwt.

All of the individual markets indicated increased consumption from 1972 to 1976 even though the increase in some markets was relatively small (Table LVII, Appendix B). Several of the markets did, however, have a single year of decreased fluid milk usage. For example, the Knoxville, St. Louis, and Indianapolis markets had a decline in consumption in 1975 as compared with 1974. The Dallas and New Orleans areas experienced a similar condition in 1973. On the other hand, the Phoenix and Jacksonville markets increased consumption over 10 percent during the 5 year period. The New York market showed a 2.9 percent consumption increase.

Intermarket Movement of Milk. Of the milk supplied in each market, only 81.3 percent was permitted to be available to meet demand in the market, i.e., a 23 percent reserve was required in each market.

Only a few markets were unable to meet their market demand with their internal source of supply. Intermarket transfers of milk totaled 5.7 million cwt. in 1972, less than 2 percent of total demand (Table III). This was much below the 45 percent estimated for Kloth's model involving existing plant numbers and sizes and the basing point pricing structure [8]. It is, however, about the same as Kloth's estimate for a one-price structure.

The deficit Southeast markets were the major importers. The Memphis, Atlanta, Jacksonville and Miami markets all imported milk with Atlanta importing the largest quantity, 1.8 million cwt. in 1972 (Figure 8, and Table LVIII, Appendix B). New Orleans exported about 1.0 million cwt. of milk into the Miami market, but by far the largest quantities of imports into Region 4 came from outside the region. The Baltimore market in Region 3 was the major supplier to the northern Florida market. Atlanta received its 1972 imports from the Louisville, Kentucky market. Kansas City helped supply the milk to meet the Memphis demand. Imports by the Jackson and Lubbock markets were each less than 0.15 million cwt.

After 1972, no milk moved into the Southwest region. By 1975, the Baltimore market no longer shipped milk into Florida. Memphis still imported from either St. Louis or Kansas City over 1.0 million cwt. through 1976. Miami also received over 1.0 million cwt. in 1976 (Figure 9, and Table LVIII, Appendix B). The Knoxville market provided most of Miami's imports with some assistance from the Indiana market. Memphis and Miami together accounted for 75 percent of the milk imported in 1976. Total imports in the Model in 1976 were only half the quantity of milk indicated for 1972.

TABLE III

EXPORT AND IMPORT QUANTITIES OF FLUID MILK, U.S. AND REGIONAL TOTALS - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(thousand cwt.)		
			Exports		
1	0.0	0.0	0.0	0.0	0.0
2	3,125.0	2,542.8	2,276.4	2,278.1	2,812.7
3	1,336.9	1,944.8	1,662.2	0.0	0.0
4	1,155.0	0.0	0.0	768.3	0.0
5	0.0	0.0	0.0	0.0	0.0
6	36.0	0.0	0.0	0.0	0.0
U.S.	5,653.0	4,487.6	3,938.6	3,046.4	2,812.7
			Imports		
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	5,617.0	4,487.6	3,938.6	3,046.4	2,812.7
5	36.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
U.S.	5,653.0	4,487.6	3,938.6	3,046.4	2,812.7

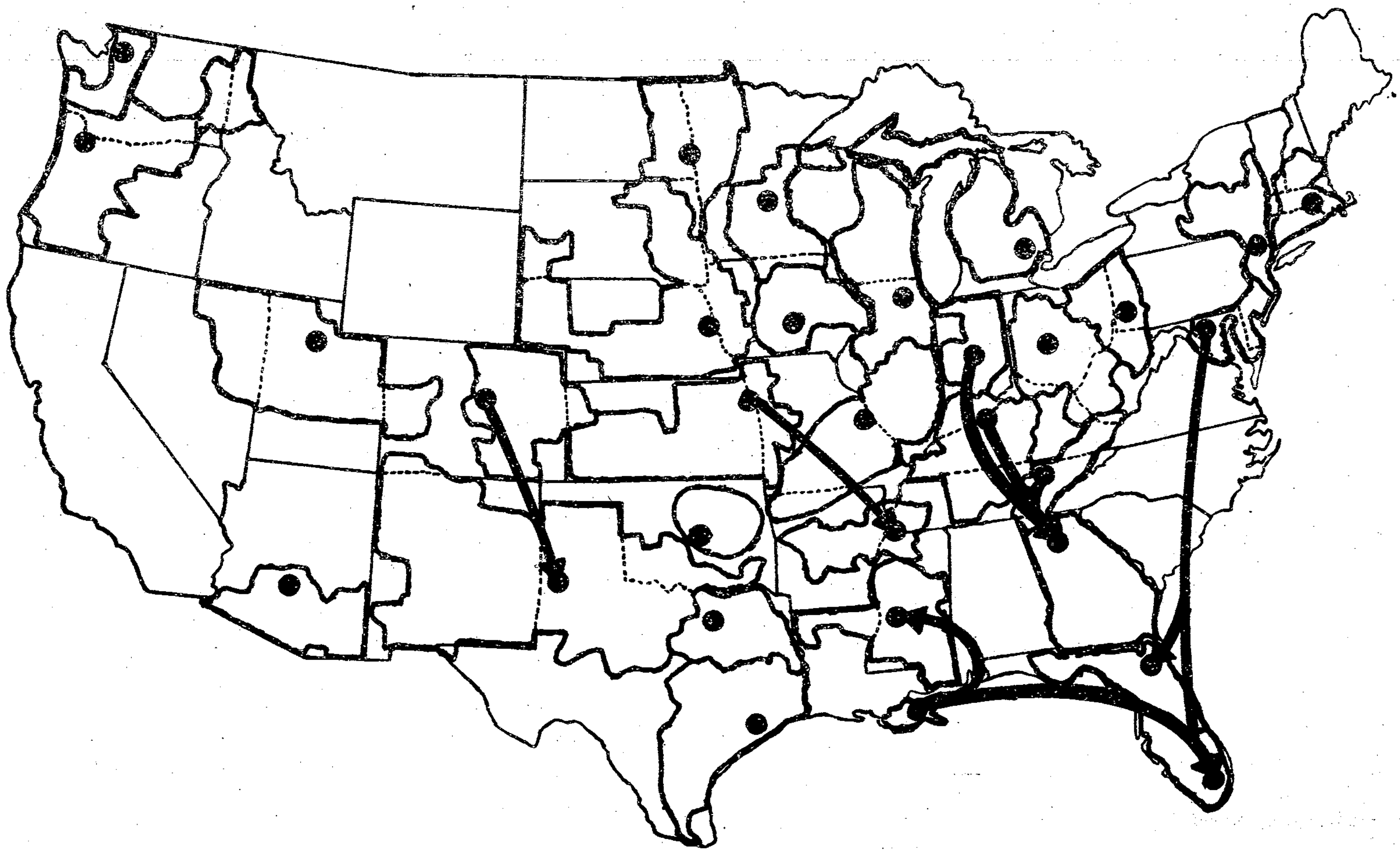

Figure 8. Intermarket Movement Pattern of Fluid Milk - Model A-1, 1972

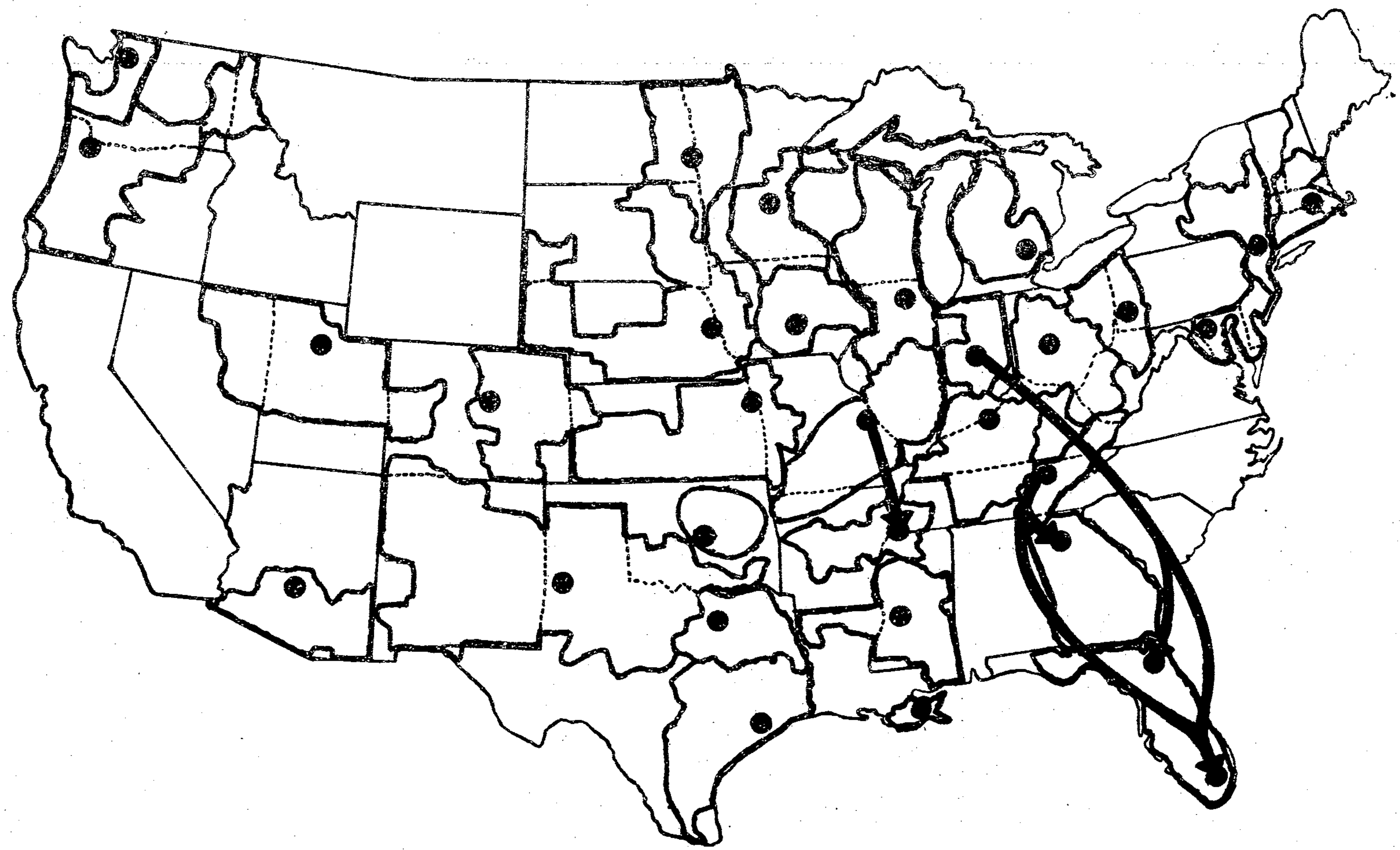

Figure 9. Intermarket Movement Pattern of Fluid Milk - Model A-1, 1976

Class I Utilization. Accounting for both consumption and exports, the percent of the milk supplied that was used for Class I or fluid purposes decreased in all but one region over the study time period (Table IV). The declines were not necessarily consistent yearly declines in all regions, however. Region 5 had the largest increase in surplus milk as Class I utilization declined from 78.1 percent in 1972 to 72.6 percent in 1976. With decreasing production but increasing consumption, Class I utilization in the Northeast increased 4.1 percentage points.

TABLE IV

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, U.S. AND REGIONAL AVERAGES - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(percent)		
1	42.3	41.5	41.1	40.8	40.9
2	69.0	67.4	66.5	65.5	65.2
3	59.4	61.2	62.3	62.5	63.5
4	81.3	78.1	77.7	78.8	77.3
5	78.1	75.9	74.3	73.1	72.6
6	59.5	58.8	58.4	58.2	58.2
U.S.	61.8	61.2	61.0	60.8	60.8

Throughout the study period the Atlanta, Jacksonville, Miami, Knoxville, and Denver markets each used the maximum allowable amount of milk supplied for Class I purposes (Table LVIX, Appendix B). The markets of the Northeast plus the Lubbock and Des Moines markets increased fluid utilization. All other markets indicated net declines.

Retail, Class I, and Blend Prices

Retail Prices. In Region 1, the Northcentral region, average retail price dropped about 6 percent or 84 cents per cwt. over the study period (Table V). Prices increased in all other regions. Generally the magnitude of percentage change in retail price increased as distance from Region 1 increased. Region 5, for example, had a 4.3 percent price increase as retail price increased from $13.69 per cwt. in 1972 to $14.28 per cwt. in 1976. Regional price changes were not consistent for each year, however. Half the regions had a lower price in 1974 than in 1973. Region 2 had its lowest price during the study period in 1974 which helped make the 1974 average U.S. price also the lowest of the 5 year span. In 1976, Regions 2 and 5 had either a decrease or no change in price over the previous year. The price spread between the regional average prices increased from 1972 to 1976.

Examining the data of individual markets comprising Region 1 reveals that the average price decrease experienced by the region rested solely on the price decrease of the Chicago market (Table LX, Appendix B). All other markets in the region maintained a constant market price. A comparable situation existed for Region 6 as the Denver market alone accounted for the upward trend in average price for that region. For all 31 markets, 10 maintained a constant price for the study period, while 5 showed a net decline in retail price in 1976 as

TABLE V

RETAIL, CLASS I, AND FARM BLEND PRICES FOR MILK, U.S. AND REGIONAL AVERAGES - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($/cwt.)		
			Retail Prices		
1	13.79	13.50	13.25	13.24	12.95
2	13.09	13.10	12.98	13.17	13.15
3	13.88	13.84	13.85	13.98	14.01
4	15.21	15.39	15.36	15.63	15.68
5	13.69	13.94	14.09	14.28	14.28
6	12.85	13.03	13.14	13.21	13.30
U.S.	13.66	13.67	13.62	13.77	13.74
			Class I Prices		
1	7.09	6.92	6.76	6.75	6.58
2	6.85	6.86	6.79	6.90	6.89
3	7.44	7.42	7.43	7.51	7.53
4	7.88	7.99	7.98	8.16	8.19
5	7.28	7.44	7.54	7.66	7.67
6	6.81	6.93	7.00	7.06	7.12
U.S.	7.19	7.20	7.17	7.26	7.25
			Farm Blend Prices		
1	5.84	5.96	6.02	6.14	6.21
2	6.25	6.34	6.35	6.49	6.56
3	6.41	6.58	6.69	6.84	6.95
4	7.34	7.44	7.46	7.65	7.70
5	6.77	6.92	7.02	7.14	7.20
6	6.05	6.25	6.38	6.50	6.63
U.S.	6.32	6.45	6.51	6.65	6.73

compared with 1972. Chicago had the largest decrease of $1.38 per cwt. In many markets the upward or downward trend for the study period was not consistent from year to year.

Class I Prices. Yearly regional and market Class I prices exhibited trends similar to those found in retail prices (Table V, and Table LXI, Appendix B). The percentage Class I price decline for Region 1, at 7.2 percent, was slightly greater than the decline in retail price, but percentage increases in prices for the remaining regions were also slightly greater. Consequently, the dispersion in regional prices increased over the study period. In 1976, Region 4's Class I price of $8.19 per cwt. was $1.61 per cwt. higher than in Region 1. In 1972, the largest price difference was $1.07 per cwt. and existed between Regions 4 and 6. The average U.S. Class I price in 1976 was $7.25 per cwt.

Blend Prices. Aided by an increased support (and Class II) price each year, the blend price paid farmers for all milk produced had increased by 4.9 percent or more for all regions by 1976 (Table V). The increase for the U.S. as a whole was from $6.32 per cwt. in 1972 to $6.73 per cwt. in 1976, a 6.5 percent increase. The reported 1972 farm price for all milk eligible for fluid use was $6.40 per cwt. [51, March 1973, p. 11].

Among all regions, neither the geographical pricing pattern nor the total differential between the high and low regional blend prices changed over time. Region 3 had declining production and increasing consumption, and the farm price gain averaged 13 cents per cwt. per year for an 8.4 percent increase from 1972-1976. The percentage increase, however, was second to the 9.6 percent blend price increase in

Region 6 over the same period. Despite declining retail and Class I prices, average blend price in the Northcentral region increased from $5.84 per cwt. in 1972 to $6.21 per cwt. in 1976, an increase of 37 cents per cwt.

In general each market area showed an increase in blend price each year (Table LXII, Appendix B). The Jackson market indicated a declining price the first 3 study years but reversed the trend after 1974 and showed a net loss of 1 cent per cwt. from 1972 to 1976. The lowest blend price also occurred in 1974 for the Atlanta, St. Louis, Indianapolis, and Knoxville markets. Each of these latter 4 markets, however, rebounded in 1975 with a price higher than their equilibrium farm blend price for 1973.

Retail and Farm Revenues

Retail Values. The small regional increases in retail prices combined with the increases in consumption of fluid milk resulted in an aggregate 5.2 percent increase in revenue from U.S. retail sales of fluid milk from 1972 to 1976 (Table VI). Retail revenue, i.e., consumer expenditure, increased from $5,784.7 million to $6,086.7 million. Over the study period, only 2 of the 6 regional increases were proportionally less than the U.S. average. For Region 1, the Northcentral area, revenue declined as retail price decreased. For Region 2, a small increase in price plus a less than average increase in demand resulted in only a 3.1 percent increase in revenue. Both Regions 4 and 6 increased revenue from retail fluid milk sales in excess of 10 percent from 1972 to 1976.

TABLE VI

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL TOTALS - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
			Retail Value of Fluid Milk Sales		
1	792.4	788.5	785.4	793.4	788.5
2	1,835.8	1,849.2	1,851.1	1,881.4	1,893.1
3	1,581.2	1,596.2	1,615.7	1,646.7	1,669.2
4	696.6	716.4	731.9	754.0	772.5
5	498.5	511.1	522.2	534.3	542.8
6	380.1	391.6	401.4	410.8	420.6
U.S.	5,784.7	5,852.9	5,907.6	6,020.7	6,086.7
			Farm Value of All Milk Sales		
1	794.1	839.4	868.5	902.0	925.1
2	1,298.0	1,352.3	1,383.7	1,438.6	1,476.5
3	1,245.4	1,261.6	1,270.3	1,288.4	1,303.6
4	373.4	400.6	419.9	445.7	462.4
5	315.2	334.6	350.1	365.6	376.9
6	301.3	319.9	334.0	347.1	360.1
U.S.	4,327.5	4,508.4	4,626.5	4,787.3	4,904.7

Farm Values. Translated to the farmer, the U.S. sales value of Class I fluid milk increased 5.5 percent. With relatively stable retailing and processing costs but a decline in transportation cost, the farmer captured 0.1 percentage point more of the retail value of fluid milk sold. Farmer Class I revenue was $3,209.8 million in 1976 and represented 52.7 percent of the retail value of fluid milk.

When the increased value of Class II or surplus milk sales was added to Class I sales, the increase in the farm value of all milk sold was more than double the increase in farm Class I value alone. The value of all milk sold was $4,904.7 million in 1976 compared with $4,327.5 million in 1972 (Table VI). Even more noticeable was that the farm value of all milk sold increased in all regions, including Region 1 where retail value declined several years. Increased price offset decreased supply in the Northeast region. In the Southeast with large increases in price, supply, and demand, the farm value of all milk sold increased almost 24 percent over the study time period. The Southwest and West regions showed gains in farm value of all milk sold of 19.6 and 19.5 percent respectively.

In comparing the change in farm revenue from 1972 to 1976 with the change in retail sales value or consumer expenditure, total farm revenue in the U.S. increased $1.91 for each $1.00 increase in consumers' expenditures. For Region 2 the ratio was $3.12 to $1.00. At the opposite end of the spectrum Region 3 farmers gained only 77 cents for each dollar retail revenue change from 1972 to 1976. Region 3 was the only region to have a ratio less than 1.0.

Transportation, Processing, and Retailing Costs

Transportation Costs. Only those regions exporting fluid milk experienced a cost for transportation of a portion of their sales (Table VII). This cost was less than one-half of 1 percent of the total costs of transporting, processing, and retailing. Region 2 yearly transportation cost declined with decreased and shorter distance shipments from the region through 1974. Thereafter, Region 2 had more milk exported and at greater distances. Based on average per hundredweight hauling cost, the average haul was about 540 miles in 1976 compared with 285 miles in 1974.

Transportation cost for the U.S. declined from $6,775.9 thousand in 1972 to $3,188.6 thousand with the 50 percent decrease in quantity shipped. Average distance hauled for all milk exported was about 550 miles each year.

Processing Costs. Processing cost at $1.45 per cwt. remained essentially constant for the U.S. throughout the study period (Table VIII). The increased aggregate quantity of milk processed was insufficient to obtain large additional economies of size. The processing cost structure indicated that the southern and western regions tended to process a smaller quantity of milk per market order as compared with the central and northern regions. The higher per hundredweight costs also reflected smaller processing facilities handling the fluid milk. As a result of the stability of cost, the increase in total processing cost for the U.S. from $612.7 million in 1972 to $639.8 million in 1976 reflected only an increased quantity handled.

TABLE VII

TRANSPORTATION COSTS FOR FLUID MILK EXPORTED, U.S. AND REGIONAL TOTALS AND PER CWT. COSTS - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($ thousand)		
1	0.0	0.0	0.0	0.0	0.0
2	2,878.3	2,177.2	1,597.6	2,112.4	3,188.6
3	2,110.0	3,520.4	3,066.6	0.0	0.0
4	1,747.8	0.0	0.0	1,243.3	0.0
5	0.0	0.0	0.0	0.0	0.0
6	39.7	0.0	0.0	0.0	0.0
U.S.	6,775.9	5,697.6	4,664.2	3,355.7	3,188.6
			($/cwt.)		
1	0.0	0.0	0.0	0.0	0.0
2	0.92	0.86	0.70	0.93	1.13
3	1.58	1.81	1.84	0.0	0.0
4	1.51	0.0	0.0	1.62	0.0
5	0.0	0.0	0.0	0.0	0.0
6	1.10	0.0	0.0	0.0	0.0
U.S.	1.20	1.27	1.18	1.10	1.13

TABLE VIII

PROCESSING COSTS FOR FLUID MILK SOLD, U.S. AND REGIONAL TOTALS AND PER CWT. COSTS - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
1	83.5	84.8	86.0	86.9	88.2
2	203.0	204.2	206.2	206.7	208.2
3	160.2	162.1	163.9	165.6	167.4
4	67.6	68.7	70.2	71.0	72.4
5	54.5	54.9	55.4	56.0	56.8
6	43.9	44.5	45.2	46.0	46.7
U.S.	612.7	619.2	627.1	632.1	639.8
			($/cwt.)		
1	1.45	1.45	1.45	1.45	1.45
2	1.45	1.45	1.45	1.45	1.45
3	1.41	1.41	1.41	1.41	1.41
4	1.48	1.48	1.47	1.47	1.47
5	1.50	1.50	1.50	1.50	1.49
6	1.48	1.48	1.48	1.48	1.48
U.S.	1.45	1.45	1.45	1.45	1.44

Retailing Costs. Retailing cost, the largest of the marketing costs, increased from $2,128.2 million in 1972 to $2,237.1 million in 1976 with the increased U.S. consumption each year (Table IX). In Region 1 the decline in retail price offset the increased quantity demanded and retailing costs declined over the study period. In other regions, an increased regional price added to the higher retailing cost associated with the larger quantity processed. The retailing cost was more than 38 percent of the retail value of milk in both Regions 1 and 4. For the remaining regions the cost represented between 35.4 percent and 36.6 percent of the retail value.

TABLE IX

RETAILING COSTS FOR FLUID MILK SOLD, U.S. AND REGIONAL TOTALS - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
1	301.6	299.9	298.6	301.6	299.5
2	672.0	676.8	677.4	688.6	692.8
3	572.9	578.3	585.4	596.8	605.0
4	268.2	275.6	281.3	289.6	296.6
5	178.8	183.3	187.2	191.6	194.6
6	134.7	138.7	142.1	145.3	148.7
U.S.	2,128.2	2,152.7	2,172.0	2,213.5	2,237.1

Total Costs. The decline in total transportation cost only tempered the increase in total cost (Table X). The total cost of getting the raw fluid milk from the farmer to a purchased consumable good from the grocery store was $2,747.7 million in 1972. By 1976 the cost was $2,880.1 million. The largest percentage change in cost for the U.S. occurred in 1975 when total cost increased 1.6 percent over the 1974 cost. All regions followed much the same trend except for Region 1 where total cost changes paralleled retailing cost changes over the study period.

TABLE X

TOTAL COSTS FOR TRANSPORTATION, PROCESSING, AND RETAILING FLUID MILK SOLD; U.S. AND REGIONAL TOTALS - MODEL A-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
1	385.1	384.7	384.6	388.5	387.8
2	877.8	883.3	885.3	897.4	904.2
3	735.2	743.9	752.4	762.3	772.4
4	337.6	344.3	351.5	361.9	369.0
5	233.3	238.2	242.7	247.5	251.4
6	178.6	183.2	187.3	191.3	195.4
U.S.	2,747.7	2,777.6	2,803.7	2,849.0	2,880.1

Summary

Model A-1, or the general equilibrium model, was characterized by essentially an unrestricted Class I price system but an increasing support or Class II price over time. From 1972 to 1976 milk consumed in each region increased, but the increase was less than the increasing supply of milk. The Northeast region was an exception with supply decreasing.

Price at the retail level was stable in about one-third of the markets over the study period although the aggregate retail price showed an upward trend. Supported by the increasing surplus milk price, farm price increased proportionately more than retail price for all regions. Both a price increase and an increased supply contributed to the higher revenue generated for the U.S. production sector each year.

Regionally, retail and Class I prices, and associated revenues, generally changed proportionally more for a region the further the region was located from the Northcentral region. Regional blend prices did not follow rigidly this pattern. Region 4 had the smallest proportional blend price increase but the largest farm revenue increase over the study period. Region 4 also led the nation in the proportional increase in production and consumption from 1972 to 1976.

CHAPTER VI

ALTERNATIVE PRICE STRUCTURES FOR THE FLUID MILK INDUSTRY

The present classified pricing system for fluid milk is arbitrary in the sense that producers and handlers initiated and have accepted the provisions of the Federal milk marketing orders.[1] A report of the Milk Pricing Advisory Committee, USDA [54], has suggested that the present pricing system needs to be re-evaluated, given the rapid decline of Grade B or manufacturing milk production.[2] Models discussed in this chapter are alternative methods of pricing that may be considered. Each model is compared with the general equilibrium model of the previous chapter. Note that Model A-1 is, likewise, an alternative pricing scheme.

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[1]Market orders generally become effective only if approved by the majority of producers and handlers. An order can likewise be terminated by request of the majority of handlers and producers [49, p. 63].

[2]The Federal order markets face a minimum Class I price for milk based on the value of Grade B or manufacturing grade milk sold in the Minnesota-Wisconsin area (Minnesota-Wisconsin price series). About half of the Federal orders also use the Minnesota-Wisconsin price series in setting the price for Class II or surplus milk. In 1970 only 25 percent of all milk production was manufacturing grade milk. In Minnesota and Wisconsin the proportion of milk produced that was of manufacturing grade showed significant decline from 1965 to 1970 [54, Part I, p. 18].

Federal Order Minimum Class I Prices - Model B-1

In Model A-1, 7 of the 31 market areas had 1972 equilibrium Class I prices that were more than two cents per cwt. below the established Federal order minimum Class I prices for the markets. For both the Baltimore and Denver markets the differences were in excess of $1.25 per cwt. Model B-1 incorporated a minimum Class I price structure similar to the present day Federal order structure. The 1972 minimum Class I prices were adapted from reported Federal order data (Table XI). For each year thereafter, 1973-1976, the minimum price for each market was increased by the absolute value increase in the Class II or support price for each study year. Minimum differentials between Class I and Class II prices established in 1972 were carried throughout the study period. All other conditions in Model B-1 were equivalent to Model A-1 restrictions.

Federal order minimum prices often were inconsistent with a minimum cost solution. To obtain a least cost movement of milk among regions, the model sought to lower prices in some markets below the minimum prices for the markets. In 1972, the minimum Federal order prices in the Baltimore and New Orleans markets, combined with fixed Class II prices and with projected quantities supplied, prevented the model from obtaining a least cost spatial equilibrium. To obtain equilibrium, the transportation model was activated only during the initial iterative stages of the reactive programming routine. Thereafter milk was allowed to move among markets with regard to achieving

TABLE XI

MINIMUM FEDERAL ORDER CLASS I PRICES, MARKET AVERAGES, 1972[a]

Market	Price	Market	Price
	($/cwt.)		($/cwt.)
1	6.86	17	6.70
2	6.96	18	6.47
3	6.92	19	6.87
4	7.53	20	7.79
5	7.37	21	7.64
6	7.32	22	7.99
7	7.77	23	6.77
8	6.99	24	6.27
9	6.48	25	6.07
10	7.48	26	6.35
11	7.86	26	6.30
12	8.08	28	6.61
13	7.85	29	6.75
14	7.31	30	7.31
15	6.55	31	7.10
16	6.58		

[a]Source: Adapted from [47 and 48, 1972]. Federal order prices were weighted by Gross Class I sales in each order to obtain the market minimum Class I price.

spatial equilibrium but without regard to movement in an absolutely least cost pattern.[3]

Supply and Demand Quantities

Supply Quantities. Producers responded to the minimum Federal order Class I price structure by producing larger quantities of milk (Table XII and Table LXIII, Appendix C). The 728 million cwt. of milk produced in Model A-1 by 1976 had been produced in Model B-1 by 1975. Supply in 1976 was 738.9 million cwt. for the U.S., an increase of 7.8 percent over quantities supplied in 1972.

Region 4 led in percentage supply increase. Supply increased from 50.9 to 61.4 million cwt. over the study period. The 1976 supply for the region was also 1.3 million cwt. larger than projected in Model A-1. Region 3, as in Model A-1, showed a decline in production of 2.4 percent over the entire study period. Regions 1, 2, and 3 continued to supply over 75 percent of the nation's supply.

Demand Quantities. By 1976, U.S. consumers in Model B-1 were consuming only slightly more milk than Model A-1 consumers bought in 1973 (Table XII and Table LXIV, Appendix C). Demand in each year of Model B-1 was not only less than consumption in Model A-1 but also increased proportionately less over the study period. Demand for 1972, based on consumption under a Federal order minimum price

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[3]Model B-1 required that at least five checks be made for a least-cost movement of milk during the iterative allocation procedure. If a final equilibrium solution had not been achieved by that point in the solution process, the least-cost flow requirement was abandoned in reaching price equilibrium.

TABLE XII

SUPPLY AND DEMAND QUANTITIES OF MILK, U.S. AND REGIONAL TOTALS - MODEL B-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(million cwt.)		
			Supply		
1	135.9	141.5	145.7	148.9	151.3
2	207.8	213.8	219.0	223.5	227.4
3	194.2	192.0	190.6	189.8	189.5
4	50.9	54.3	57.1	59.4	61.4
5	46.6	48.9	50.8	52.4	53.9
6	49.8	51.3	52.8	54.1	55.3
U.S.	685.2	701.8	715.9	728.1	738.9
			Demand		
1	56.7	57.6	58.1	58.9	59.2
2	138.5	138.9	139.0	139.4	139.0
3	113.1	113.6	114.4	115.2	116.0
4	44.5	45.2	46.0	47.0	47.6
5	35.7	36.0	36.2	36.4	36.5
6	29.4	29.7	30.1	30.5	31.0
U.S.	417.9	421.0	423.8	427.3	429.3

structure, was 417.9 million cwt. Consumption increased an average of 2.8 million cwt. each year.

Regional consumption increased yearly with the exception of Region 2 which had a 1976 consumption that was less than consumption in 1975. Region 4, the Southeast, as in Model A-1, led the nation in percentage increase in consumption over the study period. Region 4 consumption was 47.6 million cwt. in 1976 as compared with 44.5 million cwt. in 1972. The 1976 consumption was 2.3 million cwt. less than projected fluid milk usage in Model A-1 for the same period.

Intermarket Movement of Milk. Less milk moved among markets in Model B-1 as compared with Model A-1, and smaller quantities were shipped each year (Table XIII). Region 3 had increasing exports and imports though net imports were increasing after 1974. Region 1 markets also had increasing exports. In 1972, Region 4 imported all the milk that moved interregionally. By 1976, the Baltimore market in the Northeast, which was an export market in Model A-1, received the largest proportion of fluid milk transported among markets (Table LXV, Appendix C). The New York market exported milk each year while the Chicago market exported in all years except 1972. Milk flows among markets in 1972 and 1976 for Model B-1 are depicted in Figures 10 and 11.

Class I Utilization. The U.S. fluid milk utilization percentage declined from 61.0 percent in 1972 to 58.1 percent in 1976 for Model B-1 (Table XIV). Relative to the supply increase, utilization in Region 5 declined 8.9 percentage points to 67.8 percent in 1976. Region 3, as in Model A-1, had an increased utilization of milk supplied for Class I use. In general, however, every region had a lower Class I

TABLE XIII

EXPORT AND IMPORT QUANTITIES OF FLUID MILK, U.S. AND REGIONAL TOTALS - MODEL B-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(thousand cwt.)		
			Exports		
1	7.4	237.8	46.6	164.5	238.7
2	3,609.5	2,608.7	2,010.6	1,638.1	1,307.0
3	2.0	730.3	941.5	1,114.7	1,190.9
4	864.3	358.9	153.2	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
U.S.	4,483.2	3,935.8	3,151.9	2,917.3	2,736.6
			Imports		
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	2.0	741.5	941.5	1,199.9	1,533.6
4	4,481.2	3,194.2	2,210.3	1,717.4	1,203.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
U.S.	4,483.2	3,935.8	3,151.9	2,917.3	2,736.6

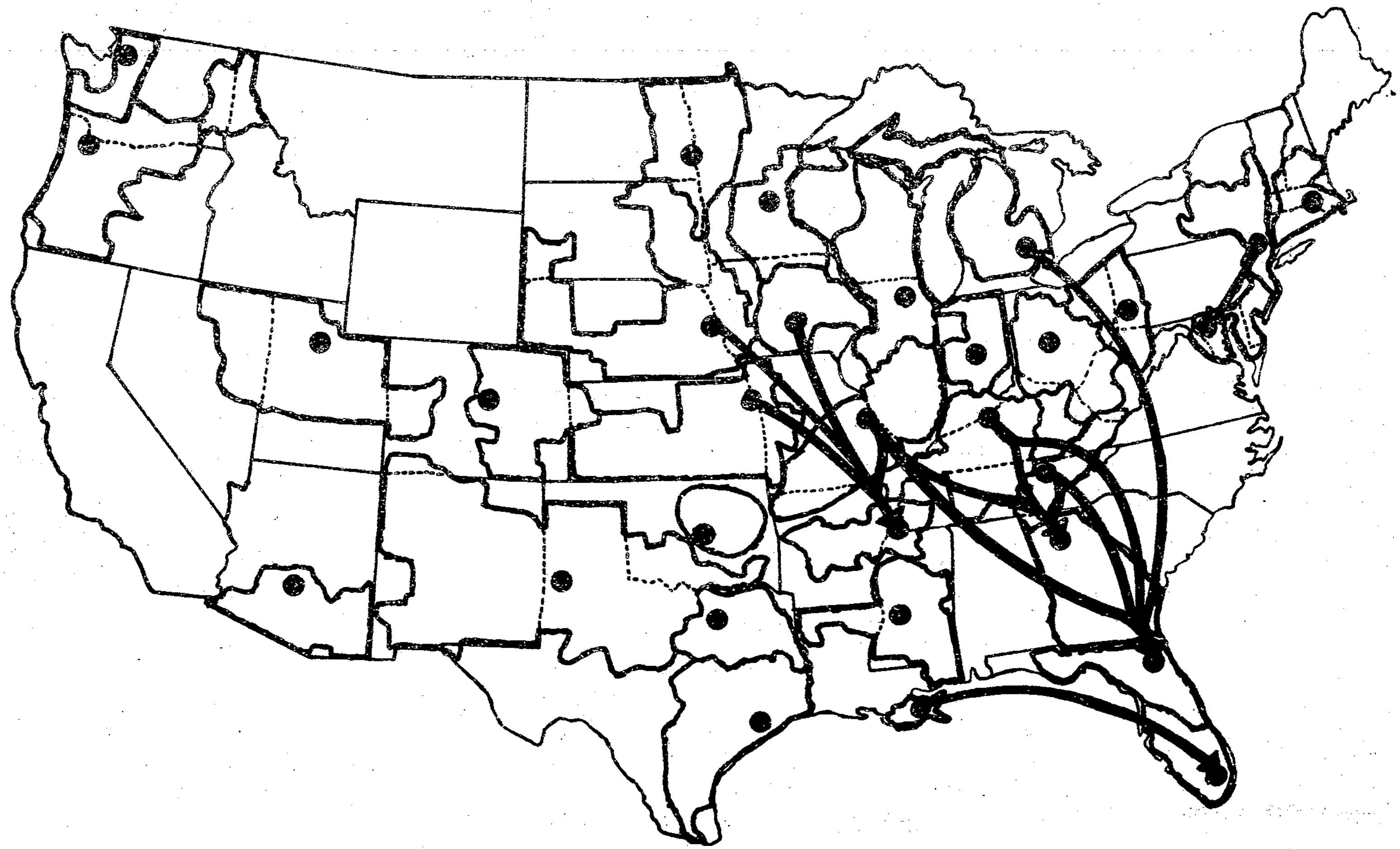

Figure 10. Intermarket Movement Pattern of Fluid Milk - Model B-1, 1972

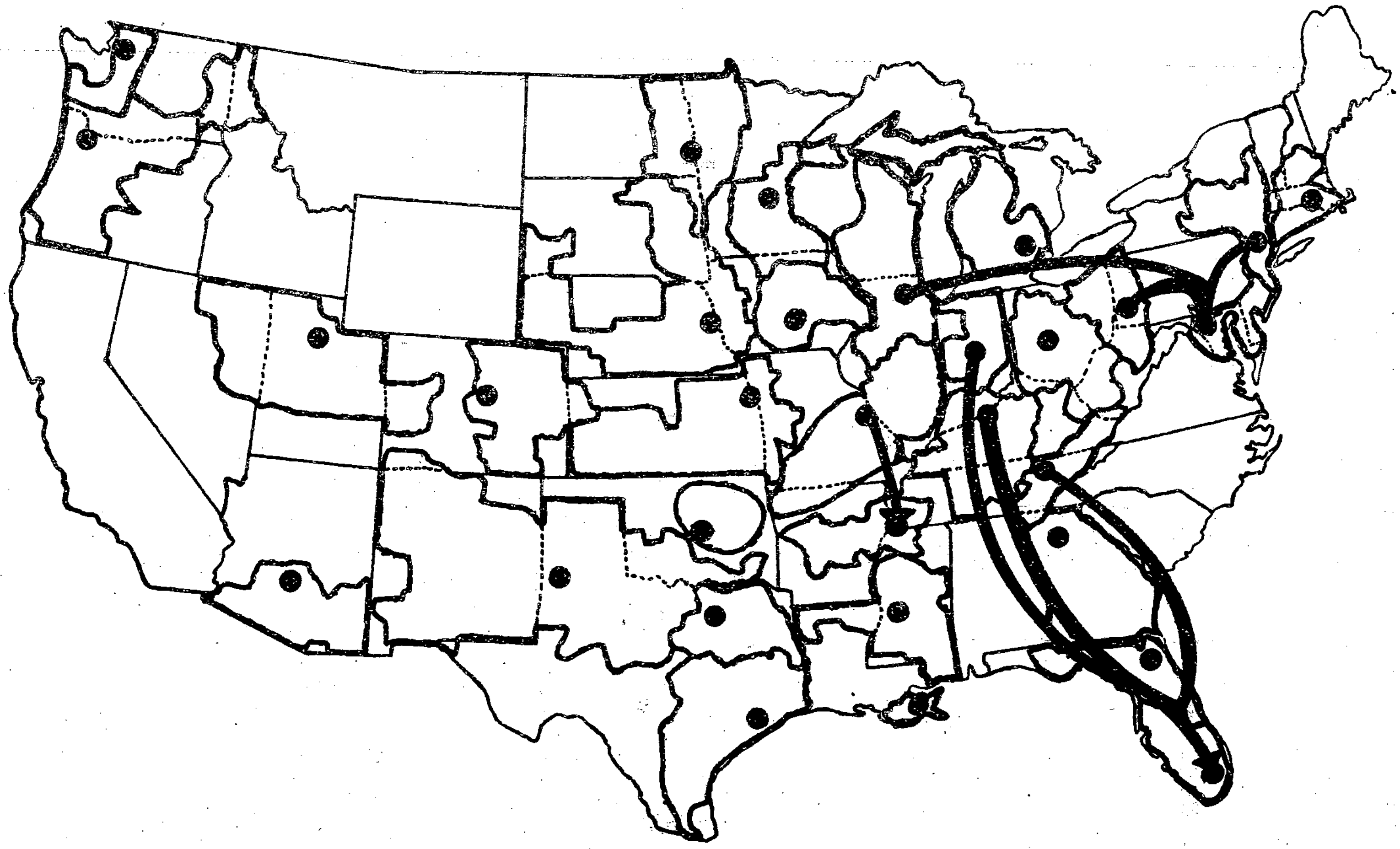

Figure 11. Intermarket Movement Pattern of Fluid Milk -
Model B-1, 1976

utilization than in Model A-1. In addition for all but Region 3, the decline in Class I utilization in Model B-1 over time was greater than the decline in Model A-1.

TABLE XIV

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, U.S. AND REGIONAL AVERAGES - MODEL B-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(percent)		
1	41.7	40.8	39.9	39.7	39.3
2	68.4	66.2	64.4	63.1	61.7
3	58.2	59.2	60.0	60.7	61.0
4	80.4	78.1	76.9	76.1	75.5
5	76.7	73.7	71.3	69.4	67.8
6	59.0	57.9	57.0	56.4	56.0
U.S.	61.0	60.0	59.2	58.7	58.1

Retail, Class I, and Blend Prices

Retail Prices. The U.S. retail price for Model B-1 was $14.23 per cwt. in 1972 and increased 7.4 percent to $15.29 per cwt. by 1976 (Table XV). Consistent yearly price increases were also experienced in each region except Region 1, the Northcentral region of the U.S. In Regions 3 and 6, retail prices increased by more than 10 percent over the study period. In fact, the percentage increases in prices for most all regions were more than double the changes in Model A-1 over the study period.

TABLE XV

RETAIL, CLASS I, AND FARM BLEND PRICES FOR MILK, U.S. AND REGIONAL AVERAGES - MODEL B-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($/cwt.)		
			Retail Prices		
1	14.55	14.32	14.40	14.23	14.59
2	13.56	13.73	13.98	14.19	14.56
3	14.46	14.97	15.30	15.65	16.02
4	15.95	16.12	16.30	16.36	16.63
5	14.28	14.51	14.84	15.18	15.54
6	13.31	13.86	14.18	14.51	14.86
U.S.	14.23	14.48	14.73	14.93	15.29
			Class I Prices		
1	7.55	7.41	7.47	7.37	7.59
2	7.14	7.26	7.42	7.55	7.78
3	7.81	8.14	8.35	8.57	8.80
4	8.33	8.44	8.56	8.60	8.77
5	7.66	7.81	8.02	8.24	8.47
6	7.10	7.46	7.67	7.90	8.13
U.S.	7.55	7.70	7.87	8.00	8.22
			Farm Blend Prices		
1	6.02	6.15	6.29	6.37	6.59
2	6.43	6.58	6.73	6.87	7.08
3	6.61	6.97	7.21	7.44	7.69
4	7.69	7.78	7.87	7.93	8.09
5	7.02	7.14	7.30	7.47	7.66
6	6.21	6.55	6.74	6.95	7.17
U.S.	6.52	6.73	6.90	7.05	7.27

In 1972, the U.S. average retail price was 57 cents per cwt. more than the Model A-1 price. All regions had higher prices in Model B-1 than in Model A-1, but Region 6 had the smallest difference. By 1976, most of the differences in prices between the two models had more than doubled.

Class I Prices. Several of the markets in Model A-1 for 1972 had Class I prices that were less than the Federal order minimum prices. Imposing the 1972 Federal order Class I prices as minimum prices in Model B-1, however, raised the 1972 equilibrium prices in all but four of the markets. Regionally, 1972 Class I prices were from 29 to 46 cents per cwt. higher (Table XV). The U.S. average Class I price increased from $7.19 per cwt. in Model A-1 to $7.55 in Model B-1.

In 1976, only 7 of the 31 markets in Model B-1 had Class I prices greater than the minimum prices allowed. The $8.22 per cwt. price for the U.S. was 8.9 percent greater than in 1972 and represented 53.8 percent of the retail value of the fluid milk. Though the range from low to high price remained about the same, the regions with low and high prices changed over the period. Region 6 had the low price in 1972 while Region 1 had the low in 1976. While region 4 generally had the highest regional Class I price, the highest Class I price in 1976 was $8.80 per cwt. in Region 3.

Blend Prices. Blend prices increased over the study period in all regions and were, on the average, 37 cents per cwt. higher than in Model A-1 (Table XV). The Region 4 blend price was consistently the highest regional price. The Northcentral area had the lowest regional price paid to producers for all the milk sold. In 1972, the Region 1 blend price of $6.02 per cwt. compared with $7.69 per cwt. in Region 4.

<u>Retail and Farm Revenues</u>

With the higher prices, U.S. consumers paid $163.4 million more for their fluid purchases in 1972 and $478.0 million more in 1976 as compared with purchase value in Model A-1 (Table XVI). In Region 3 consumers paid $188.9 million more in 1976 than in Model A-1 but consumed 3.1 million cwt. less milk. Retail values in 1976 had increased less than 5 percent in Regions 4 and 5 but had increased more than 9 percent in Regions 1, 3, and 6 in comparison with comparable values in the base model.

Projected farm value in 1972 was $139.1 million greater under the Federal order structure than in Model A-1 (Table XVI). By 1976 the increase over Model A-1 was $465.5 million and represented more than a 9.0 percent increase in farm income from all milk sales. In 1972 the average increase was only 3.2 percent for each region.

The proportion of the retail sales revenue change received by the farmer was not the same for all regions. In 1972, Region 4 farmers received almost 35 percent more revenue than the increase in consumer spending caused by the minimum price structure. Region 5 also showed a farm-retail revenue change ratio greater than 1.0. In all other regions revenues at the farm level increased less than 100 percent of the indicated 1972 retail revenue changes over Model A-1. Region 3 received only about 70 percent of the change.

By 1976, the ratio of change in farm revenue related to the change in consumer expenditures had increased for all regions. Regions 2, 4 and 5 had ratios greater than 1.0 while Region 3 farm revenue for all milk sales increased 81 cents for each dollar change in revenue from retail fluid milk sales.

TABLE XVI

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL TOTALS - MODEL B-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
			Retail Value of Fluid Milk Sales		
1	824.6	824.0	836.7	837.9	863.5
2	1,877.8	1,907.2	1,944.2	1,977.0	2,023.8
3	1,634.6	1,700.5	1,750.5	1,802.9	1,858.1
4	709.8	729.2	749.3	788.0	791.1
5	510.0	522.5	537.0	552.1	567.7
6	391.2	411.7	427.1	443.4	460.5
U.S.	5,948.1	6,095.0	6,244.8	6,381.3	6,564.7
			Farm Value of All Milk Sales		
1	818.8	870.9	915.4	948.6	997.5
2	1,337.2	1,407.8	1,473.7	1,534.6	1,609.1
3	1,282.9	1,338.3	1,373.5	1,413.0	1,457.1
4	391.2	422.3	449.4	471.2	496.8
5	327.0	349.1	370.2	391.3	412.9
6	309.5	336.1	356.1	376.2	396.8
U.S.	4,466.6	4,724.6	4,938.3	5,734.9	5,370.2

Summary

The Federal order marketing system imposes minimum Class I prices on each of the orders. Model B-1 attempted to simulate these minimum prices over a period of years. As compared with Model A-1, the restricted prices resulted in reduced consumption, increased supply, and higher prices. In addition, the value of the change relative to Model A-1 grew larger over the time span. The equilibrium prices and quantities represented a spatial equilibrium but were inconsistent with a least cost solution. Transportation cost, with smaller quantities moved, was less than in Model A-1. The movement pattern, however, differed significantly from Model A-1.

Region 4 showed the largest supply response. On the demand side the more surplus regions were most affected by the restrictive price structure as the study period progressed. Surplus regions showed large increases in retail prices compared with the deficit Southern markets. The average U.S. blend price in 1976 of $7.27 per cwt. was 54 cents per cwt. higher than projected in Model A-1 and 75 cents per cwt. more than projected in the model for 1972.

Both retail and farm revenues increased in Model B-1 relative to Model A-1. U.S. consumer value increased more than the farm revenue change in comparing the two models. The ratio of farm revenue change to retail revenue change, however, was not less than 1.0 for all regions. In Regions 4 and 5 farm revenue changes consistently exceed retail expenditure changes. The Northeast maintained the lowest ratio.

Uniform Minimum Class I

Prices - Model B-2

Model B-2 paralleled the structural conditions of Model A-1 but incorporated both a uniform minimum Class I price and a uniform minimum Class II price for each year of the period 1972-1976. A 23 percent reserve requirement in each market was maintained and the 1972 data base was the same for both models.

For 1972 an arbitrary uniform minimum Class I price of $7.00 per cwt. was selected.[4] The minimum Class I price for each suceeding year was increased by the same absolute amount of Class II price increase. The minimum price entered each year applied uniformly to all of the 31 study areas.

As in Model B-1, restrictions of a minimum Class I price and a minimum cost flow of product among markets were found to be conflicting requirements in the model for 1974 and the years thereafter. To reach a spatial equilibrium for 1974, 1975, and 1976, quantities were initially subjected to a minimum cost-flow requirement but were allowed to gain final equilibrium solely on the basis of being in price equilibrium.

Supply and Demand Quantities

Supply Quantities. The Model B-2 supply of milk eligible for fluid consumption in the U.S. increased to 737.9 million cwt. in 1976, an increase of 52.7 million cwt. or 7.7 percent over the 1972 supply

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[4]A $7.00 per cwt. price is approximately equal to a simple average of the Federal order minimum class prices for 1972.

(Table XVII). This was greater than the 728.3 million cwt. projected supply for 1976 in Model A-1. With the exception of 1972, all regions in Model B-2 indicated larger production than without the minimum Class I price structure. Four of the regions in Model B-2 indicated supply increases in excess of 10 percent over the study period as compared with only 2 regions in Model A-1 with increases as high as 10 percent. Region 3, the Northeast region, had declining production as all four of the markets comprising the region decreased their supply of milk over the study period (Table LXX, Appendix D). Region 4, the Southeast, again indicated the largest percentage supply gain, 20.0 percent from 1972 to 1976.

Demand Quantities. Effectively higher prices brought a greater supply increase in Model B-2 than in Model A-1, and also resulted in a smaller increase in the demand for fluid milk over the study period (Table XVII). A total of 418.9 million cwt. of fluid milk was consumed in 1972 in Model B-2. By 1976 the consumption had increased to 430.3 million cwt., an increase of 11.4 million cwt. compared with the increase of 19.5 million cwt. in Model A-1. Relative consumption in Model B-2 was also less each year.

Like the U.S. consumption estimates, all regions used less fluid milk under the uniform minimum Class I price and, except for the Southwest region, showed smaller percentage increases in demand from 1972 to 1976. The largest reductions in consumption relative to Model A-1 were in Regions 1 and 2. Region 2 consumers actually decreased consumption over the study period from 139.0 million cwt. in 1972 to 137.7 million cwt. in 1976.

TABLE XVII

SUPPLY AND DEMAND QUANTITIES OF MILK, U.S. AND REGIONAL TOTALS - MODEL B-2, 1972-1976

Region	1972	1973	1974	1975	1976
			(million cwt.)		
			Supply		
1	135.9	141.5	146.0	149.2	152.2
2	207.8	213.7	219.0	223.7	227.9
3	194.2	191.9	190.3	189.1	188.3
4	50.9	54.2	56.9	59.1	61.1
5	46.6	48.9	50.6	51.9	53.2
6	49.8	51.3	52.8	54.0	55.2
U.S.	685.2	701.5	715.6	727.1	737.9
			Demand		
1	56.6	57.1	57.9	58.2	58.4
2	139.0	138.3	138.2	138.0	137.7
3	113.3	114.4	115.7	116.9	117.9
4	44.8	45.6	46.5	47.0	47.8
5	35.7	36.2	36.7	37.1	37.4
6	29.4	29.7	30.2	30.6	31.0
U.S.	418.9	421.5	425.2	427.8	430.3

Intermarket Milk Movement. With the proportionately larger increase in supply relative to the increase in consumption in each market, the amount of milk moved between markets was 4.7 million cwt. in 1972 but declined by 1976 to less than one-fourth of the 1972 movement (Table XVIII). Only the Southeast Memphis, Atlanta, Jacksonville and Miami markets imported milk at any time. All other markets were self-sufficient. The Baltimore market shipped no milk outside of its market. Figure 12 is representative of the fluid milk flow patterns for markets indicating shipments in 1972. In 1973, the pattern was the same as in 1972 with the exception of no shipments from the Columbus, Ohio, market.

In 1974, and thereafter, the deactivation of the least-cost transportation requirement in the model allowed the Chicago and Jackson markets to ship milk in order to obtain price equilibrium (Figure 13). By 1976, however, the Atlanta markets no longer needed an outside supply of milk and Chicago shipped only a small quantity of milk to Memphis. The Central region supplied the major portion of the Southeast needs.

Class I Utilization. Fluid milk utilization of milk supplied was lower in Model B-2 as compared with Model A-1 (Table XIX). Within the study period a sharp 11.4 percent decline in utilization occurred in Region 2. In contrast, the Class I utilization percentage in the Northeast increased from 58.3 percent in 1972 to 62.6 percent in 1976.

Retail, Class I and Blend Prices

Class I Prices. Only two regions in 1972 for Model A-1 had average Class I prices less than $7.00 per cwt. Restricting Class I

TABLE XVIII

EXPORT AND IMPORT QUANTITIES OF FLUID MILK, U.S. AND REGIONAL TOTALS - MODEL B-2, 1972-1976

Region	1972	1973	1974	1975	1976
			(thousand cwt.)		
			Exports		
1	0.0	0.0	1,055.7	583.8	93.9
2	3,498.5	2,020.2	114.2	856.0	927.5
3	0.0	0.0	0.0	0.0	0.0
4	1,243.5	1,338.8	651.2	160.4	17.5
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
U.S.	4,742.0	3,359.0	2,496.9	1,600.2	1,038.9
			Imports		
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	4,742.0	3,359.0	2,496.9	1,600.2	1,038.9
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
U.S.	4,742.0	3,359.0	2,496.9	1,600.2	1,038.9

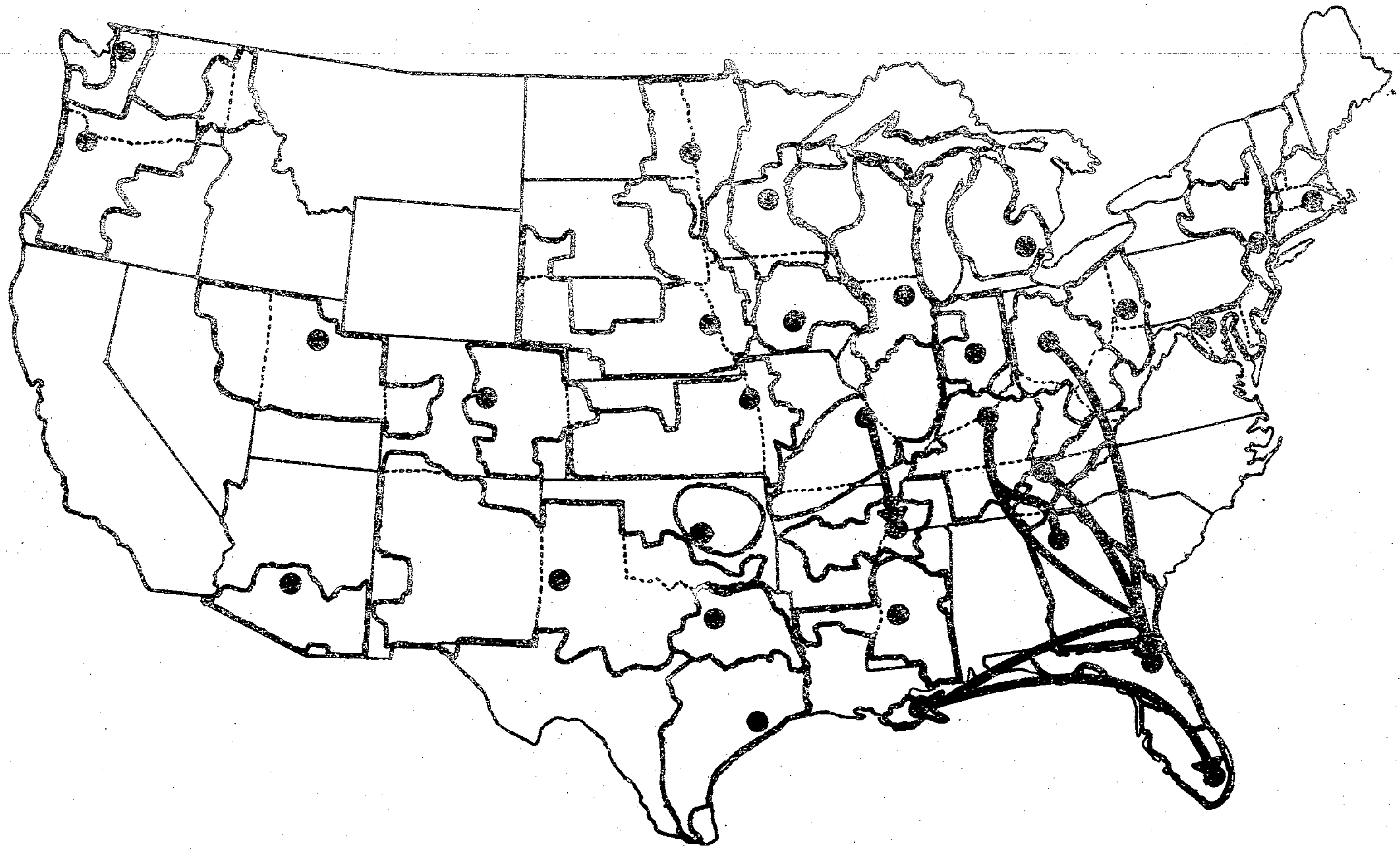


Figure 12. Intermarket Movement Pattern of Fluid Milk - Model B-2, 1972

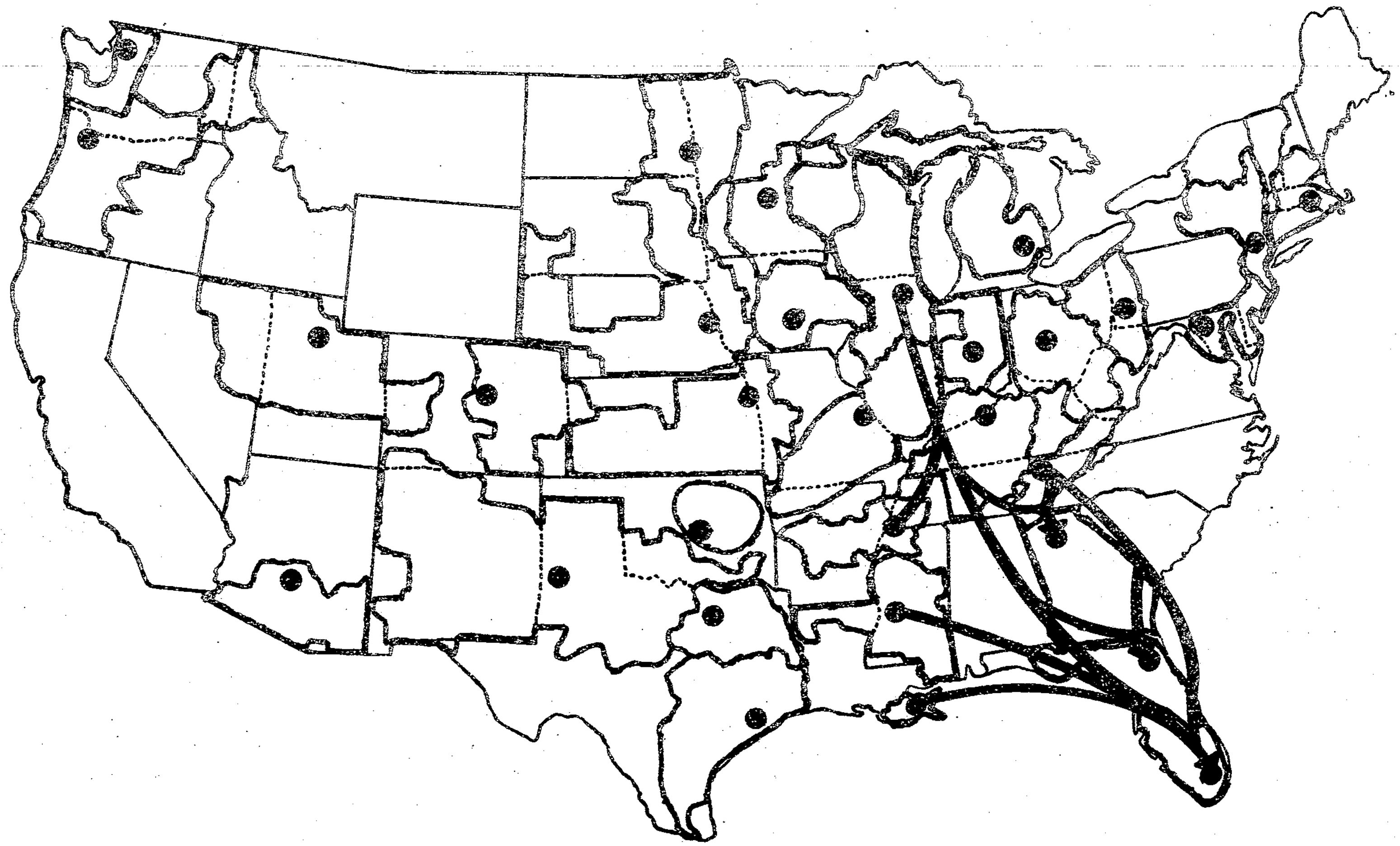


Figure 13. Intermarket Movement Pattern of Fluid Milk - Model B-2, 1974

TABLE XIX

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, U.S. AND REGIONAL AVERAGES - MODEL B-2, 1972-1976

Region	1972	1973	1974	1975	1976
			(percent)		
1	41.7	40.8	39.9	39.7	39.3
2	68.4	66.2	64.4	63.1	61.7
3	58.2	59.2	60.0	60.7	61.0
4	80.4	78.1	76.9	76.1	75.5
5	76.7	73.7	71.3	69.4	67.8
6	59.0	57.9	57.0	56.4	56.0
U.S.	61.0	60.0	59.2	58.7	58.1

prices in all markets in Model B-2 raised not only the 1972 U.S. average Class I price, but also increased the average Class I price in all regions (Table XX). For Model B-2, U.S. Class I price averaged $7.49 per cwt. in 1972, and ranged from $7.07 per cwt. in Region 2 to $8.21 per cwt. in the Southeast.

With an increase each year in the minimum Class I price restriction, the equilibrium U.S. Class I price likewise increased. By 1976, the U.S. average Class I price in Model B-2 was $8.10 per cwt., an increase of 61 cents per cwt. as compared with an increase of $1.02 per cwt. in the minimum prices entered the model. By 1976, only one region, the deficit Southeast, had an average price above the minimum Class I price allowed and the geographic dispersion of prices had been essentially eliminated. In 1972, 20 of the 31 individual market areas, indicated Class I prices in excess of the $7.00 per cwt. minimum Class I price entered. With the minimum price at $8.02 per cwt. in 1976, the number was reduced to 7.

The surplus northern markets experienced large changes in Class I prices over the study period. In Region 1, where Class I prices had declined in Model A-1, the projected 1976 Class I price in Model B-2 was $8.02 per cwt. This was $1.44 per cwt. higher than in Model A-1 and $0.43 per cwt. higher than in Model B-1. The differences for the same period in Region 2 were $1.14 and $0.25 per cwt. respectively. The Class I price changes were $0.35 and -$0.45 per cwt. for the same model comparisons in Region 5.

Retail Prices. Given higher Class I prices, retail prices were also higher (Table XX). U.S. retail price averaged $14.14 per cwt. in 1972 and $15.10 per cwt. in 1976. Regional retail prices ranged

TABLE XX

RETAIL, CLASS I AND FARM BLEND PRICES FOR MILK, U.S. AND REGIONAL AVERAGES - MODEL B-2, 1972-1976

Region	1972	1973	1974	1975	1976
			($/cwt.)		
			Retail Prices		
1	14.58	14.69	14.54	14.89	15.26
2	13.44	13.93	14.26	14.60	14.96
3	14.30	14.45	14.45	14.55	14.79
4	15.75	15.87	15.99	16.32	16.50
5	14.28	14.32	14.39	14.61	14.84
6	13.29	13.76	14.03	14.36	14.71
U.S.	14.14	14.41	14.53	14.80	15.10
			Class I Prices		
1	7.58	7.66	7.57	7.79	8.02
2	7.07	7.38	7.59	7.81	8.03
3	7.71	7.80	7.80	7.87	8.02
4	8.21	8.29	8.37	8.58	8.70
5	7.66	7.69	7.73	7.87	8.02
6	7.09	7.39	7.57	7.79	8.02
U.S.	7.49	7.66	7.74	7.91	8.10
			Farm Blend Prices		
1	6.03	6.25	6.33	6.53	6.74
2	6.39	6.66	6.83	7.01	7.21
3	6.55	6.79	6.90	7.05	7.25
4	7.61	7.70	7.76	7.93	8.05
5	7.02	7.07	7.12	7.26	7.41
6	6.20	6.51	6.68	6.89	7.11
U.S.	6.49	6.71	6.83	7.01	7.20

from 35 to 79 cents per cwt. higher in 1972 than Model A-1 retail prices. For Region 1, the 1972 difference of 79 cents per cwt. increased to a $2.31 per cwt. difference by 1976. Regions 2 and 6 also showed differences in the two models' prices of more than a dollar by 1976. The smallest average change over the study period occurred in Region 5. The uniformity of prices was not as evident at the retail level as at the Class I level although the dispersion among regional retail prices decreased over time. The reason was different rates of markup at the retail sector.

Blend Price. The U.S. average farm blend price in Model B-2 was $7.20 per cwt. in 1976 (Table XX), a 10.9 percent increase over 1972, and a 47 cents per cwt. increase over the 1976 projected blend price in Model A-1. The regional blend prices increased each year but, because of the restricted minimum Class I prices, increased proportionately more in the surplus production regions. The higher blend prices for Model B-2 as compared with Model A-1, resulted in the increased production response discussed earlier.

Total Values and Costs

The inelasticity of retail demand with higher retail prices resulted in increased retail values of fluid milk sales. All regions participated in the increase but the largest increase was $190.6 million for Region 2 to reach $2,059.2 million in 1976. Higher consumer prices combined with increased quantity produced resulted in increasing farm values over the study period also (Table XXI). In 1972, the farm values of all milk sold was $4,444.0 million. By 1976, the figure was $5,314.0 million. With the exception of Region 3 where supply

TABLE XXI

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL TOTALS - MODEL B-2, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
		Retail Value of Fluid Milk Sales			
1	825.6	839.3	841.6	866.3	892.0
2	1,868.6	1,926.5	1,970.6	2,014.2	2,059.2
3	1,620.5	1,653.0	1,672.5	1,701.3	1,744.1
4	706.2	724.4	743.8	767.1	788.5
5	510.0	519.1	528.9	541.6	554.9
6	390.7	409.2	423.4	439.5	456.5
U.S.	5,921.7	6,071.5	6,180.6	6,330.1	6,495.3
		Farm Value of All Milk Sales			
1	820.2	883.9	923.6	974.3	1,026.3
2	1,328.0	1,442.8	1,495.8	1,569.0	1,644.4
3	1,272.6	1,302.6	1,313.2	1,332.7	1,364.6
4	387.0	417.2	441.4	468.7	492.4
5	327.0	345.4	360.3	376.8	393.7
6	309.1	334.0	352.7	372.4	392.7
U.S.	4,444.0	4,706.0	4,886.5	5,093.9	5,314.0

declined, the farm value for each region increased more than 20 percent over the study period. Despite the decreased production in the Northeast, the increase in farm revenue was greater than 7 percent.

Restricting Class I prices did not benefit all regions equally, based on the ratios of changes in farm revenue to changes in consumer value. For example, in 1972, Region 1 consumers spent $33.2 million more for fluid milk in Model B-2 than in Model A-1. Producers, given increased sales of surplus milk and reduced sales of fluid milk at higher prices, saw an increase in revenue of only $26.1 million. The ratios in Regions 2 and 3 were also less than 1.0 with Region 3 producers gaining only 69 cents per dollar of retail expenditure increase. In Region 4, however, the additional dollar spent by consumers for fluid milk generated an additional $1.42 for producers from the sale of all milk. In Region 5, the ratio of change in farm revenue to change in consumer expenditure was not as high, but still exceeded 1.0.

By 1976, the ratio of changes in Model B-2 as compared with Model A-1 was greater for each region than in 1972. In Region 2, producer value of all milk was $167.9 million more than in Model A-1. Since consumers in the region paid $166.1 million more for the fluid milk they purchased, the ratio was slightly above 1.0. The ratios were also above 1.0 for Regions 4 and 5 but less than 1.0 for Regions 1, 3 and 6.

The larger retail values were accompanied by higher service costs (Tables LXXXVI-LXXXVIII, Appendix E). Relative to Model A-1, total processing and transportation costs declined as a result of decreased quantities alone. However, these cost declines were offset by the higher retailing service cost. In final equilibrium, producers received more than 53 percent of the retail value of fluid milk sales.

Summary

Yearly increased uniform minimum Class I prices brought relatively large price increases for both producers and consumers from 1972 to 1976. Over time, however, the regional differences in prices decreased. The deficit Southeast region maintained the highest product prices throughout the study period. Given the price structure, supply increased, and the difference between supply and demand increases each year grew larger.

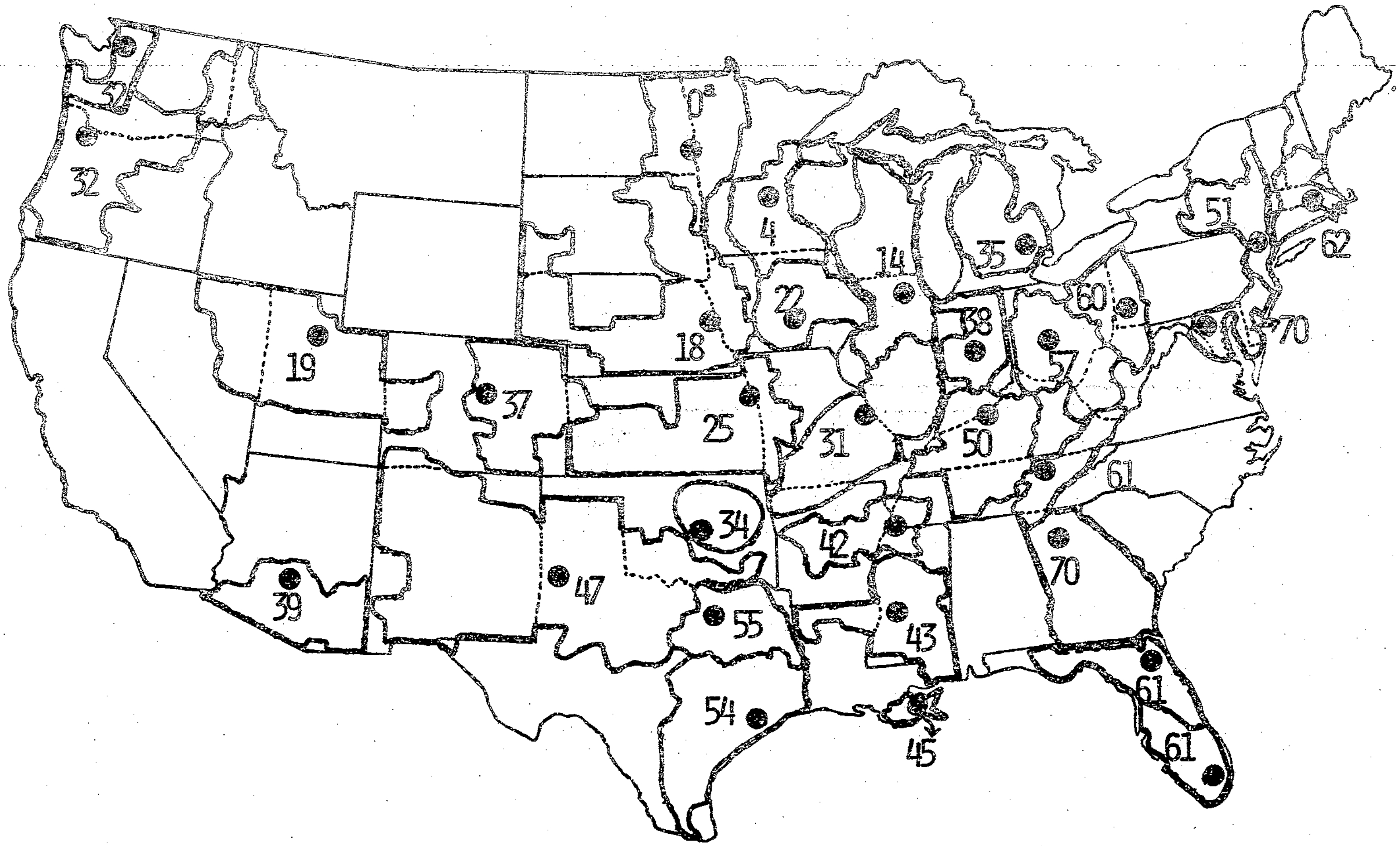
Compared with Model A-1, U.S. prices at all levels of Model B-2 were not only greater, but also showed greater change during the 1972-1976 study period. Producers received increased revenues from increased output and higher prices while consumers demanded less of the product for fluid consumption at the higher prices and paid more for that which they did consume. On a regional basis, those regions of the country that had the lower prices in the base model, showed, under Model B-2, both larger changes in prices and revenues from Model A-1 levels as well as larger changes from 1972 to 1976. Value increases experienced by farmers in Regions 4 and 5 were greater than increased consumer expenditures. Ratios of change in farm value from all milk sales to change in consumer values, compared with comparable values in Model A-1, increased with time.

Minimum Class I Prices Based on Feed Cost - Model B-3

A cost of feed for each market was estimated on the basis of a fixed ration composed of 2.70 tons of 16 percent protein dairy feed plus 3.15 tons of alfalfa hay. A cow fed this ration over a period of one year would be expected to produce 120 cwt. of milk. Prices for the components of the ration were average prices for the years 1968 through 1972. Costs, on a state basis, ranged from $2.03 per cwt. of milk in North Dakota to $2.92 per cwt. of milk in Virginia (Table LV, Appendix A).

The feed cost of milk delivered to each of the Federal order milk markets was calculated by weighting the differences in feed cost from Minnesota for each state from which producers delivered milk to an order by the 1969 proportion of milk received in an order from a state. Order costs were weighted by 1969 deliveries to obtain feed cost differences associated with the markets of this study (Figure 14). Market costs generally increased with distance from the Minnesota-North Dakota area.

To account for the feed cost differences, a minimum Class I price structure was imposed on the dairy industry for the year 1972. The minimum Class I price for each market equalled the 6.37 per cwt. Class I price of Model A-1 for the Fargo market plus the estimated feed cost difference for the specific market as compared with the Fargo market. Seven of the 31 markets had minimum prices based on feed cost differences higher than the equilibrium prices derived in Model A-1 and ten had prices higher than the Federal order minimum prices used in Model B-2.



[a]Model A-1 Class I price was $6.37 per cwt. in the Fargo market.

Figure 14. Market Fixed Ration Cost Differences (cents/cwt.) from the Fargo Market

Supply and Demand Quantities

Imposing on the industry the minimum Class I price structure described above for 1972 resulted in a reduction in U.S. consumption of 4.0 million cwt. of fluid milk to 419.4 million cwt. as compared with Model A-1 (Table XXII). Consumption declines occurred in each region. Region 2, the Central region, had the largest absolute decline of 1.2 million, however, Region 4 showed the largest percentage decline. Little change took place in the West region.

TABLE XXII

DEMAND QUANTITIES OF FLUID MILK, U.S. AND REGIONAL TOTALS - MODEL B-3, 1972

Region	Model B-3
	(million cwt.)
1	56.9
2	139.0
3	113.5
4	44.8
5	35.7
6	29.5
U.S.	419.4

Retail, Class I, and Blend Prices

Retail Prices. The U.S. retail price for fluid milk averaged $14.05 per cwt. under Model B-3 compared with $13.66 per cwt. under

Model A-1 (Table XXIII). Given the decreased consumption, the retail price was also higher for each region. Regional retail prices per hundredweight ranged from $13.12 in Region 6 to $15.78 in the Southeast. Unlike the change in consumption, Region 5 had both the largest absolute and relative increase in retail price.

Class I Prices. The changes in retail prices were reflected in the Class I prices (Table XXIII). All but five of the individual markets had Class I prices higher than the limit imposed (Table LXXIV, Appendix D). With the exception of the Chicago market, Class I prices in Region 1 markets under Model B-3 were projected to be the same as the limit prices for the markets. Class I prices in the Omaha and Denver markets were also at limit level in the model. Model B-3 equilibrium Class I prices did, however, show greater deviation from the minimum prices as distance increased from the central part of the United States.

A Federal order minimum Class I price structure raised the equilibrium Class I prices in all but one region more than did the imposition of minimum Class I prices based on feed cost differences. The Southwest region with a Class I price of $7.66 per cwt. had the same Class I price and quantity consumed as in both Models B-2 and B-1. Class I prices in Model B-3 were as much as 14 cents per cwt. lower than Class I prices in Model B-1. The Model B-3 U.S. average Class I price of $7.43 per cwt. compared with U.S. acreage Class I prices of $7.55 per cwt. in Model B-1 and $7.19 per cwt. in Model A-1.

Blend Prices. Farmers benefited from increased retail prices as the blend price rose to $6.45 per cwt. in Model B-3 (Table XV). Blend prices in Regions 4 and 5 of $7.63 and $7.02 per cwt. respectively

TABLE XXIII

RETAIL, CLASS I, AND FARM BLEND PRICES FOR MILK, U.S. AND REGIONAL AVERAGES - MODEL B-3, 1972

Region	Model B-3
	($/cwt.)
Retail Prices	
1	14.32
2	13.41
3	14.18
4	15.78
5	14.28
6	13.12
U.S.	14.05
Class I Prices	
1	7.41
2	7.05
3	7.64
4	8.23
5	7.66
6	6.98
U.S.	7.43
Farm Blend Prices	
1	5.97
2	6.37
3	6.51
4	7.63
5	7.02
6	6.14
U.S.	6.45

represented increases of more than 3.5 percent over Model A-1. Although other regional prices increased, the change was not as great as for the Southeast and Southwest markets.

Retail and Farm Revenues

Increased blend prices for all milk, given the minimum Class I price structure based on feed costs, resulted in U.S. farmers receiving \$94.6 million more for all the milk they sold in 1972 as compared with Model A-1 (Table XXIV). Consumers, on the other hand, spent \$108.1 million more for the lesser quantity of milk they consumed. In Regions 4 and 5, farmers gained in revenue more than consumers had to pay with the higher prices in the market. In Region 4, farm revenue of \$387.9 million was \$14.5 million more than the revenue derived without the Class I price restrictions and \$4.3 million more than the change in consumer value. At the other extreme, Northeast consumers paid \$28.4 million more for fluid milk consumed in Model B-3 but farm revenue increased only \$19.8 million or about 70 cents for each dollar increase in expenditure at the retail level.

Summary

Conditions prevalent in the general equilibrium model were inconsistent with estimated costs of production among markets based on a fixed ration feed cost. Imposing a minimum Class I price structure which incorporated differences in ration costs resulted in decreased consumption with higher prices faced by both consumer and producer. For the U.S. as a whole, the increased outlay for the product by the consumer was greater than additional revenue gained at the production level.

TABLE XXIV

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL TOTALS - MODEL B-3, 1972

Region	Model B-3
	($ million)
Retail Value of Fluid Milk Sales	
1	815.1
2	1,864.6
3	1,609.6
4	706.8
5	510.0
6	386.6
U.S.	5,892.8
Farm Value of All Milk Sales	
1	811.4
2	1,324.5
3	1,265.2
4	387.9
5	327.0
6	306.1
U.S.	4,422.1

From a regional standpoint, the major proportional changes occurred in the two southern regions. Over 40 percent of the U.S. consumption decline took place in the Southeast and Southwest regions. Proportional price changes were also relatively higher in most cases than for the other regions. Only in these two regions did the additional farm revenue associated with higher blend prices surpass the additional revenue generated at the retail level from the sales of fluid milk.

Summary

Three alternative pricing policies were discussed in this chapter. Each model imposed a minimum restriction on the Class I price for each market. In Model B-1, minimum Class I prices resembled the present Federal order price structure. Model B-2 assumed a uniform minimum Class I price. Differences in feed costs were the basis for the minimum prices imposed in Model B-3. Model B-3 simulated only 1972 data while the other models used a 1972-1976 study period.

Minimum prices imposed generally were higher than equilibrium prices generated in the general equilibrium model. As a result, equilibrium prices under the models also were higher. Over the study period supply increased proportionately more than consumption increased. The demand changes were, however, much less than the yearly changes in demand quantities given the unrestricted Class I prices.

Model B-1 indicated equilibrium regional prices that were significantly larger than equilibrium prices developed in Model A-1. In fact, the differences in prices between the two models grew even larger over the time period. Compared with Model B-2, retail prices in Model

B-1 for Regions 1 and 2 were lower while for the remaining regions equilibrium prices were higher for most of the study years. U.S. average retail and blend prices were higher in Model B-1 than in Model B-2 which accounted for slightly more consumption but less production with uniform minimum Class I prices as compared to consumption with the simulated Federal order structure.

Compared with Model A-1, the uniform minimum Class I price structure of Model B-2 raised the prices by 1976 to both consumer and producer proportionately more in the West, Northcentral, and Central study regions. With the exception of Region 4, 1976 regional Class I prices were all essentially equal to the minimum Class I price imposed. In 1972, Model B-2 indicated the largest retail price changes in Regions 1 and 5 relative to Model A-1.

Model B-3 for the single study year had a larger consumption than either of the other models considered in the chapter, but still 4.0 million cwt. less than Model A-1. With the exception of Region 4, prices at each level of Model B-3 were lower than or equal to prices of Model B-2. All Model B-3 prices were lower than or equal to prices under Model B-1 for 1972. Blend and retail prices for Region 5 were the same for all three models.

In all three models, consumers paid more for the fluid milk they consumed. Farmers, in turn, received more for the milk they sold. Generally, farm revenue increased by more than a dollar for each dollar change in consumer expenditure in Regions 4 and 5. Regions 1, 3 and 6 had a ratio of farm to retail value change of less than 1.0 in comparing the changes with Model A-1. Region 3 had the lowest ratio. The ratio in Region 2 varied about the 1.0 level over the period.

CHAPTER VII

ALTERNATIVE INDUSTRY STRUCTURES FOR THE FLUID MILK INDUSTRY

The growth of the cooperative element in marketing, new methods of retailing, increased efficiency in handling facilities, technological advances at the production level, and changes in consumer preference are but a few of the changes that have been occurring in the fluid milk industry. In this chapter three basic changes in structure are considered. First, in Model C-1 a smaller reserve requirement is permitted to be effective. Second, in Model C-2 the effect of a uniform percentage retailing cost for all markets is evaluated. Third, in Models C-3 and C-4 the transportation rate structure is allowed to change. The results from each model were compared with equilibrium under Model A-1.

A Utilization Limitation Based on Daily Reserves - Model C-1

There are definite patterns of seasonality in the consumption of fluid milk and in the production of milk. Several of the Federal orders have attempted to lessen this divergence in seasonal production and consumption through seasonal pricing patterns or supply and demand price adjustments to producers in accordance with the relationship of supply and demand. Seasonal base plans[1] have also been used to help match the flow of milk produced with the flow of milk consumed at the retail level in fluid form.

Even with success in solving the seasonal production consumption dilemma, there would remain the problem of the large daily variation in fluid milk purchases. The weekend is a peak buying time with peak sales on Saturday at 116.2 percent of the average daily sales during the week (Table L, Appendix A). There is little possibility of adjusting the production schedule to meet this type of daily variation. Some adjustment can be achieved by storage of bulk milk or packaged milk or both. A 12.6 percent reserve of milk to meet short term variations would be consistent with meeting peak sales from inventories averaged over a two-day period. Reserves at this level would require about half as much milk in reserve as is necessary to accomodate the 23.0 percent reserve for both daily and seasonal variations used in the other models. Model C-1 examined the effects on the industry of having to maintain this smaller average reserve, i.e., of permitting no more than 88.8 percent of the fluid eligible milk produced to actually be used for packaged fluid products. The study period was for the years 1972 through 1976.

Supply and Demand Quantities

Regional supply and demand quantities for Model C-1 are presented in Table XXV. For the U.S., changing the utilization limitations on

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[1]The milk base plan is basically a marketing quota system. Producers sell milk specifically for fluid use according to the amount of "base" they hold.

TABLE XXV

SUPPLY AND DEMAND QUANTITIES OF MILK, U.S. AND REGIONAL TOTALS - MODEL C-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(million cwt.)		
			Supply		
1	135.9	140.6	143.9	146.5	148.6
2	207.8	213.3	218.0	221.9	225.3
3	194.2	192.0	190.3	189.1	188.3
4	50.9	53.7	56.3	58.2	59.8
5	46.6	48.4	50.1	51.5	52.6
6	49.8	51.0	52.2	53.4	54.3
U.S.	685.2	699.1	710.7	720.6	728.9
			Demand		
1	57.6	58.7	59.3	60.1	60.9
2	140.2	141.0	141.9	142.9	143.9
3	113.1	114.5	115.8	117.2	118.5
4	46.5	46.9	48.6	49.6	50.6
5	36.3	36.5	36.8	37.4	38.0
6	29.7	30.2	30.5	31.1	31.6
U.S.	423.3	427.8	433.0	438.2	443.5

the markets had little apparent effect on either the rate of change in quantities over the study period or in the absolute value of the quantities in relation to Model A-1. Aggregate demand and supply projections deviated in the two models by less than 1 million cwt. On the average, U.S. fluid consumption represented about 61 percent of the total supply. Regionally, the quantities supplied and demanded changed at about the same rates and reached about the same levels as in Model A-1.

In 1972, with the lower reserve requirement, only 3,118.8 thousand cwt. of milk needed to be moved (Table XXVI). This quantity represented less than 1 percent of the milk consumed. Exporters were the New Orleans, Louisville, Knoxville, and Kansas City markets with the two Florida markets, the Atlanta market, and the Memphis market as the recipients (Table LXXII, Appendix D). From 1973 through 1976, the deficit demand markets remained the same with the exception of the Atlanta market which became self-sufficient in 1976. The primary exporting markets from 1973-1976 were St. Louis and Knoxville with quantity moved declining each year. By 1976, only 1,073.5 thousand cwt. of fluid milk moved across market boundaries at a cost of $1.4 million, less than 0.05 percent of total service costs in the industry.

Class I utilization changed very little with the new reserve requirement with the exception of Region 4. The deficit Southeast region had an average increase in Class I utilization of 5.5 percentage points as compared with Model A-1. For the region, 82.8 percent of the milk supplied was used for fluid products in 1976 in Model C-1.

TABLE XXVI

EXPORT AND IMPORT QUANTITIES OF FLUID MILK, U.S. AND REGIONAL TOTALS - MODEL C-1, 1972-1976

Region	1972	1973	1974	1975	1976
			(thousand cwt.)		
			Exports		
1	0.0	15.0	0.0	0.0	0.0
2	1,962.2	1,925.3	1,754.8	1,293.2	1,073.5
3	0.0	0.0	0.0	0.0	0.0
4	1,156.6	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
U.S.	3,118.8	1,940.3	1,754.8	1,293.2	1,073.5
			Imports		
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	3,118.8	1,940.3	1,754.8	1,293.2	1,073.5
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
U.S.	3,118.8	1,940.3	1,754.8	1,293.2	1,073.5

Retail, Class I, and Blend Prices

Retail Prices. The retail prices were higher in Model C-1 for the higher utilization rate but differed from Models A-1 by no more than 20 cents per cwt. in any one year. In 1975, for example, the U.S. retail price was $13.81 per cwt. only 4 cents per cwt. higher than the $13.77 per cwt. reported for Model A-1. In Model C-1, the U.S. retail price in 1972 averaged $13.76 per cwt. (Table XXVII). A peak U.S. price of $13.82 per cwt. was reached in 1974 with the price declining one cent per year for the next two years.

On a regional basis, the higher utilization limit showed its major impact on Regions 3 and 4. In the Southeast, individual markets had more of their own milk available to fulfill the large demand requests. In addition, more milk was also available to be transported from the nearby Knoxville market at a lower cost than transporting milk into the Southeast from the Louisville market. As a result, prices in Region 4 remained about the same during the study period but were lower than projected in Model A-1. The 1972 regional price of $14.85 per cwt. increased to $14.93 per cwt. The 1976, Region 4 retail price projected for Model A-1 was $15.68 per cwt. The higher utilization rate (lower reserve requirement) also brought less dispersion in prices among regions.

For Region 3, and Region 2 to a much lesser extent, prices were generally higher for Model C-1 as compared with Model A-1. Again, the increased availability of milk in the Southeast, as well as from markets near the Southeast region, made the Northeast region no longer a potential supplier of milk to the deficit areas in achieving a least

TABLE XXVII

RETAIL, CLASS I AND FARM BLEND PRICES FOR MILK, U.S. AND REGIONAL AVERAGES - MODEL C-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($/cwt.)		
			Retail Prices		
1	13.69	13.16	13.22	13.07	12.93
2	13.12	13.17	13.22	13.24	13.25
3	14.45	14.38	14.42	14.41	14.41
4	14.85	15.17	14.83	14.88	14.93
5	13.80	14.13	14.28	14.28	14.28
6	12.63	12.78	13.29	13.29	13.29
U.S.	13.76	13.77	13.82	13.81	13.80
			Class I Prices		
1	7.03	6.71	6.74	6.65	6.57
2	6.87	6.90	6.94	6.95	6.95
3	7.80	7.76	7.78	7.78	7.78
4	7.66	7.86	7.66	7.69	7.73
5	7.35	7.56	7.66	7.67	7.67
6	6.67	6.77	7.10	7.11	7.11
U.S.	7.25	7.26	7.29	7.29	7.28
			Farm Blend Prices		
1	5.82	5.88	6.01	6.10	6.20
2	6.25	6.37	6.44	6.51	6.60
3	6.60	6.76	6.89	7.00	7.10
4	7.31	7.46	7.30	7.36	7.42
5	6.82	7.00	7.09	7.13	7.19
6	5.97	6.17	6.44	6.53	6.63
U.S.	6.36	6.49	6.59	6.67	6.76

cost solution. Consequently there was no impetus to reduce price in the region.[2] A slight decrease in price over the study period arose in Region 3 from the relative demand and supply conditions in the region.

Class I and Blend Prices. The changes that occurred in retail prices carried to the farm level as refelcted in both Class I and blend prices (Table XXVII). Although Region 4 was able to use more of its production for the higher priced fluid market than was the case in Model A-1, the inealsticity of fluid demand actually resulted in less revenue in 4 of the 5 study years from all milk sold. Region 4 consumers in 1976 valued fluid usage at $755.3 million, $17.2 million less than in 1976 under Model A-1 (Table XXVIII). As a result, 1976 farm blend price in the region at $7.42 per cwt. was 28 cents per cwt. lower with the lower reserve requirement. Farmers in Region 4 received in 1976, $443.9 million or $18.5 million less than for the same period in Model A-1. Farmers absorbed the increased cost of processing the larger quantity of milk. The decrease in farm revenue derived in the region was less in the earlier study years of the period.

Compared with Model A-1, Region 1 blend price declined as a result of the price declines in Region 4. With a geographic pricing pattern evident in the industry, the lower price in Region 4 kept producers in Region 1 from moving milk into Region 4. Instead, the fluid milk was placed on the local market and thus, decreased the

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[2]See the "Limitations" section of Chapter III for a description of the process that reduces prices if a market is a potential exporter during the iterative process for model equilibrium.

TABLE XXVIII

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL TOTALS - MODEL C-1, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
		Retail Value of Fluid Milk Sales			
1	788.2	772.8	783.9	785.5	787.3
2	1,838.5	1,857.1	1,877.1	1,891.8	1,906.0
3	1,633.8	1,646.7	1,670.0	1,688.7	1,708.2
4	690.0	712.1	720.5	737.5	755.3
5	500.7	515.1	526.1	534.4	542.8
6	374.7	385.4	405.3	412.7	420.3
U.S.	5,826.0	5,889.1	5,982.6	6,050.6	6,119.9
		Farm Value of All Milk Sales			
1	791.0	827.1	865.0	894.2	922.0
2	1,298.8	1,358.1	1,404.4	1,445.5	1,485.1
3	1,282.3	1,298.3	1,311.1	1,323.2	1,337.1
4	371.9	400.6	410.9	428.2	443.9
5	317.4	339.1	355.4	367.5	378.2
6	297.2	314.8	335.9	348.3	359.9
U.S.	4,358.6	4,538.0	4,682.8	4,807.0	4,926.2

price in Region 1.

In the Northeast, higher prices created a slight decline in consumption relative to Model A-1 but resulted in consumers paying in 1976, $39.0 million more for a smaller quantity or a total of $1,708.2 million (Table XXVIII). With a farm value of $1,337.1 million, the farm blend price increased, relative to the prices derived given a higher reserve requirement.

The magnitude of increases in the U.S. blend price was not the same as for retail or Class I price changes. The U.S. blend price increased at most 8 cents per cwt. in any one year over Model A-1. For Model C-1, a U.S. blend price of $6.59 per cwt. in 1974 compared with $6.51 per cwt. in Model A-1 for the same year (Table XXVII). In 1975, the U.S. average blend prices in Models C-1 and A-1 were $6.67 and $6.65 respectively.

Summary

The change in reserve requirements for markets from 23 percent in Model A-1 to 12.6 percent in Model C-1 had no major effect on prices, production or consumption for the U.S. Aggregate prices and revenues were only slightly higher in Model C-1 compared with Model A-1. This was not true on a regional basis, however. The increased availability of milk in each market for fluid purposes allowed consumption to increase in the already deficit markets at accompanying lower prices. Markets in regions generally supplying the deficit markets had slightly higher prices. The inelasticity of demand resulted in revenues from sales of milk moving in the same direction as price changes. Thus, the lost revenue sustained by farmers in the Southeast was transferred as additional revenue primarily to farmers in the Northeast with some spinoff to farmers in the Central region. Conversely, reduced consumer value of fluid milk in the Southeast came at the expense of higher prices to consumers in the Northeast and Central regions of the U.S.

Uniform Retailing Cost Markup - Model C-2

Changes in the methods of distribution of the packaged product to the consumer have occurred in the fluid milk industry. Once dominant, the door to door delivery has given way to distribution by convenience stores, grocery markets, self-service vendors, and gasoline stations. Without regard to firm numbers, the varied, alternative methods of distribution would seem to indicate increased competition for the consumers' business among the retailing enterprises. Price is an obvious means of competition, barring government, state, or local retail price restrictions. A major factor in setting retail price is the level of retailing cost established. With government intervention in the pricing system, it is quite possible that the rate of markup be given the restricting role.

To evaluate the effects of changing toward the use of a uniform percentage of retail price for the retailing cost function, Model C-2 was tested. A uniform 36.69 percent retailing markup for all markets was assumed. This percentage represented a simple average of the percentage markups given in Table LIV, Appendix A. The regional percentages ranged from about 35.0 percent to 38.5 percent. Given a uniform restricted markup of 36.69 percent, Regions 1 and 4 with average costs in excess of 38.0 percent and Region 6 with a 35.4 percent markup would be expected to make the most noticeable changes during the study period. The study time period of 1972-1976 was used with Model A-1 as a basis for comparison of results.

Supply and Demand Quantities

Supply Quantities. The quantity supplied for the U.S. increased from 685.2 to 728.4 million cwt. (Table XXIX). Quantities in both Models A-1 and C-2 were similar. Quantities increase in most regions but various differences were noted between the models. The largest supply change of 0.4 million cwt. occurred in Regions 5 and 6 for 1976 as compared with similar estimates for Model A-1. Regional supply projections of 52.0 and 53.9 million cwt. respectively were lower than in Model A-1. All other regions showed less than a 0.5 percent increase in quantity supplied for any one year compared with the base model.

Demand Quantities. Compared with Model A-1, no noticeable changes in quantities consumed occurred in Region 6 (Table XXIX) for any year. Slight increases, however, were observed in Regions 1 and 4. In Region 4, demand was 46.1 million cwt. in 1972 and increased to 49.6 million cwt. in 1976. This compared with consumption of 45.8 and 49.3 million cwt. for the same two years in the model based on the nonuniform markup. Other regions presented no consistent directional changes in consumption under the Model C-2 restriction.

Intermarket Milk Movement. With the exception of the Jacksonville market in 1976, deficit markets in Model C-2 were the same as in Model A-1 but were supplied in a somewhat different manner. The exporting markets are shown in Table LXXVII, Appendix D. The Jackson, Mississippi,

TABLE XXIX

SUPPLY AND DEMAND QUANTITIES OF MILK, U.S. AND REGIONAL TOTALS - MODEL C-2, 1972-1976

Region	1972	1973	1974	1975	1976
			(million cwt.)		
			Supply		
1	135.9	140.6	144.3	146.9	149.1
2	207.8	213.3	218.1	222.0	225.3
3	194.2	191.8	189.9	188.6	187.8
4	50.9	54.0	56.5	58.5	60.3
5	46.6	48.3	49.8	51.0	52.0
6	49.8	51.0	52.1	53.1	53.9
U.S.	685.2	699.1	710.8	720.1	728.4
			Demand		
1	57.9	58.6	59.5	60.2	60.9
2	140.3	141.0	142.2	142.9	143.7
3	113.3	115.2	116.2	117.2	119.2
4	46.1	47.1	48.1	49.0	49.6
5	36.2	36.5	37.0	37.5	38.1
6	29.6	30.1	30.6	31.1	31.6
U.S.	423.4	428.4	433.6	437.9	443.1

market was an importing market in 1972 but an exporting market over the remainder of the study period. The Indianapolis market likewise assumed more than a supplementary role. Total movement of milk was only slightly larger than in Model A-1 for all years but 1974, where movement was 3,898.2 thousand cwt. compared with 3,938.6 thousand cwt. in Model A-1.

Retail, Class I, and Blend Prices

Retail Prices. The U.S. retail price in 1972, averaging $13.70 per cwt., declined in 1973 and 1974, jumped to $13.78 per cwt. in 1975, but declined to $13.72 by 1976 (Table XXX). Region 1 had a decline in retail price each year over the study period while retail prices in Regions 4, 5, and 6 moved in the upward direction. Regions 2 and 3 indicated periods of rising prices but also some years where retail prices declined relative to the previous year. In 1972, consumers in the West paid the lowest price for milk. By 1976, the Northcentral buyers paid the lowest price. The deficit Southeast market continued to be the highest priced retail market.

In comparing Model A-1 and Model C-2, Region 6 had to adjust most to an increased retailing cost, yet, retail prices projected in Model C-2 differed little from those projected in Model A-1. In fact, no change in Model C-2 prices compared with Model A-1 prices were shown in 1974-1976 with only a 2 cents per cwt. change in the other two years of the study. In Region 5, where markup averaged 35.9 percent in Model A-1, prices with the 36.69 percent markup were higher the first two years but as much as 5 cents per cwt. lower in 1975 and 1976.

TABLE XXX

RETAIL, CLASS I, AND FARM BLEND PRICES FOR MILK, U.S. AND REGIONAL AVERAGES - MODEL C-2, 1972-1976

Region	1972	1973	1974	1975	1976
			($/cwt.)		
			Retail Prices		
1	13.36	13.29	13.03	12.95	12.91
2	13.05	13.18	13.11	13.16	13.22
3	14.32	13.92	14.17	14.38	13.98
4	14.98	15.01	15.05	15.19	15.44
5	13.84	14.06	14.11	14.23	14.24
6	12.87	13.01	13.14	13.21	13.30
U.S.	13.70	13.66	13.69	13.78	13.72
			Class I Prices		
1	7.00	6.97	6.80	6.75	6.72
2	6.82	6.89	6.86	6.89	6.92
3	7.66	7.41	7.56	7.70	7.44
4	8.01	8.03	8.05	8.14	8.31
5	7.26	7.41	7.43	7.52	7.52
6	6.67	6.75	6.84	6.89	6.94
U.S.	7.23	7.20	7.22	7.28	7.24
			Farm Blend Prices		
1	5.81	5.99	6.04	6.14	6.27
2	6.23	6.37	6.40	6.48	6.58
3	6.52	6.57	6.76	6.95	6.90
4	7.47	7.49	7.54	7.65	7.80
5	6.74	6.89	6.94	7.04	7.10
6	5.96	6.15	6.28	6.40	6.53
U.S.	6.34	6.45	6.54	6.66	6.73

A Region 5 price of $13.84 per cwt. in 1972 compared with a Model A-1 price of $13.69 per cwt. For the two regions with markups of 38.0 percent or more in Model A-1, retail prices with a lower percentage markup were noticeably less. Region 4 had a price of $15.19 per cwt. in 1975, 44 cents per cwt. less than the price projected in Model A-1. In Region 1, a price reduction of 43 cents per cwt. was indicated in the 1972 price of $13.36 per cwt. A $12.91 per cwt. price in Region 1 of Model C-2 in 1976 compared with the $12.95 of Model A-1. Region 1 prices did not decline over the study period as much in Model C-2 as they did in Model A-1.

Class I Prices. In comparison with Model A-1, Class I price changes were unlike retail price changes. With a higher retail cost markup but little change in retail prices, Class I prices in Region 6 had to decline. Prices of $6.67 per cwt. in 1972 and $6.94 per cwt. in 1976 were 14 and 18 cents per cwt. lower than Model A-1 projections. A similar situation occurred with respect to Region 5. Region 3, with a 36.2 percent markup in Model A-1, had an increase of 22 cents per cwt. in the 1972 Class I price but indicated a decrease of 9 cents per cwt. in the 1976 price.

The lower retail prices for Regions 1 and 4, compared with Model A-1, were not sufficient to cause a downward change in Class I prices for each year. In Region 4, with the exception of a 2 cents per cwt. decrease in price for 1975 to $8.14 per cwt., Class I prices were higher than in Model A-1. The $8.01 and $8.31 per cwt. Class I prices were 13 and 12 cents per cwt. higher than Model A-1 prices for 1972 and 1976 respectively. For Region 1, the 1972 price was $7.00 per cwt. in Model C-2, 9 cents per cwt. lower than the Model A-1 projection. For subsequent years, prices were at least 4 cents per cwt. higher in Model C-2 than in Model A-1, except for 1975. Region 1 Class I price in Model C-2 was $6.72 per cwt. in 1976.

Blend Prices. U.S. average blend price in 1972 was $6.34 per cwt. and increased to $6.73 per cwt. in 1976 (Table XXX). The increasing Class II price restriction served to increase the blend prices in both Regions 1 and 3 over the period despite the declining retail and Class I prices in those regions. Region 3 did, however, indicate a price of $6.90 per cwt. in 1976, a 5 cents per cwt. decline from 1975. All other regions showed price increases each year. From 1972 to 1976 increases ranged from 9.6 percent in Region 6 to 4.4 percent in Region 4.

Comparing blend prices under a uniform retailing cost markup restriction with Model A-1, blend prices in Region 6 were 10 cents per cwt. lower for 4 of the 5 study years and 9 cents per cwt. lower for 1972. Blend price was $6.15 per cwt. in 1973 and $6.53 per cwt. in 1976. Region 5 price reductions ranged from 3 cents per cwt. in 1972 and 1973 to 10 cents per cwt. in 1975 and 1976. Average blend price for Region 5 in 1976 was $7.10 per cwt.

For the two regions with relatively lower markups in comparison with Model A-1, blend prices in Region 4 were higher than in Model A-1 by 10 cents per cwt. or more in 1972 and 1976. Model C-2 blend price for Region 4 in 1972 was $7.47, 13 cents higher than the $7.34 per cwt. price in Model A-1. For 1973 and 1974, Model C-2 prices in Region 4 of $7.49 and $7.54 per cwt. were higher by 5 and 8 cents per cwt. respectively. Projected prices were equal in 1975 under the 2 models. In Region 1, however, prices were both higher and lower than in Model A-1. The change in either direction was relatively small with the largest change of 6 cents per cwt. occurring in 1976 when the projected blend price was $6.27 per cwt. for Model C-2 and $6.21 per cwt. for Model A-1.

Retail and Farm Revenues

Retail Values. The consumer value of milk in Model C-2 as compared with comparable values for Model A-1, showed the same directional change as was exhibited by the changes in the retail price structure. In Region 1, the retail value of fluid milk at $773.2 million was $19.2 million less than the value in Model A-1 (Table XXXI). Region 1 consumer value reductions of $10.0 million or more were in fact observed in each of the first 4 study years. In Region 4, the reduction was $5.7 million or more each year, a somewhat lesser percentage decline than for Region 1. Region 4 consumer value was $723.9 million in 1974 compared with $731.9 million in Model A-1.

In Region 3, the largest projected increase in revenue occurred as compared with Model A-1. In fact, each penny per hundredweight change in retail price resulted in about a $1 million change in retail sales value. Consumer expenditure was estimated to be $1,665.4 million in 1976 for Model C-2 compared with $1,669.2 million in Model A-1. In 1972, the Region 3 retail value in Model C-2 was $1,621.9 million or $40.7 million more than in Model A-1 for the same period.

Farm Values. U.S. farm receipts for all milk sold increased from $4,343.3 million in 1972 to $4,904.2 million in 1976 (Table XXXI). For

TABLE XXXI

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL TOTALS - MODEL C-2, 1972-1976

Region	1972	1973	1974	1975	1976
			($ million)		
		Retail Value of Fluid Milk Sales			
1	773.2	778.5	775.0	779.8	786.4
2	1,831.8	1,857.2	1,865.1	1,880.8	1,900.1
3	1,621.9	1,603.7	1,645.9	1,685.6	1,665.4
4	690.9	707.0	723.9	743.6	766.4
5	501.4	513.5	522.4	533.4	541.9
6	380.7	391.0	401.5	410.7	420.6
U.S.	5,799.7	5,850.9	5,933.8	6,033.9	6,080.8
		Farm Value of All Milk Sales			
1	790.2	841.9	871.1	902.3	934.3
2	1,295.7	1,358.7	1,396.2	1,438.6	1,482.4
3	1,266.4	1,259.9	1,284.4	1,310.9	1,295.6
4	379.9	404.4	426.0	448.0	470.3
5	314.1	332.7	345.5	358.9	369.4
6	297.0	314.0	327.7	339.9	352.2
U.S.	4,343.3	4,511.6	4,651.0	4,798.7	4,904.2

the years 1972-1975 farm receipts were projected to be slightly higher than expected receipts without the uniform retail cost markup restriction. Farm receipts for Regions 1 and 4 changed in the opposite direction of the retail revenue changes in comparison with Model A-1. For Region 4 the average increased value paid to farmers each year was $5.6 million dollars or about a 1.3 percent increase over value received in Model A-1. Farm revenue was $379.9 million in 1972 and $470.3 million in 1976 for Region 4. For Region 1 the average increased value each year was somewhat less. The 1973 revenue of $841.9 million was $2.5 million greater than in Model A-1. With little change in retail sales value of the fluid milk for Regions 5 and 6 but increased retailing cost, farm value for all milk sold decreased. In Region 6, a $7.2 million reduction in 1975 farm value from Model A-1 made Model C-2 farm value $339.9 million. Regions 2 and 3 showed both increased and reduced revenues in accordance with the change in farm blend prices experienced.

Retailing Costs

The 1976 retailing cost associated with each region is shown in Table LXXXVIII, Appendix E. Since there was little change in prices or quantities at the aggregate level and Model A-1 aggregate percentage markup differed little from the uniform markup of Model C-2, U.S. retailing costs were quite similar in Models A-1 and C-2. Regionally, costs increased or decreased, compared with Model A-1, according to the increase or decrease in retail markup percentage for the market. In Region 6 for 1976, cost at $201.0 million was $5.6 million higher than in Model A-1, but was at \$354.1 million or \$14.9 million lower in Region 4 for the same period.

Summary

Imposing a uniform retailing cost markup margin on all markets as compared with existing margins affected both consumers and producers. In Regions 5 and 6 where the uniform markup of 36.69 percent was relatively higher than under existing pricing arrangements, consumers saw little change in consumption or retail prices. Producers absorbed most all of the increased cost in reduced revenues received for the milk sold. In Regions 2 and 3, where a small increase in percentage markup was imposed, rather wide ranging price increases and decreases occurred at the consumer level. Directional changes in these two markets, in most every case, were also carried to the producer level.

In Regions 1 and 4, where retail markup cost was relatively less with the uniform markup scheme, retail prices showed marked declines in each year relative to Model A-1. Gains for the consumers in terms of decreased revenues expended for fluid milk purchased were not passed to the producers. The decreased retailing cost allowed producers to also show gain in terms of increased revenue received for all milk sold.

Alternative Transportation Rate Structures -

Models C-3 and C-4

One of the frequently stated transportation charges among industry personnel is 15 cents per cwt. per 100 miles one-way distance. This compared with the declining per hundredweight cost function entered for Model A-1, i.e., increased one-way distance hauled reduced the per hundredweight cost. For example, in Model A-1 the per hundredweight per 100 miles cost was 40.7 cents for a 100 mile haul and 18.3 cents for a 1,000 mile haul. For Model C-3, a cost function was entered of the form:

$$T_{ij} = .0015M_{ij} \quad (i = 1,2,\ldots,m,\ j = 1,2,\ldots,n - 1) \qquad (7.1)$$

where:

T_{ij} = transportation cost ($ per cwt.) for moving milk between supply area i and demand market j; and

M_{ij} = one-way mileage between i and j.

Equation 7.1 replaced equation 4.3 in Model A-1. Model C-4 allowed no transportation of fluid milk among markets. Each market was completely independent of all other markets.

Model C-3 with the 15 cents per cwt. per 100 mile charge represented the changing technology in the transportation sector that has allowed milk to flow economically and with safety among markets. It is the sector of the fluid milk industry that has contributed to making the industry one of great interdependence. Changing the transportation cost structure revealed the sensitivity of the industry to change in this sector. The effects were contrasted with Model A-1. The year 1972 served as the study period.

Demand Quantities

Model C-3. A 15 cents per cwt. per 100 miles uniform transportation cost in Model C-3 was lower than the applicable rates of Model

A-1. As a result 1972 U.S. consumption increased 0.9 million cwt. to 424.3 million cwt. (Table XXXII). The increase came as a result of increases in consumption of 0.7 and 0.5 million cwt. in the Southern Regions 4 and 5 respectively. Region 3, the Northeast, had a slight decline in consumption from 114.0 to 113.7 million cwt. with the change in the transportation rate structure. All other regions showed no change in fluid milk consumed.

TABLE XXXII

DEMAND QUANTITIES OF FLUID MILK, U.S. AND REGIONAL TOTALS - MODELS C-3, AND C-4, 1972

Region	Model C-3	Model C-4
	(million cwt.)	
1	57.5	58.4
2	140.2	140.3
3	113.7	113.1
4	46.5	40.0
5	36.9	35.7
6	29.6	29.6
U.S.	424.3	417.1

The intermarket movement of milk increased in Model C-3 compared with Model A-1 (Table XXXIII). A movement of 7,102.0 thousand cwt. of milk was transferred among markets with the 15 cents per cwt. per 100 miles rate structure compared with 5,653.0 thousand cwt. in Model A-1.

In Model C-3, more of the regions indicated intramarket transfers. The largest quantities of milk moved interregionally, however.

TABLE XXXIII

EXPORT AND IMPORT QUANTITIES OF FLUID MILK, U.S. AND REGIONAL TOTALS - MODEL C-3, 1972

Region	Model C-3
	(thousand cwt.)
	Exports
1	0.0
2	4,188.0
3	1,545.2
4	1,196.1
5	111.9
6	60.7
U.S.	7,102.0
	Imports
1	0.0
2	601.9
3	0.0
4	6,327.5
5	172.7
6	0.0
U.S.	7,102.0

By far the largest flow of milk was into Region 4. The flow originated primarily in Regions 2 and 3. The flow pattern of milk is shown in Figure 15. Quantities of fluid milk imported and exported by individual markets are given in Table LXXVII, Appendix D. The

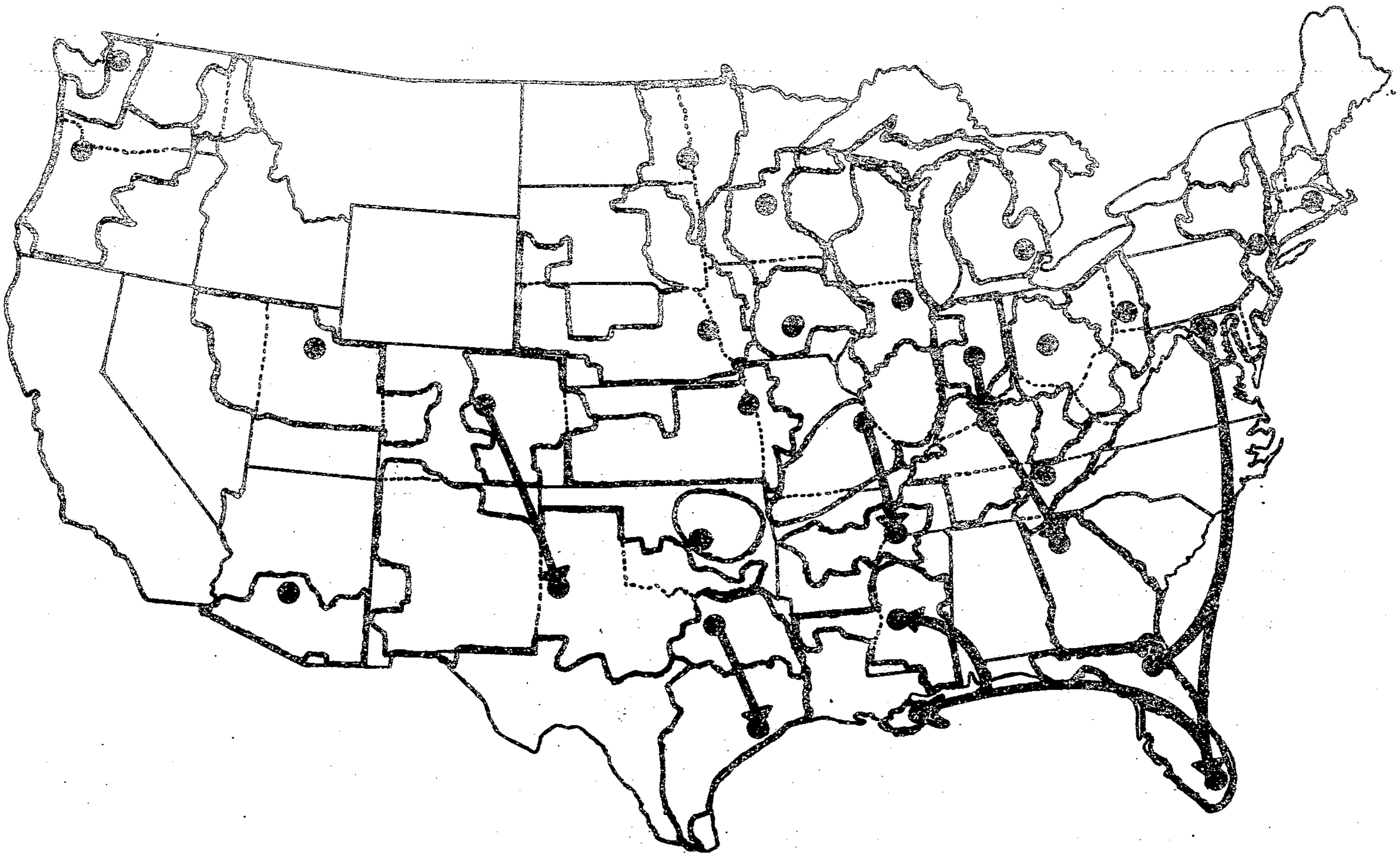

Figure 15. Intermarket Movement Pattern of Fluid Milk - Model C-3, 1972

Louisville market imported from the Indianapolis market in the same region and then exported to Region 4 over 2 million cwt. of fluid milk.

Model C-4. Consumption with no movement of fluid milk allowed was 417.1 million cwt., over 6 million cwt. less than in either Models A-1 or C-3. Fluid consumption represented 60.9 percent of total milk supplied (Table XXXIV). Consumption was slightly higher in Regions 1 and 2, compared with models allowing transportation; less in Regions 3, 4, and 5; and showed no change in Region 6. A fuller explanation of consumption changes for both Models C-3 and C-4 is given in the next section.

TABLE XXXIV

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, U.S. AND REGIONAL AVERAGES - MODEL C-4, 1972

Region	Model C-4
	(percent)
1	43.0
2	67.5
3	58.2
4	78.7
5	76.7
6	59.3
U.S.	60.9

Retail, Class I, and Blend Prices

Model C-3. Only minor changes in price occurred with the imposition of the new transportation rate (Table XXXV). Retail price for the U.S. as a whole declined from $13.66 per cwt. to $13.63 per cwt. The blend price change was in the same direction but only $0.01 per cwt.

The most significant changes in prices occurred in Regions 4 and 5 where retail prices declined 36 cents and 40 cents per cwt. respectively. Region 4 still had the highest consumer prices in the U.S. however. Translating these price changes to the farm level showed a farm blend price of $7.18 per cwt. in Region 4 and $6.59 per cwt. in Region 5. Regions 2, 3, and 6 had price increases, but the increased retail prices in Regions 2 and 6 were not enough to have a noticeable affect on consumption in the regions.

With a lower transportation cost it was unnecessary to maintain as high a price in Region 4 to meet the deficit market demand. The lower price in the region increased consumption. In the process of minimizing the cost of obtaining the extra milk needed, the lower transport cost made it unncecssary that prices in the potential export markets, i.e., Regions 2 and 3, be pulled downward as much by the iterative process of the model. The second factor that helped increase the prices in the two primary exporting regions was the increased exports, which left less milk in the regions to meet their own demands.

Model C-4. With no movement of milk between markets, the U.S. average retail price in Model C-4 was $14.00 per cwt. with a comparable farm blend price of $6.44 per cwt. (Table XXXV). Regionally, the largest price change occurred in the deficit Southeast region where retail

TABLE XXXV

RETAIL, CLASS I, AND FARM BLEND PRICES FOR MILK, U.S. AND MARKET AVERAGES - MODELS C-3, AND C-4, 1972

Region	Model C-3	Model C-4
	($/cwt.)	
	Retail Prices	
1	13.74	12.86
2	13.12	13.05
3	14.02	14.45
4	14.85	18.30
5	13.29	14.28
6	12.91	12.90
U.S.	13.63	14.00
	Class I Prices	
1	7.06	6.52
2	6.87	6.83
3	7.53	7.80
4	7.66	9.77
5	7.03	7.66
6	6.85	6.84
U.S.	7.17	7.40
	Farm Blend Prices	
1	5.83	5.62
2	6.26	6.21
3	6.46	6.60
4	7.18	8.74
5	6.59	7.02
6	6.07	6.07
U.S.	6.31	6.44

price was $18.30 per cwt., $3.45 per cwt. higher than for Model C-3. With no forced least cost movement of milk out of the Northeast, higher prices were indicated for both producers and consumers. In fact, in both Regions 3 and 5 of Model C-4, projected prices were higher than in either Models A-1 or C-3. Blend prices for Regions 3 and 5 were $6.60 and $7.02 per cwt. respectively. In Region 6, the prices at all levels were essentially the same for both Models C-3 and C-4.

Retail and Farm Revenues

The transportation industry saved U.S. fluid milk consumers $54.7 million, comparing the consumer expenditures of $5,839.4 million in Model C-4 and $5,784 million in Model A-1 (Table XXXVI). The movement of milk cost $6,775.9 thousand. In addition, milk movement also brought higher processing costs with the increased quantity of milk processed. Given cheaper consumer prices though, a cost savings was made at the retailing level. With more of the milk used for fluid milk products, less of the supply was available for surplus sales. Consequently, with milk movement permitted, lower retail revenue, reduced revenue from Class II sales, and only a slight decrease in total costs combined to reduce U.S. total farm revenue by $82.7 million.

Allowing milk movement reduced consumer expenditures in Region 4 compared with Model A-1, from $732.4 million to $696.6 million, but reduced producer income by $71.0 million to $373.4 million. A reduction in value of $52.7 million accrued to consumers in Region 3 but resulted in only $37.0 million loss to farmers as producers were able to ship milk to other higher priced regions. Lesser consumer expenditure reductions in Model C-4 occurred in Regions 5 and 6. Consumers

TABLE XXXVI

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL TOTALS - MODELS C-3, AND C-4, 1972

Region	Model C-3	Model C-4
	($ million)	
	Retail Value of Fluid Milk Sales	
1	790.5	750.8
2	1,838.5	1,830.9
3	1,594.7	1,633.9
4	690.0	732.4
5	490.2	510.0
6	381.6	381.4
U.S.	5,785.5	5,839.4
	Farm Value of All Milk Sales	
1	792.6	763.2
2	1,301.0	1,290.5
3	1,255.5	1,282.4
4	365.1	444.4
5	306.8	327.0
6	302.4	302.2
U.S.	4,323.4	4,409.8

in Region 1, however, paid $41.6 million more or $792.4 million for the smaller total quantity of milk they purchased in Model A-1 compared with Model C-4.

Summary

Permitting a transportation sector to work within the fluid milk industry tended to benefit those consumers in the more deficit regions of the country as more milk was consumed at lower prices. Ability to move milk, however, imposed a rather substantial retail price increase in the large fluid milk surplus Northcentral region. What was gain or loss to the consumer had the opposite effect on the producer. Regional inelasticity of demand, utilization of milk for fluid purposes, and costs of services affected the amount of expenditure increase or reduction at the retail level that was passed to the producer. Retailing cost for the U.S. declined and helped contribute to the decline in total expenditures for fluid milk in the U.S., given the freedom of milk movement at a declining per hundredweight per 100 miles cost with longer distances hauled.

With a lower, uniform per hundredweight transportation cost, compared with Model A-1, prices and consumer expenditures decreased in the most Southern and Northern markets. In the primary exporting regions of the country the opposite change in prices and revenues occurred. Gains in revenue by exporting farmers were seen as losses of revenue by the importing farmers. Exporters could move more milk into deficit markets at a lesser per hundredweight and, therefore, total cost.

Summary

In this chapter, a structural change in each of the retailing, transportation, and processing sectors was considered. With the exception of assuming complete independence of markets, little change was observed in the industry considering the U.S. as a whole. On a regional basis though, some structural changes had a marked effect.

Model C-1 imposed a reserve requirement of 12.6 percent as compared with the 23.0 percent requirement of Model A-1. Prices at both the farm and retail levels were reduced in the Southeast but increased in Region 3. The price changes were not uniform over the 1972-1976 study period, however. Other regions had only slight changes during the period. For the U.S., prices were no more than 20 cents per cwt. higher at the retail level for any one year while Region 4 indicated a change of as much as 75 cents per cwt. in retail price.

Model C-2 established a uniform retailing cost markup for all markets. Compared with Model A-1, the Southeast and Northcentral areas had lower retail prices for consumers but higher prices for producers. In the Southwest and West, consumers felt little effect of the markup change. Producers, however, absorbed the increased retailing cost percentage for these markets.

Models C-3 and C-4 changed the transportation rate structure in the fluid milk industry. Allowing milk movement brought substantial savings to the consumers in the U.S. On a regional basis, milk movement increased the price to consumers in the Northcentral region as much of the surplus milk was kept off the local markets. A reduction in the transportation rate raised prices in the primary export regions and allowed more milk to move among markets.

CHAPTER VIII

IMPACTS OF ALTERNATIVE RATES OF CHANGE IN QUANTITIES OF SUPPLY AND DEMAND

Increased technology, changes in the relative prices of resources or products, weather and other short run phenomena, all affect the quantities of goods produced in any one time period. On the other hand, a decline in the rate of population growth, redistribution of income, increased prices of substitute goods, and changes in consumer tastes are factors affecting the quantity of goods demanded in that same time period. Consequently, projected supply or demand for a future period may be too high or too low in light of the conditions that will actually exist.

Percentage Increase and Decrease in Projected Quantities Supplied - Models D-1 and D-2

To test the sensitivity of an equilibrium in the fluid milk industry to deviations from projected supply, supply was alternatively increased and decreased by 5 percent from the projected market quantities in Model A-1. Model D-1 assumed a 5 percent larger supply in 1976 than had been projected. Model D-2 assumed a 5 percent smaller supply in 1976. The changes in supply, however, were not allowed to remove the industry from a relatively surplus situation. That is, the demand for surplus milk was assumed perfectly elastic at a price of $5.95/cwt.

Demand Quantities

An almost negligible effect on consumption of fluid milk products was observed with the changes in the projected quantities of milk supplied (Table XXXVII). With decreased supply in Model D-2, consumption decreased in each region by less than 1.0 million cwt. and by less than 0.5 percent in total. No change in fluid milk products sold occurred in Region 6. With increased supply only Regions 4 and 6 had increased consumption, but, again, no region had either an increase or decrease in demand of more than 1.0 million cwt.

TABLE XXXVII

DEMAND QUANTITIES OF FLUID MILK, U.S. AND REGIONAL CHANGES FROM MODEL A-1 - MODELS D-1, AND D-2, 1976; MODELS D-3 AND D-4, 1973

Region	Model D-1	Model D-2	Model D-3	Model D-4
		(million cwt.)		
1	-0.1	-0.5	-0.2	-1.1
2	-0.1	-0.8	-2.1	-5.5
3	-0.6	-0.5	-0.9	-0.9
4	1.0	-0.4	-1.9	-3.8
5	0.0	-0.1	-0.7	-1.3
6	0.2	0.0	-0.3	-0.8
U.S.	0.5	-2.3	-6.0	-13.3

Intermarket Movement of Milk. With an increased availability of milk in each market, slightly less fluid milk was transported between markets (Table XXXVIII). The flow pattern was the same as in Model A-1 with the exception of the Indianapolis market which no longer exported milk (Table LXXXII, Appendix D). In Model D-2, the aggregate quantity of milk moved increased by 1,910.6 thousand cwt. The change in exports occurred in the markets that were the primary exporters in Model A-1; however, markets in the Southwest and West regions became net importers of milk although quantities imported were only 1.0 and 0.6 percent of the regional demand quantities respectively (Figure 16 and Table LXXXII, Appendix D).

Class I and Blend Prices

Model D-1. The increased supply of milk available in Model D-1 did not result in price declines in all regions (Table XL). Consumers in Regions 1, 2, and 3, faced higher fluid milk prices. The price increase in each region, with perhaps the exception of Region 3, was relatively small but reflected the diminished need for milk to be imported into the deficit markets from nearby surplus areas. The increased availability of milk in the deficit markets was reflected in the 38 cents per cwt. drop in Class I price for the Southeast. The change in supply did not affect Class I price, and therefore, consumer price in the Southwest, Region 5.

At the farm level, decreased Class I utilization (Table XXXIX) of the milk supplied resulted in small or no blend price changes for those regions where the retail price increased. In the remaining regions, blend prices declined as much as 32 cents per cwt. Model D-1 blend price for Region 4 was $7.38 per cwt. as compared with $7.70 per cwt. in Model A-1 for the same year.

TABLE XXXVIII

IMPORT AND EXPORT QUANTITIES OF FLUID MILK, U.S. AND REGIONAL CHANGES FROM MODEL A-1 - MODELS D-1 AND D-2, 1976; MODELS D-3 AND D-4, 1973

Region	Model D-1	Model D-2	Model D-3	Model D-4
		(thousand cwt.)		
		Exports		
1	0.0	0.0	0.0	0.0
2	-711.5	289.1	1,973.8	168.2
3	0.0	0.0	-1,944.8	-772.9
4	0.0	1,621.5	1,099.3	1,060.8
5	0.0	0.0	24.0	222.0
6	0.0	0.0	0.0	125.4
U.S.	-711.5	1,910.6	1,152.4	803.6
		Imports		
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	-711.5	1,366.9	1,109.2	456.2
5	0.0	226.8	24.0	222.0
6	0.0	316.8	19.2	125.4
U.S.	-711.5	1,910.6	1,152.4	803.6

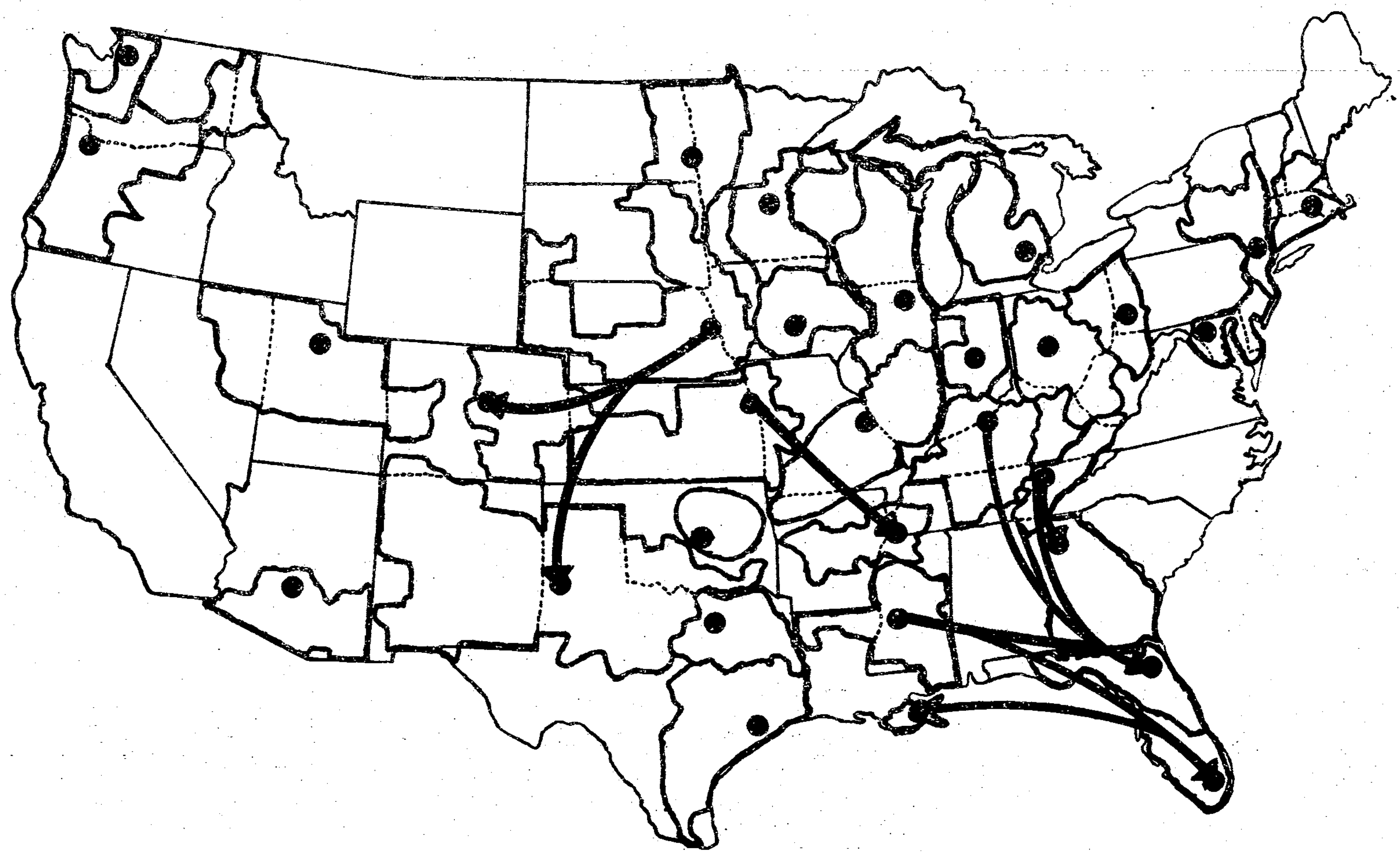

Figure 16. Intermarket Movement Pattern of Fluid Milk - Model D-2, 1976

TABLE XXXIX

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, U.S. AND REGIONAL CHANGES FROM MODEL A-1 - MODELS D-1 AND D-2, 1976; MODELS D-3 AND D-4, 1973

Region	Model D-1	Model D-2	Model D-3	Model D-4
		(percentage points)		
1	-1.0	1.8	2.6	3.3
2	-3.4	3.2	3.8	3.4
3	-3.3	3.1	-0.5	2.1
4	-0.8	4.0	3.2	3.2
5	-3.5	3.1	3.8	4.9
6	-2.4	2.5	2.9	3.8
U.S.	-2.8	2.9	2.3	3.2

Model D-2. The U.S. average Class I price increased 16 cents per cwt. to $7.41 per cwt. with the 5 percent smaller supply projection for 1976 (Table XL). Only in the Northcentral and Northeast regions did the increase in Class I price for the region exceed the national average price change. In Regions 4 and 6, Class I prices of $8.29 per cwt. and $7.14 per cwt., respectively, represented small price changes relative to the size of the price changes indicated for the regions in Model D-1.

The blend price in the Northeast region increased 21 cents per cwt. in Model D-2 (Table XL). In the Southern and Western regions, the blend price change for each region was greater than the change in Class I price. All regional blend prices in the model, however, represented less than a 3.5 percent increase in price over the blend prices reported in Model A-1.

TABLE XL

CLASS I AND FARM BLEND PRICES OF MILK, U.S. AND REGIONAL CHANGES FROM MODEL A-1 - MODELS D-1 AND D-2, 1976; MODELS D-3 AND D-4, 1973

Region	Model D-1	Model D-2	Model D-3	Model D-4
		($/cwt.)		
		Class I Prices		
1	.03	.27	.11	.62
2	.05	.13	.34	.94
3	.25	.24	.38	.38
4	-.38	.10	.66	1.29
5	.00	.06	.36	.71
6	-.25	.02	.34	1.15
U.S.	.03	.16	.35	.77
		Farm Blend Prices		
1	.00	.12	.66	1.45
2	.00	.12	.60	1.32
3	.10	.21	.63	1.04
4	-.32	.14	.78	1.47
5	-.06	.10	.57	1.06
6	-.17	.04	.65	1.53
U.S.	-.01	.14	.63	1.27

Retail and Farm Revenues

Model D-1. Retail values changed, with the 5 percent reduction in supply, in the same direction as retail prices changed (Table XLI). The U.S. total retail revenue of $6,114.6 million, however, was only $27.9 million more than projected for the same period in the base model.

U.S. farm revenue, however, at $5,135.7 million was $231.0 million greater than in Model A-1. The increased quantity of milk sold by each region was more than enough to offset the price declines. In the Southeast where blend price decreased the most, farm revenue increased by $3.1 million.

Model D-2. Regional retail revenue changes were small and none were proportionately more than the 2.6 percent increase in consumer expenditure in Region 1. The small increase in retail revenue in each region, was not enough to offset the effect of the 5 percent lower production as farm revenue in each region decreased. Therefore, the West region had the largest percentage decline, 4.4 percent. The smallest change of 2.2 percent occurred in the Central region, Region 2.

Summary

In a relatively surplus situation, 5 percent changes in the level of supply had only minor effects on the projected equilibrium conditions. Increased supply brought increased prices to the Northern regions. Total consumer expenditure increased as did farm revenue in Model D-1.

Model D-2 with its 5 percent decrease in supply, indicated increased fluid milk movement into the Southwest and West regions.

TABLE XLI

RETAIL AND FARM REVENUES DERIVED FROM MILK SALES, U.S. AND REGIONAL CHANGES FROM MODEL A-1 - MODELS D-1 AND D-2, 1976; MODELS D-3 AND D-4, 1973

Region	Model D-1	Model D-2	Model D-3	Model D-4
		($ million)		
		Retail Value of Fluid Milk Sales		
1	2.2	20.8	7.9	41.8
2	11.0	19.3	48.6	130.7
3	39.2	37.1	56.9	56.9
4	-14.1	3.0	17.6	31.2
5	0.0	1.9	10.8	21.0
6	-10.4	0.7	12.5	42.2
U.S.	27.9	82.7	154.3	323.9
		Farm Value of Fluid Milk Sales		
1	46.0	-28.6	33.9	107.2
2	73.3	-49.0	46.6	143.5
3	84.7	-28.4	97.5	129.4
4	3.1	-15.2	5.0	25.4
5	15.6	-13.9	3.9	15.0
6	8.4	-16.0	13.4	44.7
U.S.	231.0	-151.3	200.1	465.1

Prices generally increased but, with a decreased quantity of milk to be sold in each region, farm revenue declined.

Percentage Changes in Quantities of Fluid Milk Demanded

Models in which the 1976 demand functions for each market were increased and decreased 5 percent were also used to test the sensitivity of the industry. Regional prices derived in the models, however, were essentially identical to those derived in Models D-1 and D-2. A 5 percent increase in demand was equivalent to a 5 percent decrease in supply for each market. Likewise, the spatial equilibrium prices with a 5 percent decrease in demand were equal to the regional retail, Class I, and blend prices in Model D-1 where supply had been increased 5 percent. Given the similarity of results, the models with the demand changes are not reported separately in this study.

Percentage Decreases in Quantities Supplied Models D-3 and D-4

It is possible that equilibrium in the fluid milk industry under relative surplus conditions would be vastly different from equilibrium under relative scarcity conditions. Short run shortages have prevailed in the past and 1973 was a current example. The 1973 projected supply of fluid eligible milk in the U.S. under Model A-1 was 699.0 million cwt. But, in 1973, producers encountered high feed prices and in some key milk producing areas, poor quality roughages. In addition, the price of beef was much higher than it had been in previous years. Each of these conditions contributed to a sharp decline in milk production for the year to result in a scarcity environment. In this environment, the demand for fluid milk and the demand for manufactured milk products both contributed to forcing changes in prices.

In Model D-3, the fixed supply entered for the 1973 study year was 3 percent less than the supply of fluid eligible milk in 1972. The reduction was comparable to an approximately 5 percent reduction from projected 1973 supply in Model A-1. Model D-4 assumed an additional 3 percent reduction in 1973 supply. Model D-4 supply was 6 percent below 1972 supply, or approximately 8 percent under projected 1973 supply in Model A-1.

To account for the assumed shortage situation in both models, the price of Class II or surplus milk was considered a function of quantity of surplus milk available. A -0.49 farm equivalent price elasticity of demand for surplus milk was used in deriving the functional relationship.[1] The estimated 1973 aggregate farm surplus demand function was:

$$P_n = 11.4720 - 382.9282\ (10^{-8})\ X'_n \qquad (8.1)$$

where:

X'_n = the excess milk (cwt.) in the system exclusive of the 23 percent required reserves.[2]

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[1]The farm surplus price elasticity of demand and surplus demand equation was derived from data presented by Blakley [7, pp. 10-12] under the assumption of a constant per unit marketing margin.

[2]The derived P_n reflected the presence of the required reserves of surplus milk in the system.

Demand Quantities

With reduced supply, consumption of fluid milk in Models D-3 and D-4 was reduced. Deviations in consumption quantities from Model A-1 are shown in Table XXXVIII. The 6.0 million cwt. reduction in Model D-3 brought total U.S. consumption to 422.1 million cwt. in 1973, a 1.4 percent reduction from projected 1973 fluid usage in the base model. The additional 3 percent reduction in supply more than doubled the decline in U.S. demand for the same period.

On a regional basis, the Central region in both models had the largest absolute reduction in consumption, but Region 4 had the largest percentage reduction. The respective declines for Model D-4 were 5.5 million cwt. in Region 2 and 3.8 million cwt. in Region 4. No change in consumption was indicated for Region 3 for the additional supply restriction. All other regions generally showed at least twice as large a decline in consumption for an 8 percent decline in 1973 projected supply as for the 5 percent supply change. As a reflection of the different environment, the net 5 percent reduction in supply under an elastic demand for manufactured products brought regional consumption changes that were, with the exception of Region 1, less than the changes that occurred with the 5 percent reduction in supply under the inelastic demand for manufactured products (Models D-2 and D-3).

Intermarket Movement of Milk. The quantity of milk moved between regions and markets increased with the reduction in supply for each model (Table XXXVIII). In 1973, Region 3 exported less milk while markets in Regions 2 and 4 exported more. With additional reductions in supply, increased interregional movement of milk occurred in the

the Southwest and West. The intermarket movement of milk decreased with the additional 3 percent supply reduction in Model D-4 as compared with Model D-3. The higher prices caused lower consumption and, in some regions, the decline was enough to cause imports to decrease.

Individual market quantities exported and imported in Models D-3 and D-4 are given in Table LXXXII, Appendix D. The patterns of flow for each model are shown in Figures 17 and 18. Directions of flows were generally the same for each model. A change in direction associated with milk imported into the Denver market did, however, occur in Model D-4.

Class I Utilization. The changes in regional Class I utilization for the supply reductions are shown in Table XXXIX. Only Region 3 in Model D-3 had a slight decline in the utilization rate. In the other regions, utilization of milk for fluid products increased from 2.1 to 4.9 percentage points. Class I utilization for Region 4 was at the maximum 81.3 percent allowed for both Models D-3 and D-4.

Class I and Blend Prices

Class I Prices. With both levels of decreased production, U.S. average Class I prices were higher (Table XL). The 35 cents per cwt. increase in Model D-3 over Model A-1 raised the 1973 Class I price to $7.55 per cwt. in the U.S. The U.S. Class I price increased to $7.97 per cwt. for Model D-4.

Regional Class I prices increased in the two models. The Southeast had the largest percentage changes over Model A-1, 8.3 and 16.1 percent respectively. Like changes in consumption, the majority of the regional Class I price changes in Model D-4 were generally double the

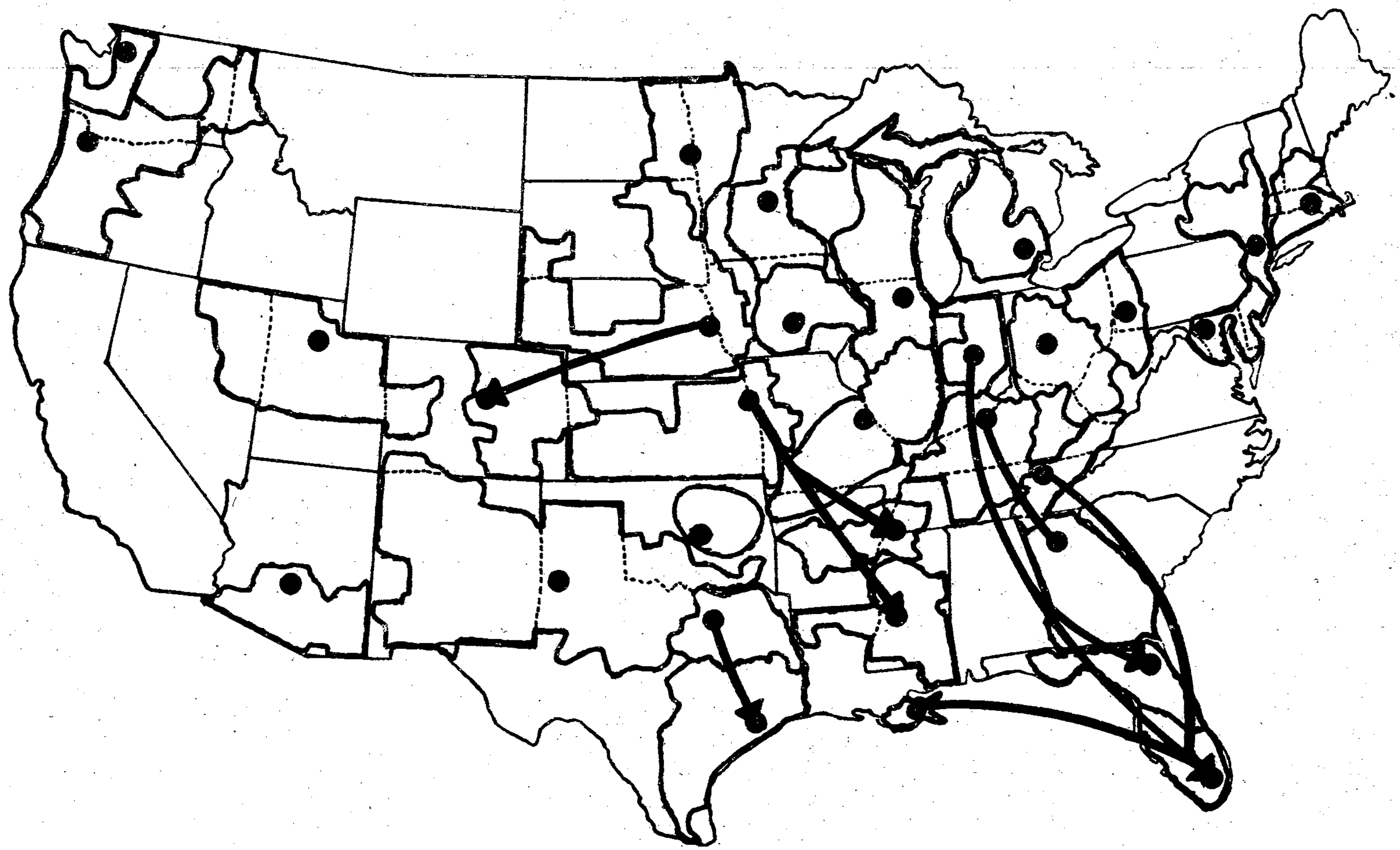

Figure 17. Intermarket Movement Pattern of Fluid Milk - Model D-3, 1973

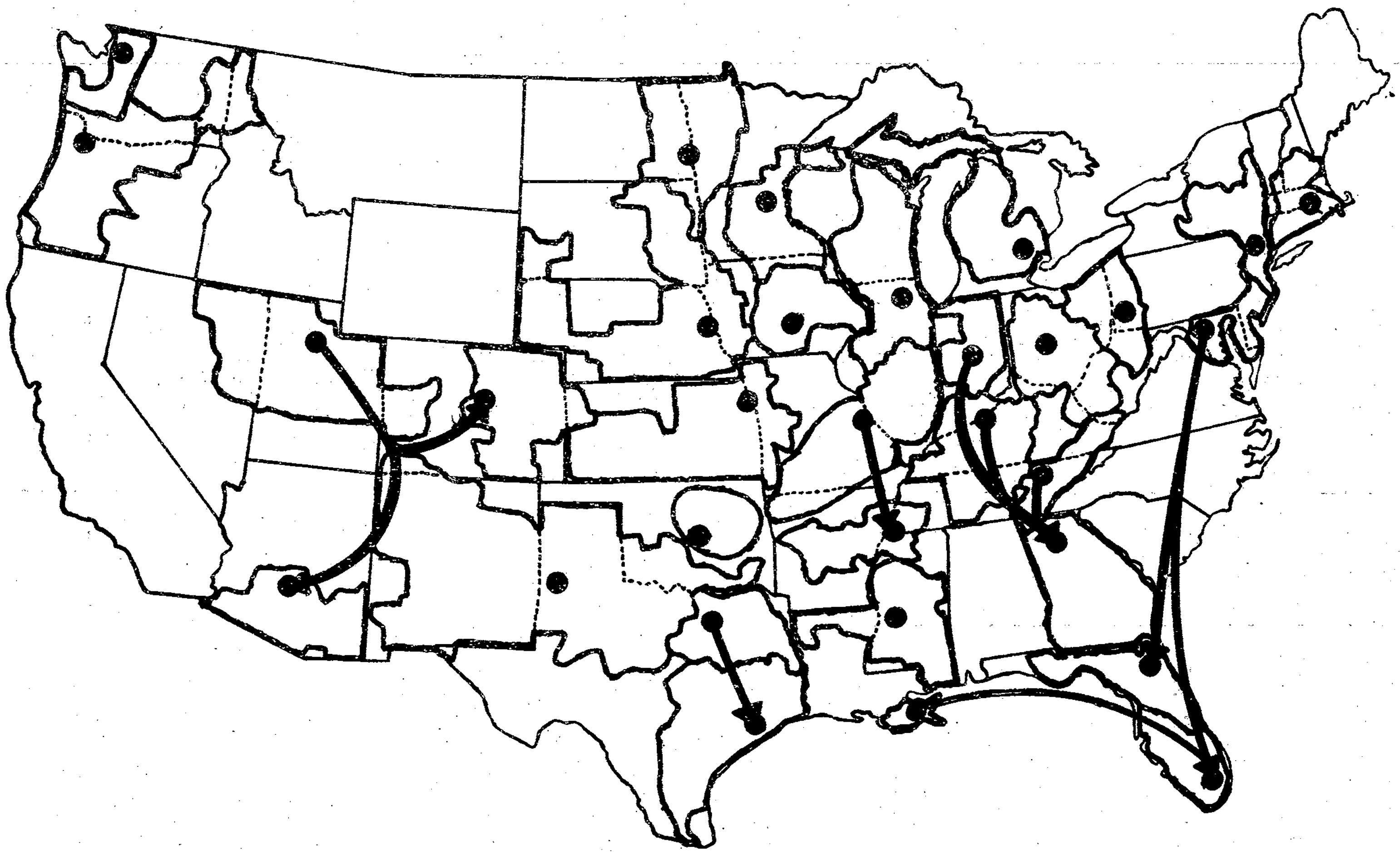

Figure 18. Intermarket Movement Pattern of Fluid Milk - Model D-4, 1973

changes in Model D-3 despite the less than double decline in production for the two models.

Blend Prices. Blend prices also increased in both Models D-3 and D-4 (Table LXI). The changes were 63, and 127 cents per cwt. respectively for the U.S. For Model D-4, farm blend prices increased in a manner that for Regions 1, 2, and 3, prices differed from each other by no more than 25 cents per cwt. A major factor in the level of Class I and blend prices in Models D-3 and D-4 was the level of Class II price in each model. For Model D-3 the supply reduction raised Class II price to $6.30 per cwt. from the basic support price of $5.29 per cwt. Class II price was an additional $1.00 per cwt. higher in Model D-4 at $7.30 per cwt. As a result of both increased Class I and Class II prices, blend price changes for the 1973 models were as much as 6 times greater than the comparable changes in Class I prices.

Retail and Farm Revenues

Retail Revenues. With increased retail prices and an inelastic retail demand, the total retail value of consumer expenditures for fluid milk products increased (Table LXII). The $154.3 million increase in total U.S. expenditures in Model D-3 over the 1973 base value brought total spending to $6,007.2 million.

Region 3 led retail revenue changes with a 3.6 percent increase in Model D-3. The change was only 1.0 percent in the Northcentral region for Model D-3. In Model D-4, the West region had the largest percentage increase over Model A-1.

Farm Revenues. The aggregate farm revenue in Models D-3 and D-4 increased by more than the increase in consumer expenditure as the increased Class II prices more than offset the effect of lower quantities produced. For Model D-3, the Southeast, Southwest and Central regions indicated larger consumer expenditure changes than changes in farm revenue. The same held true given the additional supply reduction of Model D-4, with the exception of Region 2. Region 3 experienced the largest percentage increase in farm revenue in Model D-3. In Model D-4, the West region showed a 14.0 percent increase in farm revenue compared with Model A-1.

Summary

Reductions in the quantity of milk supplied by each market raised the market prices in the industry. The percentage changes in retail prices were generally less than the percentage change in quantities supplied in Model D-3. A rather marked increase in prices, however, was noted at the farm level in both Models D-3 and D-4 as increased Class II prices helped offset the quantity reductions in supply. Consequently, revenues derived at both the retail and farm levels increased. Additional uniform percentage reductions in supply had a more than proportional effect on equilibrium conditions.

Summary

The fluid milk industry was examined at different levels of supply and demand for a single time period. Models D-1 and D-2 represented a 5 percent increase and decrease respectively in each market supply quantity for the year 1976. The industry was assumed to be governed in such a manner that the Class II surplus milk price remained constant regardless of the supply change.

Models D-3 and D-4 allowed supply in 1973 to decrease 3 and 6 percent respectively below the 1972 supply, or approximately 5 and 8 percent below projected 1973 supply quantities in Model A-1. In addition, Models D-3 and D-4 were assumed to represent the fluid milk industry as characterized by shortages of milk. Class II prices were allowed to change in accordance with the demand for manufacturing products in the industry.

Equilibrium conditions in Models D-1 and D-2 differed only slightly from the 1976 equilibrium of Model A-1. A decrease in supply of 5 percent brought slightly higher prices in both the retail and production sectors. Farm revenue, however, decreased. With the exception of the Northcentral region, changes in revenues, prices and quantities in Model D-2 were consistently less than changes in Model D-3.

Increased supply in Model D-1 allowed prices in the Northern regions to increase slightly. The Southeast, Southwest and West regions had lower prices. Regional price changes differed somewhat from the magnitude of change with decreased supply in Model D-2 but remained small relative to the absolute levels of changes in Models D-3 and D-4. Model D-2 farm revenue increased for each region despite the reduced farm price in some regions. In combination, Models D-1 and D-2 indicated the industry in a relative surplus situation would be rather insensitive to supply changes. The same was also found to hold true for price changes given proportional changes in demand.

Models D-3 and D-4 had proportional declines in aggregate consumption quantities that were in most regions less than the proportional changes in supply available. With increased Class II prices, blend prices showed rather sharp increases over prices in the general equilibrium model. Both retail and farm revenues increased with the supply reductions.

Models D-3 and D-4 indicated that the sensitivity of the industry depends partially on the relative magnitude of supply change. Although Model D-4 represented only a 3 percent additional supply reduction over Model D-3, changes experienced in the majority of the regional revenues, prices, and quantities were double or more the changes experienced with the initial 1973 supply reduction of 5 percent. Only in the Northeast did the change in consumption, retail price, and retail revenue remain the same for the two models.

CHAPTER IX

SUMMARY AND CONCLUSIONS

The future environment that will prevail in the dairy industry is uncertain. Governmental policy towards inflation and the role of the dairy inudstry in helping to solve the balance of payments problems could change the industry from one of a relatively surplus condition to one of relative scarcity, or to a relative surplus condition with large imports and much lower prices. At the same time consumer attitudes about the products of the industry may have turned in favor of the industry as per capita consumption appears to be reversing a previous downward trend. Sectors are more interrelated as integration of functions has occurred, and procedures for influencing prices are subject to intensive review.

The response to a new environment is unlikely to be uniform for each each sector of the industry or to be uniform for the different geographical regions of the country. Producers may gain and consumers lose (or vice versa), given a change in the conditions faced by the participants in the industry. A new institutional pricing arrangement may change, for example, consumption in a market in one region of the U.S. but have no effect on another region.

The objective of the study was to examine the fluid milk industry under alternative pricing and structural conditions. Particular emphasis was on determining the impact of change on sectors and regional markets of the industry. The effect of alternative projections in supply and demand quantities was also to be determined.

The Models

To fulfill the study's objectives, a spatial equilibrium algorithm was employed. Of the several available, the Tramel and Seale reactive programming routine for achieving a least cost spatial equilibrium was selected and adapted to the conditions of the fluid milk industry. The United States was divided into 31 markets by combining the Federal order markets in existence January 1, 1972, according to the similarity of orders. Data were obtained primarily from the Federal order system which represented 80 percent of the milk produced in the U.S. that was eligible for fluid use. Equilibrium market results were further aggregated and reported for six regional demarcations.

The analysis of the industry under change began with a general equilibirum model (Model A-1). This model presented a base for comparison of changes attributed to specific parameters or programs covered in succeeding models. Model A-1 assumed an increasing Class II support price throughout the 1972-1976 study period. Market retail price was a function of quantity consumed in the market. From the retail price the Class I price was derived by subtracting processing and retailing costs incurred. Class I price could be no less than Class II price plus 20 cents per cwt. Processing cost was a function of the volume of milk consumed in the market and the market structure for that market size. Retailing cost was calculated as a fixed percentage of the retail price for each market. In equilibrium, the net blend price for all milk sold by a market could differ from the net blend price of any other market by no more than the transportation cost between the markets. Distance affected the per hundredweight cost of moving milk. To maintain a reserve supply of milk to account for seasonal and daily variations in supply and demand, only 81.3 percent of the fixed quantity of milk supplied in any one period was allowed to be used for fluid purposes.

Three alternative pricing arrangements were analyzed in comparison with the base model. Model B-1 simulated the minimum Federal order price structure in 1972. For the four years thereafter, the 1972 minimum Federal order price was increased by the same amount as the Class II price was increased each year. Model B-2 applied to all markets a uniform minimum Class I price each year which ranged from $7.00 per cwt. in 1972 to $8.02 per cwt. in 1976. Model B-3 assumed a minimum Class I price for each market based on the cost of specified feed ration for that market in 1972.

Four changes in the fluid milk industry's structure were also considered. In Model C-1, the reserve requirement was lowered to 12.6 percent to account for only the daily variation in supply and demand. At the retailing level in Model C-2, the retailing percentage cost markup was assumed uniform for each market. The transportation rate structure was lowered and raised in Models C-3 and C-4. In the latter model, the transportation rate was raised high enough to prevent intermarket milk movement.

The industry under conditions of relative surplus or shortage was considered. Models D-1 and D-2 represented the surplus environment.

The 1976 supply in the base model was raised and lowered 5 percent respectively. The Class II price was assumed to be independent of the quantity of Class II milk sold. Models D-3 and D-4 represented the shortage environment in which 1973 supply was projected to be first 3 percent and then 6 percent less than in 1972. With shortages in the market, Class II price was assumed to be a function of the quantity of milk in the industry not used for Class I purposes.

Industry Equilibrium

Consumers represented in the base general equilibrium model (Model A-1) valued the 442.9 million cwt. of fluid milk products purchased at $6,086.7 million. The 1976 consumption was 19.5 million cwt. more than consumed in 1972. Fluid milk usage in the U.S. was 61.8 percent of the supply of milk in 1972 and 60.8 percent of the larger 728.3 million cwt. of milk supplied in 1976. Relative to actual conditions in 1972, equilibrium under the model indicated lower prices and increased consumption. Although the model assumptions were not identical, the results were consistent with the Ruane and Hallberg [37] study which also indicated increased consumption and lower prices for 1967 in comparison with actual 1967 conditions.

The quantity of fluid milk consumed in the Southeast (Region 4) was 49.3 million cwt. in 1976 as compared with the 1972 demand of 45.8 million cwt. All other regional designations, likewise, indicated increased consumption. Regional response, however, was not uniform. Supply increased by more than demand quantities in each region with the exception of the Northeast (Region 3) in which the supply of 194.2 million cwt. in 1972 had declined to 187.5 million cwt. by 1976.

Equilibrium 1972 retail prices ranged from $12.85 per cwt. in the West (Region 6) to $15.21 per cwt. in the deficit Southeast. The average U.S. retail price was $13.66 per cwt. for the same year but stood at $13.74 per cwt. by 1976. While retail prices increased in most regions over the study period, retail price declined in Region 1 (Northcentral) from $13.79 per cwt. in 1972 to $12.95 per cwt. in 1976.

With an increasing support price for each study year, farm blend prices increased in all regions and at a proportionately greater rate than the retail price increases. Regional prices conformed to a basing point system with the 1976 blend price in Region 1 at $6.21 per cwt. as compared with a $7.70 per cwt. blend price for Region 4. The average U.S. blend price in 1972 of $6.32 per cwt. had increased to $6.73 per cwt. by 1976.

Conclusions

Given the equilibrium conditions of the base model and the changes in equilibrium that occurred under alternative pricing and structural conditions, several general conclusions can be stated. In addition, several trends were apparent at the sectorial and regional levels.

General Industry Analysis

Interdependence of Markets. Few markets in the fluid milk industry are independent of all other markets in the industry. This interdependence is apparent in those markets that frequently import or export milk. The deficit Atlanta, Jacksonville, Miami, and Memphis markets relied heavily on the surplus markets, primarily in Regions 2 and 3 (Central and Northeast), to help meet their excess needs. This held true regardless of the change experienced by the industry.

The interdependence of markets holds even though markets may not be actually involved in intermarket transfers of fluid milk. When all markets were considered independent (Model C-4 with no movement of milk permitted), prices in the deficit regions were higher than in the base Model A-1. Retail prices were also higher in the Southwest (Region 5), an area which imported little or no milk from other regions even when movement was permitted. Region 1 retail price at $12.86 per cwt. was, in 1972, 93 cents per cwt. lower in Model C-4 with movement restricted.

Multiple Equilibria. There is no single set of equilibrium prices and quantities for all markets in the fluid milk industry. Though markets involved in imports and exports must have price differences consistent with such movements, prices in many markets could move up or down over a fairly wide range before prices were high enough to attract imports or low enough to supply other markets. Moreover, the price level for all markets could be higher or lower than current levels by moving in concert in response to either a relative scarcity or a surplus environment.

Governmental Support. The government support price for dairy products provides a floor for the Class II price in Federal order markets. In Model A-1, only the support price was specified and was equal to the Class II milk price. In Model B-1, the floor price plus Class I price differentials were specified. Given the different results of the two models, the conclusion was that the support price of milk has its major impact on the blend price of milk. An increase in the support price will be only partially passed to the fluid milk consumer.

From 1972 to 1976, the support price increased 20.7 percent. In response, the U.S. average retail price of milk increased only 0.6 percent in Model A-1, the general equilibrium model, but increased 7.4 percent in Model B-1.

If the Class II price were raised within a given time period, the same conclusion could be drawn. In Model D-3, the Class II price was determined endogenously to be $6.30 per cwt. Regional 1973 blend prices in the model were all higher than the blend prices derived in Model B-1 in which the present Federal order pricing system was simulated with a Class II or support price of $5.29 per cwt. Regional retail prices, on the other hand, in Model D-3 were less than the 1973 regional retail prices for Model B-1 in 5 of the 6 regions.

Minimum Class I Prices. The goals of minimizing total industry cost and of maintaining a minimum Class I price for each market can be conflicting goals. In Model B-1, transportation minimization was inconsistent with the Federal order minimum Class I price structure. The conflict also arose beginning with the 1974 period in Model B-2. Solving for spatial equilibrium alone in Models B-1 and B-2 changed the milk movement pattern as the more northerly markets exported milk to achieve equilibrium with surrounding markets.

Imposing a minimum Class I price on each market likely will raise the price to consumers as compared with the consumer price when no minimum Class I price is specified. Restricting Class I prices according to the 1972 Federal order system of prices (Model B-1) raised the equilibirum prices in all but four markets even though only a few of the markets in Model A-1 had 1972 equilibrium Class I prices that were below 1972 Federal order minimum prices. The 1972 U.S. blend price was

$6.52 per cwt. in Model B-1, 20 cents per cwt. more than in the base model for the same priod.

As time progresses, the minimum price in a market could also be the prevailing price in the market. In Models B-1 and B-2, many of the markets had prevailing Class I prices in 1972 well above the minimum prices stated for the markets. By 1976, in both models, over two-thirds of the markets indicated a prevailing price equal to the minimum price imposed.

Model B-2, with the uniform minimum Class I price in each market, is not comparable with the Blakley [6], Associated Reserve Standby Pool Committee [3], or Babb and Minden [4] studies in which a single Class I price system was analyzed. The minimum Class I price in Model B-2 served as only a limit. No attempt was made to force the uniform limit price to be the prevailing price. It appeared, however, that a uniform prevailing price with milk movement occurring was not consistent with a spatial equilibrium.

Structural Changes. Structural changes in the industry which were considered have little effect on the quantities of milk produced or consumed. In Models C-1 and C-2, quantities of milk produced or consumed usually changed less than 1.0 million cwt. in any one period as compared with Model A-1. Such was not the case in Models B-1 and B-2 with pricing system changes.

Alternative Supply and Demand Balances. An industry characterized by a large amount of surplus milk on the market would be rather insensitive to changes in the relative supply and demand in the market. In Model D-2, a 5 percent decrease in supply increased the average U.S.

blend price for 1976 by only 14 cents per cwt. In Model D-1, with an additional 5 percent supply quantity available in each market, retail prices in the Northern markets increased. The U.S. average blend price at $6.72 per cwt. was only one cent per cwt. lower than the equilibrium blend price in Model A-1.

Prices derived with a 5 percent increase in supply (Model D-1) were equal to the prices derived given a 5 percent reduction in demand. The decline in the aggregate price agreed with the directional price change when 5 percent of the fluid milk market was surrendered to a synthetic milk product in the Ruane and Hallberg [37] study.

The industry is rather responsive to decreased supply quantities if there is a general shortage of milk. In Model D-3, with a derived higher Class II price and increased retail prices, the U.S. average blend price in 1973 increased 63 cents per cwt. While the response in Model D-3 to an initial 5 percent decrease in market supply quantities was relatively large, an additional 3 percent supply reduction (Model D-4) indicated price and quantity responses in most regions that were about double the responses of Model D-3 in relation to the base model. U.S. blend price in Model D-4 was $1.27 per cwt. higher than in Model A-1 and 64 cents per cwt. more than the $7.08 per cwt. price of Model D-3.

Sector Analysis

Transportation. Transportation cost associated with intermarket transfers of fluid milk is a small part of the total service costs of the industry. The transportation rate structure does, however, have an impact on the quantity of milk exported among markets, the movement pattern of milk, and the prices for milk. In Model B-3, slightly over 7 million cwt. of fluid milk was transported between the markets at a cost of $5,464.5 thousand, about 0.20 percent of the total service costs. With a slightly higher transport rate, the cost of moving the 6,001.2 thousand cwt. of milk in 1972 for Model C-2 was 0.24 percent of the total processing, retailing, and transportation costs.

The Blakley and Kloth [8] and Dobson and Babb [14] studies indicated considerably larger quantities of milk movement than were indicated in all the models of this study. In each of the other studies, however, prices in the various markets were not allowed to respond to the quantities of milk imported or exported. The models employed were primarily transportation or transshipment models.

Prices of milk in the areas importing milk are likely to decrease with reduced transportation rates. The retail price of $18.30 per cwt. for the deficit Southeast in Model C-4 decreased to $15.21 and $14.85 per cwt. respectively in Models A-1 and C-3 with decreased transportation rates. Retail prices in markets exporting milk in Models A-1 and C-3 moved in the opposite direction of transportation rate changes to imply that cost changes are not fully passed to either the importing or exporting milk markets.

Processing. Processing cost is unresponsive to changes in the fluid milk industry. U.S. average processing cost was $1.45 per cwt. in the models. In 1976, several of the models had a U.S. average cost of $1.44 per cwt. Regional costs ranged from $1.50 per cwt. in the Southwest to $1.41 per cwt. in the Northeast. With essentially no change in per unit cost, total processing cost in a model was a function of the quantity of milk processed.

Retailing. Retailing cost in the models increased and decreased according to the change in the retail price, i.e., a higher retail price increases the market retailing cost. Such occurred as a result of the inelasticity of retail demand for each market and the constant percentage retail cost markup. Changes in the industry did not appear to shift consumption enough to significantly affect the national or regional weighted average retailing markups. As shown in Model C-2, changing the retailing markup percentages would have some effect on the industry. Retail prices, for markets in which retailing markup cost was reduced, were less while producer blend prices increased. To have raised the retailing cost percentage brought increased retail prices to some regions and no change to others.

Regional Analysis

Changes in the price or market structure of the fluid milk industry will not affect the geographic regions of the country uniformly. In Model B-1, the 1976 retail price in Region 3 at $16.02 per cwt. showed the greatest proportional change relative to Model A-1. Blend price for the same model and time period increased over Model A-1 proportionately more in Region 2. A uniform retailing cost markup (Model C-2) had the greatest proportional affect on the 1972 retail price in Region 1 but changed blend price in the Southeast region the most of any region. While the Southeast had the greatest percentage response at the retail level in Model D-4, Region 1, the Northcentral area, had the largest farm blend price response. The response of supply and demand to industry change was likewise as inconsistent among regions. Despite the wide variation in response for the same model, however, prices in all models generally conformed to a basing point pricing scheme in which Northcentral prices were the lowest in the U.S. with the Southeast having the highest level of prices.

Prices in comparison with Model A-1 will generally move in the same direction given changes in the fluid industry pricing structure. Structural changes can be instigated though that could raise prices in some areas but decrease them in others. For example, the increase in supply in Model D-1 raised the retail prices in the Northern regions of the U.S. but reduced them in the Southern markets. Lower transportation costs in Model C-3 had a similar effect but with different regions being affected.

To indicate the equitableness of change in the fluid milk industry, changes in consumer expenditure and producer revenue were defined to be proxy measures of changes in consumer surplus and producer surplus, respectively. Seldom will a change in retail value be transferred to producers in a one-to-one relationship or in the same ratio for each region. In most all models the ratio of change in farmer revenue to change in consumer value, given price or structural change, was greater than 1.0 for Regions 4 and 5. On occasion, such as in 1976 for Model B-2, the ratio was also greater than 1.0 for the Central region. The Northeast rather consistently had the lowest ratio. For the 1972 period in Model B-2, farmer revenue increased only 69 cents for each one dollar increase in consumer value. Such is a result of the relative elasticity of retail demand in the regions.

Further Research and Model Development

This study dealt with only the aggregate of fluid milk products.

Changes in the industry could affect the manufactured products sector as well, especially if the industry is characterized by shortages of milk. The addition of a derived demand for these dairy products into the model would enable an evaluation of the changes in consumer welfare derived from the consumption of both the fluid and manufactured dairy products in relation to the changes in welfare of the producer under alternative milk industry conditions. To conform to the regional and sector analysis for the fluid milk portion of the industry, the derived manufactured products demand should reflect regional differences in demand as well as the process of moving the raw milk product through the channels of transformation into the final consumable product.

Retailing cost was treated as a fixed percentage of the retail price regardless of the quantity of milk in the market retail channel. The percentage or cost structure, however, may change with volume. The level of competition may also change the markup of fluid products. Changing the retailing cost markup in the present model did affect the prices in the industry. If, indeed, the retailing cost structure of the fluid milk industry is a function of volume, incorporating the relationship into the model would add to its realism.

The level and composition of milk consumption has been changing over the past several years. This change would likely be reflected in the demand schedule for fluid products. The demand could shift in a parallel move, but, more than likely, the change in consumer attitude would be reflected in a combination demand schedule shift as well as a change in the elasticity of the consumer demand schedule. The sensitivity of the industry equilibrium conditions to demand elasticity changes was not evaluated in this study.

Both the Blakley and Kloth [8] and Dobson and Babb [14] studies indicated rather large quantities of packaged milk moved among markets. In the Kloth study the quantity of packaged milk moved was less than the quantity of bulk milk transported. The relationship was the opposite in the Dobson and Babb study. The addition of a packaged milk transfer dimension to the present study model could reflect new equilibrium relationships with changes experienced by the industry. In view of the small quantity of bulk milk moved in this study, however, only a small quantity of packaged milk could be expected to be transported among markets in that type of model.

The effect of a noncompetitive bargaining environment needs to be investigated. In the model perfect competition was assumed, but with the growth of cooperatives and their ability to negotiate prices as well as to influence the quantity of milk supplied, the structure of the production sector will continue to change. As was discussed by Kottke [29], pricing under conditions other than competitive should be appropriately considered in any model.

Finally, consumption estimates, demand and supply functional relationships, the structure of the processing and retailing sectors, transportation costs, and other industry conditions that are described in the model should be updated to reflect changes that occur in the fluid milk industry. The results of a model simulating a present day situation or predicting the future are only as accurate as the accuracy of the data entered into the model.

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APPENDIX A

MODEL DATA

TABLE XLII

DEMARCATION OF REGION, KEY CITY, AND FEDERAL ORDERS FOR EACH STUDY MARKET

Market	Region	Key City	Federal Milk Orders (Order Number)
1	6	Seattle	Puget Sound (1125)
2	6	Portland	Oregon-Washington (1124) Inland Empire (1133)
3	6	Salt Lake City	Great Basin (1136) Western Colorado (1134)
4	6	Phoenix	Central Arizona (1131)
5	5	Lubbock	Rio Grande (1138) Texas Panhandle (1132) Lubbock-Plainview (1120) Red River Valley (1104) Central West Texas (1128)
6	5	Dallas	North Texas (1126)
7	5	Houston	South Texas (1121) Corpus Christi (1130) San Antonio (1127) Austin-Waco (1129)
8	5	Oklahoma City	Oklahoma Metropolitan (1106)
9	4	Memphis	Memphis (1097) Central Arkansas (1108) Ft. Smith (1102)
10	4	Jackson	Mississippi (1103) Northern Louisiana (1096)
11	4	New Orleans	New Orleans (1094)
12	4	Miami	Tampa Bay (1012) Southeastern Florida (1013)
13	4	Jacksonville	Upper Florida (1006)
14	4	Atlanta	Georgia (1007)

TABLE XLII (Continued)

Market	Region	Key City	Federal Milk Orders (Order Number)
15	2	Louisville	Nashville (1098) Louisville-Lexington-Evansville (1046) Paducah (1099)
16	2	St. Louis	Southern Illinois (1032) St. Louis-Ozarks (1062)
17	2	Columbus	Ohio Valley (1033)
18	2	Indianapolis	Indiana (1049)
19	2	Pittsburgh	Eastern Ohio-Western Pennsylvania (1036)
20	3	Baltimore	Middle Atlantic (1004)
21	3	New York	New York-New Jersey (1002)
22	3	Boston	Boston Regional (1001) Connecticut (1015)
23	2	Detroit	Southern Michigan (1040) Upstate Michigan (1043) Michigan Upper Peninsula (1044)
24	1	Chicago	Chicago Regional (1030) Central Illinois (1050)
25	1	Minneapolis	Duluth-Superior (1069) Minneapolis-St. Paul (1068) Southern Minnesota-Northern Iowa (1061)
26	1	Des Moines	North Central Iowa (1078) Quad Cities-Debuque (1063) Des Moines (1079) Cedar Rapids-Iowa City (1070)
27	1	Fargo	Minnesota-North Dakota (1060)
28	2	Omaha	Eastern South Dakota (1076) Nebraska-Western Iowa (1065) Black Hills (1075)

TABLE XLII (Continued)

Market	Region	Key City	Federal Milk Orders (Order Number)
29	2	Kansas City, Missouri	Kansas City (1064) Wichita (1073) Neosho Valley (1071)
30	6	Denver	Eastern Colorado (1137)
31	2	Knoxville	Knoxville (1101) Appalachian (1011) Chattanooga (1090)

TABLE XLIII

MARKET DATA FOR ESTIMATING 1972 RETAIL FLUID MILK DEMAND FUNCTIONS

Market	Retail Price Elasticity of Demand[a]	Retail Price Equivalent 1972[c]	Fluid Milk Sales 1972[d]
		($/cwt.)	(cwt.)
1	-.20	13.60	6,248,700
2	-.20	13.21	8,625,620
3	-.15	13.45	3,524,530
4	-.15	12.31	4,953,170
5	-.50	14.61	7,165,100
6	-.50	14.41	9,415,220
7	-.50	14.27	13,437,230
8	-.30	13.67	5,699,690
9	-.60	14.18	6,582,750
10	-.60	14.95	6,247,770
11	-.50	14.86	3,705,750
12	-.55	14.31	11,109,980
13	-.55	13.88	6,015,000
14	-.60[b]	16.16	12,784,740
15	-.48[b]	13.81	12,590,010
16	-.30	13.65	18,026,780
17	-.35	13.09	22,729,940
18	-.35	12.54	13,675,800
19	-.35	13.51	21,738,970
20	-.20	14.76	30,813,200
21	-.20	14.32	51,083,310
22	-.20	14.35	31,192,650
23	-.22	12.38	25,828,540
24	-.22	13.30	36,174,160
25	-.22	11.83	13,084,820
26	-.30	12.24	7,047,290
27	-.22	13.80	2,073,460
28	-.30	12.51	7,263,650
29	-.30	14.37	8,955,780
30	-.20	13.83	6,047,900
31	-.60	14.21	8,898,930

[a]Source: Adapted from [9].

[b]Estimated.

[c]Estimated from data in [55, January-December, 1972 and 47]. Retail price equivalent is equal to the price of a half gallon of milk in a paper carton converted to a price per hundredweight basis.

[d]Source: Adapted from [47].

TABLE XLIV

ESTIMATED MARKET RETAIL DEMAND FUNCTION COEFFICIENTS FOR FLUID MILK, 1972-1976[a]

Market	Slope Coefficient (a_j)	Intercept Coefficients (b_j)				
		1972	1973	1974	1975	1976
	(hundred millionths)					
1	-1,088.226	81.600	82.552	83.517	84.496	85.489
2	-765.742	79.260	79.854	80.454	81.059	81.670
3	-2,544.074	103.117	104.730	106.374	108.046	109.749
4	-1,656.851	94.377	97.413	100.562	103.827	107.213
5	-407.810	43.830	44.356	44.891	45.436	45.991
6	-306.100	43.230	43.605	43.984	44.369	44.758
7	-212.395	42.810	43.352	43.905	44.468	45.042
8	-799.459	59.237	59.647	60.061	60.478	60.899
9	-359.019	37.813	38.050	38.288	38.529	38.773
10	-398.809	39.867	40.240	40.620	41.005	41.396
11	-801.997	44.580	45.234	45.902	46.585	47.283
12	-234.188	40.328	41.317	42.343	43.408	44.514
13	-419.557	39.116	39.545	39.982	40.425	40.877
14	-210.669	43.093	43.632	44.181	44.742	45.314
15	-228.521	42.581	42.926	43.275	43.629	43.987
16	-252.402	59.150	59.332	59.515	59.698	59.882
17	-164.541	50.490	50.901	51.317	51.738	52.163
18	-261.985	48.369	48.727	49.089	49.454	49.823
19	-177.561	52.110	52.187	52.265	52.342	52.420
20	-239.508	88.560	90.036	91.542	93.077	94.643
21	-140.163	85.920	86.421	86.926	87.434	87.946
22	-230.022	86.100	86.889	86.687	88.494	89.309
23	-217.870	68.653	69.103	69.557	70.014	70.475
24	-167.121	73.755	74.480	75.214	75.957	76.709
25	-410.955	65.603	66.248	66.901	67.562	68.231
26	-578.946	53.040	53.244	53.449	53.655	53.862
27	-3,025.246	76.527	76.778	77.030	77.283	77.537
28	-574.092	54.210	54.377	54.544	54.712	54.881
29	-534.850	62.270	62.557	62.847	63.137	63.430
30	-1.143.342	82.980	84.432	85.915	87.429	88.974
31	-266.137	87.893	38.035	38.178	38.322	38.467

[a]Functions are linear and of the form $P_j = a_j + b_jX_j$, where P_j = retail price of fluid milk ($ per cwt.) in market j; X_j = consumption of fluid milk (cwt.) in market j; b_j = slope coefficient in market j; and a_j = intercept coefficient in market j.

TABLE XLV

MARKET PROJECTS OF FLUID MILK CONSUMPTION, 1972-1976

Market	Yearly Percentage Increase	1972[a]	1973	1974	1975	1976
				(cwt.)		
1	1.4	6,248,700	6,336,182	6,424,888	6,514,837	6,606,044
2	0.9	8,625,620	8,703,251	8,781,580	8,860,614	8,940,360
3	1.8	3,524,530	3,587,972	3,652,555	3,718,301	3,785,230
4	3.7	4,953,170	5,136,437	5,326,485	5,523,565	5,727,937
5	1.8	7,165,100	7,294,072	7,425,365	7,559,022	7,695,084
6	1.3	9,415,220	9,537,618	9,661,607	9,787,208	9,914,441
7	1.9	13,437,230	13,692,537	13,952,696	14,217,797	14,487,935
8	0.9	5,699,690	5,750,987	5,802,746	5,854,971	5,907,666
9	1.0	6,582,750	6,648,578	6,715,063	6,782,214	6,850,036
10	1.5	6,247,770	6,341,487	6,436,609	6,533,158	6,631,155
11	2.2	3,705,750	3,787,277	3,870,597	3,955,750	4,042,776
12	3.8	11,109,980	11,532,159	11,970,381	12,425,256	12,897,416
13	1.7	6,015,000	6,117,255	6,221,248	6,327,010	6,434,569
14	2.0	12,784,740	13,040,435	13,301,244	13,567,268	13,838,614
15	1.2	12,590,010	12,741,090	12,893,983	13,048,711	13,205,296
16	0.4	18,026,780	18,098,887	18,171,283	18,243,968	18,316,944
17	1.1	22,729,940	22,979,969	23,232,749	23,488,309	23,746,681
18	1.0	13,675,800	13,812,558	13,950,684	14,090,190	14,231,092
19	0.2	21,738,970	21,782,448	21,826,013	21,869,665	21,913,404
20	2.0	30,813,200	31,429,464	32,058,053	32,699,214	33,353,199
21	0.7	51,083,310	51,440,893	51,800,979	52,163,586	52,528,731
22	1.1	31,192,650	31,535,769	31,882,663	32,233,372	32,587,939
23	0.8	25,828,540	26,035,168	26,243,450	26,453,397	26,665,024
24	1.2	36,174,160	36,608,250	37,047,549	37,492,120	37,942,025
25	1.2	13,084,820	13,241,838	13,400,740	13,561,549	13,724,287

TABLE XLV (Continued)

Market	Yearly Percentage Increase	1972[a]	1973	1974	1975	1976
				(cwt.)		
26	0.5	7,047,290	7,082,526	7,117,939	71,535,288	7,189,296
27	0.4	2,073,460	2,081,754	2,090,081	2,098,441	2,106,835
28	0.4	7,263,650	7,292,705	7,321,875	7,351,163	7,380,568
29	0.6	895,578	9,009,515	9,063,572	9,117,953	9,172,661
30	2.1	6,047,900	6,174,906	6,304,579	6,436,975	6,572,152
31	0.6	8,898,930	8,952,324	9,006,038	9,060,074	9,114,434
Total	1.2	422,740,440	427,806,309	432,955,293	438,189,186	443,509,831

[a]Gross Class I sales adapted from [47].

TABLE XLVI

REGIONAL LONG-RUN AND SHORT-RUN PRICE ELASTICITIES OF SUPPLY[a]

Region[c]	Short-Run	Long-Run
1	.0479	.2875
2	.0451	.2707
3	.1913	.5358[b]
4	.1113	.6679
5	.3009	1.0200
6	.1058	.4233
7	.1488	.4099
8	.1592	1.5018
9	.1437	.4311

[a]Source: Adapted from [21].

[b]Estimated.

[c]Regional definitions are as follows: <u>Region 1</u>: Northeast+Ohio+West Virginia+Virginia; <u>Region 2</u>: Corn Belt+Michigan; <u>Region 3</u>: Minnesota+Wisconsin; <u>Region 4</u>: The Carolinas+Georgia+Florida; <u>Region 5</u>: Tennessee+Alabama+Mississippi+Louisiana+Arkansas+Oklahoma+Texas; <u>Region 6</u>: The Dakotas+Nebraska+Kansas; <u>Region 7</u>: Montana+Wyoming+Colorado+New Mexico+Utah+Nevada; <u>Region 8</u>: California+Arizona; <u>Region 9</u>: Washington+Oregon+Idaho.

TABLE XLVII

MARKET SUPPLY QUANTITIES AND BLEND PRICES OF MILK, 1971 AND 1972[a]

Area	Producer Milk Deliveries to Federal Order Handlers		Weighted Average Federal Order Minimum Blend Price[b,c]	
	1972	1971	1972	1971
	(million pounds)		($/cwt.)	
1	1,507.510	1,456.155	5.86	5.66
2	1,465.468	1,430.221	6.15	5.90
3	590.331	563.013	6.14	5.94
4	647.629	604.517	6.92	6.70
5	920.407[d]	1,070.926	6.77	6.32
6	1,257.764	1,234.845	6.66	6.43
7	1,707.218	1,544.357	7.09	6.88
8	772.187[d]	1,097.286	6.37	5.77
9	651.376	644.065	6.70	6.52
10	752.586	818.234	6.94	6.51
11	618.820	605.855	6.78	6.48
12	1,158.225	1,093.491	7.89	7.63
13	589.244	538.618	7.78	7.52
14	1,315.484	1,219.475	6.99	6.74
15	1,763.804	1,757.036	6.07	5.86
16	2,705.280	2,509.213	6.02	5.81
17	3,131.340	3,039.411	6.17	5.96
18	1,924.721	1,845.157	6.03	5.82
19	3,315.269	3,358.993	6.22	5.99
20	4,474.421	4,506.541	6.78	6.58
21	10,067.459	10,279.666	6.43	6.23
22	4,879.178	4,934.443	7.00	6.74
23	4,064.995	3,967.179	6.05	5.84
24	8,621.057	8,333.365	5.66	5.46
25	2,954.486	2,809.957	5.53	5.31
26	1,224.305	1,248.077	5.78	5.56
27	792.617	745.070	5.39	5.19
28	1,312.098	1,190.642	5.90	5.73
29	1,455,232	1,491.605	6.08	5.87
30	771.497	748.836	6.74	6.46
31	1,108.984	1,038.301	6.58	6.38

[a]Source: Adapted from [48].

[b]Grade A milk of 3.5 percent butterfat content.

[c]Market prices reflect order prices weighted by supply quantities of milk.

[d]Adjusted from reported data to reflect average conditions in the market.

TABLE XLVIII

ESTIMATED MARKET FARM SUPPLY FUNCTION COEFFICIENTS FOR MILK

Market	Intercept Coefficient (a_i)	Lagged Production Coefficient (b_i)	Lagged Blend Price Coefficient (c_i)
1	319.624	.667	38.274
2	300.922	.667	35.693
3	143.851	.637	14.788
4	4.091	.894	15.388
5	-15.562	.705	42.347
6	8.735	.705	58.859
7	104.744	.705	74.666
8	8.356	.705	31.719
9	1.313	.705	30.061
10	50.719	.705	34.785
11	5.490	.705	28.735
12	118.438	.833	16.895
13	74.993	.833	8.721
14	153.248	.833	21.723
15	231.280	.762	32.992
16	493.096	.833	21.000
17	449.521	.833	25.166
18	300.900	.833	14.915
19	358.427	.833	26.511
20	506.146	.833	32.572
21	1,022.264	.833	77.405
22	535.078	.833	34.675
23	577.006	.833	31.392
24	1,628.440	.647	293.211
25	582.493	.643	106.439
26	129.441	.833	9.931
27	161.911	.634	29.215
28	280.296	.750	24.227
29	182.212	.750	26.289
30	179.688	.637	17.771
31	137.709	.726	34.086

[a]Equations have a Koyck distribution of lag and are of the form $PT_i = a_i + b_i\ PT_{i,t-1} + c_i\ BPJ_{i,t-1}$ where: PT_i = milk production (million lbs.) in supply market i for period t; $PT_{i,t-1}$ = milk production (million lbs.) in supply market i for period t-1; $BPJ_{i,t-1}$ = blend price ($ per cwt.) for milk in supply market i for period t-1; a_i = intercept constant for supply market i; b_i = lagged production coefficient for supply market i; and c_i = lagged blend price coefficient for supply market i.

TABLE XLIX

SEASONAL INDEX OF AVERAGE DAILY DELIVERY PER PRODUCER, AND IN-AREA SALES OF FLUID MILK FOR COMPARABLE FEDERAL ORDER MARKETS[a]

Month	Index of Producer Deliveries[b]	Index of In-Area Sales[c]
January	98.2	103.3
February	100.6	104.3
March	102.9	103.1
April	108.0	101.8
May	111.1	98.3
June	108.1	92.5
July	97.6	91.8
August	94.6	93.0
September	95.1	102.7
October	94.7	104.6
November	93.6	103.1
December	96.1	101.5

[a]Source: [10].

[b]Based on years 1965-1969.

[c]Based on years 1963-1972.

TABLE L

DAILY INDEX OF IN-AREA SALES OF FLUID MILK, COMPARABLE FEDERAL ORDER MARKETS, 1963-1972

Day	Index –[a] Sunday Sales Included	Index –[b] Sunday Sales Excluded
Sunday	7.3	0.0
Monday	124.2	107.6
Tuesday	102.4	88.7
Wednesday	99.8	86.4
Thursday	106.4	92.2
Friday	125.7	108.9
Saturday	134.2	116.2

[a]Source: [10].

[b]The series was constructed from the Index including Sunday sales.

TABLE LI

YEARLY CLASS II MILK PRICE FOR
STUDY MODEL, 1972-1976

Year	Price
	($/cwt.)
1972	4.93
1973	5.29
1974	5.50
1975	5.72
1976	5.95

TABLE LII

AVERAGE MARKET SHARE OF PROCESSORS BY SIZE OF MARKET[a]

Market Size	Largest Firm	2nd Largest Firm	3rd Largest Firm	4th Largest Firm	5th-8th Largest Firm	Smaller Than 8th Largest Firm
			(percent)			
Small	41.05	21.15	13.30	6.55	12.35	5.60
Medium Small	35.80	21.75	13.00	7.80	12.95	8.70
Medium	35.60	17.90	13.80	8.70	17.10	6.90
Large	23.40	15.70	12.75	10.40	23.30	14.45
Very Large	17.90	13.10	7.60	6.60	16.40	38.40

[a]Adapted from [31, p. 19].

TABLE LIII

SIZE CLASSIFICATION OF STUDY MARKETS

Market Size	Fluid Milk Sales[a]	Federal Orders Represented[b]	Sales Per Order	Size Range	Study Federal Orders Represented	Study Markets Represented
	(thousand lbs.)	(number)	(thousand lbs.)		(number)	
Small	1,057,752	14	75,554	<150,000	5	1
Medium Small	4,043,880	22	183,813	150,000-250,000	13	5
Medium	3,044,280	10	304,428	250,000-450,000	21	8
Large	11,497,428	20	574,871	450,000-900,000	12	8
Very large	10,743,600	6	1,790,600	>900,000	11	9
Total	30,386,940	72			62	31

[a]December 1965 data reported in [31, p. 4] adjusted to yearly basis.

[b]Market orders represented in [31].

TABLE LIV

MARKET DATA FOR ESTIMATING RETAILING COST PERCENTAGE MARKUPS

Market	Orders Per Market	Sales Per Order[c]	Processing Cost[d]	Marketing Margin	Retailing and Distribution Margin	Retail Equivalent Price	Retailing Cost Markup[e]
	(number)	(cwt.)	($/cwt.)				(percent)
1	1	6,248,700	1.45	6.74	5.29	13.60	38.90
2	2	4,312,810	1.48	6.25	4.77	13.21	36.11
3	2	1,762,265	1.61	6.55	4.94	13.45	36.73
4	1	4,953,170	1.47	4.77	3.30	12.31	26.81
5	5	1,433,020	1.66	7.05	5.39	14.61	36.89
6	1	9,415,220	1.43	6.90	5.47	14.45	37.85
7	3[a]	4,479,076	1.48	6.27	4.79	14.27	33.57
8	1	5,699,690	1.46	6.48	5.02	13.67	36.72
9	3	2,194,250	1.57	7.02	5.45	14.18	38.43
10	2	3,123,885	1.52	7.47	5.95	14.95	39.80
11	1	3,905,750	1.49	7.01	5.52	14.86	37.15
12	2	5,554,990	1.46	6.24	4.78	14.31	33.40
13	1	6,015,000	1.46	6.03	4.57	13.88	32.93
14	1	12,784,740	1.42	8.62	7.20	16.16	44.55
15	3	4,196,670	1.48	6.76	5.28	13.81	38.23
16	2	9,013,390	1.44	6.85	5.41	13.65	39.63
17	1	22,729,940	1.41	6.17	4.76	13.09	36.36
18	1	13,675,800	1.42	5.71	4.29	12.54	34.21
19	1	21,738,970	1.41	6.46	5.05	13.51	37.38
20	1	30,813,200	1.41	6.89	5.48	14.76	37.13
21	1	51,083,310	1.40	6.67	5.27	14.32	36.80
22	2	15,596,325	1.42	6.37	4.95	14.35	34.49
23	3	8,609,513	1.44	5.47	4.03	12.38	32.55
24	1[b]	36,174,160	1.40	6.67	5.27	13.30	39.62

TABLE LIV (Continued)

Market	Orders Per Market	Sales Per Order[c]	Processing Cost[d]	Marketing Margin	Retailing and Distribution Margin	Retail Equivalent Price	Retailing Cost Markup[e]
	(number)	(cwt.)			($/cwt.)		(percent)
25	3	4,361,607	1.48	5.49	4.01	11.83	33.90
26	4	1,761,822	1.61	5.85	4.24	12.24	34.64
27	1	2,073,460	1.58	7.43	5.85	13.80	42.39
28	3	2,421,217	1.55	5.89	4.34	12.51	34.69
29	3	2,985,260	1.52	7.49	5.97	14.37	41.54
30	1	6,047,900	1.45	6.53	5.08	13.83	36.73
31	3	2,966,310	1.52	6.82	5.30	14.21	37.30

[a]Excludes Austin-Waco order.

[b]Excludes Central Illinois order.

[c]$\frac{\text{Fluid Milk Sales in Market}}{\text{No. of Milk Orders in Market}}$.

[d]From Equation 4.5.

[e]$\frac{\text{Retailing and Distribution Margin}}{\text{Retail Price Equivalent}} \times 100$.

TABLE LV

FIVE-YEAR AVERAGE PRICES PAID FOR DAIRY FEED (16% PROTEIN), PRICES RECEIVED FOR ALFALFA HAY (BALED), AND ESTIMATED COSTS FOR A FIXED RATION, BY STATES, 1968-1972

State	Dairy Feed (16% Protein)	Alfalfa Hay (Baled)	Fixed Ration Cost	
	($/ton)	($/ton)	(dollars)[a]	($/cwt. of milk)[b]
Maine	76.95	34.04	314.99	2.63
New Hampshire	76.12	38.30	326.17	2.72
Vermont	75.45	35.86	316.67	2.64
Massachusetts	74.85	42.17	334.93	2.79
Rhode Island	75.30	44.72	344.18	2.87
Connecticut	74.72	43.74	339.53	2.83
New York	77.35	28.65	299.09	2.49
New Jersey	81.43	40.43	347.22	2.89
Pennsylvania	80.30	33.81	323.31	2.69
Ohio	84.12	28.29	316.24	2.64
Indiana	80.82	27.19	303.86	2.53
Illinois	82.63	25.53	303.52	2.53
Michigan	77.38	25.08	287.93	2.40
Wisconsin	71.03	20.69	256.96	2.14
Minnesota	66.18	21.24	245.59	2.05
Iowa	75.73	21.20	271.25	2.26
Missouri	71.20	25.66	273.07	2.28
North Dakota	68.85	18.24	243.35	2.03
South Dakota	77.98	19.32	271.40	2.26
Nebraska	74.70	20.91	267.56	2.23
Kansas	74.22	24.47	277.48	2.31
Delaware	80.25	39.43	340.88	2.84
Maryland	79.28	37.72	332.87	2.77
Virginia	81.72	41.24	350.55	2.92
West Virginia	83.47	36.70	340.97	2.84
North Carolina	77.25	38.38	329.47	2.75
South Carolina	77.30	37.04	325.39	2.71
Georgia	79.20	37.04	330.52	2.75
Florida	72.75	39.33	318.97	2.66
Kentucky	75.67	31.84	304.61	2.54
Tennessee	74.42	34.54	309.74	2.58
Alabama	74.87	37.25	319.49	2.66
Mississippi	71.55	32.48	295.50	2.46
Arkansas	70.98	31.19	289.90	2.42
Louisiana	73.85	32.30	301.14	2.51
Oklahoma	69.70	31.29	286.75	2.39
Texas	75.40	34.80	313.20	2.61
Montana	68.47	24.97	263.53	2.20
Idaho	73.82	23.68	273.91	2.28
Wyoming	80.10	23.55	290.45	2.42

TABLE LV (Continued)

State	Dairy Feed (16% Protein)	Alfalfa Hay (Baled)	Fixed Ration Cost	
	($/ton)	($/ton)	(dollars)[a]	($/cwt. of milk)[b]
Colorado	75.52	28.07	292.33	2.44
New Mexico	75.63	32.56	306.77	2.56
Arizona	72.22	30.86	292.20	2.44
Utah	66.80	26.92	265.16	2.21
Nevada	74.68	27.90	289.52	2.41
Washington	71.97	28.43	283.87	2.37
Oregon	71.98	29.03	285.79	2.38
California	70.88	31.15	289.50	2.41
U.S.	75.39	25.65	284.35	2.37

[a]Total ration cost based on 3.15 tons hay + 2.70 tons concentrate.

[b]Ration cost divided by 120 cwt. of milk.

APPENDIX B

SELECTED MARKET EQUILIBRIUM CONDITIONS -

MODEL A-1, 1972-1976

TABLE LVI

SUPPLY QUANTITIES OF MILK, MARKET TOTALS - MODEL A-1, 1972-1976

Market	1972	1973	1974	1975	1976
			(million cwt.)		
1	15.1	15.4	15.8	16.0	16.3
2	14.7	15.0	15.2	15.4	15.6
3	5.9	6.1	6.2	6.4	6.4
4	6.5	6.9	7.3	7.6	7.9
5	9.2	9.2	9.3	9.4	9.5
6	12.7	12.8	13.1	13.4	13.7
7	17.1	18.4	19.3	20.1	20.7
8	7.7	7.9	8.1	8.3	8.5
9	6.5	6.7	6.8	6.9	7.0
10	7.5	8.3	8.8	9.1	9.4
11	6.2	6.3	6.5	6.6	6.7
12	11.6	12.2	12.7	13.2	13.7
13	5.9	6.3	6.7	7.0	7.3
14	13.2	14.1	14.9	15.5	16.1
15	17.6	17.9	18.1	18.3	18.5
16	27.1	28.8	30.2	31.4	32.4
17	31.3	32.2	32.9	33.6	34.1
18	19.2	20.0	20.6	21.1	21.6
19	33.2	32.9	32.7	32.6	32.5
20	44.7	44.3	44.0	43.8	43.7
21	100.7	99.0	97.7	96.8	96.1
22	48.8	48.4	48.1	47.9	47.8
23	40.6	41.6	42.4	43.1	43.7
24	86.2	89.7	92.1	93.8	95.2
25	29.5	30.7	31.7	32.4	33.0
26	12.2	12.1	11.9	11.8	11.8
27	7.9	8.3	8.6	8.8	9.0
28	13.1	14.0	14.6	15.1	15.6
29	14.6	14.3	14.1	13.9	13.9
30	7.7	7.7	7.8	8.0	8.1
31	11.1	11.7	12.2	12.6	12.9

TABLE LVII

DEMAND QUANTITIES OF FLUID MILK, MARKET TOTALS - MODEL A-1, 1972-1976

Market	1972	1973	1974	1975	1976
			(million cwt.)		
1	6.2	6.3	6.4	6.5	6.6
2	8.6	8.7	8.8	8.9	8.9
3	3.5	3.6	3.7	3.7	3.8
4	5.0	5.1	5.3	5.5	5.7
5	7.2	7.4	7.5	7.6	7.7
6	9.7	9.6	9.7	9.8	9.9
7	13.7	13.9	14.0	14.2	14.5
8	5.8	5.8	5.8	5.9	5.9
9	6.6	6.6	6.7	6.7	6.7
10	6.2	6.3	6.4	6.5	6.6
11	3.9	3.8	3.9	4.0	4.0
12	10.6	11.0	11.4	11.7	12.2
13	5.9	6.0	6.1	6.1	6.2
14	12.5	12.8	13.2	13.2	13.5
15	12.7	12.8	12.9	13.0	13.2
16	18.0	18.0	18.3	18.1	18.3
17	22.7	23.0	23.2	23.5	23.7
18	13.7	13.8	14.1	14.0	14.2
19	21.7	21.7	21.8	21.8	21.8
20	31.7	32.3	32.9	33.4	34.0
21	51.0	51.4	51.8	52.2	52.5
22	31.2	31.5	31.9	32.2	32.6
23	25.8	26.0	26.2	26.5	26.7
24	35.3	36.0	36.7	37.1	37.9
25	13.1	13.2	13.4	13.6	13.7
26	7.0	7.1	7.1	7.2	7.2
27	2.1	2.1	2.1	2.1	2.1
28	7.4	7.5	7.6	7.5	7.5
29	9.1	9.2	9.3	9.3	9.4
30	6.2	6.3	6.4	6.5	6.6
31	9.0	9.0	9.2	9.1	9.2

TABLE LVIII

EXPORT (IMPORT) QUANTITIES OF FLUID MILK,
MARKET TOTALS - MODEL A-1, 1972-1976

Market	1972	1973	1974	1975	1976
			(thousand cwt.)		
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	(36.0)	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0
9	(1,275.4)	(1,235.3)	(1,213.0)	(1,149.7)	(1,081.8)
10	(111.7)	0.0	0.0	0.0	0.0
11	1,155.0	0.0	0.0	768.3	0.0
12	(1,232.4)	(1,084.1)	(1,030.4)	(936.7)	(1,076.7)
13	(1,147.9)	(860.7)	(631.8)	(381.1)	(263.0)
14	(1,849.6)	(1,307.4)	(1,063.4)	(578.9)	(391.2)
15	1,629.2	799.3	0.0	0.0	0.0
16	0.0	0.0	1,213.0	0.0	1,081.8
17	0.0	0.0	0.0	0.0	0.0
18	209.8	0.0	308.8	0.0	411.8
19	0.0	0.0	0.0	0.0	0.0
20	1,336.9	1,944.8	1,662.2	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0
29	1,275.4	1,235.3	0.0	1,149.7	0.0
30	36.0	0.0	0.0	0.0	0.0
31	10.6	508.1	754.6	1,128.3	1,319.1

TABLE LVIX

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, MARKET AVERAGES - MODEL A-1, 1972-1976

Market	1972	1973	1974	1975	1976
			(percent)		
1	41.5	41.0	40.7	40.6	40.6
2	58.9	58.1	57.7	57.4	57.3
3	59.7	58.8	58.5	58.5	58.8
4	76.5	74.5	73.2	72.4	72.1
5	78.2	79.7	80.3	80.5	80.8
6	76.9	75.2	74.0	73.0	72.4
7	80.4	75.5	72.4	70.7	70.0
8	74.7	73.3	72.1	70.7	69.7
9	81.3	81.3	81.3	81.3	81.3
10	81.3	76.7	73.5	71.8	70.9
11	81.3	60.2	60.1	72.6	60.3
12	81.3	81.3	81.3	81.3	81.3
13	81.3	81.3	81.3	81.3	81.3
14	81.3	81.3	81.3	81.3	81.3
15	81.3	75.9	71.3	71.2	71.5
16	66.5	62.7	64.6	57.7	59.7
17	72.6	71.4	70.6	70.0	69.6
18	72.1	69.0	69.8	66.5	67.9
19	65.6	66.1	66.6	67.0	67.3
20	73.9	77.4	78.6	76.3	77.9
21	50.7	52.0	53.0	53.9	54.7
22	63.9	65.2	66.3	67.3	68.2
23	63.5	62.6	61.9	61.4	61.1
24	40.9	40.1	39.8	39.6	39.8
25	44.3	43.1	42.3	41.8	41.5
26	57.6	58.7	59.6	60.4	61.1
27	26.2	25.2	24.4	23.9	23.4
28	56.5	53.6	51.7	49.8	48.2
29	71.6	73.4	65.9	75.2	67.4
30	81.3	81.3	81.3	81.3	81.3
31	81.3	81.3	81.3	81.3	81.3

TABLE LX

RETAIL PRICES FOR FLUID MILK, MARKET AVERAGES - MODEL A-1, 1972-1976

Market	1972	1973	1974	1975	1976
			($/cwt.)		
1	13.60	13.60	13.60	13.60	13.60
2	13.21	13.21	13.21	13.21	13.21
3	13.45	13.45	13.45	13.45	13.45
4	12.31	12.31	12.31	12.31	12.31
5	14.32	14.33	14.42	14.61	14.61
6	13.63	14.13	14.21	14.40	14.41
7	13.65	13.92	14.15	14.27	14.27
8	13.12	13.20	13.34	13.67	13.67
9	14.22	14.18	14.17	14.38	14.56
10	15.02	14.95	14.95	14.93	14.95
11	13.50	14.86	14.81	14.42	14.86
12	15.39	15.54	15.66	16.05	16.00
13	14.20	14.38	14.52	14.95	14.93
14	16.67	16.75	16.46	16.95	16.91
15	13.53	13.71	13.79	13.89	13.81
16	13.76	13.83	13.31	13.94	13.69
17	13.09	13.09	13.09	13.09	13.09
18	12.55	12.61	12.21	12.69	12.54
19	13.51	13.57	13.61	13.63	13.64
20	12.57	12.57	12.64	13.09	13.22
21	14.40	14.33	14.32	14.32	14.32
22	14.35	14.35	14.35	14.35	14.35
23	12.38	12.38	12.38	12.38	12.38
24	14.83	14.35	13.93	13.91	13.45
25	11.83	11.83	11.83	11.83	11.83
26	12.24	12.24	12.24	12.24	12.24
27	13.80	13.80	13.80	13.80	13.80
28	11.62	11.31	11.09	11.43	11.78
29	13.35	13.11	13.18	13.19	13.39
30	11.68	12.56	13.08	13.47	13.90
31	13.93	13.98	13.70	14.13	14.09

TABLE LXI

CLASS I PRICES FOR FLUID MILK SOLD, MARKET AVERAGES - MODEL A-1, 1972-1976

Market	1972	1973	1974	1975	1976
			($/cwt.)		
1	6.86	6.86	6.86	6.86	6.86
2	6.96	6.96	6.96	6.96	6.96
3	6.90	6.90	6.91	6.91	6.91
4	7.54	7.54	7.55	7.55	7.55
5	7.38	7.39	7.45	7.57	7.58
6	7.04	7.35	7.40	7.52	7.52
7	7.59	7.77	7.93	8.01	8.01
8	6.84	6.89	6.99	7.20	7.20
9	7.19	7.16	7.16	7.29	7.40
10	7.53	7.49	7.49	7.48	7.49
11	6.99	7.85	7.81	7.58	7.85
12	8.79	8.89	8.97	9.23	9.20
13	8.07	8.19	8.29	8.57	8.56
14	7.82	7.87	7.70	7.98	7.96
15	6.88	6.98	7.04	7.10	7.05
16	6.87	6.92	6.60	6.98	6.83
17	6.92	6.92	6.92	6.92	6.92
18	6.84	6.88	6.62	6.93	6.83
19	7.05	7.09	7.11	7.12	7.13
20	6.50	6.50	6.54	6.83	6.91
21	7.70	7.66	7.65	7.65	7.65
22	7.98	7.98	7.98	7.98	7.99
23	6.91	6.91	6.91	6.91	6.92
24	7.55	7.26	7.01	7.00	6.72
25	6.34	6.34	6.34	6.34	6.34
26	6.39	6.39	6.39	6.39	6.39
27	6.37	6.37	6.37	6.37	6.38
28	6.04	5.84	5.70	5.92	6.15
29	6.29	6.15	6.19	6.20	6.31
30	5.93	6.49	6.82	7.07	7.34
31	7.21	7.25	7.07	7.34	7.31

TABLE LXII

FARM BLEND PRICES FOR MILK, MARKET AVERAGES - MODEL A-1, 1972-1976

Market	1972	1973	1974	1975	1976
			($/cwt.)		
1	5.73	5.93	6.05	6.18	6.32
2	6.12	6.26	6.34	6.43	6.53
3	6.11	6.24	6.32	6.42	6.52
4	6.93	6.97	7.00	7.04	7.10
5	6.85	6.97	7.07	7.21	7.27
6	6.55	6.84	6.91	7.03	7.09
7	7.07	7.16	7.26	7.34	7.39
8	6.36	6.47	6.57	6.76	6.82
9	6.84	6.87	6.90	7.04	7.17
10	7.05	6.98	6.96	6.98	7.04
11	6.52	6.83	6.89	7.00	7.10
12	8.13	8.27	8.37	8.62	8.64
13	7.58	7.71	7.81	8.06	8.09
14	7.35	7.43	7.32	7.57	7.59
15	6.48	6.56	6.60	6.70	6.74
16	6.22	6.31	6.19	6.45	6.47
17	6.38	6.46	6.50	6.56	6.63
18	6.30	6.39	6.27	6.53	6.54
19	6.32	6.48	6.57	6.66	6.74
20	6.08	6.21	6.31	6.56	6.70
21	6.34	6.52	6.64	6.76	6.88
22	6.88	7.05	7.15	7.24	7.34
23	6.19	6.31	6.38	6.45	6.54
24	6.00	6.08	6.10	6.23	6.26
25	5.55	5.74	5.86	5.98	6.11
26	5.77	5.94	6.03	6.13	6.22
27	5.31	5.56	5.71	5.88	6.05
28	5.56	5.59	5.60	5.82	6.05
29	5.87	5.90	5.95	6.07	6.20
30	5.75	6.27	6.57	6.82	7.08
31	6.78	6.87	6.76	7.01	7.03
U.S.	6.32	6.45	6.51	6.65	6.73

APPENDIX C

SELECTED MARKET EQUILIBRIUM CONDITIONS -

MODEL B-1, 1972-1976

TABLE LXIII

SUPPLY QUANTITIES OF MILK, MARKET TOTALS -
MODEL B-1, 1972-1976

Market	1972	1973	1974	1975	1976
			(million cwt.)		
1	15.1	15.4	15.8	16.2	16.4
2	14.7	15.0	15.3	15.6	15.9
3	5.9	6.1	6.3	6.4	6.5
4	6.5	6.9	7.3	7.7	8.1
5	9.2	9.3	9.4	9.6	9.8
6	12.6	13.0	13.4	13.8	14.1
7	17.1	18.6	19.6	20.5	21.2
8	7.7	8.0	8.3	8.5	8.8
9	6.5	6.8	7.0	7.1	7.3
10	7.5	8.3	8.9	9.3	9.6
11	6.2	6.4	6.6	6.8	7.0
12	11.6	12.3	12.9	13.4	13.8
13	5.9	6.4	6.8	7.1	7.4
14	13.2	14.1	15.0	15.7	16.3
15	17.6	18.0	18.3	18.5	18.7
16	27.1	28.8	30.3	31.6	32.6
17	31.3	32.2	33.0	33.7	34.3
18	19.2	20.0	20.7	21.2	21.7
19	33.2	32.9	32.8	32.7	32.7
20	44.7	44.6	44.6	44.6	44.8
21	100.7	99.0	97.9	97.1	96.7
22	48.8	48.4	48.2	48.1	48.1
23	40.6	41.6	42.4	43.2	43.9
24	86.2	90.4	93.3	95.5	97.0
25	29.5	30.8	31.8	32.6	33.4
26	12.2	12.1	12.0	11.9	11.9
27	7.9	8.3	8.6	8.8	9.1
28	13.1	14.1	14.8	15.5	16.0
29	14.6	14.4	14.3	14.3	14.3
30	7.7	7.9	8.1	8.3	8.4
31	11.1	11.8	12.4	12.8	13.2

TABLE LXIV

DEMAND QUANTITIES OF FLUID MILK, MARKET TOTALS - MODEL B-1, 1972-1976

Market	1972	1973	1974	1975	1976
			(million cwt.)		
1	6.2	6.3	6.3	6.4	6.5
2	8.6	8.6	8.7	8.7	8.7
3	3.5	3.6	3.6	3.7	3.7
4	5.0	5.1	5.3	5.5	5.6
5	7.2	7.2	7.3	7.3	7.4
6	9.4	9.5	9.5	9.5	9.5
7	13.4	13.6	13.7	13.8	13.9
8	5.7	5.7	5.7	5.7	5.7
9	6.4	6.4	6.5	6.5	6.5
10	6.1	6.2	6.2	6.2	6.2
11	3.7	3.7	3.8	3.8	3.8
12	10.3	10.6	11.0	11.5	11.8
13	5.7	5.8	5.9	6.0	6.0
14	12.3	12.5	12.7	13.0	13.2
15	12.5	12.5	12.5	12.8	12.8
16	17.8	17.8	17.8	17.9	17.8
17	22.5	22.7	22.9	22.9	23.0
18	13.4	13.6	13.6	13.8	13.8
19	21.5	21.5	21.3	21.1	20.9
20	30.9	31.2	31.7	32.2	32.7
21	51.0	51.0	51.2	51.3	51.4
22	31.2	31.3	31.5	31.7	31.9
23	25.8	25.9	26.0	26.0	26.1
24	34.6	35.3	35.8	36.5	36.7
25	13.0	13.2	13.3	13.4	13.4
26	7.0	7.0	7.0	7.0	6.9
27	2.1	2.1	2.1	2.1	2.1
28	7.3	7.2	7.2	7.1	7.1
29	8.9	8.9	8.9	8.9	8.9
30	6.0	6.1	6.2	6.3	6.4
31	8.8	8.8	8.8	8.8	8.7

TABLE LXV

EXPORT (IMPORT) QUANTITIES OF FLUID MILK, MARKET TOTALS - MODEL B-1, 1972-1976

Market	1972	1973	1974	1975	1976
	(thousand cwt.)				
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0
9	(1,094.2)	(936.6)	(804.7)	(736.4)	(613.8)
10	0.0	0.0	0.0	0.0	0.0
11	864.3	358.9	153.2	0.0	0.0
12	(864.3)	(646.2)	(544.7)	(595.0)	(589.2)
13	(927.3)	(619.1)	(364.0)	(195.3)	0.0
14	(1,595.4)	(992.4)	(497.0)	(190.8)	0.0
15	1,821.2	387.6	14.4	235.9	61.3
16	1,151.2	981.8	823.8	736.4	613.8
17	0.0	404.3	0.0	0.0	0.0
18	0.0	51.6	10.0	354.9	133.9
19	0.0	11.2	0.0	85.2	104.0
20	(2.0)	(741.5)	(941.5)	(1,199.9)	(1,533.6)
21	2.0	730.3	941.5	1,114.7	1,190.9
22	0.0	0.0	0.0	0.0	0.0
23	1.2	0.0	0.0	0.0	0.0
24	0.0	237.8	46.6	164.5	238.7
25	0.0	0.0	0.0	0.0	0.0
26	7.4	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0
28	102.3	0.0	0.0	0.0	0.0
29	339.1	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0
31	194.5	772.2	1,162.3	225.7	394.0

TABLE LXVI

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, MARKET AVERAGES - MODEL B-1, 1973

Market	1972	1973	1974	1975	1976
			(percent)		
1	41.4	40.7	40.1	39.6	39.2
2	58.9	57.6	56.6	55.8	55.1
3	59.7	58.4	57.6	57.1	56.9
4	76.5	74.1	72.2	70.8	69.7
5	77.8	77.8	77.1	76.2	75.0
6	74.9	72.7	70.7	68.9	67.2
7	78.7	73.3	69.8	67.5	65.8
8	73.8	71.4	69.2	67.2	65.4
9	81.3	81.3	81.3	81.3	81.3
10	81.3	74.3	69.8	66.7	64.4
11	73.8	63.3	59.0	55.9	55.2
12	81.3	81.3	81.3	81.3	81.3
13	81.3	81.3	81.3	81.3	81.3
14	81.3	81.3	81.3	81.3	80.8
15	81.1	71.5	68.8	70.3	68.7
16	70.0	65.1	61.4	58.9	56.4
17	71.8	71.8	69.4	68.1	67.0
18	69.8	68.0	66.1	66.9	64.4
19	64.9	65.2	64.9	64.7	64.2
20	69.0	68.4	69.1	69.5	69.7
21	50.7	52.3	53.2	54.0	54.4
22	63.9	64.7	65.4	65.9	66.3
23	63.4	62.2	61.2	60.2	59.4
24	40.2	39.3	38.4	38.4	38.1
25	44.1	42.9	41.8	41.0	40.3
26	56.9	57.9	58.3	58.5	58.5
27	26.2	25.0	24.0	23.3	22.6
28	56.2	51.2	48.3	46.2	44.5
29	63.8	62.2	62.5	62.4	62.0
30	78.4	77.3	76.8	76.6	76.5
31	81.3	81.3	80.7	70.0	68.9

TABLE LXVII

RETAIL PRICES FOR FLUID MILK, MARKET AVERAGES - MODEL B-1, 1972-1976

Market	1972	1973	1974	1975	1976
			($/cwt.)		
1	13.60	14.79	14.54	14.89	15.27
2	13.21	13.77	14.10	14.45	14.81
3	13.48	14.05	14.37	14.72	15.08
4	12.31	12.79	13.07	13.37	13.68
5	14.61	14.88	15.21	15.55	15.91
6	14.41	14.66	15.00	15.35	15.72
7	14.27	14.66	14.78	15.11	15.45
8	13.67	13.92	14.25	14.59	14.96
9	14.87	14.96	15.09	15.08	15.39
10	15.47	15.54	15.89	16.26	16.64
11	14.89	15.53	15.79	16.14	16.50
12	16.25	16.42	16.53	16.48	16.77
13	15.13	15.24	15.39	15.38	15.67
14	17.20	17.33	17.48	17.46	17.59
15	14.04	14.44	14.60	14.44	14.79
16	14.23	14.42	14.64	14.58	14.97
17	13.51	13.48	13.64	14.98	14.34
18	13.15	13.21	13.33	13.19	13.54
19	13.91	14.07	14.50	14.89	15.32
20	14.62	15.20	15.53	15.88	16.25
21	14.42	14.87	15.20	15.55	15.92
22	14.36	14.91	15.23	15.57	15.94
23	12.51	12.70	13.01	13.34	13.68
24	15.90	15.51	15.44	14.93	15.30
25	12.04	11.96	12.28	12.61	12.96
26	12.74	12.73	13.05	13.39	13.74
27	13.80	14.29	14.66	15.04	15.44
28	12.50	13.05	13.37	13.71	14.06
29	14.46	14.76	15.12	15.50	15.89
30	13.85	14.42	14.75	15.10	15.46
31	14.42	14.51	14.66	15.01	15.38

TABLE LXVIII

CLASS I PRICES FOR MILK, MARKET AVERAGES - MODEL B-1, 1972-1976

Market	1972	1973	1974	1975	1976
			($/cwt.)		
1	6.86	7.22	7.43	7.65	7.88
2	6.96	7.32	7.53	7.75	7.98
3	6.92	7.28	7.49	7.71	7.94
4	7.54	7.89	8.10	8.32	8.55
5	7.56	7.73	7.94	8.16	8.39
6	7.52	7.68	7.89	8.11	8.34
7	8.00	8.13	8.34	8.56	8.79
8	7.19	7.35	7.56	7.78	8.01
9	7.58	7.64	7.72	7.72	7.91
10	7.79	7.84	8.05	8.27	8.50
11	7.86	8.27	8.43	8.65	8.88
12	9.36	9.47	9.54	9.52	9.71
13	8.69	8.77	8.86	8.85	9.05
14	8.11	8.19	8.27	8.26	8.33
15	7.19	7.43	7.54	7.43	7.65
16	7.15	7.27	7.40	7.37	7.60
17	7.19	7.17	7.27	7.49	7.72
18	7.23	7.27	7.35	7.26	7.49
19	7.30	7.40	7.67	7.91	8.18
20	7.79	8.15	8.36	8.58	8.81
21	7.71	8.00	8.21	8.43	8.66
22	7.99	8.35	8.56	8.78	9.03
23	7.00	7.13	7.34	7.56	7.79
24	8.20	7.96	7.92	7.61	7.84
25	6.48	6.43	6.64	6.86	7.09
26	6.71	6.71	6.92	7.14	7.37
27	6.37	6.66	6.87	7.09	7.32
28	6.61	6.97	7.18	7.40	7.63
29	6.93	7.11	7.32	7.54	7.77
30	7.31	7.67	7.88	8.10	8.33
31	7.52	7.58	7.67	7.89	8.12

TABLE LXVIX

FARM BLEND PRICES FOR MILK, MARKET AVERAGES - MODEL B-1, 1972-1976

Market	1972	1973	1974	1975	1976
			($/cwt.)		
1	5.73	6.07	6.27	6.48	6.71
2	6.12	6.46	6.65	6.85	7.07
3	6.12	6.45	6.65	6.86	7.08
4	6.93	7.22	7.38	7.56	7.76
5	6.98	7.19	7.38	7.58	7.78
6	6.87	7.03	7.19	7.37	7.55
7	7.35	7.37	7.48	7.64	7.82
8	6.60	6.76	6.92	7.10	7.30
9	7.16	7.26	7.35	7.38	7.57
10	7.26	7.18	7.28	7.42	7.59
11	6.97	7.11	7.20	7.36	7.57
12	8.59	8.73	8.82	8.84	9.03
13	8.08	8.17	8.27	8.28	8.47
14	7.58	7.68	7.77	7.79	7.87
15	6.71	6.81	6.90	6.92	7.12
16	6.46	6.55	6.65	6.68	6.87
17	6.55	6.64	6.73	6.93	7.14
18	6.54	6.63	6.72	6.74	6.94
19	6.47	6.67	6.91	7.14	7.38
20	6.90	7.26	7.49	7.73	7.97
21	6.34	6.70	6.93	7.17	7.41
22	6.89	7.27	7.50	7.74	7.99
23	6.24	6.44	6.63	6.83	7.04
24	6.24	6.34	6.43	6.45	6.67
25	5.61	5.78	5.98	6.19	6.41
26	5.94	6.11	6.33	6.55	6.78
27	5.31	5.63	5.83	6.04	6.26
28	5.87	6.15	6.31	6.50	6.70
29	6.19	6.42	6.64	6.86	7.08
30	6.79	7.13	7.33	7.54	7.77
31	7.02	7.12	7.21	7.23	7.42

APPENDIX D

SELECTED MARKET EQUILIBRIUM CONDITIONS,

ALTERNATIVE PRICING POLICY AND

STRUCTURAL CHANGE MODELS

TABLE LXX

SUPPLY QUANTITIES OF MILK, MARKET TOTALS - MODELS B-2, C-1, AND C-2, 1976

Market	Model B-2	Model C-1	Model C-2
		(million cwt.)	
1	16.5	16.3	16.4
2	15.9	15.6	15.6
3	6.6	6.4	6.4
4	8.0	7.9	7.5
5	9.6	9.5	9.6
6	13.9	13.8	13.7
7	20.8	20.8	20.3
8	8.8	8.6	8.5
9	7.3	7.1	7.1
10	9.5	9.3	9.3
11	6.9	6.7	6.7
12	13.8	13.5	13.7
13	7.4	7.2	7.3
14	16.3	15.9	16.1
15	18.7	18.4	18.5
16	32.7	32.5	32.6
17	34.4	34.1	34.1
18	21.8	21.6	21.6
19	32.7	32.5	32.5
20	44.5	44.4	44.2
21	96.1	96.1	96.1
22	47.8	47.8	47.5
23	44.0	43.7	43.5
24	96.8	94.8	95.5
25	34.2	33.0	32.7
26	11.9	11.8	11.7
27	9.2	9.0	9.1
28	16.1	15.8	15.7
29	14.4	14.1	14.0
30	8.3	8.1	8.1
31	13.1	12.6	12.9

TABLE LXXI

DEMAND QUANTITIES OF FLUID MILK, MARKET TOTALS - MODEL B-2, 1972, 1976, MODEL B-3, 1972

Market	Model B-2		Model B-3
	1972	1976	1972
		(million cwt.)	
1	6.2	6.4	6.2
2	8.6	8.7	8.6
3	3.5	3.7	3.5
4	5.0	5.7	5.0
5	7.2	7.5	7.2
6	9.4	9.7	9.4
7	13.4	14.5	13.4
8	5.7	5.7	5.7
9	6.4	6.4	6.4
10	6.1	6.4	6.1
11	3.8	3.9	3.8
12	10.4	11.9	10.4
13	5.8	6.0	5.7
14	12.4	13.2	12.4
15	12.6	12.5	12.5
16	17.8	17.4	17.9
17	22.7	22.7	22.6
18	13.5	13.5	13.5
19	21.7	21.0	21.6
20	31.1	33.3	31.3
21	51.0	52.1	51.0
22	31.2	32.6	31.2
23	25.8	25.9	25.8
24	34.9	36.6	34.8
25	12.8	13.1	13.1
26	6.9	6.8	7.0
27	2.0	2.0	2.1
28	7.2	7.0	7.3
29	8.9	8.8	9.0
30	6.1	6.5	6.1
31	8.9	8.7	8.9

TABLE LXXII

EXPORT (IMPORT) QUANTITIES OF FLUID MILK, MARKET TOTALS - MODEL B-2, 1972, 1976, MODEL B-3, 1972

Market	Model B-2		Model B-3
	1972	1976	1972
		(million cwt.)	
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	(1,119.9)	(395.5)	(1,130.0)
10	0.0	15.3	0.0
11	1,243.5	2.2	1,251.1
12	(962.3)	(631.2)	(940.7)
13	(967.4)	(12.3)	(955.5)
14	(1,692.4)	0.0	(1,663.9)
15	1,764.1	0.0	1,790.0
16	1,119.9	301.6	1,130.0
17	491.1	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	374.2
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	93.9	0.0
25	0.0	0.0	0.0
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	123.4	625.9	144.9

TABLE LXXIII

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, MARKET AVERAGES - MODEL B-2, 1972, 1976, MODEL B-3, 1972

Market	Model B-2		Model B-3
	1972	1976	1972
		(percent)	
1	41.3	39.0	41.5
2	58.8	55.0	58.9
3	59.6	56.7	59.7
4	76.5	71.4	76.5
5	77.8	78.0	77.8
6	74.9	69.4	74.9
7	78.7	69.5	78.7
8	73.8	65.4	73.8
9	81.3	81.3	81.3
10	81.3	67.9	81.3
11	81.3	56.9	81.3
12	81.3	81.3	81.3
13	81.3	81.3	81.3
14	81.3	81.3	81.3
15	81.3	66.8	81.3
16	70.1	54.2	70.2
17	73.9	66.0	72.1
18	70.3	62.2	70.1
19	65.3	64.4	65.2
20	69.5	74.8	70.7
21	50.7	54.2	50.7
22	63.9	68.2	63.9
23	63.4	58.9	63.5
24	40.4	37.9	40.4
25	43.5	38.3	44.2
26	56.2	56.6	57.1
27	25.7	21.9	26.2
28	54.6	43.5	55.5
29	61.3	61.1	61.6
30	78.9	77.9	79.4
31	81.3	71.3	81.3

TABLE LXXIV

CLASS I PRICES FOR MILK, MARKET AVERAGES - MODEL B-2, 1972, 1976, MODEL B-3, 1972

Market	Model B-2		Model B-3
	1972	1976	1972
		($/cwt.)	
1	7.00	8.02	6.86
2	7.00	8.02	6.96
3	7.00	8.02	6.90
4	7.54	8.02	7.54
5	7.56	8.02	7.56
6	7.52	8.02	7.52
7	8.00	8.02	8.00
8	7.19	8.02	7.19
9	7.53	8.23	7.51
10	7.79	8.02	7.79
11	7.43	8.51	7.47
12	9.20	9.69	9.24
13	8.57	9.05	8.61
14	8.00	8.26	8.04
15	7.07	8.02	7.10
16	7.09	8.13	7.06
17	7.00	8.02	7.08
18	7.09	8.02	7.13
19	7.14	8.02	7.19
20	7.45	8.02	7.18
21	7.70	8.02	7.70
22	7.98	8.02	7.98
23	7.00	8.02	6.92
24	7.94	8.02	8.02
25	7.00	8.02	6.41
26	7.00	8.02	6.59
27	7.00	8.02	6.37
28	7.00	8.02	6.55
29	7.00	8.02	6.87
30	7.00	8.02	6.74
31	7.40	8.05	7.43

TABLE LXXV

FARM BLEND PRICES FOR MILK, MARKET AVERAGES - MODEL B-2, 1972, 1976, MODEL B-3, 1972

Market	Model B-2		Model B-3
	1972	1976	1972
		($/cwt.)	
1	5.78	6.76	5.73
2	6.15	7.09	6.12
3	6.16	7.12	6.11
4	6.93	7.43	6.93
5	6.98	7.56	6.98
6	6.87	7.39	6.87
7	7.35	7.39	7.35
8	6.60	7.30	6.60
9	7.11	7.82	7.10
10	7.26	7.35	7.26
11	6.85	7.40	6.88
12	8.47	9.02	8.49
13	7.99	8.47	8.02
14	7.49	7.83	7.52
15	6.62	7.33	6.65
16	6.41	7.12	6.39
17	6.45	7.32	6.48
18	6.45	7.24	6.47
19	6.38	7.28	6.40
20	6.68	7.50	6.52
21	6.34	7.07	6.34
22	6.88	7.36	6.88
23	6.24	7.17	6.19
24	6.15	6.73	6.18
25	5.83	6.74	5.58
26	6.09	7.12	5.88
27	5.46	6.40	5.31
28	6.06	6.85	5.83
29	6.20	7.21	6.13
30	6.56	7.56	6.37
31	6.93	7.41	6.96

TABLE LXXVI

DEMAND QUANTITIES OF FLUID MILK, MARKET TOTALS - MODELS C-1 AND C-2, 1972, 1976, MODELS C-3 AND C-4, 1972

Market	Model C-1		Model C-2		Model C-3	Model C-4
	1972	1976	1972	1976	1972	1972
				(million cwt.)		
1	6.2	6.6	6.2	6.6	6.2	6.2
2	8.6	8.9	8.6	8.9	8.7	8.6
3	3.5	3.8	3.5	3.8	3.5	3.5
4	5.0	5.7	5.0	5.7	5.0	5.0
5	7.5	7.7	7.2	7.7	7.3	7.2
6	9.5	9.9	9.8	10.0	9.8	9.4
7	13.6	14.5	13.4	14.5	14.0	13.4
8	5.7	5.9	5.7	5.9	5.8	5.7
9	6.7	6.7	6.6	6.9	6.7	5.3
10	6.5	6.6	6.3	6.6	6.3	6.1
11	3.8	4.0	3.8	4.0	3.8	3.7
12	10.7	12.7	10.1	11.7	10.8	9.4
13	5.9	6.5	5.6	5.9	6.0	4.8
14	12.7	14.1	13.6	14.4	12.9	10.7
15	12.6	13.2	12.6	13.2	12.7	12.6
16	18.0	18.1	18.4	18.3	18.1	18.0
17	22.7	23.7	22.7	23.7	22.7	22.7
18	13.7	14.2	13.6	13.9	13.7	13.7
19	21.7	21.9	21.7	21.9	21.6	21.7
20	30.9	33.4	31.1	34.1	31.6	30.8
21	51.0	52.5	51.0	52.5	50.8	51.1
22	31.2	32.6	31.2	32.6	31.3	31.2
23	25.8	26.7	25.7	26.5	25.8	25.8
24	35.4	37.9	35.7	37.9	35.3	36.2
25	13.1	13.7	13.1	13.7	13.1	13.1
26	7.0	7.2	7.0	7.2	7.1	7.0
27	2.1	2.1	2.1	2.1	2.1	2.1
28	7.3	7.4	7.3	7.4	7.4	7.5
29	9.2	9.2	9.3	9.6	9.0	9.3
30	6.3	6.6	6.2	6.6	6.2	6.2
31	9.1	9.5	9.0	9.1	9.0	9.0

TABLE LXXVII

EXPORT (IMPORT) QUANTITIES OF FLUID MILK, MARKET TOTALS - MODELS C-1 AND C-2, 1972, 1976, MODELS C-3, 1972

Market	Model C-1		Model C-2		Model C-3
	1972	1976	1972	1976	1972
			(thousand cwt.)		
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	(46.0)	0.0	(60.7)
6	0.0	0.0	0.0	0.0	111.9
7	0.0	0.0	0.0	0.0	(111.9)
8	0.0	0.0	0.0	0.0	0.0
9	(897.0)	(387.8)	(1,343.1)	(1,089.7)	(1,394.3)
10	0.0	0.0	(213.5)	0.0	(169.7)
11	1,156.6	0.0	1,189.9	0.0	1,196.1
12	(455.3)	(656.0)	(718.6)	(588.5)	(1,364.8)
13	(701.3)	(29.7)	(817.2)	0.0	(1,206.8)
14	(1,065.1)	0.0	(2,862.8)	(1,310.0)	(2,191.8)
15	353.5	0.0	0.0	0.0	2,191.8
16	0.0	387.8	2,709.3	0.0	1,394.3
17	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	2,056.0	0.0	601.9
19	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	534.8	1,545.2
21	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0
29	897.0	0.0	0.0	1,089.7	0.0
30	0.0	0.0	46.0	0.0	60.7
31	711.6	685.7	0.0	1,363.7	0.0

TABLE LXXVIII

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, MARKET AVERAGES - MODELS C-1 AND C-2, 1972, 1976, MODELS C-3 AND C-4, 1972

Market	Model C-1		Model C-2		Model C-3	Model C-4
	1972	1976	1972	1976	1972	1972
			(percent)			
1	41.5	40.6	41.5	40.4	41.3	41.5
2	58.9	57.3	58.9	57.5	59.0	58.9
3	59.7	58.8	59.7	58.8	59.7	59.7
4	76.7	72.2	76.5	76.6	76.5	76.5
5	81.3	81.3	77.8	80.6	78.9	77.8
6	75.4	71.9	78.2	72.6	78.5	74.9
7	79.7	69.7	78.7	71.5	81.3	78.7
8	74.1	69.1	74.4	69.6	75.2	73.8
9	88.8	88.8	81.3	81.3	81.3	81.3
10	86.6	71.2	81.3	71.4	81.3	81.3
11	80.8	60.2	81.3	59.9	81.3	59.9
12	88.8	88.8	81.3	81.3	81.3	81.3
13	88.8	88.8	81.3	81.3	81.3	81.3
14	88.8	88.5	81.3	81.3	81.3	81.3
15	73.6	71.6	71.4	71.3	81.3	71.4
16	66.6	56.8	78.0	56.2	72.0	66.6
17	72.6	69.6	72.6	69.5	72.6	72.6
18	71.1	66.0	81.3	64.6	74.4	71.1
19	65.6	67.3	65.6	67.4	65.2	65.6
20	69.0	75.2	69.5	78.3	74.0	68.9
21	50.7	54.7	50.7	54.7	50.5	50.7
22	63.9	68.2	63.9	68.6	64.2	63.9
23	63.5	61.1	63.1	61.0	63.5	63.5
24	41.0	39.9	41.4	39.7	40.9	42.0
25	44.3	41.5	44.3	41.8	44.3	44.3
26	57.6	61.1	57.2	61.2	57.7	57.6
27	26.2	23.4	26.2	23.1	26.2	26.2
28	55.4	46.7	55.8	47.4	56.2	57.0
29	69.2	65.1	63.7	76.1	62.2	63.5
30	81.8	81.2	81.3	81.3	81.3	80.6
31	88.8	81.1	81.3	81.3	81.3	81.3

TABLE LXXIX

CLASS I PRICES FOR MILK, MARKET AVERAGES - MODELS C-1 AND C-2, 1972, 1976, MODELS C-3 AND C-4, 1972

Market	Model C-1		Model C-2		Model C-3	Model C-4
	1972	1976	1972	1976	1972	1972
				($/cwt.)		
1	6.86	6.86	7.16	7.16	7.02	6.86
2	6.96	6.96	6.88	6.89	6.84	6.96
3	6.90	6.91	6.91	6.92	6.90	6.90
4	7.37	7.55	6.32	6.33	7.54	7.54
5	6.76	7.58	7.47	7.61	7.17	7.56
6	7.40	7.52	6.88	7.59	6.85	7.52
7	7.75	8.01	7.56	7.56	7.22	8.00
8	7.07	7.20	6.97	7.20	6.66	7.19
9	6.95	7.50	7.28	7.39	6.93	9.97
10	6.84	7.49	7.74	7.96	7.39	7.79
11	7.15	7.85	7.23	7.92	7.20	7.84
12	8.64	8.42	9.04	9.34	8.58	10.70
13	8.08	7.81	8.41	8.63	7.90	11.28
14	7.58	7.26	7.78	8.05	7.42	9.97
15	7.00	7.05	7.26	7.26	6.82	7.05
16	6.84	7.17	6.64	7.21	6.72	6.81
17	6.92	6.92	6.86	6.94	6.92	6.92
18	6.83	6.83	6.66	7.01	6.75	6.83
19	7.05	7.12	7.14	7.14	7.18	7.05
20	7.78	7.79	7.51	6.88	6.75	7.88
21	7.70	7.65	7.74	7.67	7.89	7.65
22	7.98	7.99	7.67	7.67	7.75	7.98
23	6.91	6.92	6.63	6.60	6.91	6.91
24	7.45	6.69	7.52	7.02	7.52	6.63
25	6.34	6.34	5.97	6.15	6.34	6.34
26	6.39	6.39	6.28	6.15	6.31	5.39
27	6.37	6.38	7.16	7.16	6.37	6.37
28	6.62	6.62	6.18	6.15	6.23	5.82
29	6.19	6.88	6.53	6.27	6.59	6.01
30	5.40	7.30	6.01	7.34	6.11	6.09
31	7.00	6.70	7.28	7.43	7.19	7.19

TABLE LXXX

FARM BLEND PRICES FOR MILK, MARKET AVERAGES - MODELS C-1 AND C-2, 1972, 1976, MODELS C-3 AND C-4, 1972

Market	Model C-1		Model C-2		Model C-3	Model C-4
	1972	1976	1972	1976	1972	1972
				($/cwt.)		
1	5.73	6.32	5.85	6.44	5.79	5.73
2	6.12	6.53	6.08	6.49	6.06	6.12
3	6.11	6.52	6.11	6.52	6.11	6.11
4	6.80	7.11	6.00	6.24	6.93	6.93
5	6.42	7.27	6.91	7.29	6.70	6.98
6	6.79	7.08	6.46	7.14	6.44	6.87
7	7.18	7.38	7.00	7.10	6.80	7.35
8	6.52	6.81	6.45	6.82	6.23	6.60
9	6.75	7.34	6.92	7.15	6.62	9.02
10	6.59	7.05	7.23	7.38	6.94	7.26
11	6.63	7.09	6.70	7.13	6.67	6.68
12	8.24	8.16	8.31	8.73	7.97	9.62
13	7.77	7.60	7.84	8.13	7.44	10.09
14	7.31	7.11	7.34	7.68	7.02	9.03
15	6.44	6.74	6.59	6.89	6.43	6.44
16	6.20	6.64	6.22	6.66	6.19	6.18
17	6.38	6.63	6.33	6.64	6.38	6.38
18	6.28	6.53	6.30	6.64	6.27	6.28
19	6.32	6.74	6.38	6.76	6.40	6.32
20	6.90	7.33	6.73	6.68	6.26	6.96
21	6.34	6.88	6.35	6.89	6.42	6.31
22	6.88	7.34	6.68	7.13	6.74	6.88
23	6.19	6.54	6.00	6.34	6.19	6.19
24	5.96	6.25	6.00	6.37	5.99	5.64
25	5.55	6.11	5.39	6.03	5.55	5.55
26	5.77	6.22	5.70	6.07	5.73	5.77
27	5.31	6.05	5.51	6.23	5.31	5.31
28	5.87	6.26	5.63	6.04	5.66	5.44
29	5.78	6.56	5.95	6.18	5.96	5.62
30	5.32	7.05	5.81	7.08	5.89	5.86
31	6.75	6.55	6.84	7.12	6.77	6.77

TABLE LXXXI

DEMAND QUANTITIES OF FLUID MILK, MARKET TOTALS - MODELS D-1 AND D-2, 1976, MODELS D-3 AND D-4, 1973

Market	Model D-1	Model D-2	Model D-3	Model D-4
		(million cwt.)		
1	6.6	6.6	6.3	6.2
2	8.9	8.9	8.7	8.6
3	3.8	3.8	3.6	3.5
4	5.7	5.7	5.1	5.0
5	7.7	7.6	7.3	7.0
6	9.9	9.9	9.5	9.4
7	14.5	14.5	13.5	13.3
8	5.9	5.9	5.8	5.7
9	6.6	6.7	6.3	6.0
10	6.6	6.7	6.0	5.7
11	4.0	4.1	3.8	3.7
12	12.6	12.1	10.5	10.1
13	6.4	6.1	5.7	5.5
14	14.0	13.3	12.3	11.8
15	13.2	13.1	12.5	12.0
16	18.0	18.1	17.8	17.4
17	23.7	23.6	22.7	22.1
18	14.2	14.1	13.5	13.2
19	21.9	21.8	21.5	21.1
20	33.4	33.4	31.4	31.4
21	52.5	52.5	51.4	51.4
22	32.6	32.6	31.5	31.5
23	26.7	26.7	26.0	25.6
24	37.8	37.4	35.9	35.7
25	13.7	13.7	13.2	12.8
26	7.2	7.2	7.0	6.7
27	2.1	2.1	2.1	2.0
28	7.4	7.5	7.3	7.0
29	9.3	9.3	9.1	8.8
30	6.7	6.6	6.1	6.0
31	9.6	9.0	8.7	8.3

TABLE LXXXII

EXPORT (IMPORT) QUANTITIES OF FLUID MILK, MARKET TOTALS - MODELS D-1 AND D-2, 1976, MODELS D-3 AND D-4, 1973

Market	Model D-1	Model D-2	Model D-3	Model D-4
	(thousand cwt.)			
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	125.4
4	0.0	0.0	0.0	(57.8)
5	0.0	(226.8)	0.0	0.0
6	0.0	0.0	24.0	222.0
7	0.0	0.0	(24.0)	(222.0)
8	0.0	0.0	0.0	0.0
9	(691.0)	(1,306.7)	(1,208.4)	(1,008.2)
10	0.0	552.6	(82.2)	0.0
11	0.0	1,068.9	1,099.3	1,060.8
12	(927.5)	(1,541.9)	(1,347.8)	(1,244.2)
13	(194.8)	(479.7)	(1,060.1)	(988.5)
14	(288.0)	(851.4)	(1,898.2)	(1,702.8)
15	0.0	312.8	1,457.8	1,439.1
16	691.0	0.0	0.0	1,008.2
17	0.0	0.0	1,260.3	0.0
18	0.0	0.0	440.4	129.9
19	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	1,171.9
21	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0
28	0.0	543.7	19.2	0.0
29	0.0	1,306.7	1,290.6	0.0
30	0.0	(316.8)	(19.2)	(67.5)
31	1,410.2	928.7	48.3	133.8

TABLE LXXXIII

CLASS I UTILIZATION PERCENTAGES OF MILK SUPPLIED, MARKET AVERAGES - MODELS D-1 AND D-2, 1976, MODELS D-3 AND D-4, 1973

Market	Model D-1	Model D-2	Model D-3	Model D-4
		(percent)		
1	38.7	42.8	43.3	44.0
2	54.6	60.3	61.2	62.3
3	56.0	61.9	62.7	66.1
4	68.7	75.9	81.3	81.3
5	77.0	81.3	81.3	81.3
6	69.0	76.3	78.2	81.2
7	66.7	73.7	81.3	81.3
8	66.4	73.4	76.8	78.3
9	81.3	81.3	81.3	81.3
10	67.5	81.3	81.3	81.1
11	57.4	81.3	81.3	81.3
12	81.3	81.3	81.3	81.3
13	81.3	81.3	81.3	81.3
14	81.3	81.3	81.3	81.3
15	68.1	76.4	81.3	81.3
16	55.0	58.6	67.7	72.4
17	66.3	72.9	78.8	75.1
18	62.8	68.7	74.9	73.8
19	64.1	70.8	67.0	67.7
20	72.9	80.6	72.4	77.5
21	52.1	57.6	52.7	54.4
22	65.0	71.8	66.6	68.8
23	58.1	64.3	65.9	67.0
24	37.8	41.4	42.9	44.1
25	39.6	43.7	46.0	46.1
26	58.2	64.3	59.3	58.9
27	22.3	24.7	27.0	27.0
28	45.1	54.4	57.7	57.1
29	63.5	80.6	73.3	64.3
30	79.4	81.3	81.3	81.3
31	81.1	81.3	81.3	81.3

TABLE LXXXIV

CLASS I PRICES FOR MILK, MARKET AVERAGES - MODELS D-1 AND D-2, 1976, MODELS D-3 AND D-4, 1973

Market	Model D-1	Model D-2	Model D-3	Model D-4
		($/cwt.)		
1	6.86	6.86	6.86	7.54
2	6.96	6.96	6.96	7.54
3	6.91	6.91	6.90	7.60
4	7.55	7.55	7.90	9.11
5	7.58	7.87	7.66	8.22
6	7.52	7.52	7.57	7.83
7	8.01	8.01	8.29	8.60
8	7.20	7.20	7.19	7.54
9	7.64	7.53	7.83	8.61
10	7.49	7.39	8.26	8.92
11	7.85	7.51	7.88	8.44
12	8.57	9.34	9.70	10.30
13	7.92	8.78	9.00	9.61
14	7.31	8.18	8.43	9.04
15	7.05	7.23	7.45	8.03
16	7.24	7.18	7.30	7.86
17	6.92	7.05	7.25	7.84
18	6.83	7.11	7.30	7.85
19	7.11	7.15	7.31	7.82
20	7.79	7.74	7.88	7.88
21	7.65	7.65	7.65	7.65
22	7.99	7.99	7.98	7.98
23	6.92	6.92	6.98	7.56
24	6.76	7.15	7.34	7.54
25	6.34	6.34	6.52	7.54
26	6.39	6.39	6.52	7.54
27	6.38	6.38	6.52	7.54
28	6.62	6.15	6.52	7.54
29	6.63	6.41	6.75	7.54
30	6.15	7.42	7.81	8.82
31	6.65	7.55	7.81	8.40

TABLE LXXXV

FARM BLEND PRICES FOR MILK, MARKET AVERAGES - MODELS D-1 AND D-2, 1976, MODELS D-3 AND D-4, 1973

Market	Model D-1	Model D-2	Model D-3	Model D-4
		($/cwt.)		
1	6.30	6.34	6.54	7.41
2	6.50	6.56	6.71	7.45
3	6.49	6.55	6.68	7.50
4	7.05	7.17	7.60	8.77
5	7.20	7.52	7.40	8.05
6	7.04	7.15	7.29	7.73
7	7.32	7.47	7.92	8.36
8	6.78	6.86	6.99	7.49
9	7.35	7.28	7.59	8.40
10	6.99	7.11	7.90	8.61
11	7.04	7.16	7.52	8.18
12	8.11	8.77	9.14	9.80
13	7.56	8.28	8.58	9.24
14	7.06	7.79	8.09	8.75
15	6.70	6.92	7.22	7.88
16	6.65	6.67	6.98	7.70
17	6.59	6.75	7.04	7.70
18	6.50	6.74	7.04	7.71
19	6.70	6.80	6.98	7.65
20	7.29	7.39	7.44	7.74
21	6.84	6.93	7.01	7.49
22	7.27	7.41	7.42	7.77
23	6.51	6.57	6.75	7.47
24	6.26	6.44	6.75	7.41
25	6.11	6.12	6.40	7.41
26	6.21	6.24	6.43	7.44
27	6.05	6.06	6.36	7.37
28	6.25	6.06	6.43	7.44
29	6.38	6.31	6.62	7.46
30	6.11	7.16	7.53	8.54
31	6.50	7.23	7.53	8.19

APPENDIX E

SELECTED REGIONAL EQUILIBRIUM COSTS,

ALTERNATIVE PRICING POLICY AND

STRUCTURAL CHANGE MODELS

TABLE LXXXVI

TRANSPORTATION COSTS FOR EXPORTING FLUID MILK, U.S. AND REGIONAL TOTALS - MODELS B-1, B-2, B-3, C-1, C-2, AND C-3, 1972

Region	Model B-1	Model B-2	Model B-3	Model C-1	Model C-2	Model C-3
			($ thousand)			
1	9.0	0.0	0.0	0.0	0.0	0.0
2	3,635.9	3,240.7	2,564.6	1,575.9	4,907.9	1,988.0
3	1.1	0.0	561.1	0.0	0.0	2,009.8
4	1,398.6	1,877.8	1,876.2	1,536.4	1,570.5	1,377.3
5	0.0	0.0	0.0	0.0	0.0	40.1
6	0.0	0.0	0.0	0.0	50.8	49.2
U.S.	5,044.7	5,118.5	5,001.9	3,112.3	6,229.1	5,464.5

TABLE LXXXVII

PROCESSING COSTS FOR FLUID MILK PRODUCTS, U.S. AND REGIONAL TOTALS AND AVERAGES PER CWT. - MODELS B-1, B-2, C-1, C-2, D-1 AND D-2, 1976

Region	Model B-1	Model B-2	Model C-1	Model C-2	Model D-1	Model D-2
			($ millions)			
1	85.9	84.8	88.3	88.3	88.2	87.6
2	201.3	199.4	208.0	207.8	208.1	207.1
3	163.1	165.8	166.6	167.5	166.1	166.6
4	70.1	70.4	74.3	72.9	73.9	72.0
5	54.7	55.9	56.8	56.8	56.8	56.6
6	45.8	45.9	46.7	46.7	47.0	46.7
U.S.	620.9	622.3	640.7	640.1	640.6	636.7
			($/cwt.)			
1	1.45	1.45	1.45	1.45	1.45	1.45
2	1.45	1.45	1.45	1.45	1.45	1.45
3	1.41	1.41	1.41	1.41	1.41	1.41
4	1.47	1.47	1.47	1.47	1.47	1.47
5	1.50	1.50	1.49	1.49	1.49	1.49
6	1.48	1.48	1.48	1.48	1.48	1.48
U.S.	1.45	1.45	1.44	1.44	1.44	1.44

TABLE LXXXVIII

RETAILING COSTS FOR FLUID MILK SALES, U.S. AND REGIONAL TOTALS - MODELS B-1, B-2, C-1, C-2, D-1, AND D-2, 1976

Region	Model B-1	Model B-2	Model C-1	Model C-2	Model D-1	Model D-2
			($ million)			
1	328.3	338.6	299.1	288.5	300.4	307.8
2	740.6	753.6	697.9	697.1	697.1	700.1
3	673.8	632.6	619.4	611.0	619.5	618.7
4	303.6	302.6	290.0	281.2	291.1	297.7
5	203.6	199.1	194.6	198.8	194.6	195.3
6	162.8	161.7	148.6	154.3	144.9	149.0
U.S.	2,412.7	2,388.2	2,249.6	2,231.0	2,247.7	2,268.5

VITA

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