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Future Structure of the Dairy Industry: Historical Trends, Projections and Issues

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Executive Summary

The livelihood of farmers, processors and others connected with the U.S. dairy industry will be determined to a great extent by the future structure of the industry. At the same time, the investments made by farmers and processors will depend, in part, on the expected structure. This publication reports an effort to collect and synthesize information on the changes that have taken place in the dairy industry, project the structure of the industry under the assumption that current trends continue, and then discuss the factors that might cause the industry to evolve differently from that suggested by current trends. Finally, some ideas on how to alter the evolving structure are introduced.

The size of the dairy industry will be determined by the demand for milk. Although imports and exports could be an important determinant in final demand, they are highly political and net imports have been relatively modest recent years. Thus, the demand for milk is largely determined by domestic consumption. In recent years declines in fluid milk consumption have been slightly more than off set by increases in cheese demand, resulting in constant to slightly increasing per capita demand for milk and milk products. Based on these historical trends, total demand for milk produced in the United States will increase from 168 billion pounds in 2000 to 195 to 201 billion pounds in 2020. New York State and the Northeast are expected to experience slight declines in market share of the increasing market, resulting in approximately constant total milk production levels.

Among the factors that could change rates of milk consumption are health claims about milk, advertising, new product development, competition from other products, cheese fatigue, changing ethnic population mix and a more economically oriented dairy policy in the European Union. There appears to be little reason to suggest that any of these factors will cause a major change in trends. Possible cheese fatigue and an increase in the non-Hispanic black population will cause slight declines while the changes in the European Union could result in increases in rates of consumption.

Milk production per cow is expected to increase more rapidly than demand, resulting in a decline in the size of the U.S. dairy herd from 9.2 million cows in 2000 to 7.9 million in 2020. Farms will continue to increase in size and decline in number. The total number of U.S. dairy farms is expected to decline from 105,000 in 2000 to 16,000 by 2020, with large farms (over 500 cows) increasing from 2,700 to 3,400 and farms with fewer than 100 cows declining from 84,000 to 7,000 over the same time period. Large farms area expected to produce over 80 percent of the milk.

Trends in number and size of dairy farms in the Northeast and New York are similar to those in the U.S, though the rate of growth in size is slightly slower. The number of dairy farms in the Northeast is projected to decline from 23,000 in 2000 to 5,000 by 2020, with about half of the herds having fewer than 100 cows. Herd size is growing slightly more rapidly in New York than in the Northeast as a whole. The number of dairy farms is expected to decline from 7,900 in 2000 to 1,800 by 2020. The average herd will have about 250 cows producing over 25,000 pounds per cow per year.

Factors that might influence the number and size of farms include economies of size, disease (bio-security) risk and environmental regulations. Large farms appear to have a $0.50 per hundredweight economies of size advantage, which, though not large, will continue the economic push to larger size farms. Size related health risk likely can be controlled by a good bio-security program. Concentrated Animal Feeding Operations (CAFO) regulations could place a higher burden on large farms in the short run. However, Farm Service Agency's Environmental Quality Incentives Program (EQIP), if fully funded, will help to mitigate that burden.

The competitive position of the Northeast dairy industry will remain strong. Although some USDA cost of production data indicate very high costs for the Northeast, these data likely do not represent true competitive position. Data on comparison of input costs provide mixed results with each region exhibiting advantage in some areas. The most comparable data appear to be Farm Business Summary data on groups of farms where farm size and the method of calculation are held constant. These data show the Northeast to have about a $0.25 per hundredweight cost of production disadvantage compared to the Upper Midwest and a $1 per hundredweight disadvantage compared to the West Coast.

The number and size of dairy processing and manufacturing plants is experiencing a decline in numbers and increase in size that is similar to farms. Continuation of trends will decrease the number of U.S. plants from 1,200 in 2000 to 600 in 2020, with average size more than doubling. Similar trends in New York will reduce the number of plants from 87 in 2000 to 55 by 2020. The Northeast share of plant capacity has remained about constant over the last 30 years.

Factors that might alter the future number and size distribution of dairy plants include economies of size, sector efficiency and efficiency of price transmission. There are significant economies of size in both processing and manufacturing milk, which will continue to push for fewer, larger plants. The cost differences between low and high cost plants often exceed $2 per hundredweight of milk, indicating considerable opportunity to reduce costs by moving milk to more efficient plants. Using market price as an indicator of sector efficiency, modest improvements in farm level efficiency have been offset by slight declines in processing/manufacturing/retailing sector. Price transmission in the sector is imperfect. Farm level price increases are much more completely transmitted to the retail level than farm level price decreases. All of these factors tend to push toward fewer and larger plants.

The proportion of New York milk that is sold for fluid consumption continues to decline. As more of the milk is manufactured and the number of plants decline, the amount of milk shipped to out of state plants continues to increase. New York production of (unfrozen) manufactured products continues to increase similar to the rates of change experienced at the National level. However, New York's production of frozen dairy products has declined precipitously while U.S. production has increased. This appears to be the result of production decisions rather than plant capacity, since the rate of decline in number of plants producing various frozen dessert products has not declined more rapidly in New York than the U.S. as a whole.

If the populous finds the projected future structure unacceptable, there are policy tools that can be used to modify the trends. If the farm level changes are too rapid, tools include small farm group action, targeting of subsidy programs towards small farms or pastoral countryside laws. Alternately, change could be accelerated with programs to encourage and subsidize large farms or programs to ease and speed the exit of small farms. Similarly, at the processing/manufacturing/retailing level change could be slowed with tax or other subsidy programs to keep existing plants in local communities, or with laws or regulations to limit merger of plants and firms. The process could be accelerated with state support of new manufacturing/processing plant construction, state support for incubator plants for specialty cheeses or programs to facilitate conversion of current plants to other uses.

Future Structure of the Dairy Industry: Historical Trends, Projections and Issues

By
Eddy LaDue, Brent Gloy and Charles Cuykendall[1]

The livelihood of farmers, processors and others connected with the U.S. dairy industry will be determined to a great extent by the future structure of the industry. At the same time the investments made by farmers and processors will depend, in part, on the expected structure. The intent of this publication is to collect and synthesize information on the changes that have taken place in the dairy industry, project the structure of the industry under the assumption that current trends continue, and then discuss the factors that might cause the industry to evolve differently from that suggested by current trends.

General Perspective

A general perspective on the industry is necessary to identify a logical procedure of analysis. Our general perspective on the dairy industry starts with the idea that consumers determine the demand for milk. This demand is influenced by efforts made to promote consumption of milk and milk products, the degree of competition provided by other beverages and substitutes for milk products and the efficiency with which the demands of consumers are transmitted to processors and farmers. But, in net, the amount of milk that farmers will be able to sell, and thus, need to produce, will be directly determined by what consumers are willing to buy.

The milk supply is determined by farmers. This is the result of the number of farms, number of cows per farm and the level of production per cow. The number and location of farms will depend upon the relationship between production costs and the price of milk. Since the dairy farm sector meets many of the conditions for a perfect market, farms can be expected to enter and leave milk production such that there are no profits above normal returns to all resources (including operator supplied labor, management and equity capital) used in production. Whenever the farm price received for milk moves outside the range that provides the minimum amount farmers are willing to accept for their inputs, farmers will enter (or expand) or leave the sector such that production will be increased or decreased.

The interaction of consumer demand and farmer supply is modified by the post farm-gate processing/manufacturing/retailing sector, through which all pricing signals characterizing supply and demand must flow. The processing/manufacturing/retailing sector exerts its influence through plant location, product development and the pricing of dairy products. Cost control throughout this sector also influences the final cost of dairy products, and thus, the level of final demand.

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[1] W. I. Myers Professor of Agricultural Finance, Assistant Professor, and Senior Extension Associate, Department of Applied Economics and Management, Cornell University. The authors would like to thank Mark Stephenson, Charles Nicholson and George Casler for helpful reviews of an earlier version. We would also like to thank Wayne Knoblauch, Robert Milligan, Mark Stephenson, Charles Nicholson and Andrew Novakovic for useful comments on an early outline of the ideas presented in this publication.

In general, in this industry supply adjusts to demand. The demand for milk and milk products is very inelastic[2]. Thus, modest normal price changes in milk and milk products have little effect on the quantity of milk demanded by consumers. When this is combined with extreme resistance on the part of retailers to lower market prices, which they will likely have to raise sometime in the near future, the price the consumer pays changes is relatively insensitive to changes in farm level prices, particularly in the short run. The normal perfect market assumption that excess supply reduces consumer prices so that consumers demand more, thereby assisting the adjustment of supply and demand, does not fit this market. Within this environment farm prices vary widely as they attempt to equate changing farm supply with relatively constant effective farm level demand. Small changes in supply result in large changes in farm level prices. This variation in farm price is exacerbated by the processing/manufacturing/retailing sector's efforts to improve efficiency by limiting inventories and moving to "just in time" deliveries. The resultant lower stocks provide smaller stocks to buffer changes in supply and demand. Adjustment within the sector occurs by farms exiting and other farms delaying expansions until demand increases sufficiently (primarily from increasing population) and farm prices recover to acceptable levels. Imports and exports, although typically a small percent of U.S. milk use, change opportunistically to assist with short run excess or deficits in supply.

Consistent with this general perspective, this publication is organized into three major sections. These three sections deal with (1) the demand for milk, (2) the size and number of farms, and (3) the processing/manufacturing/retailing sector. Each of the three sections contains three subsections that cover (1) recent national level trends and projections for 2020, (2) a discussion of factors that may influence those trends in the future, and (3) projections and discussion of factors influencing those trends at the New York State and Northeast levels. Finally, we provide a short thought section to assist stakeholders in the process of contemplating actions or strategies for proactively shaping current trends that they may find unappealing.

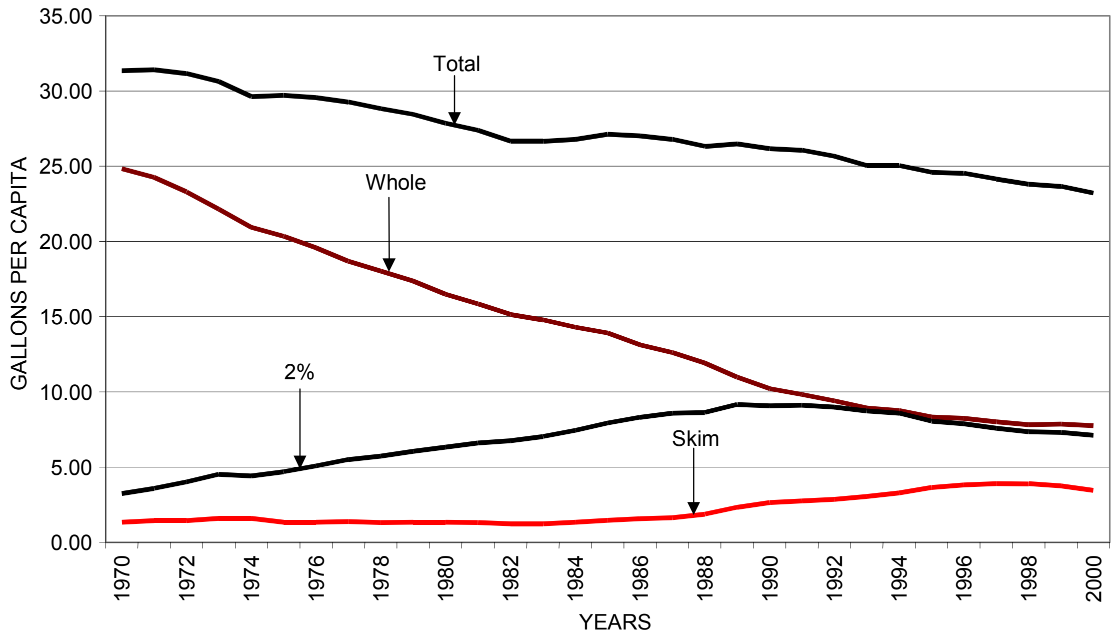
THE DEMAND FOR MILK

The overall size of the dairy industry will be determined by the demand for milk. This will be influenced by tastes, habits and customs, as well as the price of milk and milk products. During the last 30 years, the per capita consumption of fluid milk products has slowly declined (Figure 1). A rather strong decline in whole milk consumption has been partially offset by increases in the consumption of low fat and skim milk. However, those increases have leveled off or declined slightly in recent years. Butter demand has remained flat for the last 30 years (Figure 2). At the same time the demand for cheese has increased quite dramatically. Cheese has clearly been the bright spot for the dairy industry. Total milk used (total milk demand) includes milk used as fluid milk as well as milk used in manufacture of milk products, such as butter and cheese. The combined effect of these changes has been a modest and irregular increase in the per capita use of milk over the last 30 years (Figure 3). However, if only the last 20 years of data are considered, the data are consistent with constant per capita consumption. Changing per

[2] Recent research found the price elasticity of demand for fluid milk to be -.16 and cheese -.37 indicating that a one percent decline in the price of milk would increase milk demand by 0.16 percent. Schmit, Todd M., Chanjin Chung, Diansheng Dong, Harry M. Kaiser, and Brian Gould. "Identifying the Effects of Generic Advertising on the Household Demand for Fluid Milk and Cheese: A Two-Step Panel Data Approach." Journal of Agricultural and Resource Economics. 27(2002):165-186.

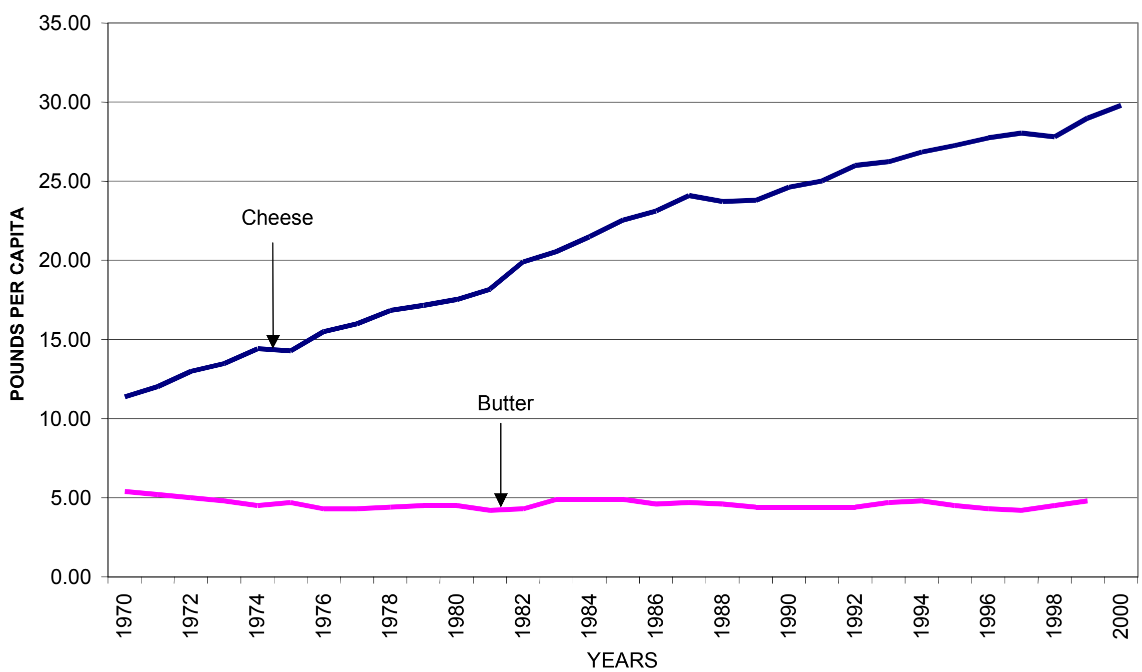
capita consumption combined with an increasing U. S. population has resulted in a steadily increasing total demand for milk (Figure 4).

FIGURE 1. PER CAPITA CONSUMPTION OF FLUID MILK



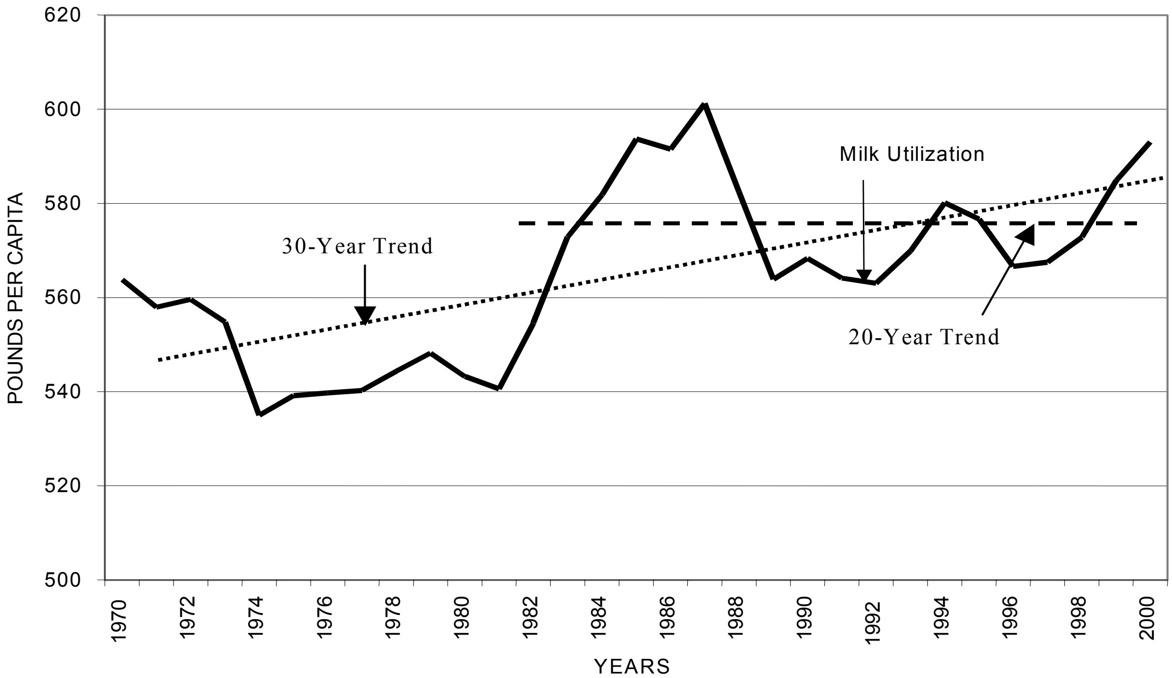
Source: USDA, ERS Includes flavored milk with buttermilk

FIGURE 2. PER CAPITA CONSUMPTION OF BUTTER AND CHEESE



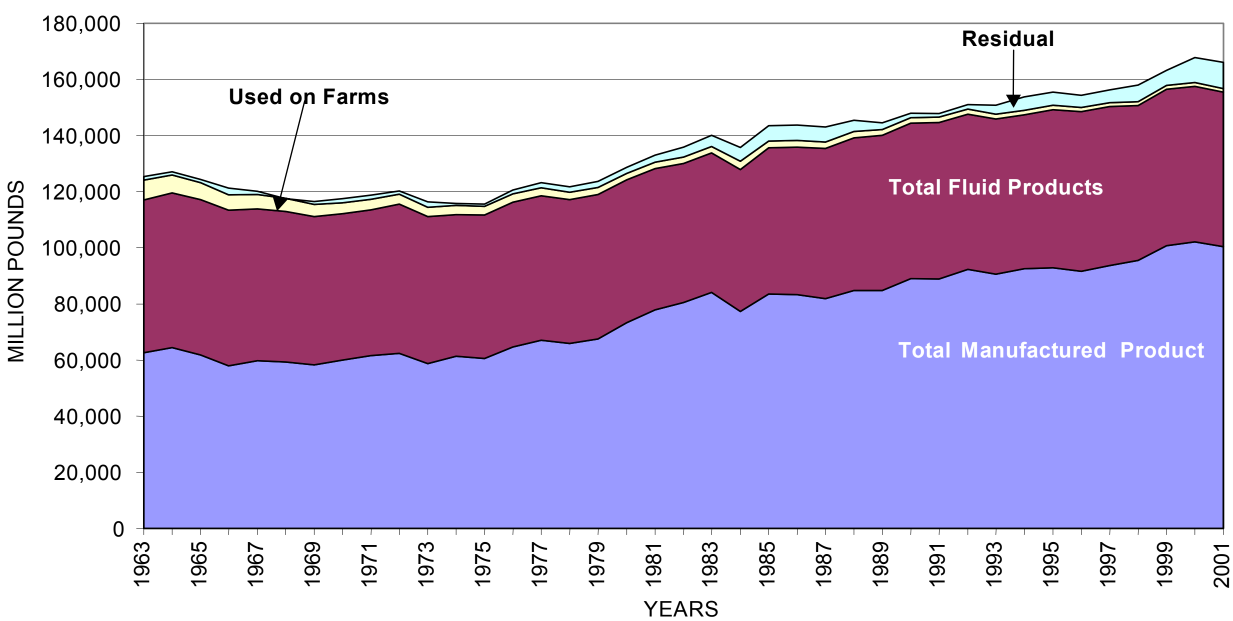
Source: USDA, ERS

FIGURE 3. PER CAPITA MILK UTILIZATION (ME MF BASIS)



Source: ERS, USDA

FIGURE 4. U.S. MILK UTILIZATION

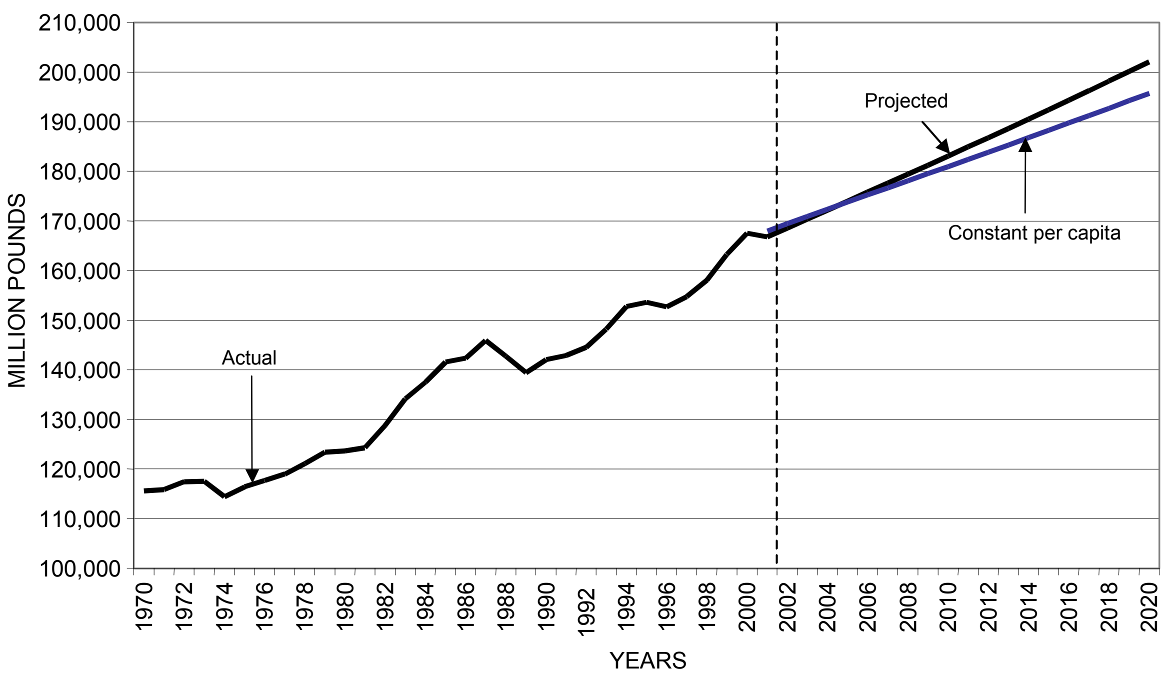


Source: Agricultural Statistics

In projecting the future demand for milk, there are at least two scenarios that might be expected. A "continuation" scenario assumes that the historical 30-year trend in total milk use will continue, resulting in continued modest growth in per capita milk-equivalent consumption into the future. That is, people will continue to eat more cheese, the decline in the consumption of whole milk will be offset by health conscious substitutions of low fat or no-fat milk for soft drinks, manufacturing uses of milk will increase, or other similar occurrences will increase consumption. Alternately, a "constant consumption" scenario assumes that per capita consumption will remain constant. Declines in whole milk consumption will be just offset by increases in cheese use, low- and no-fat milk consumption and increased industrial uses. In this case, changes in the demand for milk are totally determined by changes in the population.

The quantity of milk demanded by 2010 and 2020 under these two scenarios differs significantly (Figure 5), but both result in an increased market for milk compared to present levels. Present trends would imply 183,055 million pounds by 2010 and 202,089 million pounds by 2020. A leveling of per capita consumption at average 1999 and 2000 per capita consumption levels would imply a need for 180,953 million pounds in 2010 and 195,716 million pounds by 2020.

FIGURE 5. QUANTITY OF MILK DEMANDED

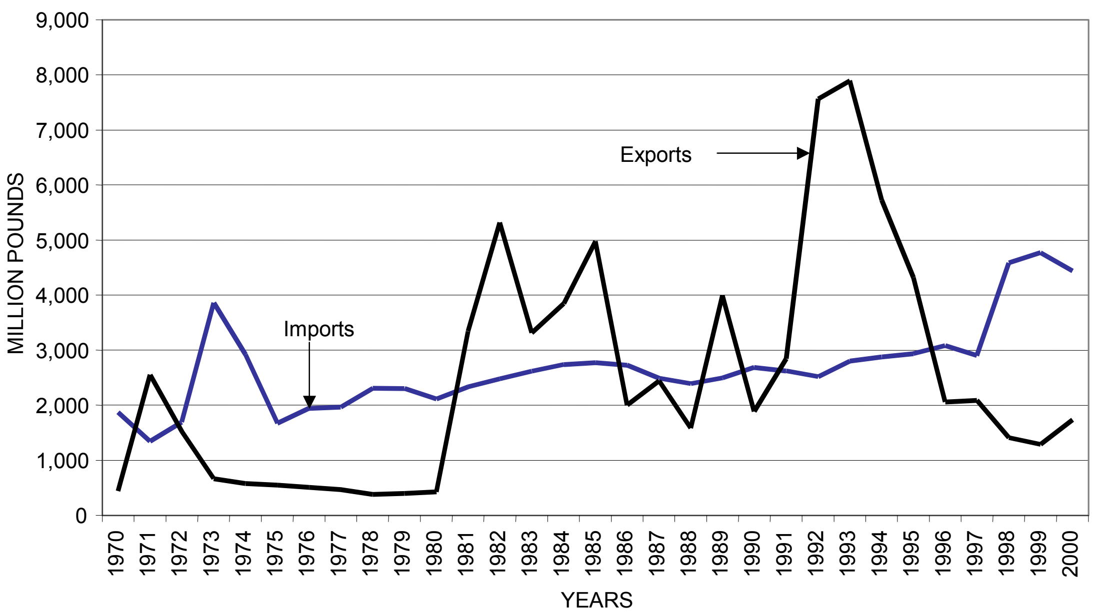


Source: USDA, ERS, Stat Bulletin No. 965, 1970-1997
USDA, ERS Internet Agricultural Outlook, July 2002

Total U.S. milk consumption is modified by two factors to determine the amount that will be produced on farms. A small amount of milk is used on the farms where it is produced. Most of this is fed to calves. Over the last 30 years farm use of milk on farms has declined from about 1.5 percent of production to 0.5 percent as calf feeding practices and milk production levels have changed. Modest declines are expected in the future as production levels increase and calf-feeding practices continue to optimize the amount of milk used. For projection purposes, the amount used on farms is expected to decline to 0.4 percent by 2010 and 0.3 percent by 2020.

The second, and more important factor in determining prices, is imports and exports. These tend to offset each other so that net imports or exports are quite small, usually only one to two percent of total use. In general, imports have increased gradually over the last 30 years (Figure 6). Exports are much more variable because they tend to be based on short term relative prices and special sales opportunities rather than long term contracts. Exports are also difficult to estimate, so that there is likely more error in the estimates[3]. In some years they significantly exceed imports, in other years they are much less.

FIGURE 6. US MILK EQUIVALENT (MF) IMPORTS AND EXPORTS



Source: USDA, ERS, Stat. Bulletins No. 965, 1970-1997 with more recent data from USDA, ERS Internet Agricultural Outlook, July 2002

The United States is not the low cost world wide dairy producer (Figure 7). This portends stiff competition as other countries, such as New Zealand and Australia, attempt to export into the higher price U.S. market. On the other hand, the U.S. is a lower cost producer than the European Union, but will see continued pressure from countries in the European Union to export into the U.S. at low world prices in order to unload excess commodities produced by a heavily subsidized dairy industry.

The net import/export picture will be largely determined by domestic and foreign political decisions. Over the 5 years from 1995 to 1999 average imports have exceeded exports by 1,230 million pounds, representing less than 0.8 percent of milk used in the U.S. There is little reason to expect basic change in the political position of the dairy industry.

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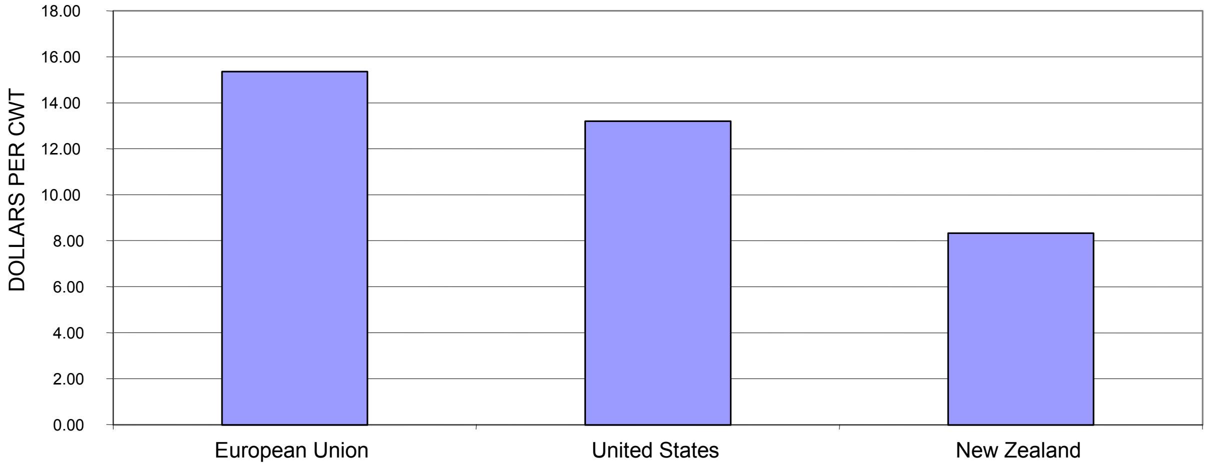
[3] Personal correspondence with Jim Miller, ERS, USDA

FIGURE 7. COMPARISON OF STANDARDIZED 2000 PRODUCER PRICES FOR MILK



Source: LTO Nederland
Converted from Euro to Dollars with 5/1/02 Conversion rate

The U.S. will continue to try to sell its products abroad while protecting its markets at home. As other countries also pursue their own self-interest, the political landscape will change only modestly. Within the current environment, short-term excess supply or demand balances are handled by imports or exports, but in the long-term U.S. production is driven by domestic consumption. The U.S. cannot continue to increase supply and export the excess to other countries any more than those countries can increase their domestic supply and export the excess to the U.S. This implies that it is unlikely that imports or exports will be a major factor in the supply of milk in the U.S. For projection purposes, net imports are expected to continue to meet 0.8 percent of total milk demand.

Combining the basic domestic demand for milk with the added farm use and subtracting the net amount expected to be supplied by imports (imports less exports) indicates the level of milk production (over the last twenty years (Table 1)) and amount needed to be produced in the U.S. (Table 2). Demand would increase from 168 billion pounds in 2000 to 195 to 201 billion pounds in 2020 under the assumption of increasing or constant per capita consumption, respectively.

Table 1. Historical and Total U. S. Milk Production (Million Pounds)

Item	1980	1990	2000
Domestic Use	128,127	146,390	168,350
Farm Use[a]	1,395	1,484	1,101
Net Imports[b]	1,116	153	1,793
Total US Production	128,406	147,721	167,658

[a] Includes nonfood use. Projections based on pounds of milk used per cow in 2002. Estimated at 0.4 percent of production in 2010 and 0.3 percent in 2020.
[b] Imports minus exports minus shipments to U.S. territories, estimated at 0.8 percent of total milk domestic use. Stocks assumed constant.
Source: ERS, USDA.

Table 2. Historical and Projected Total U. S. Milk Production (Million Pounds)

		2010		2020	
Item	2000	Continue trend	Constant consumption	Continue trend	Constant consumption
Domestic use	168,350	183,058	180,956	202,092	195,719
Farm use [a]	1,101	729	721	603	584
Net imports [b]	1,793	1,464	1,448	1,617	1,566
Total U. S. production	167,658	182,323	180,229	201,078	194,737

[a] Includes nonfood use. Projections based on pounds of milk used per cow in 2002. Estimated at 0.4 percent of production in 2010 and 0.3 percent in 2020.
[b] Imports minus exports minus shipments to U.S. territories, estimated at 0.8 percent of total milk domestic use. Stocks assumed constant.
Source: ERS, USDA 2000 Data.

What Might Change Rates of Consumption?

The above projections are based on a continuation of current trends. Current trends may or may not continue into the future. The future is extremely uncertain. However, a continuation of current trends is one possible future outcome. In the discussion that follows, we discuss some of the factors that could modify trends so that the future is not like the past. In the past few years there has been a slight increase in per capita consumption of milk and milk products. Consumption of cheese increased more than enough to offset the decline in consumption of fluid milk. A major issue is what will happen to per capita consumption of all milk and milk products in the future.

Health Claims

Health claims continue to be important to milk and milk product sales. Sales in the future will undoubtedly be influenced by the changing mix of positive (cholesterol in butter may not be worse for you than the fatty acids in margarine, milk calcium helps prevent osteoporosis) and negative (cholesterol contributes to heart attacks, lactose intolerance) research results and claims. Research results and health claims change daily. Each succeeding piece of evidence seems to point in a different direction. There is anecdotal evidence that many people are “fed up” with the continually changing message and are “tuning out” the discussion. At this point there does not appear to be a body of research or direction of public opinion that would be expected to lead to a significant increase or decrease in per capita consumption.

Advertising and Promotion

There are thousands of food and drink products on the market today. The demand for any of these products is influenced by the amount and character of advertising conducted. The dairy check-off program has attempted to increase demand for milk through generic advertising efforts. Research indicates that generic advertising of milk (“got milk”?) has had a positive influence on demand[4]. However, the check-off programs for a variety of products continue to be

[4] Kaiser, Harry M. "Impact of Generic Dairy Advertising on Dairy Markets, 1984-99." NICPRE Research Bulletin 00-01, National Institute for Commodity Promotion Research and Evaluation, Department of Agricultural, Resource, and Managerial Economics, Cornell University, September 2000.

challenged in court. If challenges to the milk check-off program were successful, demand would likely be somewhat lower than current trends indicate.

New product development

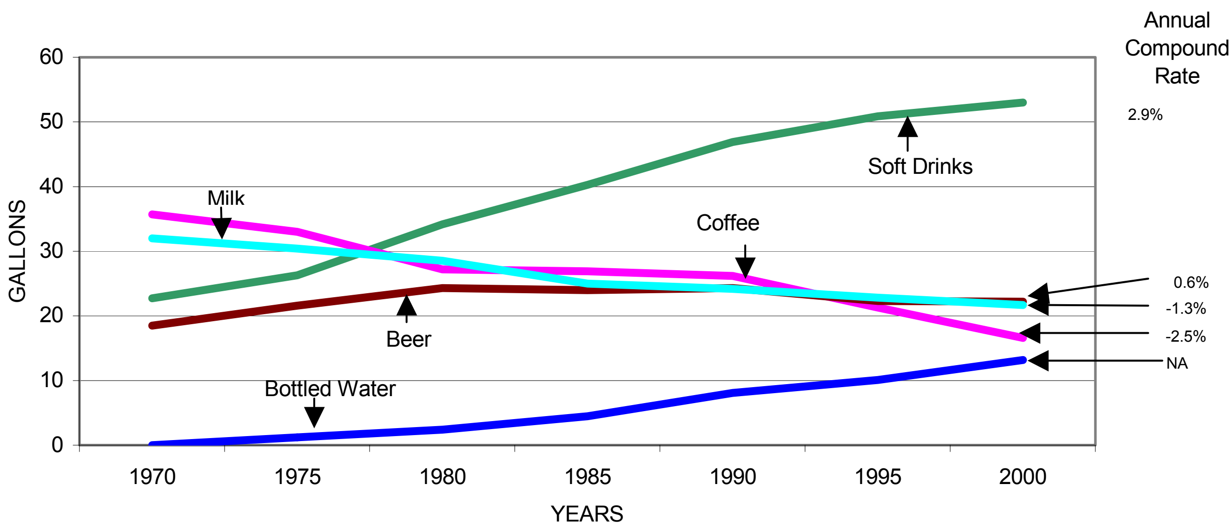
Demand could be influenced by development of new milk products that meet consumers changing needs. Only in the last few years has milk started to compete with more than two flavors of milk (white and chocolate), advertising what is not in the bottle (fat free, caffeine free, cholesterol free) and to focus on individual components of the milk. Soymilk and similar products are being developed that can be expected to continue to erode the market for milk. Continued product development will be necessary for milk products to maintain their place in the market.

The future impact of new products or uses for milk is a "wildcard" in projecting the future demand for milk. Many researchers are investigating a variety of ideas that range from medicines or dietary supplements made from milk to modifying cow breeding and feeding in an effort to make the milk contain more healthy "things" and less fat. Opportunities also likely exist to develop non-traditional markets for milk components, such as protein. Some of these efforts may be very successful, but use a very small part of current milk supply. Others might have a significant affect on demand.

Competition

Competition is strong (Figure 8). Soft drinks (flavored bottled water) and bottled water (unflavored bottled water) have high mark-ups and large advertising budgets. Consumption of soft drinks and bottled water has been increasing rapidly over the last 30 years. They will be strong competition for milk in the future. Continued decline in per capita consumption of fluid milk appears likely.

FIGURE 8. U.S. PER CAPITA CONSUMPTION



Source: Davenport and Co., LLC

Cheese fatigue?

In recent years cheese has been the savior of the dairy industry. Cheese demand has increased enough to offset declines in fluid milk consumption. A serious question in the current environment is whether cheese demand can be expected to continue to increase. Over the past couple of decades fast food and semi-fast food restaurants "put cheese in everything." Increased consumption of pizza has been a major contributor to cheese demand. However, alternatives to pizza are continually being developed and there is some evidence that the population may be getting "pizza fatigue." Further, some pizza makers are reputed to be reducing the amount of cheese they put on a pizza. Since cheese is the primary milk product that has been experiencing increased demand, a leveling off of cheese demand would result in a declining per capita demand for total milk and milk products.

Changing ethnic population mix

Changing emigration and birth rates are expected to change the ethnic mix of the U.S. population over the next couple of decades (Table 3). A high proportion (46 percent) of the increased population is expected to be Hispanic. In addition, the proportion of the population that is non-Hispanic Black is also expected to increase, though not as rapidly as the Hispanic population. To the degree that ethnicity influences consumption patterns, milk demand could be influenced by these changes in ethnic mix of the population.

Table 3. Projected Change in United States Population by Ethnic Group

	Population 2000		Population 2020		Change 2000 to 2020	
Ethnic Group	Millions	Percent	Millions	Percent	Millions	Percent
Hispanic	32	12	55	17	23	46
White, Non-Hispanic	197	71	207	63	10	21
Black, Non-Hispanic	33	12	41	13	8	16
American Indian	2	1	3	1	1	1
Asian & Pacific Island	11	4	19	6	8	16
Total	275	100	325	100	50	100

Source: U.S. Census Bureau, Populations Division, Populations projections Branch.

Data on consumption of milk products by ethnic background are scarce. One study collected information on the grams of milk products consumed per day (Table 4). The Hispanic population consumed slightly more milk products and a higher proportion was in the form of whole milk. On the other hand the non-Hispanic black population consumes less milk products. In net, the increased consumption by the larger Hispanic population will only partially offset the decreased consumption resulting from the larger non-Hispanic black population. This implies that the increased population as a driver for milk demand is likely to have slightly less effect than it had in the recent past.

Table 4. Dairy Product Consumption by Ethnic Group (Grams per Day)

Ethnic Group	Whole milk	Low fat milk	Cheese	Milk desserts	Total milk and milk products
Mexican American	146	63	13	12	295
Other Hispanic	110	71	13	22	285
White, Non-Hispanic	49	101	13	30	285
Black, Non-Hispanic	97	33	8	20	208

Source: ARS, USDA Food Surveys Research Group, Beltsville Human Nutrition Research Center 1994-96 Table Set 16.

A more economically minded European Union

The European Union is in the process of expanding geographically to cover a much larger number of countries. The farms in many of the added countries frequently have low production levels and the people are often relatively poor. Further, farmers make up a significant part of the population. Providing the same level of subsidy to the agriculture of the added countries could be very expensive. This may result in decisions to reduce the level of subsidy to the dairy industry and less willingness to subsidize exports. Such a decision could result in less competition in world markets and more opportunities for exports by the United States. However, since these decisions are highly political, it is likely that any change will be slow.

Conclusions on milk demand trends

At this point there is little evidence to suggest major changes in current trends. The possibility of "cheese fatigue," the changing ethnic mix of the population and continued competition from other drinks and products may have a dampening effect on demand, while changes in the European Union might improve demand. The main driver of demand is the increasing population. In net, it appears that constant per capita consumption is a better bet for the future than the slight increases that have been experienced in recent years.

Milk Sales in New York and the Northeast

A basic question for New York and the Northeast is the degree to which they will share in the national level changes in the dairy industry. This will be influenced by the location of demand, relative competitive position of Northeast dairy farmers and other factors. The Northeast has the advantage of having a large population base. In 2001 the 13 Northeastern states had 21.1 percent of the U.S. population and produced 17.4 percent of the nation's milk supply[5]. Northeast farmers are close to the market. However, milk and milk products can be shipped into the region very easily.

[5] Population data from US Census Bureau, State Population Estimates for 2002. Milk production data from NASS, USDA, Agricultural Statistics Data Base.

A Wisconsin study[6] looked at the regional location of milk production in the U.S. under the assumption that current trends continue as they have in recent years. No modifications to recent trends were made. Using this procedure, they estimated regional market shares for 2020 (Table 5). In their analysis, Jesse and Schuelke indicate that current trends likely cannot be maintained in California, the Southwest and Western regions due to higher feed costs resulting from increased competition for land and water and more stringent nutrient management (environmental) regulations. Most of the choice sites for dairy operations are already in use. It is also unlikely that the rapid declines that have occurred in the Midwest will continue. That region has low feed production cost. Low commodity prices tend to make selling those commodities through a dairy cow as milk an attractive option. Anecdotal evidence suggests that number of large dairy farms have recently been located in the Midwest. However, a continuation of recent trends appears more likely for the Northeast. The major factors influencing the location of production are not changing significantly. Dairy likely has a comparative advantage given the modest quality land and climate base, but competition for resources from non-farm uses continues to be strong. Thus, the market share data in the Wisconsin study are likely reasonable for the Northeast[7].

Table 5. Regional Distribution of Production

	Market Share (Percent of U.S. Production)		
Region	1980	2000	2020
New England	3.5	2.8	2.0
Northeast	16.9	14.9	12.5
Upper Midwest	26.9	21.0	12.3
California	10.6	19.3	28.8
Southwest	3.3	6.6	10.3
Western	2.7	5.6	12.0
Rest of U.S.	36.1	29.8	22.1

States included: Northeast: New York, Pennsylvania, Maryland, New Jersey and Delaware; Upper Midwest: Wisconsin, Minnesota, North Dakota and South Dakota; Southwest: Texas and New Mexico; Western: Wyoming, Montana, Idaho and Utah.
Source: Jesse, Ed and Jacob Schuelke, "Regional Trends in U.S. Milk Production: Analysis and Projections."

Using the market share data from the Wisconsin study and assuming that New York is able to maintain the same share of Northeast production as it had in 2002, future production in New York and the Northeast can be estimated from total U.S. demand (Table 6). Under these assumptions Northeast and New York production would stay at about its 2000 level.

[6] Jesse, Ed and Jacob Schuelke, "Regional Trends in U.S. Milk Production: Analysis and Projections", Marketing and Policy Briefing Paper No. 74, Department of Agricultural and Applied Economics, University of Wisconsin-Madison, December 2001.
[7] While it can be argued that historical trends will not continue in some other regions, the assumption that they will for the Northeast implies that changes in growth rates in other regions will be at the expense of regions other than the Northeast.

Table 6. Projected Milk Production in the Northeast and New York

Million Pounds of Milk Unless % Indicated	1980	2000	2020 Continuation	2020 Constant
Total U.S. milk production	128,270	166,920	201,078	194,737
Northeast[a] market share (%)	20.4	17.7	14.5	14.5
Northeast production	26,167	29,369	29,156	28,237
New York share of Northeast (%)	42.0	40.6	41.8[b]	41.8[b]
New York milk production	10,974	11,924	12,187	11,803

[a] Includes New York, Pennsylvania, Maryland, New Jersey and Delaware and the six New England states.
[b] Same percent as occurred in 2002.

THE NUMBER AND SIZE OF DAIRY FARMS

United States

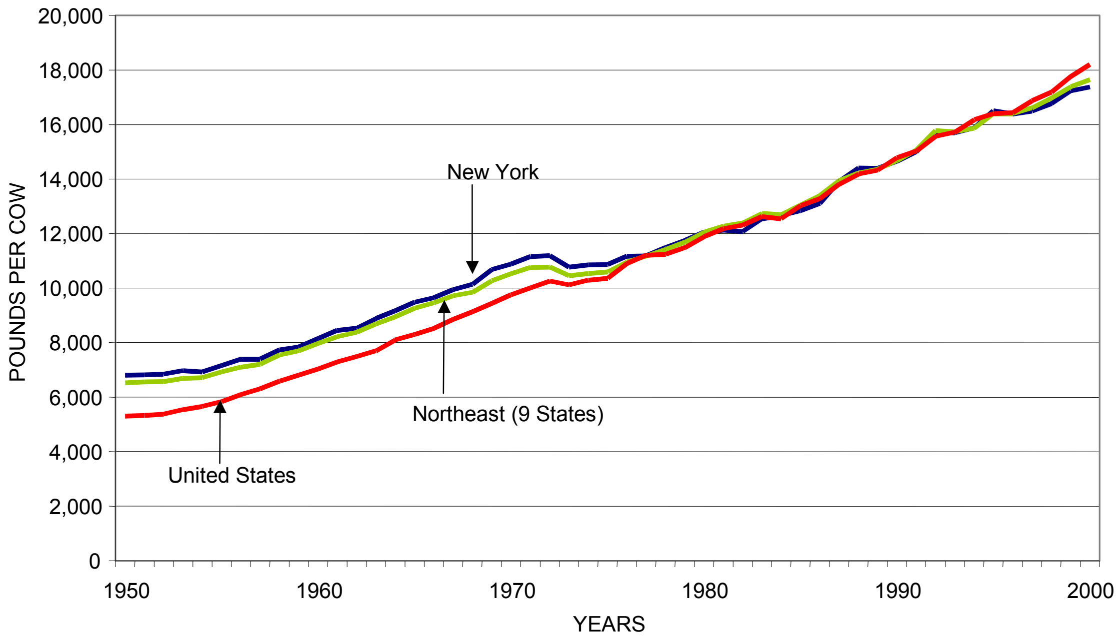
A number of factors will influence the number and size of farms in the future. These factors include the demand for milk, the level of milk per cow, economies of size and other factors that influence the size distribution of farms, including federal and state legislation. The total number of dairy cows will be determined by the demand for milk and the level of milk production per cow. The distribution of those cows on farms will depend on economies of size and other factors influencing the viability of farms of different sizes.

Milk per cow

Milk production per cow has experienced constant increases for the past 50 years (Figure 9). This has resulted from improvements in breeding, feeding and housing. A constant stream of new technology and practice has been developed, which has allowed farmers to improve production. There is every reason to believe that these increases will continue. New technology continues to be developed. Further, the production level of many current herds is nearly 50[8] percent above average production, indicating that there is a backlog of technology and practices to be adopted that will allow considerable increases in production even if new technology is not developed.

[8] Average milk per cow in New York in 2001 was 17,527 pounds (New York Agricultural Statistics 2001-2002, NASS, July 2002) while the 10 percent of farms with the highest production levels in the New York Farm Business Summary produced 25,729 pounds per cow (Knoblauch, Putnam and Karszes, Farm Business Summary New York State 2001, R. B. 2002-11, Cornell University).

FIGURE 9. MILK PER COW (POUNDS)



Source: USDA National Agricultural Statistics Services

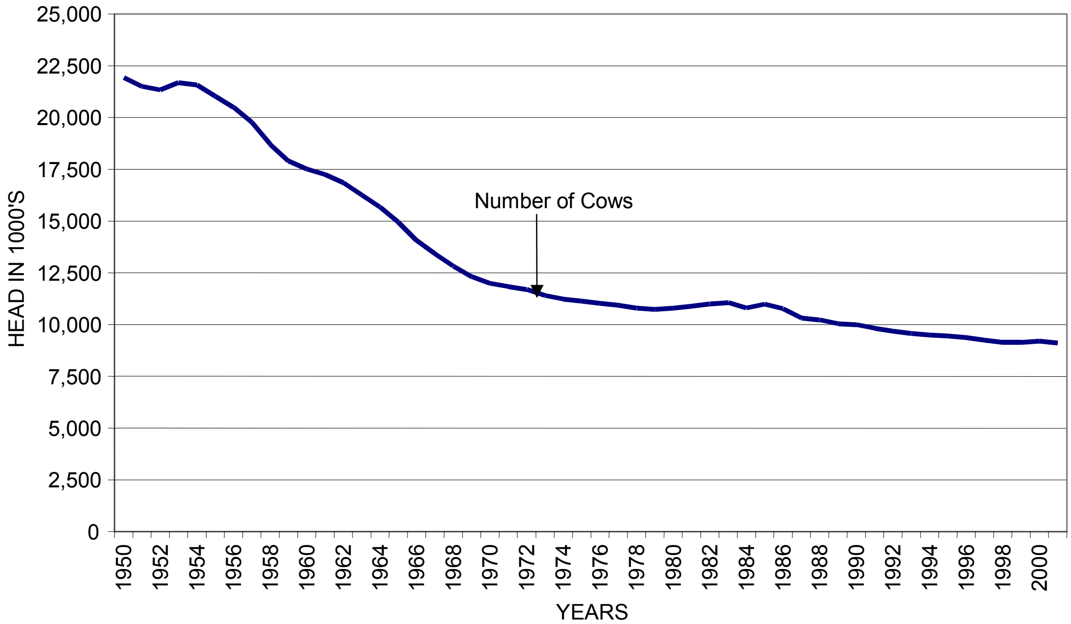
If production per cow increases at its historical rate, production per cow in the U.S. would be 21,722 pounds per cow by 2010 and 25,352 pounds per cow by 2020. Given the amount of milk that the U.S. needs to produce and expected production per cow, the number of cows would be 8,297 thousand to 8,393 thousand in 2010 and 7,681 thousand to 7,931 thousand in 2020 (Table 7). This represents a continuation of a downward trend in cow numbers over the last half-century (Figure 10) and reflects the fact that production per cow is rising more rapidly than milk demand.

Table 7. Projected Number of Dairy Cows in the United States

		2010		2020	
	2000	Continue Trend	Constant Consumption	Continue Trend	Constant Consumption
Milk produced (mil lbs)	167,658	182,323	180,229	201,078	194,737
Production lbs / cow[a]	18,212	21,722	21,722	25,352	25,352
Number of cows (1,000)	9,206	8,393	8,297	7,931	7,681

[a] Estimated from weighted average of production per cow (Table 8), cows per farm (Table 9), and farms by herd size (Table 11).

FIGURE 10. NUMBER OF DAIRY COWS, UNITED STATES



Source: USDA, NASS, Agricultural Statistics Data Base

One complicating factor relative to production per cow is the fact that production varies significantly by herd size (Table 8). Production per cow increases observed at the national level include the effect of having more cows in the hands of large herd operators who achieve higher rates of production, as well as changes in technology and cultural practices on all farms. The projections in Table 7 assume that both of these effects will continue at their historical rates. Rates of production by herd size are calculated using the historical rates of change for each group. For the years 1982-1997 U.S. Census of Agriculture data on dairy product sales indicated the proportion of milk from each size category. These data were divided by the number of cows on farms for each size group to determine the level of production per cow. For the 1998 to 2001 years, USDA NASS data, which reported percent of milk and percent of cows in each herd size, were used.

Continuation of past trends indicates that milk per cow will increase from 14,406 in 2000 to over 18,000 for small farms, while at the same time increasing from 20,821 to nearly 26,000 on large farms.

Table 8. Production per Cow by Herd Size
United States

Year	Farm Size (Number of Cows) 1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1982	10,414	12,712	13,393	14,347	15,434
1987	11,851	14,212	14,906	15,385	16,698
1992	13,614	15,771	16,314	16,799	17,553
1997	13,684	16,164	17,210	18,353	19,184
1998	13,746	15,912	17,097	18,629	19,350
1999	14,132	16,011	17,286	18,867	20,539
2000	14,406	16,053	17,494	19,623	20,821
2001	14,075	15,796	17,210	19,907	20,444
2010[a]	16,224	17,875	19,588	22,275	23,144
2020[a]	18,150	19,517	21,669	25,202	25,977

[a] Estimated from1982 through 2001 trend. Estimated equations were 1-49 cows: 192.53X+10641, 50-99 cows: 164.23X+13112, 100-199 cows: 208.11X+13553, 200-499 cows: 292.67X+13788, 500+ cows: 283.28X+14929.
Source: U.S. Census of Agriculture 1982-1997 and USDA, NASS Agricultural Statistics Data Base, July 2002.

Cows per farm

Another factor that influences the level of milk production that would result from a continuation of current trends is the number of cows per farm by herd size group. The average number of cows per farm tends to be less than the midpoint of the range (i.e. average number of cows for 50 to 99 cow farms averages 65 instead of the midpoint between the range which is 75). The average of each of the smaller herd size groups appears to settle at 30 percent of the interval (65 is 30 percent of the interval from 50 to 99).

The difficult herd size to estimate is the 500 cows and over size, because it is open ended. During the last five years this herd size group has increased 40 cows per year. That rate of increase is assumed to continue into the future (Table 9). This results in large farms averaging nearly 1900 cows per farm by 2020.

Table 9. Average Number of Cows per Farm by Farm Size
United States

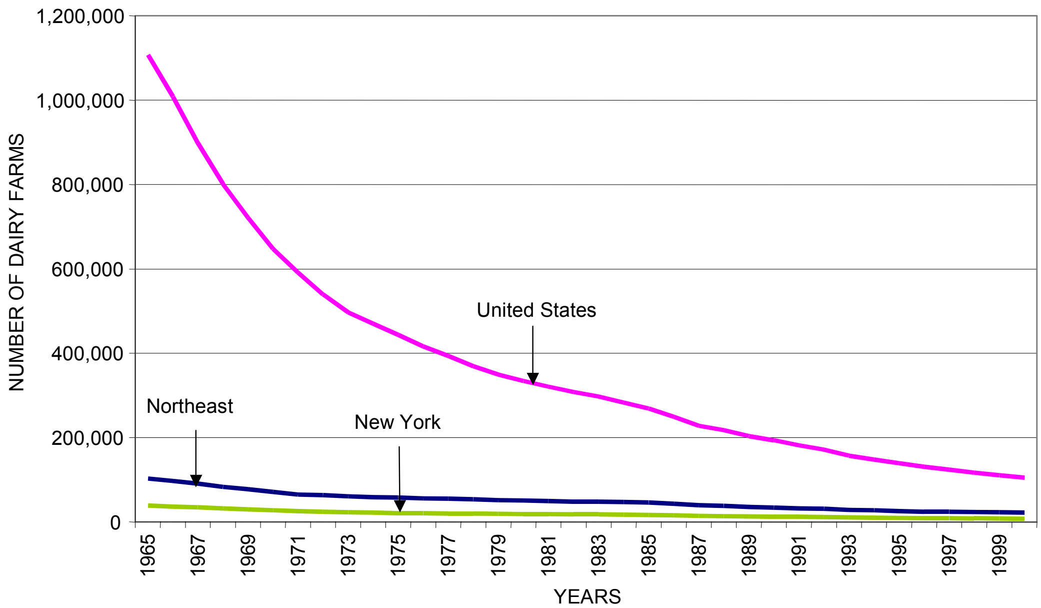
Year	Farm Size (Number of Cows) 1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1982	17.0	65.1	126.7	277.6	858.0
1987	19.9	65.7	127.8	279.2	876.3
1992	20.8	65.9	128.2	279.9	930.2
1997	20.9	67.1	131.8	263.9	966.4
1998	20.8	65.1	127.0	275.2	1023.4
1999	21.2	64.5	127.1	282.1	1037.7
2000	20.9	64.6	128.8	287.4	1077.2
2001	20.3	65.2	128.6	287.7	1128.4
2002 – 2010[a]	21.0	65.0	129.0	288.0	1488.0
2011 – 2020[a]	21.0	65.0	129.0	288.0	1888.0

[a] Estimated. 500 head and over size group increases 40 cows per year.
Source: 1982 – 1992 data from Census of Agriculture,
1997 – 2001 data from USDA NASS Agricultural Statistics Date Base, July 2002

Number of farms

The number of dairy farms in the United States has declined precipitously over the past 35 years (Figure 11). This has resulted from the need for fewer cows, given increases in production per cow and actual milk demand, and increases in the size of farms.

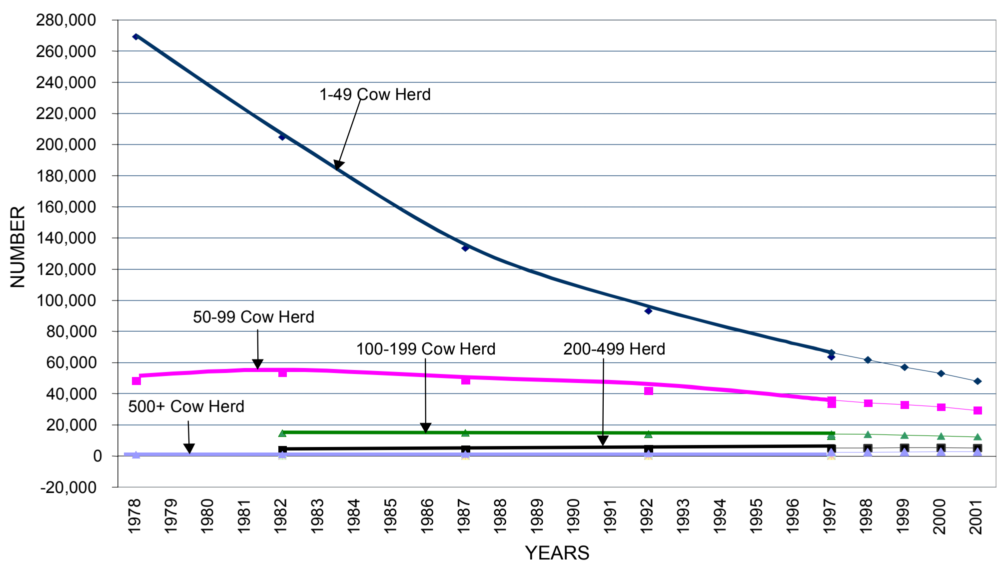
FIGURE 11. NUMBER OF DAIRY FARMS



Source: USDA, NASS Internet July 2002.

The increased prevalence of larger farms has been occurring for many years (Figure 12). Building and machinery technology have been designed to handle larger herds, and often, required larger herds to be cost effective. Reduced margins and improved living standards forced farmers to increase business size to maintain the desired level of living.

FIGURE 12. U.S. DAIRY FARMS



Source: 1978 – 1997 Census of Agriculture; 1997-2001 USDA, NASS

To estimate the distribution of farms by size, recent trends in the number of farms were used to identify rates of change in farm numbers for each size group (Table 10). These rates of change were used to identify rates of change for each size group that were consistent with recent historical experience and the total demand for milk. The rates of change may appear somewhat severe given the historical data. However, changes of this magnitude are necessary to keep production in line with demand. The rates of change listed result in production equal to estimated demand for milk with the average number of cows per farm and production per cow indicated above. Clearly, some judgment was used in making the estimates from the data available. Based on the rates of change used, the distribution of farms by size was estimated (Table 11).

Table 10. Percentage Rates of Change in Farm Numbers by Size
United States

	Farm Size (Number of Cows)				
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1998	-7.0	-5.1	-0.9	0.7	3.40
1999	-7.6	-3.2	-4.7	2.6	5.60
2000	-7.1	-4.8	-2.9	1.1	4.90
2001	-9.3	-6.8	-4.1	-2.9	4.50
Continuation of increased per capita consumption					
2002 – 2005[a]	-10.0	-8.5	-5.6	-2.0	2.50
2006 – 2010[a]	-10.0	-8.5	-5.6	-2.0	1.50
2011 – 2015[a]	-14.0	-10.0	-8.0	-4.0	0.40
2016 – 2020[a]	-18.0	-12.0	-9.3	-6.0	0.15
Constant per capita consumption					
2002 –2005[a]	-10.2	-8.8	-5.8	-2.1	2.40
2006 – 2010[a]	-10.2	-8.8	-5.8	-2.1	1.40
2011 – 2015[a]	-15.0	-11.0	-9.0	-5.0	0.30
2016 – 2020[a]	-19.0	-13.0	-10.0	-6.8	0.10

[a] Estimated.
Source: 1998 – 2001 data from USDA NASS, Agricultural Statistics Data Base.

Table 11. Distribution of Farms by Size
United States

	Farm Size (Number of Cows)					
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
Number of farms						
1982	240,747	53,341	14,608	n.a.	n.a.	202,068
1992	93,118	41,813	14,062	n.a.	n.a.	157,150
2000	52,920	31,360	12,865	5,350	2,675	105,170
Continuation of increased per capita consumption						
2010[a]	18,604	13,134	7,343	4,331	3,324	46,736
2020[a]	3,245	4,093	2,971	2,592	3,416	16,316
Constant per capita consumption						
2010[a]	18,235	12,751	7,204	4,292	3,294	45,777
2020[a]	2,821	3,549	2,655	2,335	3,361	14,721

[a] Estimated.
Source: 1982, 1992 data from U.S. Census of Agriculture.
2000 data from USDA NASS, Agricultural Statistical Data Base July, 2002.

These estimates indicate that the number of dairy farms in the United States will decline by about 59,000 farms or 55 percent from the year 2000 to 2010 and by 89,000 farms or 85 percent by 2020. This compares with a decline of 229,000 farms or 69 percent from 1980 to 2000 and a decline of 1.4 million farms or 82 percent[9] between 1960 and 1980.

The number of farms in 2020 is quite evenly distributed over the size groups (Table 12). For example, 19 percent of the farms had fewer than 50 cows and 21-23 percent of farms had over 500 cows. This is a significant change from 2000 when 50 percent of the farms had fewer than 50 cows.

Table 12. Percentage Distribution of Farms by Size [a]
United States

	Farm Size (Number of Cows)					
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
2000	50.3	29.8	12.2	5.1	2.5	100
Continuation of increased per capita consumption						
2010	39.8	28.1	15.7	9.3	7.1	100
2020	19.9	25.1	18.2	15.9	20.9	100
Constant per capita consumption						
2010	39.8	27.9	15.7	9.4	7.2	100
2020	19.2	24.1	18.0	15.9	22.8	100

[a] Calculated from Table 11.

The shift in milk production is even more dramatic (Table13). By 2020 nearly 83-85 percent of the milk will be produced on farms with over 500 cows. While making up nearly a fifth of the farms, those with fewer than 50 cows will produce less than one percent of the total milk supply.

Table 13. Percentage Distribution of Milk Production by Farm Size [a]
United States

	Farm Size (Number of Cows)					
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
2000	9.5	19.4	17.3	18.0	35.8	100
Continuation of increased per capita consumption						
2010	3.4	8.7	10.6	15.1	62.2	100
2020	0.6	3.0	4.6	9.3	82.5	100
Constant per capita consumption						
2010	3.4	8.2	10.1	15.3	63.0	100
2020	0.6	2.3	3.8	8.7	84.6	100

[a] Calculated from Table 11.

[9] Estimated from interpolations of U.S.Census of Agriculture data on farms with milk cows for 1959 and 1964 plus 1978 and 1982.

Summary of changes in the structure of U.S. dairy production

This analysis indicates that if current trends continue total milk production on U.S. farms will be 17 to 20 percent higher in 2020 than it was in 2000. Increases in milk production per cow will allow that milk to be produced with about 15 percent fewer cows. The shift towards fewer and larger farms implies that those cows will be housed on 85 percent fewer farms. The average farm in 2020 will have about 500 cows producing over 25,000 pounds per cow and about 13 million pounds per farm. Eighty-five percent of the milk will be produced on farms with over 500 cows.

Factors that Might Modify Farm Size and Numbers

There are a number of economic and cultural factors that underlie the current trends in farm size and numbers. Changes in those factors could alter the trends.

Economies of size

Economies of size can result from larger operations having lower costs than smaller farms or from larger businesses being able to obtain higher prices for products sold. Although economies of size are not as large as frequently implied, they are of sufficient magnitude that they encourage a movement to larger herd sizes.

Cost Economies. Economies of size in the dairy industry are frequently illustrated using data similar to that shown in Figure 13[10]. It is important to note that the average cost line drawn through the data in Figure 13 does not truly reflect economies of size because it has not been corrected for factors that might be correlated with size, but are not the result of differences in size. For example, production per cow tends to increase with herd size, but it is not the result of larger size. None the less, the average cost line in Figure 13 indicates the type of relationship usually shown[11]. That is, costs per unit of production decrease sharply as herd size increases, particularly up to 150 or 200 cows. Average cost presentations such as that shown in Figure 13 have led a number of people to conclude that small dairy farms are going to rapidly disappear.

However, Tauer[12] shows that much of the apparent economies of size are really a reflection of differences in efficiency between farm businesses. Efficiency refers to the level of output relative to the level of input. Less efficient farms obtain less production for a given level of inputs than more efficient farms, whether they are large or small. The data in Figure 13[13] show that a higher proportion of small farms have high costs. With a high proportion of high cost farms in the sample, the average cost for all small farms is high. When only the efficient farms are considered, the cost curve is much less steep than the average cost curve shown in Figure 13.

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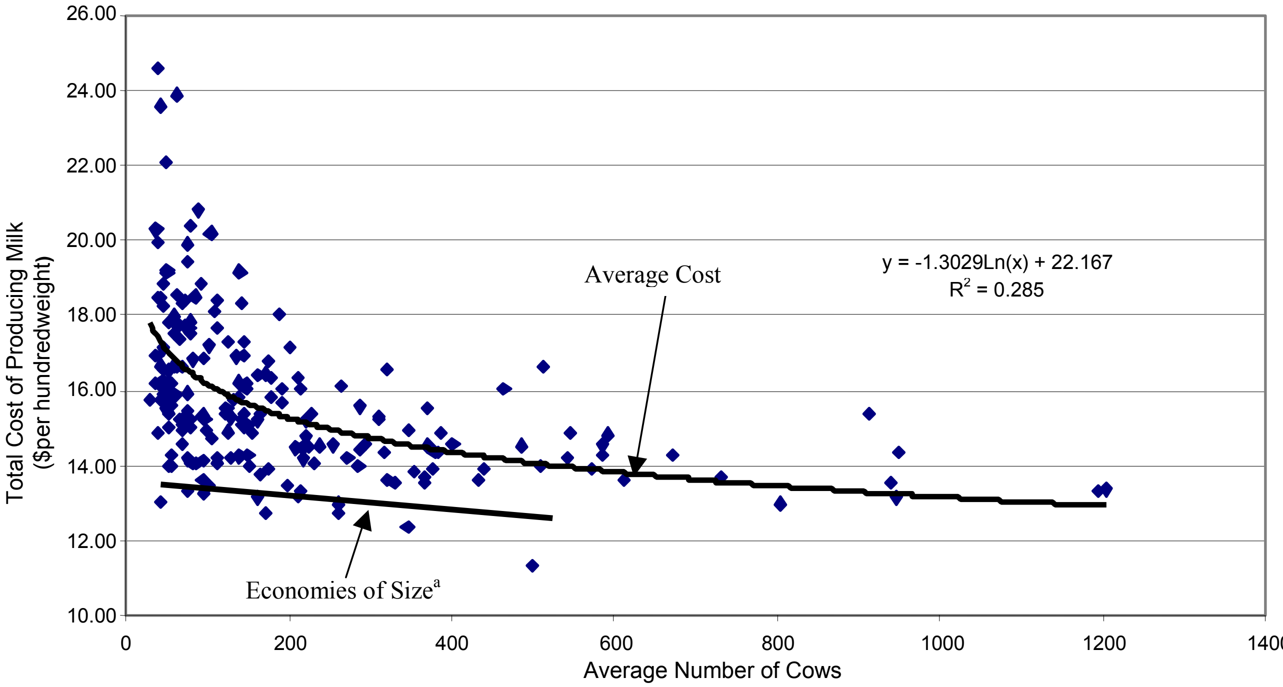
[10] Figure 13 data comes from the Dairy Farm Business Management Project of the Department of Applied Economics and Management, Cornell University. Individual farm data were averaged for 1997-1999.
[11] For an example, see Tauer, L. W. "Cost of Production for Stanchion Versus Parlor Milking in New York", J. Dairy Sci. 81:567-569, 1998.
[12] Tauer, L. W., "Efficiency and Competitiveness of Small New York Dairy Farms" Journal of Dairy Science, 84:2573-2576,2001.
[13] The data in Figure 13 comes from the Cornell Dairy Farm Business Management Project.

Figure 13. TOTAL COST OF PRODUCING MILK BY HERD SIZE
3-Year Average of 201 Farms, 1997-1999



[a] Average cost line for efficient farms is plotted from the 1999 data from Table 14.

For example, Tauer reports that farms with an average of 50 cows have, on average, \$3.34 higher costs per hundredweight due to inefficiency and \$0.58 higher costs due to economies of size, than efficient 500-cow farms (Table 14). On average, farms with 50 cows had costs of \$16.95 per hundredweight. If these farms had utilized resources in ways comparable to the most efficiently operated 50-cow herds, average costs would have been \$13.61. The difference represents the average cost of inefficiency. Efficient 500-cow farms had an average cost of producing milk of \$13.03. The difference between the average cost of efficient small farms and efficient large farms (\$13.61 - \$13.03 = \$0.58) represents the cost of production differential due to economies of size. While the \$0.58 cost, due to lack of economies of size, is an important consideration for small farms, it is less than the average cost of inefficiency (\$0.83) for large herds (average cost for 500-cow farms of \$13.86 minus the average cost on efficient 500-cow farms of \$13.03). True economies of size are illustrated in Figure 13 by the line labeled "economies of size." While economies of size are much less than many people conjecture, they still exist. Efficient farms with 500 cows had 50-cent lower costs than efficient 50-cow farms. Further, the data in Figure 13 provide little evidence that additional economies of size exist for farms larger than 500 cows.

Table 14. Comparison of Inefficiency and Economies of Size
314 New York Dairy Farms, 1999

Number of Cows	Average Actual Cost All Farms	Average Cost For Efficient Farms	Amount Due to Inefficiency	Amount Due to Economies[a]
50	$16.95	$13.61	$3.34	$.58
100	16.55	13.54	3.01	.51
150	16.16	13.47	2.69	.44
200	15.79	13.40	2.39	.37
250	15.43	13.34	2.09	.31
500	13.86	13.03	0.83	---

[a] Cost difference for efficient farms compared to 500-cow size.
Source: Tauer[9]

Inefficiency (less production for a given level of inputs) can result from a variety of sources. Organizing a farm to produce a different product, such as the production of organic milk, may reduce efficiency as measured by the cost of production. It can also result from use of lower quality resources where the lower quality is not completely reflected in the value of the resources used and the quantity of resources used is measured in dollars. In a few cases, less efficient farms are purposefully organized as they are in order to meet non-economic goals of the operator who is willing to accept a higher cost per hundredweight produced and a lower level of income from the farm, if necessary, to attain those goals.

Although the approximately 50 cents per hundredweight economies of size advantage is not large, the multiplier effect makes it important. A 500-cow farm selling 25,000 pounds per cow will have a $56,250 higher annual net income than a 50-cow farm.

Price Economies. Three reasons that larger operations may receive higher prices are transportation economies, transaction economies and product quality or consistency advantages. Transportation economies can be important in the dairy industry because a trucker spends less time and drives fewer miles to obtain a load of milk on a route that is primarily large farms. The driver may only go to one or two farms to fill the tanker instead of traveling to 10 or 15 smaller farms.

Transaction economies result when the buyer has to deal with, write checks for and do bookwork for only a few sellers. Quality and consistency economies result when a large quantity of product is handled under the same regime, by the same people and can be ready at one time. It is less costly to negotiate quality and consistency standards with one person than with six. Deviations from standards, which tend to be random events, will occur less frequently on one farm than six farms.

Although there is considerable discussion about larger farms receiving higher prices for milk, based primarily on transportation economies, data on New York dairy farms does not support the existence of such pricing differences (Table 15). Even when only Western New York farms are considered, to insure that the farms are sending milk to essentially the same market, large farms do not receive higher milk prices. It appears that transportation economies are handled by differences in hauling charges, which are reflected in cost economies.

Table 15. Milk Price by Herd Size
New York Dairy Farm Business Management Summary Farms, 1996-2000

	Milk Price per Hundredweight ($)	
Herd Size (Number of Cows)	All Farms 1996-2000	Western NY Farms 2001
Less than 50	14.57	16.14
50 to 74	14.41	15.44
75 to 99	14.47	15.72
100 to 149	14.58	n/a
150 to 199	14.63	15.88[a]
200 to 299	14.62	15.74
300 to 399	14.45	15.83
400 to 599	14.57	15.45
600 or more	14.40	15.71

[a] 100 to 199 cows

Source: Cornell Dairy Farm Business Summary. Western NY = Western and Central Plain and Western and Central Plateau DFBS counties, excluding Cayuga, Seneca, Schuyler, Chemung, Tompkins, Tioga, Broome and Cortland Counties.

The 2002 farm bill will provide payments to dairy producers, which will effectively increase their milk price. Payments are made on the first 2.4 million pounds of milk sold annually, so farmers producing that amount or less will have their average price increased more than those producing at higher levels.

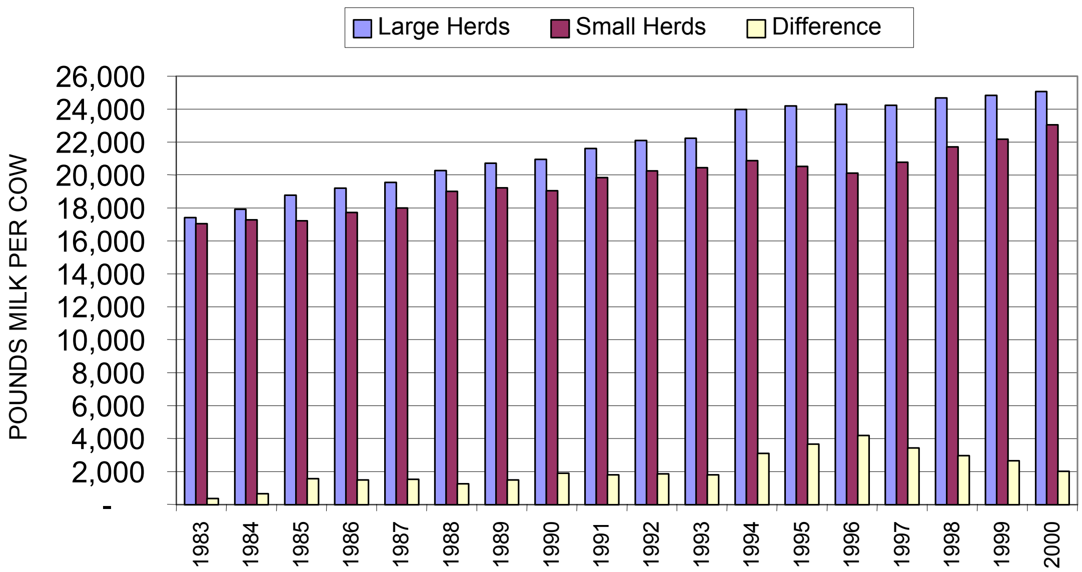
In summary, although economies of size are not as large as many imply, they are significant and will continue to push toward larger farm size. They are not so large, however, that an efficient small or mid-sized farm cannot stay in business. The multiplier effect on farm incomes will cause significant differences in farmer incomes between small and large farms. The economies of size appear to come from cost economies, not from larger farms receiving a higher price for their milk.

Maintaining production levels on large farms

Many years ago it was common knowledge that high levels of milk production occurred only on small farms. The line of reasoning went that only a farmer with a small herd could give the animals the amount of individual attention required for high production. Large farms had to hire non-family employees who were thought to not have the commitment to do the job right all the time and the “eye of the master” was necessary for top performance. Application of scientific principles to feeding, milking and general herd management have identified the practices embodied in the “eye of the master” and allowed routinization of the tasks necessary for high production. Thus, large herds are able to obtain and maintain high levels of production. This is sometimes referred to as successful “industrialization” of dairy farming.

In addition, large herd managers are more likely to follow best management practices, and thus, tend to obtain higher levels of milk production than small herds. Over the past couple of decades, the best large herds have increased their production levels more than the best small herds (Figure 14).

Figure 14. PRODUCTION LEVEL OF THE TOP 25 PERCENT OF SMALL AND LARGE HERDS[a]



[a] Small herds are the 20 percent of herds with the fewest cows, Large herds are the 20 percent with the most cows.
Source: DFBS Cornell

Health or Disease Risk (Bio-security)

Large farms likely have a somewhat higher risk of accidental contamination or contraction of disease, merely because there are more animals involved and there are a larger number of people with contact with the animals. Large farms certainly have a higher risk of intentional or malicious contamination because the farms have a higher visibility in the community and the large number of people involved in the business makes access to the farm easier for someone not connected with the business. In addition, purchase of a few animals or taking a few animals to the fair risks spreading disease to a much larger number of animals with a large herd.

Once contaminated or diseased, a large farm is likely to suffer a greater absolute loss, though the loss may not be greater as a percent of the business assets. The increased bio-security risk for large farms makes this a more important issue on large farms. At this point in time, the bio-security risks for normally operated dairy farms are not generally considered large. Most risks can be controlled with modest measures such as vaccination, maintaining a closed herd or implementation of modest bio-security program.

Environmental Risk

Large farms create large piles of manure and large silos with the potential to discharge large amounts of silage leachate. Maintaining and disposing of these potential contaminates can pose both water and air quality risk. Current, "Concentrated Animal Feeding Operation" (CAFO) environmental regulations have defined CAFO's as animal feeding operations (AFO) where a farm confines animals for at least 45 days in a 12-month period and there's no grass or vegetation in the area during the growing season. Dairy farms are "large" CAFO's if they meet the AFO definition and have at least 700 mature dairy cows, or 1000 heifers (Table 16). Dairy operations, that are AFOs, are classified as "medium" CAFO's if a man-made ditch or pipe carries manure or waste water from the operation to surface water or the animals come into contact with surface water running through the area where they're confined and the operation has at least 200 mature dairy cows or 300 heifers. Some farms no matter what size may be designated as a CAFO, if the permitting authority finds they are adding pollutants to surface water. Those farms with more animals than a cut-off point must apply for a permit, construct storage and other waste control facilities and implement discharge procedures that will avoid or reduce contamination of surface and underground water bodies. Costs of the required structures could be as much as several hundred thousand dollars per farm.

Table 16. Definitions of Concentrated Animal Feeding Operations (CAFO's)

Livestock	Large CAFO	Medium CAFO
	-------- Operations that have at least this number of livestock---------	
Mature dairy cows	700	200
Beef cattle of heifers	1,000	300
Swine (each 55 lbs or more)	2,500	750
Swine (each under 55 lbs)	10,000	3,000

Source: U.S. Environmental Protection Agency, Concentrated Animal Feeding Operations. 833-F-02-006. December 2002.

Meeting CAFO requirements will impose a large financial burden on many farms. These large investments generally result in small economic returns to the farmer, and thus, could significantly increase the costs on those farms that must comply with CAFO. Since larger farms must now meet these requirements, one might expect that complying with these regulations would reduce the competitive position of large farms and, at least, slow the movement of the dairy industry towards larger farms.

The EPA has developed estimates of the number of farms meeting CAFO definitions and the costs they would incur (Table 17). While the dairy industry does not have the most number of operations by class of livestock, they do have the largest cost estimates. The aggregate costs are roughly one-half of the total aggregate incremental costs of all livestock estimated aggregate costs (Table 17). Based upon the EPA projected number of large dairy CAFOs this is an annual average cost of over $88,000 per operation and medium dairy CAFO's annual average cost of $11,000 per operation.

Table 17. Estimated Number of Operations Subject to CAFO & Estimated Costs, 2001

	--------Number of Operations-------		Annual Costs Incurred per Farm to Meet CAFO Requirements	
Type of Livestock	Large CAFO's	Medium CAFO's	Large CAFO's	Medium CAFO's
Dairy	1,450	1,949	$88,414	$11,288
Hogs	3,924	1,485	6,346	6,397
Fed cattle	1,766	174	48,584	10,920
Heifers	242	4	15,702	342,857
All livestock[a]	10,526	4,452	26,905	8,783

[a] Includes chickens, turkeys, broilers and veal.

Source: EPA National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations (CAFOs); Final Rule. Federal Register Vol. 68, No. 29. February 12, 2003

Given the data used, EPA estimates of the number of CAFO farms is likely somewhat underestimated (Table 18). The rapid increase in dairy herds over 700 head over the past few years will result in more large CAFOs than the original estimates given by EPA.

Table 18. Number of CAFO Milk Cow Operations by Herd Size

Herd Size	Operations 1997[a]	EPA Estimate of Number of CAFO Operations[a]	Operations 2001[b,c]	Updated Estimate of Number of CAFO Operations[c]
< 200	109,736		89,525	
200-700	5,693	1,946	6,215	2,128
> 700	1,445	1,450	1,770	1,770
Total	116,874	3,399	97,510	3,898

[a] Source: U.S. Environmental Protection Agency. EPA-821-R-03-001 December 2001.
Herd size estimated from Census of Agriculture data showing 1,379 dairies with 500-999 milk cows. Assumes approximately 60 percent have 500-699 milk cows and 40 percent have 700-1000 milk cows.
[b] Source: USDA NASS , Agricultural Statistics Data Base. Internet March 2003.
[c] Estimated using the same assumptions that U.S. EPA did using 1997 data for projections for 2001.

However, there are several factors that may mitigate the impact of the environmental regulations on the structure of the dairy industry. First, experts believe that all farms ultimately will be rquired to meet the same regulations[14]. Small farms will be given more time and may be able to use somewhat less expensive options, but will have to meet the same basic requirements. Because lagoons and liquid manure handling equipment are lumpy investments, and large investments are usually much less costly per cow or per unit of storage, the actual cost per hundredweight of milk could easily be much greater for small farms than for large ones. In this case, environmental restrictions could be expected to, at most, slow the structural change in the dairy industry in the short term. Over a longer period of time, the restrictions could force many small farms out of business because the environmental costs will make them noncompetitive.

A second mitigating factor is the FSA (Farm Service Agency) EQIP (Environmental Quality Incentives Program) program. This program can provide a maximum of $450,000 per farm for structures and farm modifications designed to meet environmental regulations. This subsidy could encourage large farms by reducing their investment costs for handling manure, silage leachate and milk house waste. If appropriately designed these investments could lower operating costs for all farms taking advantage of the program, thus encouraging large farms.

The real question about the EQIP program is whether the funding level will handle those farms that need funds to meet CAFO requirements. A total of $9 billion was provided over six years, 60 percent of which ($5.4 billion) is to go to livestock producers. U.S. Environmental Agency[15] indicates that in 2001 there were about 15,000 farm operations in the United States that met the CAFO requirements (Table 18). If all the available funds went to these farms that must meet CAFO requirements, each farm could receive about $360,000 over the six-year period of the bill. Of course, some of the funds will go to smaller designated CAFO operations, and there is a considerable number of smaller operations. However, this indicates that the EQIP program could offset a large part of the costs of CAFO for large farms, if it is ultimately funded

[14] Peter Wight, Senior Extension Associate, Department of Biological and Environmental Engineering, Cornell University, June 13, 2002.
[15] Federal Register Vol. 68, No. 29. February 12, 2003

at the levels indicated. Based on this analysis, it appears that CAFO will have only a modest effect on farm structure.

Conclusions

While there are a number of factors that could alter trends in the farm level structure of the dairy industry, at this point none appear to clearly indicate that future changes in the industry will be substantially different from what we have experienced in the recent past. The future structure may not be merely a continuation of the past, but we find no clear evidence that it will not. Thus, our projections of farm numbers, farm size, number of cows and production levels appears to be based on reasonable assumptions.

The Number and Size of Dairy Farms in the Northeast

Milk per cow

The levels and changes in milk per cow in the Northeast are similar to those experienced in the U.S. as a whole (Table 19). Small farms have lower production levels than large farms and production levels have increased quite dramatically over the last few decades. A continuation of trends in production levels by farm size is expected to result in production of nearly 18,000 pounds per cow for small farms and over 25,000 pounds per cow for large farms. Average production per cow for all farms would be over 24,600 pounds.

Table 19. Northeast Production per Cow by Herd Size [a]

	Farm Size (Number of Cows)				
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1982	11,380	12,959	13,517	13,694	14,228
1987	13,030	14,591	15,244	15,230	15,665
1992	14,551	16,088	16,676	17,447	17,705
1997	13,320	16,549	16,965	18,840	18,136
1998	14,276	16,220	17,830	19,003	17,961
1999	14,913	16,382	17,969	19,226	19,444
2000	14,943	16,431	18,314	19,088	19,873
2001	14,630	16,515	18,177	19,104	20,670
2010[b]	16,290	18,438	20,574	22,414	22,645
2020[b]	17,845	20,194	22,985	25,452	25,668

[a] Based on data for New York, Pennsylvania, Vermont and Maryland, which make up 92 percent of Northeast production. Data for other Northeast states are not reported.
[b] Estimated from 1982 through 2001 trend. Estimated equations were 1-49 cows: 155.46X+11782, 50–99 cows: 175.56X+13347, 100-199 cows: 241.14X+13581, 200-499 cows: 303.85X+13602, 500+ cows: 302.28X+13879.

Source: U.S. Census of Agriculture 1982-1992, distributions of milk production by size of operation was estimated using value of dairy product sales, as milk production by size of operation is not available for that time period. 1997 through 2001 data from USDA NASS Agricultural Statistics Data Base website July 2002.

Cows per farm

Cows per farm for all the size groups of Northeast farms except those with over 500 cows are quite stable (Table 20). The average number of cows on farms with over 500 cows increased by 22 cows per year during 1997-2001. This is a slower rate than experienced by at the national level, which averaged 40 cows per year. The 22-cow increase was used in projecting 2010 and 2020 cows per farm. For 2020 the average number of cows per farm would be 237.

Table 20. Northeast Average Number of Cows per Farm by Farm Size[a]

	Farm Size (Number of Cows)				
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1982	24	65	126	259	708
1987	26	66	127	258	746
1992	27	67	128	268	778
1997	24	64	147	272	816
1998	23	64	144	289	770
1999	24	63	140	261	849
2000	23	62	142	279	933
2001	23	62	144	277	906
2002 – 2010[b]	23	62	143	279	1104
2011 – 2020[b]	23	62	143	279	1324

[a] Based on data for New York, Pennsylvania, Vermont and Maryland, which make up 92 percent of Northeast production. Data for other Northeast states not reported.
[b] Estimated. 500 and over size group is assumed to increase by 22 cows per year, the average experience during 1997-2001.

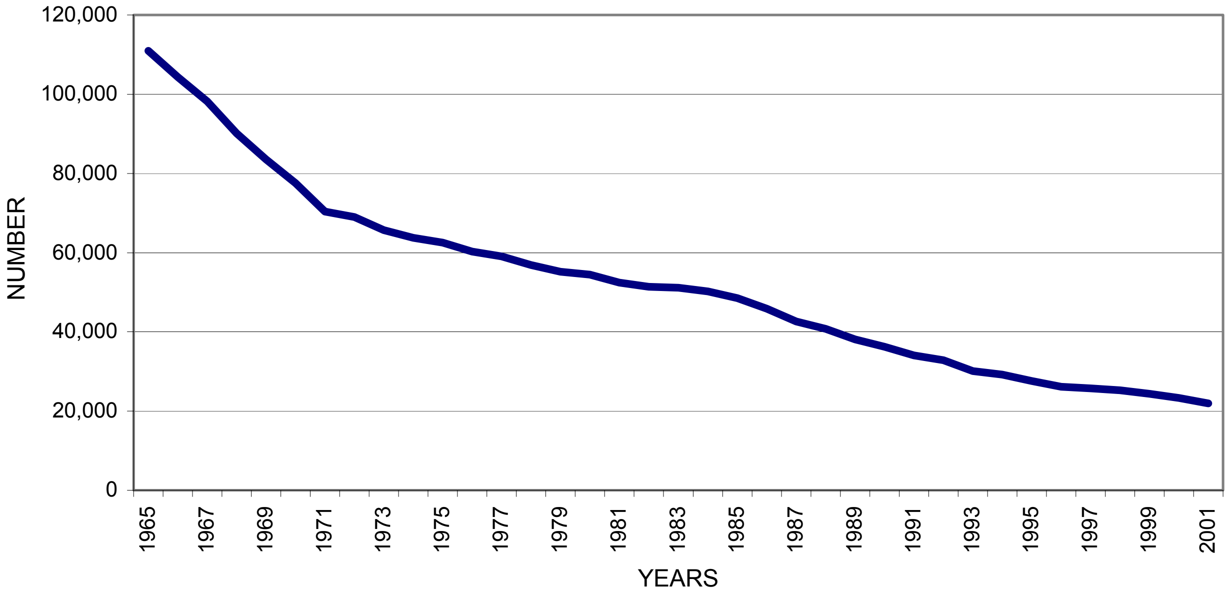
Source: 1982 – 1992 data from Census of Agriculture; 1997 – 2001 data from USDA NASS Agricultural Statistical Data Base, internet July 2002.

Number of farms

Like the rest of the U.S., the number of farms in the Northeast has been rapidly declining for decades (Figure 15). In recent years, the number of large farms has been increasing more rapidly than for the U.S. as a whole (Table 21). Because of the smaller average herd size in the Northeast, this more rapid increase in large farms is projected to continue.

The number of dairy farms in the Northeast is expected to decline from about 23,000 in 2000 to 11,000 in 2010 and 5,000 in 2020 (Table 22). The proportion of farms with less than 100 cows declines to about 50 percent while the proportion that have over 500 cows increases significantly (Table 23). Although the changes in farm numbers change drastically, there will still be a higher proportion of small farms in the Northeast than in the U.S. as a whole. Only 63 percent of total milk production will come from herds with over 500 cows (Table 24).

FIGURE 15. NUMBER OF NORTHEAST DAIRY FARMS



Source: USDA-NASS Internet 7/02

Table 21. Rates of Change in Farm Numbers by Size
Northeast

	Farm Size (Number of Cows)				
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1998	-3.2	-1.4	-1.2	4.2	14.4
1999	-5.3	-3.7	-1.9	16.5	10.4
2000	-4.5	-4.9	-1.9	0.6	-4.4
2001	-8.1	-4.7	-5.2	-1.6	17.6
Continuation of increased per capita consumption					
2002 – 2010[a]	-10.0	-7.0	-4.0	-1.0	8.1
2011 – 2020[a]	-12.0	-9.0	-6.0	-3.0	2.0
Constant per capita consumption					
2002 – 2010[a]	-10.3	-7.3	-4.3	-1.3	7.9
2011 – 2020[a]	-12.3	-9.3	-6.3	-3.2	1.95

[a] Estimated.
Source: 1998 – 2001 data from USDA NASS internet July 2002.

Table 22. Distribution of Farms by Size
Northeast

	Farm Size (Number of Cows)					
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
	--------------------------------Number of farms --------------------------------					
1982[a]	33,224	15,038	3,549	544	35	51,390
1992[a]	16,768	1,1639	3,567	779	97	32,850
2000	10,372	8,690	3,107	1,004	187	23,360
	Continuation of increased per capita consumption					
2010[b]	3,694	4,310	2,039	903	443	11,389
2020[b]	1,029	1,679	1,098	666	540	5,012
	Constant per capita consumption					
2010[b]	3,585	4,187	1,982	879	436	11,068
2020[b]	965	1,577	1,034	635	528	4,739

[a] Data by herd size for New York, Pennsylvania, Vermont and Delaware used to determine the proportion of farm in each herd size for all of the Northeast. These four states represented 92 percent of production in the Northeast in 2001.
[b] Estimated.
Source: 1982, 1992 data from U.S. Census of Agriculture. 2000 data from USDA NASS Agricultural Statistical Data Base, website July, 2002.

Table 23. Percentage Distribution of Farms by Size
Northeast

	Farm Size (Number of Cows)					
Year	1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
	--------------------------------Percent of farms --------------------------------					
1982[a]	62.6	29.3	6.9	1.1	.1	100
1992[a]	51.0	35.4	10.9	2.4	.3	100
2000	44.4	37.2	13.3	4.3	.8	100
	Continuation of increased per capita consumption					
2010[b]	32.4	37.8	17.9	7.9	3.9	100
2020[b]	20.5	33.5	21.9	13.3	10.8	100
	Constant per capita consumption					
2010[b]	32.4	37.8	17.9	7.9	3.9	100
2020[b]	20.4	33.3	21.8	13.4	10.8	100

[a] Data by herd size for New York, Pennsylvania, Vermont and Delaware used to determine the proportion of farms in each herd size for all of the Northeast. These four states represented 92 percent of production in the Northeast in 2001.
[b] Estimated.
Source: 1982, 1992 data from U.S. Census of Agriculture; 2000 data from USDA NASS Agricultural Statistical Data Base, website July 2002.

Table 24. Percentage Distribution of Milk Production by Farm Size
Northeast

Year	Farm Size (Number of Cows) 1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
	------------------------------Percent of milk produced ------------------------------					
1982 [b]	29.3	42.8	20.3	6.5	1.2	100
1992 [b]	20.8	39.5	24.0	11.5	4.2	100
2000 [b]	12.2	30.3	27.5	18.2	11.8	100
	Continuation of increased per capita consumption					
2010[a]	4.8	17.0	20.7	19.5	38.0	100
2020[a]	1.4	7.2	12.4	16.2	62.8	100
	Constant per capita consumption					
2010[a]	4.7	16.9	20.6	19.4	38.4	100
2020[a]	1.4	7.0	12.0	16.0	63.6	100

[a] Estimated.
[b] Data by herd size for New York, Pennsylvania, Vermont and Delaware used to determine the proportion of farms in each herd size for all of the Northeast. These four states represented 92 percent of production in the Northeast in 2001.
Source: 1982, 1992 data from U.S. Census of Agriculture; 2000 data from USDA NASS Agricultural Statistical Data Base, website July 2002.

Summary of projected structure for the Northeast

A continuation of current trends in milk production and demand indicates that the number of dairy farms in the Northeast will likely decline from 23,000 in 2000 to 11,000 in 2010 and 5,000 in 2020. These farms will have an average of about 240 cows per farm producing a little less than 25,000 pounds per cow for total production per farm of 5.8 million pounds. By 2020 only about half of the farms will have less than 100 cows.

The Number and Size of Dairy Farms in New York

Milk per cow

Since New York is a major part of the Northeast, trends in New York are similar to the Northeast. Milk per cow has increased somewhat more rapidly in New York than the rest of the Northeast. Unlike other regions production levels have not increased as rapidly for the largest herd size group as it has for slightly smaller herds (Table 25). But, larger herds are expected to average over 26,000 pounds per cow.

Table 25. Production per Cow by Herd Size
New York

Year	Farm Size (Number of Cows)				
	1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1982	10,483	12,379	13,062	13,377	13,651
1987	11,948	14,011	14,879	15,428	15,423
1992	13,314	15,426	16,394	17,587	17,936
1997	13,957	14,610	17,717	18,851	19,494
1998	14,183	14,790	18,696	18,997	18,159
1999	14,363	15,011	17,874	20,277	19,887
2000	14,218	14,981	17,998	20,274	19,860
2001	14,021	15,109	18,176	20,448	19,718
2010[a]	16,343	18,657	21,145	23,904	23,092
2020[a]	18,300	20,614	23,916	27,612	26,368

[a] Estimated from 1982 through 2001 trend. Estimated equations were 1-49 cows: 195.67X+10,669, 50– 99 cows: 195.67X+12,983, 100-199 cows: 277.09X+13,109, 200-499 cows: 370.88X+13,148, 500+ cows: 327.58X+13,592.
Source: U.S. Census of Agriculture 1982-1992, distributions of milk production by size of operation was estimated using value of dairy product sales as milk production by size of operation is not available for that time period. 1997 through 2001 data from USDA NASS Agricultural Statistical Data Base, website July 2002.

Cows per farm

Cows per farm for all the size groups of New York farms except those with over 500 cows are quite stable (Table 26). The average number of cows on farms with over 500 cows has recently increased by about 30 cows per year. This is a slower rate than experienced by at the national level, which averaged 40 cows per year, but more rapid than that experienced by the rest of the Northeast. The 30-cow increase was used in projecting 2010 and 2020 cows per farm. Under these assumptions, the 2020 average number of cows per farm in New York would be 253.

Table 26. Average Number of Cows per Farm by Farm Size
New York

Year	Farm Size (Number of Cows)				
	1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1982	25	65	128	264	673
1987	27	66	128	261	699
1992	27	67	129	276	781
1997	25	68	145	245	769
1998	27	68	140	270	765
1999	28	68	135	248	759
2000	26	66	137	257	800
2001	27	70	140	257	827
2002 –2010[a]	27	68	140	257	1097
2011 – 2020[a]	27	68	140	257	1397

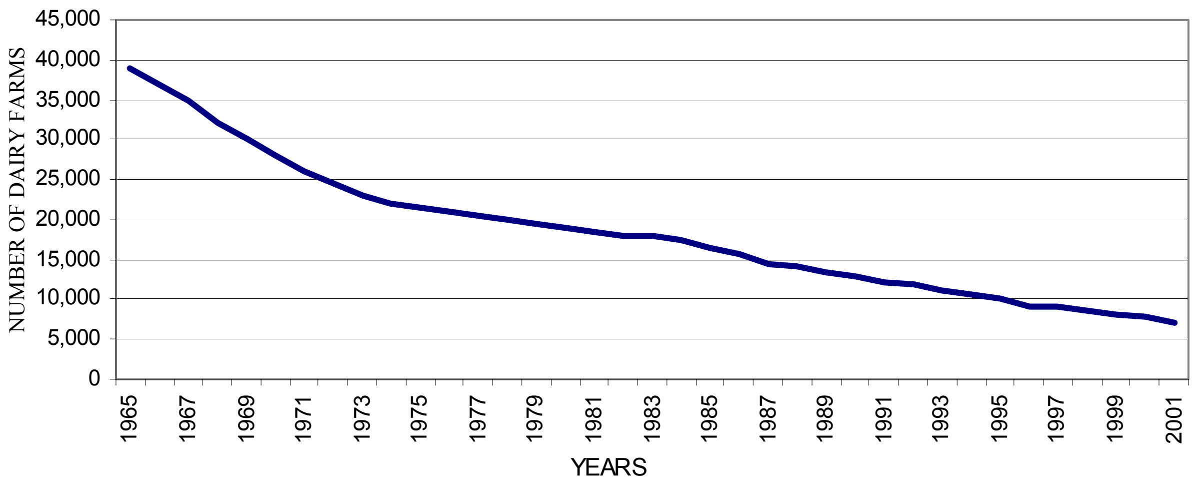
[a] Estimated. 500 and over size group is assumed to increase by 30 cows per year.
Source: 1982 – 1992 data from Census of Agriculture
1997 – 2001 data from USDA NASS Agricultural Statistical Data Base, internet July 2002.

Number of farms

Like the rest of the U.S., the number of farms in the New York has been declining rapidly for decades (Figure 16). In recent years, the number of large farms has been increasing more rapidly than for the U.S. as a whole (Table 27). Because of the smaller average herd size in the New York, this more rapid increase in large farms is projected to continue.

The number of dairy farms in the New York is expected to decline from about 7,900 in 2000 to 3,800 in 2010 and 1,800 in 2020 (Table 28). New York will continue to have a similar percent of dairy farms in the 50-199 herd sizes (Table 29). Farms with over 500 cows will produce about 64-66 percent of the milk while farms with fewer than 50 cows produce only 1 percent (Table 30).

FIGURE 16. NEW YORK DAIRY FARMS



Source: USDA, NASS Agricultural Statistical Data Base internet, July 2002.

Table 27. New York Rates of Change in Farm Numbers by Size

Year	Farm Size (Number of Cows) 1 - 49	50 - 99	100 - 199	200 - 499	500 and over
1998	-5.6	-2.8	0.0	-2.5	10.0
1999	-11.8	-8.6	7.7	23.1	9.1
2000[a]	-3.3	-6.3	0.0	0.0	0.0
2001	-13.8	-6.7	-7.2	-2.1	8.3
Continuation of increased per capita consumption					
2002 – 2010[b]	-10.0	-7.0	-5.0	-2.0	3.0
2011 – 2020[b]	-10.0	-8.0	-7.0	-4.0	2.5
Constant per capita consumption					
2002 – 2010[b]	-10.4	-7.4	-5.3	-2.1	2.9
2011 – 2020[b]	-10.5	-8.5	-7.6	-4.2	2.4

[a] Zero's are due to survey data reported to nearest 10 farms.
[b] Estimated.
Source: 1998 – 2001 data from USDA NASS Agricultural Statistical Data Base internet July 2002.

Table 28. Distribution of Farms by Size
New York

Year	Farm Size (Number of Cows) 1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
	Number of farms					
1982[a]	9751	5837	1402	231	15	17236
1992[a]	4821	4073	1389	360	52	10695
2000	2900	3000	1400	480	120	7900
	Continuation of increased per capita consumption					
2010[b]	969	1457	819	392	170	3807
2020[b]	338	633	397	261	217	1845
	Constant per capita consumption					
2010[b]	930	1402	796	388	168	3684
2020[b]	307	577	361	253	213	1711
	Percent change from 2000 (constant consumption)					
2010[b]	-68	-53	-43	-19	+40	-53
2020[b]	-89	-81	-74	-46	+78	-78

[a] Source: 1982, 1992 data from U.S. Census of Agriculture. 2000 data from USDA NASS Agricultural Statistical Data Base website July, 2002.
[b] Estimated.

Table 29. Percentage Distribution of Farms by Size
New York

Year	Farm Size (Number of Cows) 1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
	Percent of farms					
1982[a]	56.6	33.9	8.1	1.3	0.1	100
1992[a]	45.1	38.1	13.0	3.4	0.5	100
2000	36.7	38.0	17.7	6.1	1.5	100
	Continuation of increased per capita consumption					
2010[b]	25.4	38.3	21.5	10.3	4.5	100
2020[b]	18.3	34.3	21.5	14.1	11.8	100
	Constant per capita consumption					
2010[b]	25.3	38.0	21.6	10.5	4.6	100
2020[b]	17.9	33.7	21.1	14.8	12.5	100

[a] Source: 1982, 1992 data from U.S. Census of Agriculture. 2000 data from USDA NASS Agricultural Statistical Data Base website July, 2002. Source: 1982, 1992 data from U.S. Census of Agriculture. 2000 data from USDA NASS Agricultural Statistical Data Base website July, 2002.
[b] Estimated.

Table 30. Percentage Distribution of Milk Production by Farm Size
New York

Year	Farm Size (Number of Cows) 1 - 49	50 - 99	100 - 199	200 - 499	500 and over	All Farms
	------------------------------Percent of milk produced ------------------------------					
1982[a]	24.1	44.8	22.1	7.7	1.3	100
1992[a]	15.3	37.0	25.9	15.4	6.4	100
2000	9.0	25.0	29.0	21.0	16.0	100
	Continuation of increased per capita consumption					
2010[b]	3.7	16.2	21.3	21.1	37.7	100
2020[b]	1.4	7.5	11.2	15.6	64.3	100
	Constant per capita consumption					
2010[b]	3.7	15.9	21.1	21.3	38.0	100
2020[b]	1.3	6.8	10.2	15.2	66.5	100

[a] Source: 1982, 1992 data from U.S. Census of Agriculture. 2000 data from USDA NASS Agricultural Statistical Data Base website July, 2002.
[b] Estimated.

Summary of projected structure for New York

A continuation of current trends in milk production and demand indicates that the number of dairy farms in New York will likely decline from 7,900 in 2000 to 3,800 in 2010 and 1,800 in 2020. These farms will have an average of about 253 cows per farm producing over 25,000 pounds per cow for total production per farm of 6.5 million pounds. Total production on New York Farms in 2020 is expected to be similar to 2000 levels.

Competitive position of the Northeast

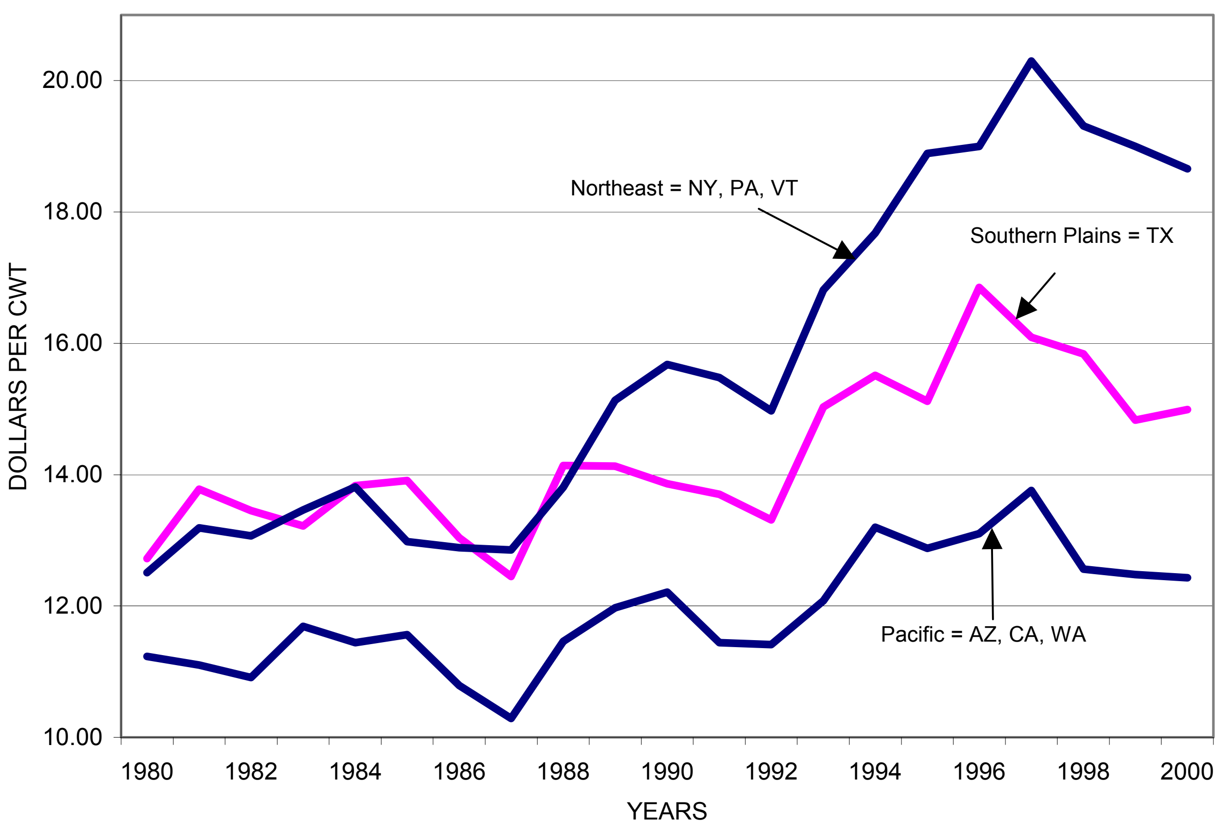
The competitive position of the Northeast, and particularly, the New York State dairy industry will strongly influence its future structure. In their discussion of the regional location of production Jesse and Schuelke[5] indicate that some current trends are unlikely to continue unabated. Specifically, the very rapid increases in production in California and the other western states is likely to encounter barriers such as water availability, higher feed costs, land availability and environmental/manure management restrictions. These barriers are largely economic in nature, and thus, will likely only gradually influence dairy expansion. They can be expected to only decrease the rate of expansion of the Western dairy industry. There is little reason to believe that any of these factors will be strong enough to result in a decrease in production in that part of the country. However, even a decrease in the rate of expansion in that region of the country means that production in other areas will be higher than projected by Jesse and Schuelke. At the same time the low prices of grains in the Midwest make dairy feed low cost and growing grain for world markets less profitable, resulting in considerable incentive to increase dairy production. This likely implies that production in that region will not likely continue its rate of decline and may even increase its production. If the rate of increase in the west declines and the Midwest only picks up some of the slack, the Northeast may benefit, and thus, the production levels for New York State and the rest of the Northeast, presented above, may be underestimated.

There are several approaches to estimating the competitive position of the Northeast dairy industry. Three of those approaches are discussed below.

USDA Costs of Production

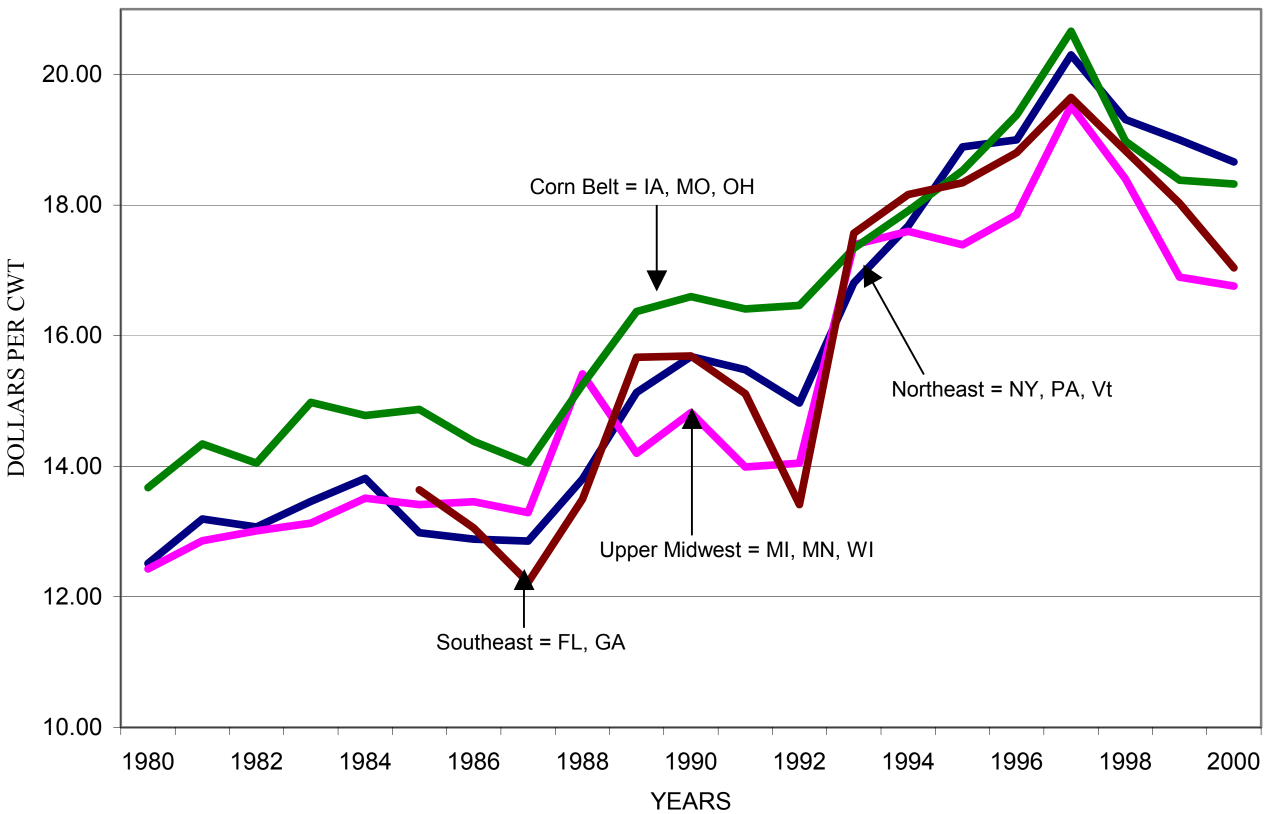
One measure of the competitive position of New York and the Northeast is the cost of producing milk relative to the cost of production in other regions. While comparing the cost of production by region sounds simple, an appropriate comparison that indicates the competitive position is difficult. The USDA has put together data on the cost of production by region. Figures 17 and 18 show that the Northeast is competitive with many regions, but currently has a $2 to $4 disadvantage compared to the Southern Plains and Pacific regions. If these figures were to be believed, it would appear that the Northeast had a very serious competitive disadvantage compared to the Western part of the United States and currently had the highest costs of all regions.

FIGURE 17. TOTAL ECONOMIC COST OF MILK PRODUCTION



Source: ERS, USDA, Costs and Returns

FIGURE 18. TOTAL ECONOMIC COSTS OF MILK PRODUCTION



Source: ERS, USDA, Costs and Returns

There are a number of reasons why these data do not accurately indicate competitive position. To illustrate the shortcomings of these data for these purposes, the data in Table 31 for the year 2000 will be used. The regions in Table 31 are different than in the above figures because the USDA has changed the region definitions for which they collect data. The Northeast is part of the Northern Crescent.

Table 31. Milk Production Costs and Returns per Hundredweight
By Regions, 2000

Item	Heartland	Northern Crescent	Prairie Gateway	Eastern Uplands	Southern Seaboard	Fruitful Rim
	Gross value of production (dollars)					
Milk	12.36	12.90	13.12	13.83	14.07	11.98
Cattle	1.42	1.17	0.84	1.32	1.40	0.71
Other income	0.79	0.63	0.33	0.49	1.16	0.42
Total value of production	14.57	14.70	14.29	15.64	16.63	13.11
Operating costs						
Feed						
Feed grains	1.83	1.16	1.48	1.23	0.74	1.11
Hay & straw	2.30	1.07	1.62	1.75	0.91	1.78
Complete feed mixes	0.87	1.09	1.47	2.86	2.95	1.63
Liquid whey & milk replacer	0.11	0.10	0.07	0.13	0.04	0.04
Silage	0.87	1.37	2.19	0.74	0.95	0.91
Grazed pasture & cropland	0.13	0.07	0.03	0.26	0.11	0.03
Other feed items	1.55	1.14	0.95	2.37	1.18	0.81
Total feed costs	7.66	6.00	7.81	9.34	6.88	6.31
Veterinary and medicine	0.75	0.77	0.55	0.55	0.57	0.50
Bedding and litter	0.23	0.23	0.02	0.10	0.10	0.07
Marketing	0.22	0.31	0.26	0.36	0.40	0.22
Custom services	0.53	0.47	0.93	0.82	0.90	0.42
Fuel, lube and electricity	0.56	0.56	0.35	0.56	0.51	0.37
Repairs	0.59	0.60	0.39	0.66	0.58	0.43
Other operating costs	0.00	0.00	0.02	0.00	0.00	0.02
Interest on operating capital	0.30	0.26	0.30	0.36	0.29	0.24
Total operating costs	10.84	9.20	10.63	12.75	10.23	8.58
Allocated overhead						
Hired labor	0.73	1.17	1.22	0.96	1.60	1.19
Opportunity cost unpaid labor	5.64	5.15	0.57	6.35	2.49	0.97
Capital recovery of machinery & equipment	4.66	4.14	1.72	4.31	3.24	1.94
Opportunity cost of land	0.09	0.09	0.01	0.20	0.06	0.02
Taxes and insurance	0.19	0.22	0.09	0.19	0.14	0.14
General farm overhead	0.56	0.61	0.35	0.51	0.52	0.32
Total allocated costs	11.87	11.38	3.96	12.52	8.05	4.58
Total listed costs	22.71	20.58	14.59	25.27	18.28	13.16

Table 31. (Continued) Milk Production Costs and Returns per Hundredweight By Regions, 2000

Item	Heartland	Northern Crescent	Prairie Gateway	Eastern Uplands	Southern Seaboard	Fruitful Rim
	Gross value of production (dollars)					
Value of production less total costs listed	-8.14	-5.88	-0.30	-9.63	-1.65	-0.05
Value of production less operating costs	3.73	5.50	3.66	2.89	6.40	4.53
Milk cows (head per farm)	57	66	474	53	133	399
Milk per cow (pounds)	18,567	19,721	21,940	16,942	19,079	21,352
Percent of farms milking more than twice a day	1.62	2.84	31.61	0.40	7.32	11.99
Homegrown feed cost as percent of total feed cost	61	52	5	35	23	14
Head per farm injected with bST	10	13	86	3	26	80

Source: ERS, USDA Cost and Returns website July 2002.

Average existing farm

These data represent the average cost of the average producer in the region, not the basic ability of farms to compete. The current cultural practices and farm size of the average farm in the region are built into the costs.

The average herd size in the Fruitful Rim (including California) is 399 cows compared to 66 cows for the Northern Crescent (including New York). Much of the difference in allocated costs per hundredweight results from differences in farm size, rather than basic regional cost differences. The relationship between farm size and the level of these costs for New York are shown in Table 32.

The correspondence between the data on general overhead from the USDA data and the New York data is only approximate. The USDA defines general overhead as "… items such as farm supplies, marketing containers, hand tools, power equipment, maintenance and repair of farm buildings, farm utilities, and general business expenses that cannot be directly attributed to a single farm enterprise." To approximate these rather nebulous categories New York machinery rent, lease and repairs, land and building repairs and miscellaneous expenses were included.

Table 32. Cost per Hundredweight for Selected Cost Items
New York Farms, 2000

	Herd Size (Number of Cows)								
Item	Under 50	50-74	75-99	100-149	150-199	200-299	300-399	400-599	600 plus
Hired labor cost	.34	.74	1.47	1.33	1.77	1.88	2.23	2.44	2.74
Opportunity cost of unpaid labor[a]	4.72	3.40	2.44	2.19	1.72	1.19	.88	.80	.52
Machinery capital recovery[b]	1.75	1.32	1.10	1.27	1.37	.98	1.13	.98	.80
Building capital recovery[c]	.63	.54	.60	.66	.78	.75	.65	.78	.80
Purchased replacements[d]	.19	.32	.11	.29	.18	.22	.43	.22	.20
Total capital recovery – excl. replacements	2.38	1.86	1.70	1.93	2.15	1.73	1.78	1.76	1.60
Total capital recovery – incl. replacements	2.57	2.18	1.81	2.22	2.33	1.95	2.21	1.98	1.80
Taxes and insurance	.98	.74	.66	.53	.62	.43	.31	.27	.25
General overhead[e]	1.94	1.72	1.67	1.57	1.77	1.34	1.47	1.36	1.42

[a] Includes unpaid family labor valued at $1,900 per full time month equivalent and operator labor and management valued by the operator at its opportunity cost.
[b] Depreciation plus interest
[c] Depreciation plus interest estimated at one-half of depreciation
[d] Cost of purchased replacements
[e] Includes machinery rent, lease and repairs, land and building repairs and miscellaneous expenses.

These data clearly show that much of the difference in costs between regions results from a difference in herd size rather than basic cost of production levels. The USDA data do give some indication of the magnitude of the adjustment process that the Northeast will be subject to as it adapts to be competitive with other regions.

Data questions. Analysis of the USDA data raises several troubling questions. First, why is the USDA estimate of capital recovery costs so much higher (as listed for the Northern Crescent) than that experienced by farms in the New York Farm Business Summary? Second, why is the hired labor cost on smaller Northern Crescent farm, where most of the labor is family, nearly the same as that found on the larger Fruitful Rim farms where most is hired (Table 31)? New York data show much smaller levels of hired labor for the smaller farms.

It is very difficult to separate some costs between enterprises. This can result in a higher level of error on farms with multiple enterprises compared to those with only a single enterprise. Many farms in the Fruitful Rim are single enterprise farms. They do not raise forages or grains and frequently do not raise their own replacements. These farms have few non-dairy overhead costs that can be allocated to the dairy enterprise.

Another problem with the costing process are that some costs are allocated among enterprises based on their “relative contribution to total farm operating margin” (value of production minus operating costs). Many dairy farmers believe, rightly so, that they do not make much money on the crops. The cows make the money. Thus, they will likely allocate a higher proportion of their crop overhead costs to the dairy, resulting in higher cost of production for milk on farms with crop operations than is economically justified. Thus, some part of expenses are double counted when feed is valued at its market value. This includes overhead costs, and results in an allocation scheme that assigns too many fixed costs to the dairy operation. A high proportion of Fruitful Rim farms have no cropping operation, and thus, are not subject to this possible double counting.

One reason that operating costs are lower in the Fruitful Rim is that farms in this region have a greater tendency to purchase rather than raise replacements, and the cost of purchased replacements are included under capital recovery (Table 33) and not included in operating costs. For regions that tend to raise replacements the costs are included with the other operating costs, because it is very difficult to separate the heifer costs from the costs of the milking herd. At the average cost of replacements in California in 2000 of $1,343[16], an average culling rate of 33 percent and average production per cow of 21,350 pounds per year, the average replacement costs for a herd that purchased all replacements would be $2.10 per hundredweight of milk. Even if the proportion of Fruitful Rim farms that buy replacements is quite small, the small difference in this cost for different regions as reported by UDSA (Table 22) raises questions about the estimating procedure.

Table 33. Breakdown of 2000 Milk Capital Recovery Costs

Region	Structures[a]	Machinery[b]	Cows	Total
U.S.	2.17	0.98	0.16	3.31
Heartland	2.85	1.71	0.10	4.66
Northern Crescent	2.79	1.25	0.10	4.14
Prairie Gateway	1.28	0.27	0.17	1.72
Eastern Uplands	2.22	1.82	0.27	4.31
Southern Seaboard	2.22	0.79	0.23	3.24
Fruitful Rim	1.35	0.36	0.23	1.94

[a] Structures include housing, milking, manure storage, and feed storage facilities.
[b] Machinery includes tractors, trucks, manure and feed handling equipment, and other dairy equipment items.
Source: USDA, ERS Special sort of data by William McBride

Given these non-comparability's, it appears that the USDA data cannot be used to accurately assess the comparative position of the various regions.

Cost/Price comparisons

Another approach to identifying relative costs is to compare prices of inputs at various locations (Table 34). Such comparisons leave out differences in productive efficiency and differences in the relative amounts of specific resources used, but give an indication of the cost environment.

Upper Midwest farmers face a slightly lower cost environment than farmers on either coast. Although 16 percent ration has similar costs in all three regions, basic feed ingredient costs (hay, corn, soybean oil meal) are considerably lower in the Midwest. California faces higher costs for basic commodities, but similar total mixed ration costs compared to the other two regions.

[16] USDA Agricultural Prices 2000 Annual Summary

Table 34. Comparison of Prices Paid and Received by Farmers (dollars)

Item	California		New York		Wisconsin		United States	
	2001	5 yr. average	2001	5 yr. average	2001	5 yr. average	2001	5 yr. average
Hay (Alfalfa) per ton	120	105	118	111	60	66	106	93
Corn per bushel	2.50	2.66	2.30	2.41	2.00	1.99	2.00	2.04
Replacement milk cows	1620	1400	1410	1170	1440	1230	1500	1270
Annual Ave All Milk Price per cwt	13.94	13.30	15.80	14.46	14.80	13.84	15.05	14.13

	Pacific		Northeast		Lake States		United States	
	2001	5 yr. average	2001	5 yr. average	2001	5 yr. average	2001	5 yr. average
Mixed Ration 16% ton	185	181	176	188	184	185	184	190
Soybean Meal 44% cwt	22.40	22.48	14.00	14.38	11.00	11.86	13.40	14.12
Unleaded Gasoline (bulk) gal.	1.82	1.56	1.55	1.36	1.48	1.32	1.47	1.29
Cottonseed meal	20.50	20.80	13.10	12.00	16.10	17.00	15.70	15.70

Source: USDA NASS Agricultural Prices Annual Summary 1997-2001
Pacific: CA, OR, WA; Northeast: CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT; Lake States: MI, MN, WI;

State Cost of Production Data

Some states compile cost of production data from actual farm records. These data are not usually calculated in exactly the same manner and they usually report data for different size groups. However, some comparisons can be made that may be useful. In the data shown in Table 35, the calculation procedure for New York was adjusted to the procedure reported for the state being compared.

Table 35. Cost of Production[a] Comparisons for New York, California and Wisconsin (dollars)

	New York	California
2000: 500 to 999 cow farms	12.41	11.51[b]
Under 500 cows (average 318 cows)[c]	12.41	11.49[b]
2001: 500 to 999 cow farms	13.40	12.27[b]
Under 500 cows (average 326 cows)[c]	13.29	12.17[b]
Under 700 cows (average 518 cows)[c]	13.21	12.52[d]
	New York[e]	Wisconsin[e]
2000: 1- 50 cow farms	10.71	10.70
51 to 75 cow farms	10.96	10.65
76 to 100 cow farms	11.10	10.65
101 to 150 cow farms	11.06	10.76
151 to 250 cow farms	11.30	11.39
250 or more cow farms (average 467)[c]	11.63	11.82
	New York	Minnesota
2001: All farms (average 122 cows)[c]	13.62	13.24[f]

[a] Excludes operator and family labor and management, and equity capital costs.
[b] Weighted average of North and South Valley areas.
[c] New York farms selected by moving the minimum (maximum) herd size down (up) until the desired average was achieved.
[d] Southern California
[e] Calculated using the "equivalent production" method (total accrual expenses/(total accrual income/U.S. average price received for milk($12.33 for 2000)).
[f] Assumes that 50 percent of purchased animals represent replacement and that the rests represent expansion animals. Expansion animals are excluded in the New York data.
Sources: California Department of Food and Agriculture, "California Cost of Production, 2001 Annual Summary": California Department of Food and Agriculture, "2000 California Cost of Production, Annual Summary"; Frank, Gary "Milk Production Costs in 2000 on Selected Wisconsin Dairy Farms", Center for Dairy Profitability, University of Wisconsin-Madison, July 2001; Olson, Westman and Nordquist "2001 Annual Report, Southeastern Minnesota Farm Business Management Association" Staff Paper PO2-4; Knoblauch, Putnam and Karszes, "Dairy Farm Management Business Summary, New York State, 2000" and data calculated by Linda Putnam.

These data indicate that New York costs are only slightly higher than Wisconsin and Minnesota, possibly in the range of 25 cents per hundredweight. This leads to the conclusion that New York can compete with the Upper Midwest in milk production. However, California has about one dollar per hundredweight lower costs than the Northeast. This implies that production will likely continue to expand in the Pacific region. The Northeast is protected only by the cost of shipping milk and milk products from the West to East Coast markets. As production in the Pacific region increases, rising input costs, water availability and cost and environmental restrictions will likely increase costs somewhat relative to other areas.

Comparative Advantage

In the long run production will move to locations where it has a comparative advantage. Resource (land) values in areas with an absolute disadvantage but a comparative advantage should adjust to keep production feasible. The Northeast has an absolute disadvantage compared to the Midwest in the production or corn and other grains. At current water prices, the Northeast also likely has an absolute disadvantage compared to California in the production of high quality hay. Thus, the price of land should be sufficiently lower to allow competitive production of grains or alternate, or more suited, crops. Compared to the Midwest and California, the Northeast likely has a comparative advantage in the production of silages (wet forages). The Northeast's short growing season is less of a handicap for corn silage than corn grain. Considerable natural precipitation allows production of hay crops without irrigation. However, that same precipitation means that much of the hay crop needs to be harvested as silage in order to maintain high quality. For much of the Northeast, silage production for livestock is its current best use. There are few other possible uses, if that becomes unprofitable.

While economics should keep the agricultural value of land low enough to make silage production feasible, much of the land in the Northeast also has development value that contributes to the price of land. While the taxes on that land could be limited by the use of agricultural assessments for farmland, the farmer buying land must pay the market value, which includes the development value. This will keep the interest cost of land high, which will make competitive production less feasible. The urban pressure, which gives the land development value, will continue to make agricultural production less profitable.

PROCESSING AND MANUFACTURING OF MILK

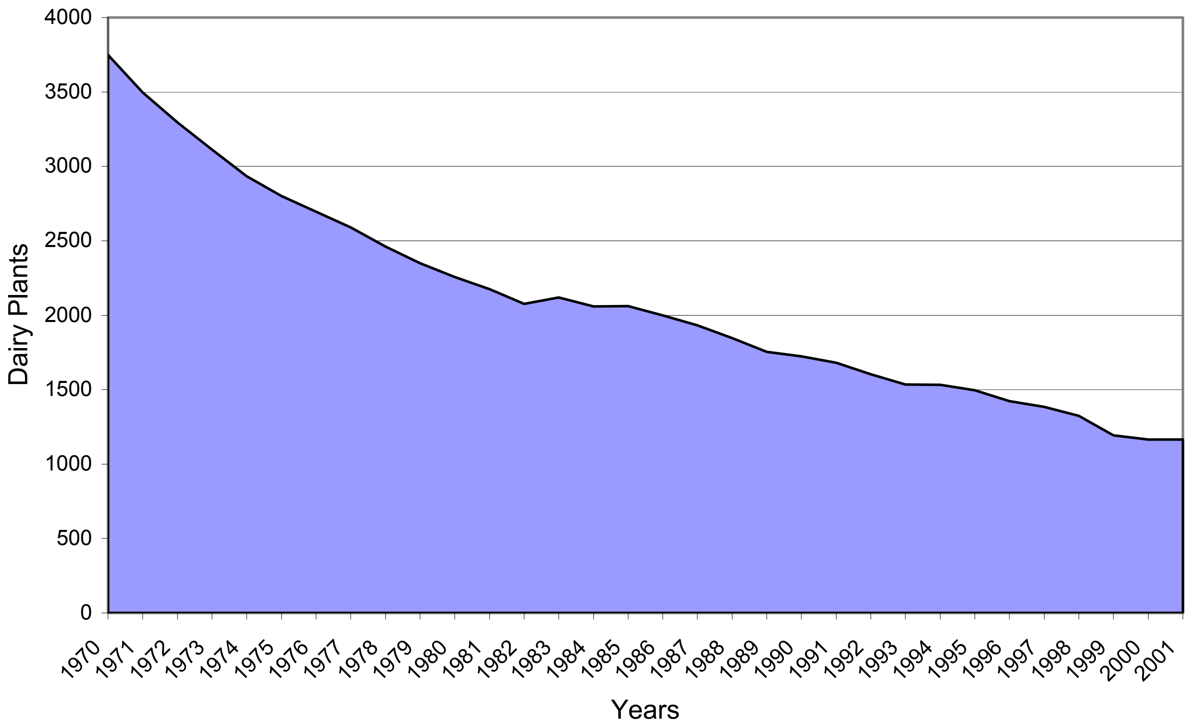
The number and size of dairy farms in New York and the United States will influence and be influenced by the structure of the milk processing and manufacturing sector. Since the processing and manufacturing sector consists of generally large firms, many of which are private companies that object to release of data about their firm, the data available to assess the changing structure of that part of the dairy industry are more difficult to obtain.

Number and Size of Dairy Plants

United States

Like farms, dairy plants are becoming larger and fewer in number (Figure 19). In fact, the rate of decline is very similar to the rate experienced by farmers. Over the last 30 years (1971 to 2001) the number of dairy plants in the United States has declined by 73 percent (from 4,278 to 1,173). At the same time the number of U.S. dairy farms has declined by 84 percent (from 591,870 to 97,510).

Figure 19. Number of United States Dairy Plants



Source: USDA, NASS, ASB, Dairy Products Summary.

A continuation of the trends shown in Figure 19 indicates that the number of plants in 2010 would be 879, and the number would drop further to 644 by 2020. Given the amount of milk expected to be produced, this would result in a more than doubling of the average amount of milk processed per plant by 2020 (Table 36).

Table 36. Number of Dairy Plants in the United States

Year	Number of Dairy Plants	Million Pounds Per Plant
1980	2257	57
1990	1723	86
2000	1164	144
2010 (projected)	879 [a]	205 [b]
2020 (projected)	644 [a]	302 [b]

[a] Based on the annual average decline of 3.07 percent from 1981 to 2001.

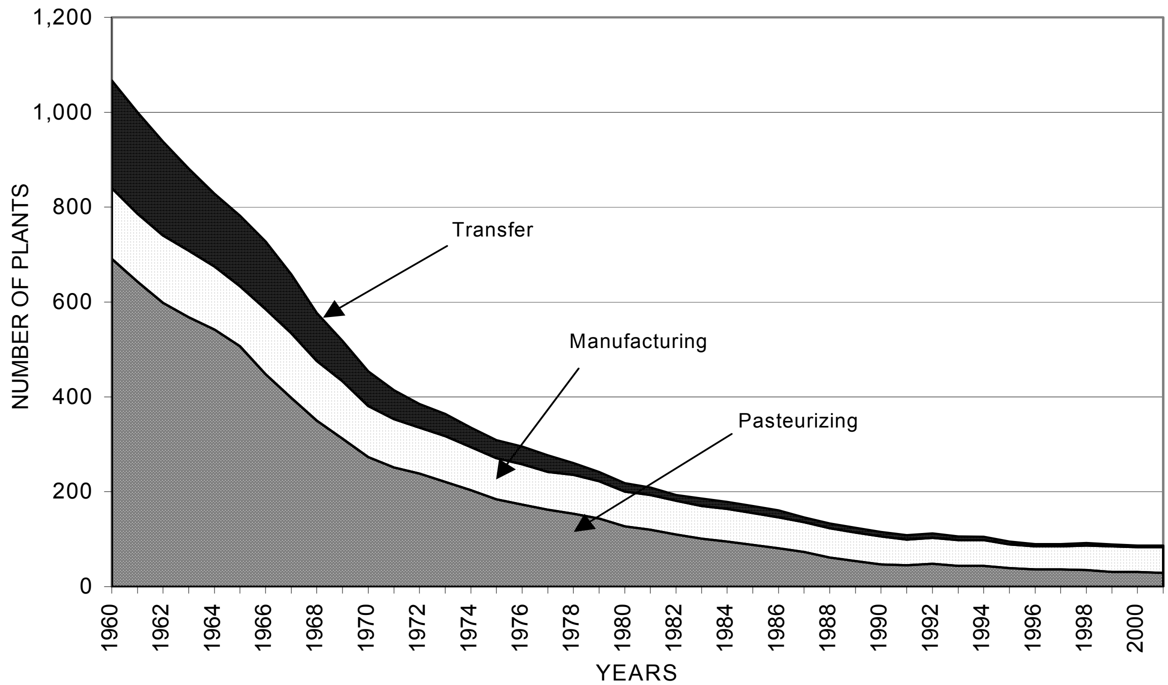
[b] Total U.S. production divided by number of plants.

Source: ERS, USDA, NASS Dairy Products Summary & Production of Manufactured Dairy Products.

New York

The number of New York dairy plants has also declined rapidly over the last 30 years (Figure 20). From 1971 to 2001 plant numbers declined 61 percent, from 223 to 87. Although this is a slightly slower rate of decline than occurred at the national level, the number of farmers also declined somewhat more slowly, 72 percent (from 26,000 to 7,200). Much of the decline in New York plants has resulted from a large decline in the number of pasteurizing plants, and to a lesser degree declines in the number of transfer plants. The decline in the number of manufacturing plants has been small. Continuation of current consolidation trends (Table 37) would result in 55 plants by 2020. The number of dairy plants in New York has declined from 1,067 to 87, or 92 percent (Figure 20).

FIGURE 20. NUMBER OF NEW YORK STATE DAIRY PLANTS



Source: NYS Dairy Statistics

Table 37. Number of Dairy Plants in the New York

Year	Number of Dairy Plants	Million Pounds of Milk Per Plant Per Year [a]
1980	214	59
1990	115	111
2000	87	157
2010 (projected)	69 [b]	190
2020 (projected)	55 [b]	248

[a] Receipts of milk and milk products (fluid equivalent basis) at New York State Dairy Plants. 2010 and 2020 projections based upon 115% of projected milk production to account for NY state in flow and out flow of milk and milk products. Source: New York State Dairy Statistics.
[b] Based on logistic function of 1982-2001 data.

Regional distribution of plants

The regional distribution of plants within the United States shows a shift number of plants from North Central areas to the Pacific and Mountain states (Table 38). This likely under estimates the proportion of production capacity in the Pacific and Mountain areas because these are the areas where the new plants have been constructed. New plants tend to be considerably larger than average existing plants. The proportion of plants in the Northeast and the Middle Atlantic states (which includes New York) has changed little over the last 30 years. Although the capacity and particular products produced by these plants could vary by region, based on number of plants only, it does not appear that processing and manufacturing capacity is moving out of the Northeast.

Table 38. Distribution of Dairy Plants by Region
1971 to 2002

	1971		1980		2002	
Region	Number	Percent	Number	Percent	Number	Percent
New England	334	7.8	141	6.6	84	7.8
Middle Atlantic[a]	697	16.3	341	15.9	181	16.8
Northeast	1,031	24.1	482	22.4	265	24.6
East North Central	1,193	27.9	638	29.7	247	22.9
West North Central	589	13.8	273	12.7	108	10.0
South Atlantic	284	6.6	156	7.2	113	10.5
South Central	425	9.9	227	10.6	105	9.8
Mountain	226	5.3	106	4.9	77	7.2
Pacific	530	12.4	267	12.4	162	15.0
United States	4,278	100.0	2,149	100.0	1,173	100.0

[a] New York, New Jersey, Pennsylvania.

Source: Alden Manchester, ERS, USDA, compiled from (manufactured) Dairy Products, NASS, USDA, Federal Order plant lists, and ERS compilations of state regulated fluid milk plants, with adjustment for dual reporting of multiple product plants.

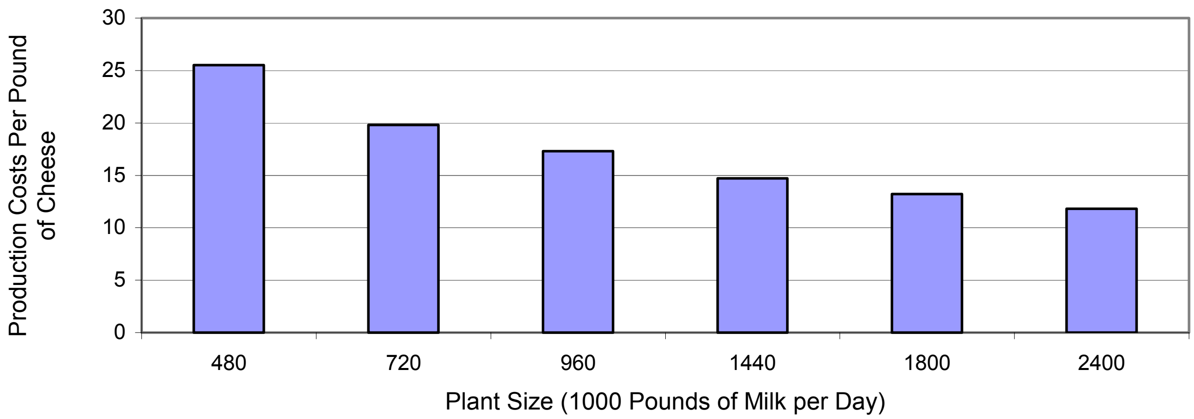
Factors that May Alter Future Trends

Many of the factors influencing the size and number of dairy plants are similar to those that influence farms. The declining number are a result of changing technology, efforts to reduce costs and increase market power, as well as economies of size.

Economies of size

Larger plants can employ larger machinery and make more efficient use of many of the facilities used in processing/manufacturing. An example of the economies of size that exist in cheese processing is shown in Figure 21.

FIGURE 21. AVERAGE PRODUCTION COSTS (EXCLUDING COST OF MILK) IN VARIOUS SIZE CHEDDAR CHEESE PLANTS



Source: AE. Res. 87-3 Department of Ag Econ, Cornell University

Economies of size also exist in the fluid milk processing industry. A recent study of processing plant costs found considerable difference in costs between plants (Table 39). Although all of the difference is not due to size, one of the authors of this study indicates that a high proportion of the difference is a reflection of economies of size.[17] As plants are constructed or modernized, there is an economic incentive to expand the plant capacity resulting in the need for fewer plants.

Table 39. Variability in Selected Fluid Milk Processing Costs

Cost Item	25% of Firms with lowest cost	25% of firms with highest cost	Spread between high and low	
	------------------------Cents per gallon		------------------------	$ per cwt.
Labor	8.3	16.1	7.8	.91
Utilities	1.9	3.7	1.8	.21
Plant cost	12.9	22.5	9.6	1.12

Source: Erba, Aplin and Stephenson, , "An Analysis of Processing and Distribution Productivity and Costs in 35 Fluid Milk Processing Plants" Cornell Department of Applied Economics and Management R.B. 97-03.

One issue raised by the movement towards fewer plants is the degree to which increased transportation costs will offset the lower costs gained by larger plant size. Farms are necessarily geographically dispersed and the milk must be hauled farther with fewer plants. Some increase in distribution costs of processed/manufactured product may also occur depending upon the relationship between the distribution of supply and the distribution of consumers. A recent Cornell study of the effects of closing a plant found that transportation costs would increase about 20 cents per hundredweight for milk produced near closing plant and 5 cents for those further away.[18] Given the difference in processing costs for more efficient plants shown in Table 39, it is clear that the savings of moving to larger more efficient plants far exceeds the added cost

[17] Private conversation with Mark Stephenson, Cornell University.
[18] Charles Nicholson, December 2002 Outlook Conference presentation, Cornell University.

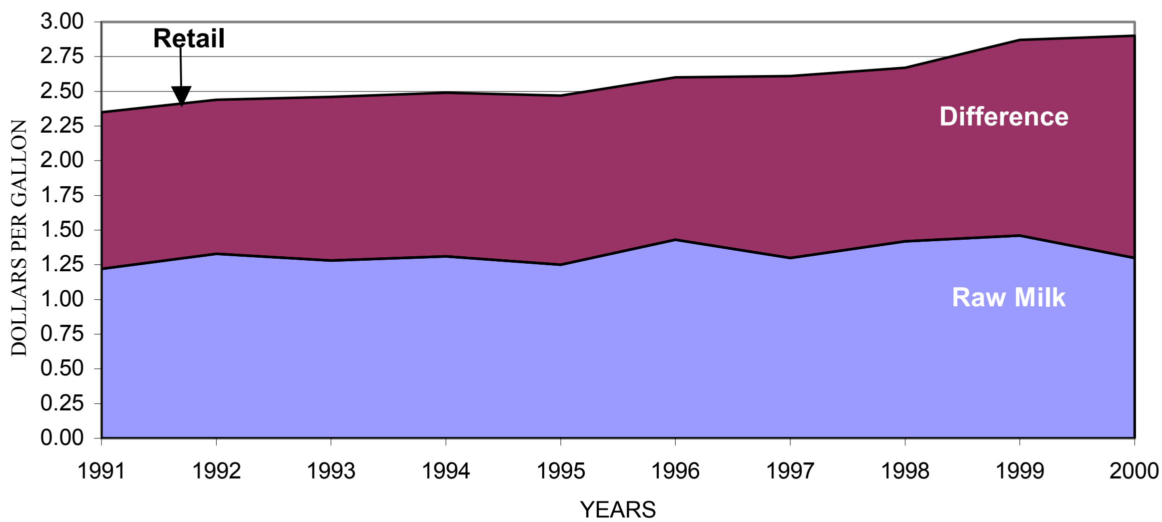
of transportation. Processors/manufacturers could pay the added transportation costs and still be better off than continuing with the smaller, less efficient plants.

Clearly, economies of size are important for both fluid and manufactured milk. They are large enough to more than offset the increased transportation cost and, thus, make consolidation of plants profitable. These economic incentives will continue to push towards fewer and larger milk plants.

Sector Efficiency

The competitiveness of the sector depends on the efficiency of all segments. Inefficiency in any segment could raise sector prices and make them less competitive with other products. One indicator of efficiency is level of costs, including profits, in a segment. The fluid milk sector of the dairy industry can be viewed as two segments: farm and manufacturing/processing/retailing. During the 1990's the price consumers paid for a gallon milk increased from $2.35 to $3.00 between 1991 and 2001 (Figure 22). This represents a 28 percent increase at a time when the prices of all beverages increased by 22 percent[19].

FIGURE 22. FOR WHOLE MILK: AVERAGE RETAIL PRICE, RAW MILK PRICE PAID BY FLUID MILK PROCESSORS

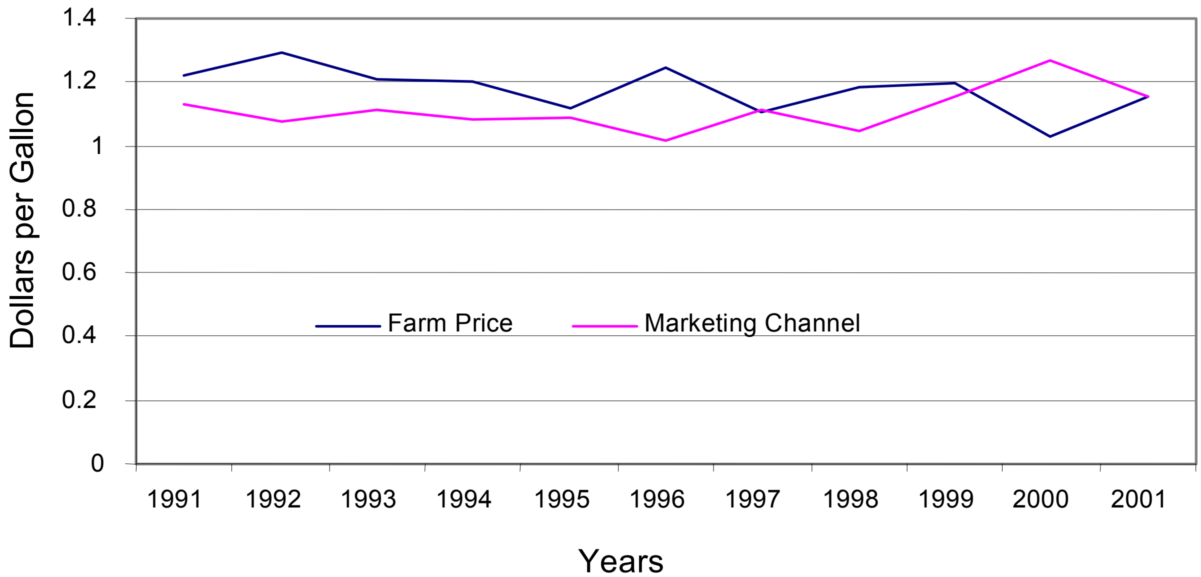


Source: AMS, USDA

Over the last 10 years the marketing channel share of the consumer's whole milk dollar has shown a slight upward trend while the farm share has shown a slight downward trend (Figure 23). These data are converted to 1991 dollars using the overall CPI index to account for the general level of costs. Improvements in efficiency have been slightly less in the marketing channel than at the farm level.

[19] The CPI for nonalcoholic beverages and beverage materials increased from 114.1 in 1991 to 139.2 in 2001.

Figure 23. Real Share of the Retail Price of Whole Milk (1991 Dollars)



For many products, processors and supermarkets could argue that product development costs have contributed to the general increase in price level. However, for fluid milk there has been relatively little product development. Milk receives the same additives, and by far, most is still sold in the same form that it was sold in 1990. It is basically the same product sold in the same form.

Processors argue that their margins have not increased, that they have been forced to keep their prices down, and that it is the supermarkets that have wielded the market power to raise their markups. Regardless of who is responsible, any inefficiency in the marketing chain that results in an increase the price of milk without higher raw commodity costs (the price paid to farmers) or a higher cost level reduces total market size.

Inefficient price transmission

In an efficient market consumer prices reflect consumer demand to farmers and the level of supply to consumers. For this system to work, prices must change when conditions change. High consumer prices transmitted to farmers indicate a need for more supply. Low consumer prices indicate a need for less supply. Excess supply is handled by lower prices to consumers who will buy more of the low priced product and lower prices to farmers who will reduce supply. If prices are not allowed to serve this function, inefficient markets result.

To look at the efficiency of price transmission in the dairy industry, the change in retail prices of milk products was compared to the change in price farmers received for milk used in those products (Table 40). As shown in Figures 22 and 23, the farm price over this period is about half of the retail price. Thus, full transmission of changes in farm level prices would result in about half as large a percent change at the retail level. For example, full transmission of a 10 percent decline in farm prices would be a 5 percent decline in retail prices.

Table 40. Relative Changes in Farm[a] and Retail Prices of Milk and Milk Products, 1991-2001

	Whole Milk	Cheese[b]	Dairy & Related Products[c]
Falling farm prices:			
Number of years	4	5	5
Farm price change (%)	-10	-9.2	-6.9
Retail price change (%)	+1	-0.2	+2.1
Rising farm prices:			
Number of years	6	5	5
Farm price change (%)	+11	+15.0	+12.2
Retail price change (%)	+10	+2.8	+3.8

[a] Farm price for whole milk comparison was price received for milk for fluid consumption, farm price for cheese comparison was class III milk sold for cheese manufacturing and farm price for dairy and related products comparison was price received for all milk sold by farmers.
[b] Cheddar and American processed cheese.
[c] Retail price based on the Consumer Price Index for dairy and related products.

As shown in Table 40 the price farmers received for milk sold for fluid consumption declined from the prior year in four years during 1992-2001. In those four years the farm price declined an average of 10 percent. During the same four years the retail price increased one percent. During the other six years of the 10-year period, the farm price of milk sold for consumption increased an average of 11 percent. During the same six years retail prices increased 10 percent. Similar, though somewhat less dramatic, results result from comparing retail cheese prices to the farm price for milk used in cheese manufacture and in comparing changes in the index of dairy and related prices to the farm level all milk price.

Table 40 provides evidence of lack of symmetry in price transmission in the dairy industry. Although the data are averaged so that some of the price variability is not shown, the average result is indicated. Price increases are transmitted more completely than decreases. Price decreases are frequently not transmitted. Consumer prices often increase when farm prices fall. On the other hand, price increases for whole milk were more than fully transmitted while increases in other products only transmitted part of the price increase. While it might be argued that there is a lag in the transmission of prices, such a lag would have tended to reduce the retail price increase in years when farm prices increased. There is not much evidence of that occurring, at least with fluid milk prices.

This result is supported by an econometric study of price pass-through, which found asymmetry in the transmission with 83 percent of price increases and 64 percent of price decreased passed through from the farm to retail price.[20]

Clearly, the dairy market is inefficient in its transmission of information through the price system. Excess supplies at the farm level are largely not reflected in consumer prices. This implies that changes in the federal order/pricing of milk that reduced the farm level fluctuations without changing the long run average price will have little effect on consumers. A leveling of prices to reduce stress caused by price variability may be as effective a pricing system as the current system.

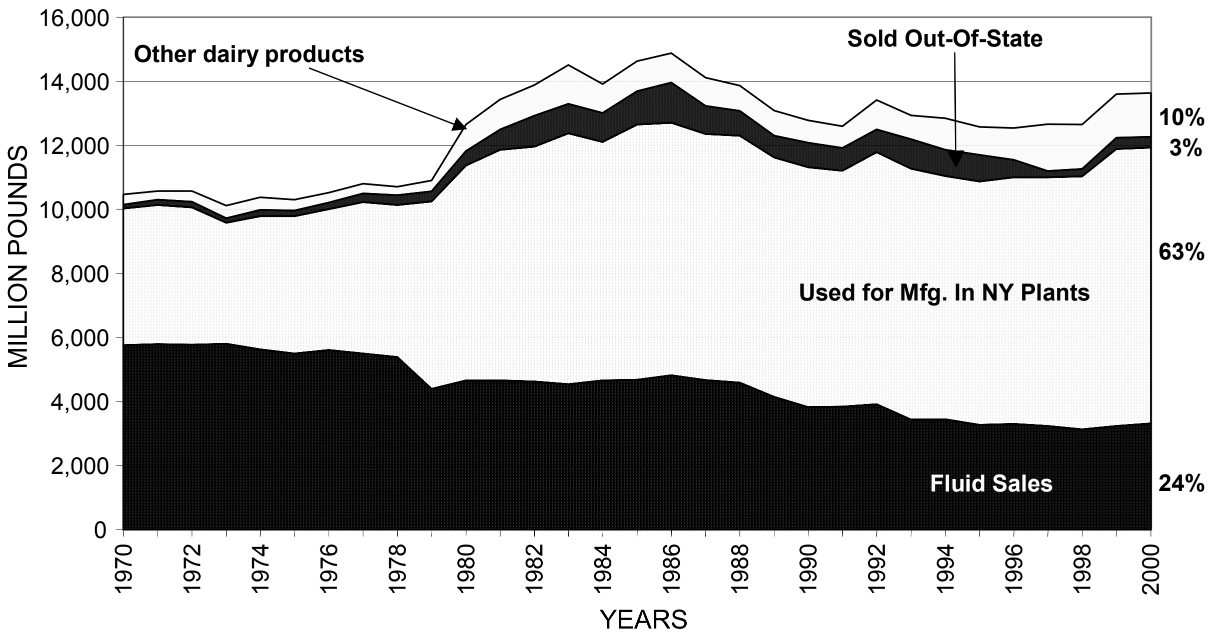
[20] Wang, Dabin. Price Transmission and the Role of Federal Dairy Policy in U.S. Dairy Markets, M.S. Thesis Cornell University, 2002.

Milk Processing and Manufacturing in New York

New York is the third largest milk producing state in the United States. With that supply one would expect processing and manufacturing of milk and milk products to occur in the state. The stability of the farmer's market for milk depends on the availability of processing plants within a reasonable distance of production.

The total amount of milk and dairy products handled by New York dairy plants declined somewhat between the mid 1980's and the late 1990's when it increased slightly (Figure 24). The proportion that is sold as fluid milk has decreased from nearly 60 percent to about 25 percent since the early 1970's. At the same time, the amount that is used in manufactured products has increased from less than 40 percent to 63 percent in 2000.

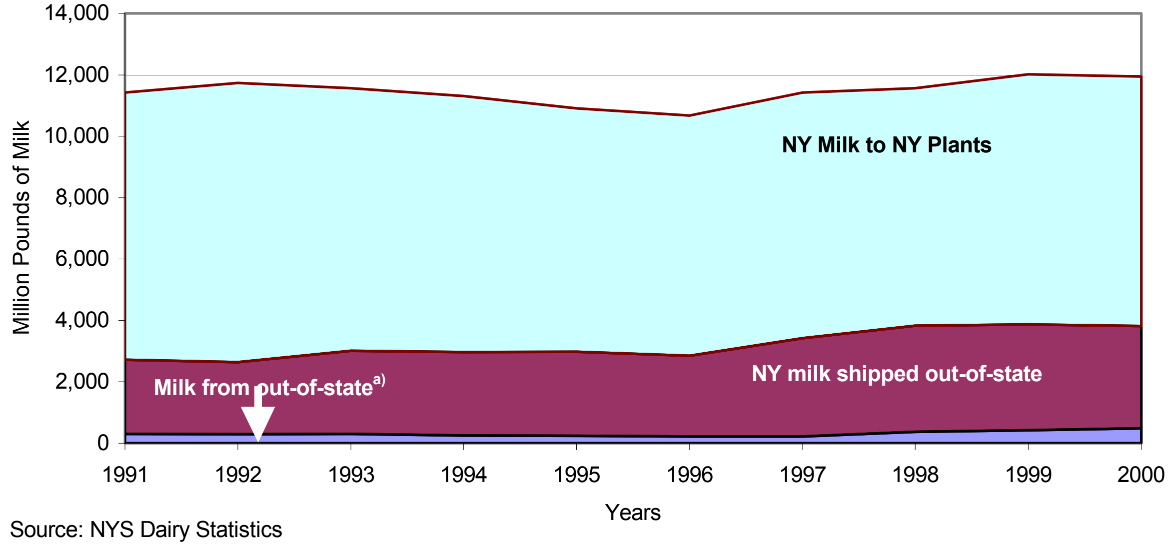
FIGURE 24. UTILIZATION OF MILK AND OTHER DAIRY PRODUCTS RECEIVED AT NYS DAIRY PLANTS



Source: NYS Dairy Statistics

As illustrated in Figure 25, more New York milk is now being shipped to out of state plants than was occurring 10 years ago. About one-third of the milk produced in New York is being processed/manufactured out of state. The amount being shipped out of state far exceeds the amount of milk shipped to New York plants from outside the state. This is not necessarily a problem from the farmer or processor point of view in that state borders are arbitrary lines and shipping milk from New York to an efficient plant in Pennsylvania or Massachusetts may represent the most efficient location of production. On the other hand, it may represent an opportunity for location of an efficient plant in New York to insure a market for milk to keep the economic activity generated by such a plant in the New York economy.

FIGURE 25. POUNDS OF MILK FROM FARMERS & OPERATOR'S OWN HERDS RECEIVED AT NY STATE DAIRY PLANTS AND NY DAIRY FARMERS SHIPMENTS TO OUT-OF-STATE PLANTS

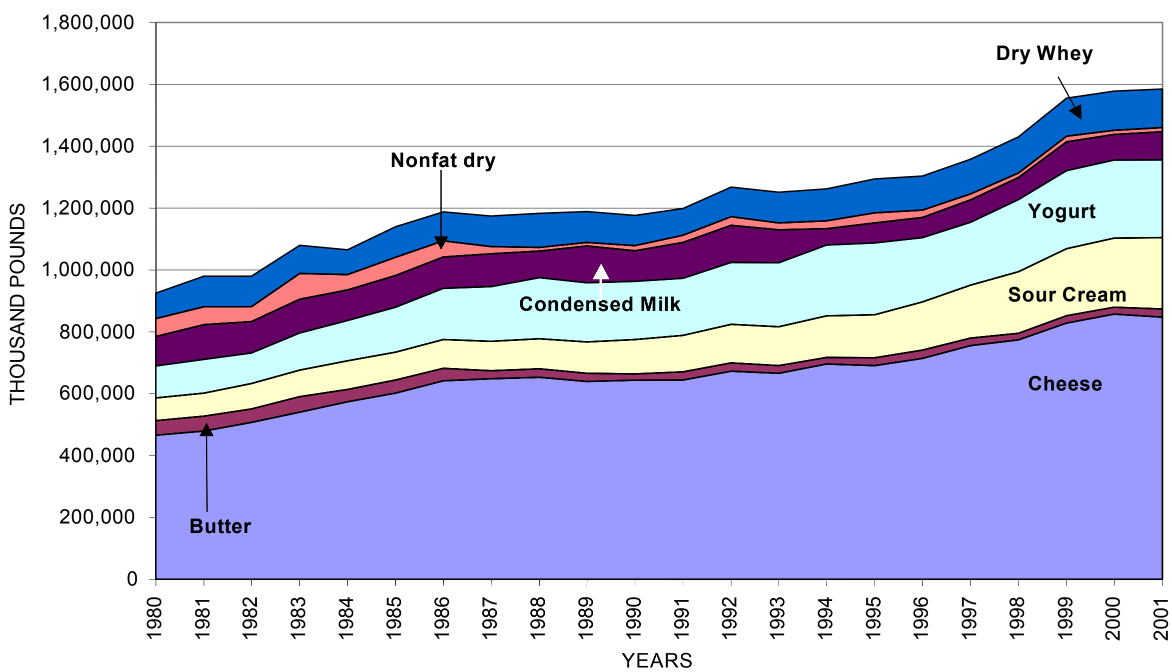


Source: NYS Dairy Statistics
a) NYS Ag & Markets personal communications

Dairy Manufacturing in New York

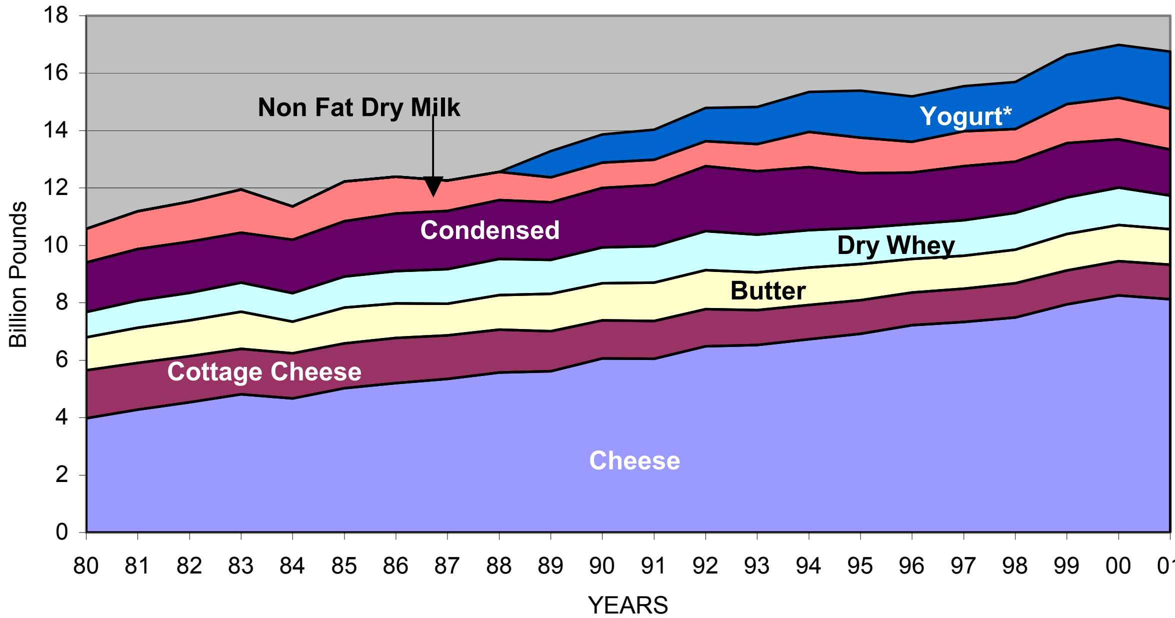
New York production of manufactured dairy products has increased steadily during the past 20 years (Figure 26). Production of cheese, sour cream and yogurt has increased and has more than offset declines in the production of butter and non-fat dry milk. This occurred in a U.S. market where cheese and yogurt production increased significantly while production of other products remained relatively constant (Figure 27).

FIGURE 26. DAIRY PRODUCTS MANUFACTURED IN NYS DAIRY PLANTS



Source: NYS Dairy Statistics

FIGURE 27. DAIRY PRODUCTS MANUFACTURED IN UNITED STATES PLANTS



* Yogurt data not available before 1989
Source: USDA, NASS, Dairy Products Summary

New York production of cheese other than cottage cheese increased more rapidly that total U.S. cheese production (Table 41) and cottage cheese production in New York remained relatively constant while U.S. production declined.

Table 41. Percent Change in Production of Various Dairy Products New York and the United States, 1981 to 2001

	1981 to 1991		1991 to 2001	
Production of:	New York	U. S.	New York	U. S.
Cheese	50[a]	42	41[a]	34
Cottage cheese	1	-20	-1	-9
Butter	-47	9	2	-7
Yogurt	70[c]	[b]	36[c]	90
Condensed milk	2	19	-22	-25
Nonfat dry milk	-60	-33	-38	61
Dry Whey	-12	34	44	-8

[a] Includes American, Italian and other cheeses (excluding cottage cheese).
[b] Data not available.
[c] Includes all cultured products for New York State.

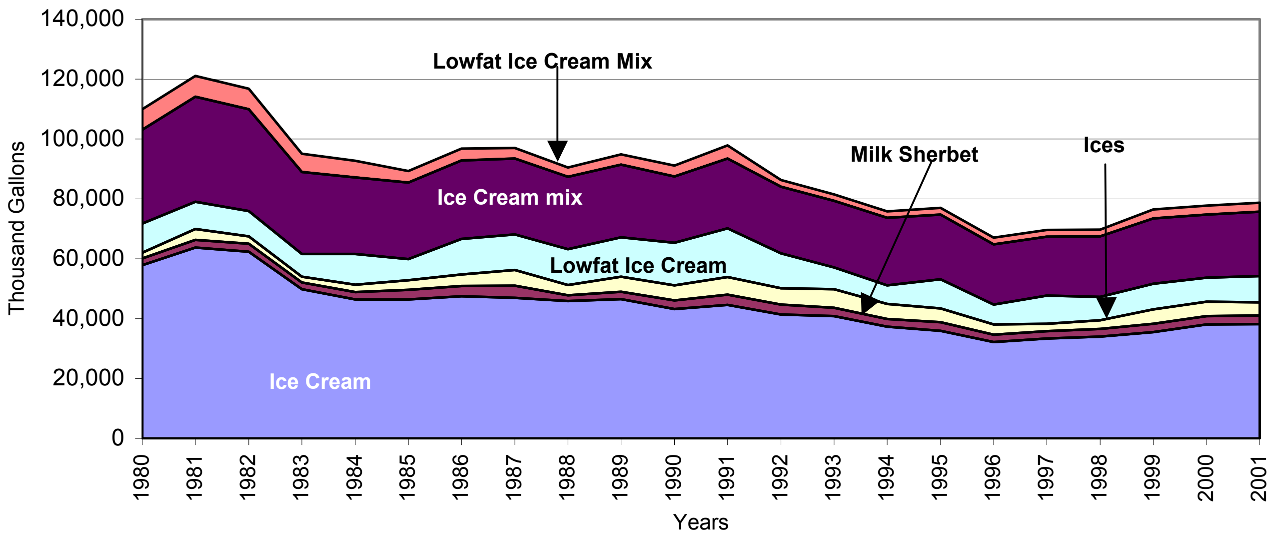
Butter production declined sharply in New York during the 1980's and then remained basically constant during the 1990's. At the same time U.S. butter production increase slightly and then returned to near earlier levels.

Although yogurt production has increased considerably in New York in the last decade, that increase has been much slower than occurred at the national level. Non-fat dry milk production has declined precipitously in New York and is now about a quarter of the 1980 level. At the same time the U.S. dry milk production increased modestly. Dry whey production in New York appears to have moved in the opposite direction from national production levels. In the 1980's when U.S. production was increasing, New York saw a precipitous decline. But, in the 1990's New York production increased while production declined for the nation as a whole.

In recent years, New York seems to be gaining in cheese and dry whey production, but losing ground in butter and nonfat dry milk production.

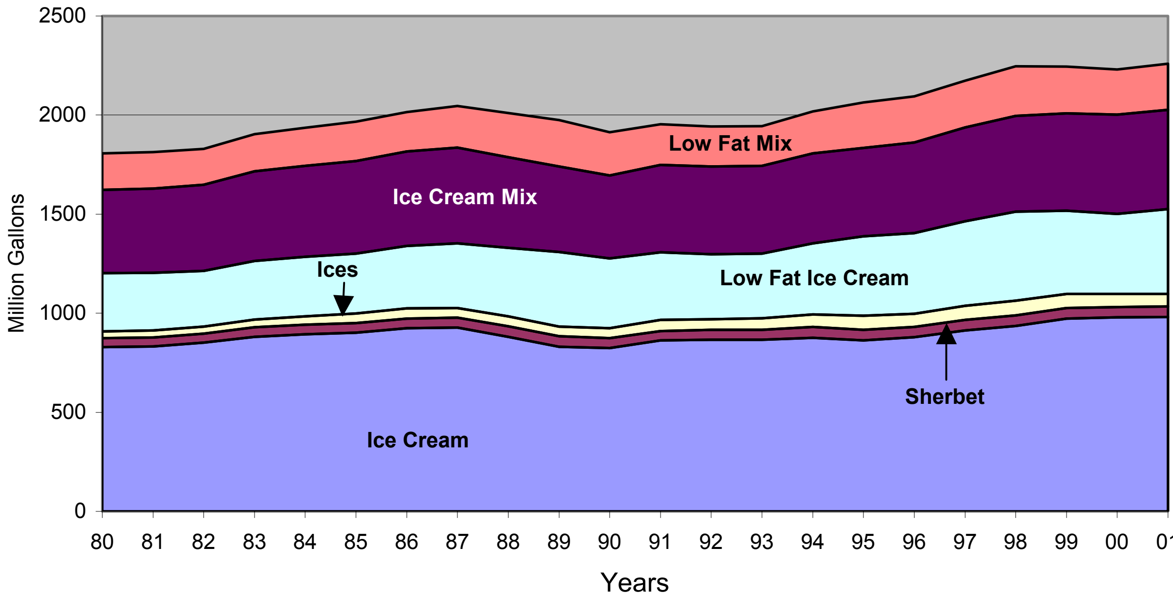
New York is losing the frozen dessert manufacturing market. Market share of frozen dessert production has declined sharply (Figure 28) at a time when the total frozen dairy dessert production in the U.S. has been slowly increasing (Figure 29). New York production of ice cream and ice cream mix has both fallen quite sharply. In fact, New York has experienced sharp decreases in the production of all frozen desserts while total U.S. production has improved strongly (Table 42).

FIGURE 28. FROZEN DESSERTS AND ICE CREAM MIX MANUFACTURED IN NYS PLANTS



Source: NYS Dairy Statistics

Figure 29. Frozen Desserts and Ice Cream Mix Produced In United States Plants



Source: USDA, NASS, Dairy Products Summary

Table 42. Percent Change in Production of Various Frozen Dessert Products New York and the United States, 1981 to 2001

	1981 to 1991		1991 to 2001	
Production of:	New York	U. S.	New York	U. S.
Ice cream	-30	4	-14	14
Sherbet	30	4	-17	11
Ices	66	63	-25	14
Low fat ice cream	78	17	-47	25
Ice cream mix	-34	4	-7	14
Low fat ice cream mix	-37	10	-32	14

The number of plants producing various manufactured milk products in New York State has declined for all products except other cheeses (everything except American, Italian and cottage cheese) (Table 43). However, there continues to be a number of plants producing all products. The number of plants producing individual products in 2001 ranged from seven producing butter and dry products to 24 plants producing “other cheeses”. Further, the decline in number of plants producing various products has been less rapid in New York that the nation as a whole.

Table 43. Percent Change in Number of Plants Producing Dairy Products
New York and the United States, 1981 to 2001

	1981 to 1991		1991 to 2001	
Product	New York	U. S.	New York	U. S.
Cheese	-9[a]	-34	7 [a]	-14
Cottage cheese	-31	-34	27	-40
Butter	-62	-39	-13	-47
Yogurt	-37[c]	[b]	24 [c]	-43
Condensed milk	-12	-30	-33	-28
Dry products	-33	-30[d]	-30	-34[d]
Simple average	**-30.7**	**-33.4**	**-3.0**	**-34.3**
Ice cream	-14	-56	-20	-28
Sherbet	-58	-62	-26	-43
Ices	12	-35	-12	-17
Low fat ice cream	-61	-49	-28	-35
Ice cream mix	-63	-52	-51	-29
Low fat ice cream mix	-60	-49	-60	-38
Simple average	**-40.7**	**-50.5**	**-32.8**	**-31.7**

[a] Average of change in plants producing American, Italian and other cheeses (excluding cottage cheese.
[b] Data not available.
[c] Includes all cultured products for New York State.
[d] Includes average of change in the number producing nonfat dry milk and dry whey.
Source: USDA, NASS, Dairy Products Summary

In spite of the rapid decline in the amount of frozen desserts produced in New York during the last 10 years, the number of plants producing these products has not declined more rapidly in New York than the nation as a whole. The number of plants has declined for all products except ices, which experienced a slight increase (Table 43). Again, there are several plants producing each product. The product produced by the smallest number of plants was low fat ice cream, which was produced by seven plants. At the other end of the continuum ice cream is manufactured in 48 plants.

Summary

Like dairy farms, the number of dairy processing plants has declined sharply over the last few decades. Economies of scale and other factors continue to shrink the number of plants. Although there has been shift of plant capacity from the Midwest to the West, the proportion of plants in the Northeast and New York State has remained relatively constant. By 2020, the number of dairy plants in the U.S. is expected to decline from the current 1,164 to 644, while the number in New York State declines from 87 to 55.

Processing and marketing efficiency has not improved as much at the processing and marketing level as it has at the farm level. From 1991 to 2001 the price of milk to the consumer increased by 65 cents. Of that increase farmers received 28 cents or 43 percent, while the processing and marketing chain received 37 cents or 57 percent. The real price farmers received declined slightly while the marketing chain costs and profit increased slightly.

Approximately one-third of the milk produced in New York is processed or manufactured out of state. While this is not necessarily a problem for the industry, it may represent an economic development opportunity for the State.

Although New York's production of butter and dry milk have declined, increased production of cheese and other products have resulted in increases in total manufactured products that are similar to the experience at the national level. However, although national production of frozen desserts has increased in recent years, New York has experienced a sharp decline. This is in spite of the fact that the number of plants producing these products has declined at a rate similar to that at the national level.

IF YOU DO NOT LIKE THE STRUCTURE THAT PAST TRENDS IMPLY, WHAT CAN YOU DO?

The analysis above projects the future based on a continuation of past trends. A discussion of factors that might change these trends does not identify factors that would be expected to change these trends. That does not mean that the projected results must occur. Concerted efforts on the part of individuals, firms or governments could change the trends and alter the outcomes. The following ideas are presented to help people start the thinking process about how to change those outcomes. Since people will differ in their view of whether change is occurring too fast or to slow, we present ideas for both alternatives.

Farm level – slow down change

1. Owners of small farms could achieve some of the advantages enjoyed by large farmers by working together. Groups of small farmers could agree to meet specific standards and market their milk cooperatively. To do this they would need to produce efficiently. Inefficient production results in high costs. For this to work, participants would have to avoid being one of the many small farms with high costs. A distinct marketing effort would be needed. This marketing plan would involve developing, promoting and distributing a high quality and marketable product and connecting with the consumers who desire such a product. They would have to identify product standards that would be of value, convince the manufacturers/processors of that value and negotiate appropriate prices for the product to be delivered. Meeting the product standards would be a must. Participants would need to set aside their preferences and organize the farm to meet the standards agreed upon. Many small farmers value their independence to "do whatever they want." This would involve following set procedures to meet the standards whether that is something "they want to do" or not.

   Since transportation costs are frequently higher when small quantities are produced, participants would need to cooperate on delivery to plants. This could be as little as shipping at a set time of day or as much as cooperative ownership of transportation facilities. Even with all these efforts small farms will likely have modest incomes because of the limited total product sold. This implies that participants will need to value the non-economic benefits of farming and being a small farmer.

2. Government programs could target benefits for small farmers. Government price supports could limit the amount of product that receives subsidy. This is currently being done with the MILC (Milk Income Loss Contract) payment program. The subsidy is paid on a per unit basis, but only on the first 2.4 million pounds.

   Alternately, the subsidy could be on a per farm basis. Each farmer, with a large or small farm, or just those with small farms, would receive a set amount; say $30,000. These might, or might not, be tied to agreements to conduct certain environmentally sound, or other desired practices.

   Grant programs could be developed for small farms. These could provide assistance with environmental issues, cooperative machinery purchases, training in production, management or finance and other problems.

   New farmer initiatives could be designed to assist people enter into agriculture. This could involve special lending programs with low interest rates, grants for startup or training, special consulting or advising programs or paid mentors.

   Small farmer cooperatives could be developed to assist with purchasing. Lower prices are often available for volume purchases. A cooperative, possibly with government paid administration, might be able to obtain lower input costs.

3. Society could pass pastoral countryside laws to encourage an attractive landscape. European type subsidies to maintain small farms could be employed. Green space laws could be put in place to insure that land stays in farming. Regulations could be put in place to protect rural amenities through zoning, limits on road construction, etc. Purchase of development rights could focus on small farms or limit purchases to sites that are suitable for small farms.

Farm level – speed up change

1. Encourage large farms. This could be done in a variety of ways. State or county tax incentives could be used to encourage new 5,000 cow units. Or, possibly easier, get 50 farms to increase herd size by 100 cows. Tax incentives are used by cities, counties, and the state to get firms to locate in their area, with less economic benefit than 5,000 cows would provide.

   Administer the EQIP program and similar state programs to provide large manure and silage leachate handling facilities nearly free of charge to large farms. This can be done under the banner of water quality and putting the money where it will have the greatest effect.

   Limit lawsuits about the smell and water quality damage that might be caused by large farms.

   Protect farm water rights. This could be particularly important in the western part of the nation.

2. Ease the adjustment process for small farms. Make it easier for small farms to quit competing for market and contributing to the surpluses, and allow the large farms to buy up their land. This could be accomplished by paying small farmers to go out of business, possible during periods of low prices when reduction of surpluses is necessary to obtain price recovery.

   A less costly alternative might be to provide special programs to help small farm owners assess their situation and opportunities. With appropriate consulting and assistance in the transition, many small farm operators may find that their best alternative is not in farm ownership.

Provide training for farm operators to pursue other job opportunities. Improve their human capital. Some operators might find that employment on a large farm is a better opportunity that continuing to farm on a small scale.

Processing/manufacturing level – slow down change

1. Subsidize existing plants to stay in business. This will support the local community by keeping the economic activity and jobs in the community. Communities frequently offer tax abatement programs for firms to locate, expand or continue operation in the community with the expectation that doing so will keep jobs in the community. Lower cost power is sometimes offered for the same reasons. A focus on these types of subsidies could potentially provide sufficient subsidy to keep plants in operation.

2. Develop laws or regulations to limit merger of plants and firms. This could be designed to insure that no firms develop monopoly or oligopoly power to restrict competition. If they cannot merge, it is unlikely that they will be able to amass a sufficient supply area and market to justify a large replacement plant.

Processing/manufacturing level – speed up change

1. Encourage state support for the construction of efficient milk processing/ manufacturing plants. Support could be in the form of tax abatements, bonding authority or direct state financing. The state might use its facilities to encourage groups with potential interest to work together. This would allow use of state-of-the-art facilities and technology. It would keep the economic activity in the state.

2. Use state facilities to encourage development of incubator plants for production of specialty cheeses. Such a plant could be used by several firm to produce their own products, but in an efficient modern plant.

3. Facilitate shift of current plants and resources to other uses. Find other uses for the facilities. Provide subsidies for firms to do the necessary retrofitting to move into these plants. Ease the transition process for the people involved to move to other jobs or locations.

OTHER A.E.M. RESEARCH BULLETINS

RB No	Title	Fee (if applicable)	Author(s)
2002-12	Prospects for the Market for Locally Grown Organic Food in the Northeast US	(12.00)	Conner, D.
2002-11	Dairy Farm Management Business Summary: New York State, 2001	($15.00)	Knoblauch, W. A., L. D. Putnam, and J. Karszes
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