

STRUCTURE OF THE U.S. DAIRY FARM SECTOR

*Joe L. Outlaw, Robert E. Jacobson, Ronald D. Knutson, and Robert B. Schwart, Jr.**

Milk is produced in every state within the United States. Traditionally, milk has been produced on small diversified crop/livestock farms primarily concentrated in the Upper Midwest and Northeast; however, over the past decade milk production has been increasing dramatically in the Southwest and West. Dairy farms located in the Southwest and West are typically very large (1,000 cows or more) and are specialized, producing very little if any crops. In the past four decades, the number of U.S. dairy farms has decreased dramatically and the average size of dairy farms has trended sharply upward. While distinct regional differences in structure are apparent, the trend toward fewer but larger farms is evident throughout the country.

Structural Changes in Milk Producer Sector

There are many alternatives that could be used to measure structural change in the milk producer sector (e.g., changes in farm numbers, herd sizes, asset values, and employment in the sector). Traditionally, most of the emphasis has been placed on tracking changes in farm numbers and the number of cows on farms.

There is a great deal of controversy over the exact definition to use when determining the number of dairy farms. The 1992 Census of Agriculture reported 155,339 farms with at least one milk cow in the United States. Using the number of farms having at least one dairy cow would tend to overstate the number of commercial dairy farms in the United States. For example, a farmer could have a milk cow on his/her farm and be classified as a dairy farm without ever selling any milk.

A second method used to define the number of farms is the Standard Industrial Classification (SIC) Definition. Of the 155,339 farms defined by the Census definition, only 113,412, or 73 percent of the total were

identified as dairy farms according to the Standard Industrial Classification, farms primarily engaged in the production of cow's milk having 50 percent or more of their sales from the dairy operation. A third method that is often used identifies the number of dairy farms with annual sales of \$10,000 or more. In 1992 there were 128,523 dairy farms with more than \$10,000 in sales. The number of dairy farms with sales of \$10,000 or more is 17 percent lower than those with one cow and is approximately 13 percent higher than the number with at least 50 percent of sales from dairy.

It is quite apparent that, depending upon the definition used, one could come up with a wide range of dairy farm numbers. Regardless of the definition used, each indicates the number of dairy farms in the United States is decreasing. The number of dairy farms and the number of dairy cows has declined over the past nine agricultural censuses (38 years) while the average number of cows per farm has increased (Table 1). Using the

Table 1. Number of U.S. Dairy Farms, Cows on Farms and Cows per Farm, Selected Years, 1954 to 1992.

Year	Farms	Cows	Cows Per Farm
1954	2,935,842	20,182,803	7
1959	1,792,393	16,522,026	9
1964	1,133,912	14,622,604	13
1969	568,237	11,174,036	20
1974	403,754	10,654,516	26
1978	312,095	10,221,692	33
1982	277,762	10,849,890	39
1987	202,068	10,849,890	54
1992	155,339	9,491,818	61

Source: *Census of Agriculture*, various issues.

*Joe Outlaw, Ronald Knutson and Robert Schwart are in the Department of Agricultural Economics at Texas A&M University and hold the positions of assistant research scientist, professor, and professor and extension economist, respectively. Dr. Knutson is also the Director of the Agricultural and Food Policy Center. Robert Jacobson is an emeritus professor at The Ohio State University.

broadest definition of a dairy farm (farms having one or more cows), from 1954 to 1992 the number of farms decreased from just over 2.9 million to 155,339, a decrease of 95 percent.

While the number of dairy farms with small herds in the United States has been declining, the number of farms with large herds has been increasing (Table 2). In 1964 about 96 percent of U.S. dairy farms had less than 50 cows (Table 2). By 1992, about 60 percent of the farms had less than 50 cows but over one-half of the dairy cows were located on farms having more than 100 cows (Table 3). This means that while in terms of farm numbers the U.S. dairy industry is still dominated by relatively small herds (less than 50 cows), the majority of the production is on farms with more than 100 cows.

The changes in the national dairy herd have been significant but aggregate numbers tend to mask the regional shifts in milk production. The seven regions indicated in Figure 1 account for about 90 percent of U.S. milk production. The regions designated are designed to encompass the major U.S. milk production areas while at the same time being relatively homogeneous in terms of structural trends and production conditions. The upper numbers for each region in

Figure 1 indicate its percentage of U.S. milk production in 1980. The lower number represents the region's percentage of U.S. production in 1994. Production has been shifting in the direction of those regions having the largest average herd size.

As indicated in Table 1, the average number of cows per farm in the United States has increased substantially. However, all regions have not experienced the same rate of increase and there is also a wide disparity in the average herd size across regions. Table 4 contains the average herd sizes for the past four census years for the production regions defined in Figure 1. Three regions (Pacific, Southern Plains, and Southeast) have experienced more rapid growth in herd size than the remaining regions. As of 1992, the average number of cows per farm in the Pacific and Southeast regions were about five and three times as large as the average herd size in the Upper Midwest region, respectively. The average herd size in the Upper Midwest, Corn Belt, and Appalachian regions had not reached 50 in 1992.

There are numerous factors that have contributed to the structural change in the dairy industry. One of the most basic is the difference in cost of production across regions of the United States.

Costs of Production

Table 5 presents the USDA average cost of production results for the 1990-92 period by region. The data are very revealing in terms of short-run and long-run economic forces affecting the U.S. dairy industry. The bottom line returns to management and risk per cwt were the highest in the Pacific, Southeast and Southern Plains regions which are characterized by large dairies (Table 4). These were likewise the regions with the

Table 2. Percent of U.S. Dairy Farms With Milk Cows by Size Category, Selected Years, 1964 to 1992.

Size of Herd	1964	1969	1974	1978	1982	1987	1992
	----- percent -----						
1-19	77.2	64.1	55.5	50.3	41.8	32.5	28.1
20-49	18.7	27.4	29.4	30.4	31.9	33.5	31.8
50-99	3.3	6.7	11.5	14.4	19.2	23.9	26.9
100+	0.8	1.8	3.6	4.9	4.1	10.1	13.1

Source: *Census of Agriculture*, various issues.

Table 3. Percent of Milk Cows in Herds of Different Size, 1964 to 1992.

Size of Herd	1964	1969	1974	1978	1982	1987	1992
	----- percent -----						
1-19	28.7	17.6	10.1	7.1	5.0	3.4	2.5
20-49	43.6	43.2	35.6	31.9	27.2	22.9	17.9
50-99	16.4	22.0	27.9	30.1	32.0	31.5	29.0
100+	11.3	17.2	26.4	30.9	35.8	42.2	50.5

Source: *Census of Agriculture*, various issues.

Table 4. Average Number of Cows Per Farm, by Region, 1978 to 1992.

Region	1978	1982	1987	1992
Pacific	79.5	107.5	165.3	242.7
Southern Plains	27.9	37.4	61.5	83.7
Upper Midwest	34.9	39.1	45.0	49.7
Corn Belt	23.3	29.1	35.5	41.6
Appalachia	19.9	26.7	38.4	47.7
Northeast	36.5	42.4	49.2	55.7
Southeast	55.4	81.1	107.8	133.8

Source: Calculated from *Census of Agriculture* data, various issues.

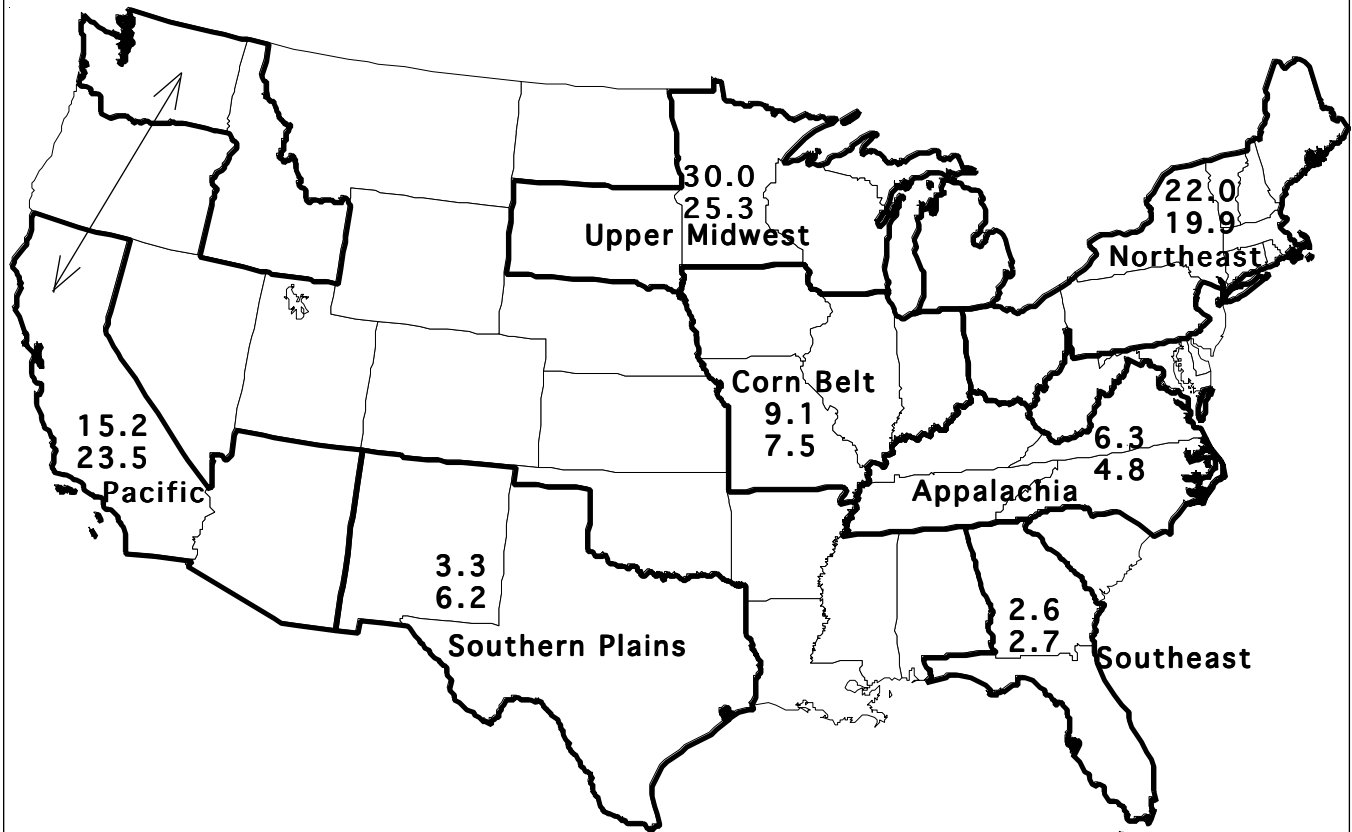
lowest total economic costs¹ per cwt. In these three regions, the milk price ranged from \$11.79 per cwt. in California to \$15.46 in Florida. The low California price reflects the cost and profit based policies of its state pricing agency. The high price in Florida reflects federal order geographic basing point pricing policies that raise the class I price based on distance from Eau Claire, Wisconsin.

The highest total economic costs are in the Appalachian and Corn Belt regions. These regions have experienced the greatest decline in share of U.S. milk production (Figure 1).

The traditional milk production areas of the Upper Midwest and Northeast have total economic costs in the \$14-15 per cwt. range. The Northeast receives the benefit of a higher milk price — being located farther from the Eau Claire basing point.

Of all regions, the Upper Midwest has the lowest cash expenses of \$9.71 per cwt. This reflects costs to farms that grow much of their own feed and have plentiful supplies of roughage in the region. The low variable (cash) costs in the Upper Midwest suggest that, in comparison with other regions, they are relatively insensitive to short-run declines in milk prices. However, one of the key economic indicators for long-run adjustment in the Upper Midwest is the cost of capital replacement of \$1.62 per cwt. compared with only \$0.73 in the Pacific region. The Upper Midwest, like the Northeast, Corn Belt and Appalachian regions has large amounts of capital tied up in buildings and equipment. The salvage value of the buildings (dairy barns and silos) is very low outside dairying. With this situation, dairy farmers in these regions continue in dairying up to the point where replacement of physical

Figure 1. Percent of U.S. Milk Production in Seven Major Regions, 1980 and 1994



* In each region, the upper number is the percent of U.S. milk production in 1980 and the lower number is the percent of U.S. milk production in 1994.

Source: USDA, NASS, various years.

¹ Total economic costs are equal to the summation of cash expenses excluding taxes, capital replacement costs, allocated returns to capital, land, and unpaid labor, and residual returns to management and risk.

facilities becomes a necessity. At that point, many of them drop out of dairying. However, there is a set of aggressive next generation dairy farmers in the Upper Midwest and Northeast. They are developing the means for expanding their operations utilizing free stall housing.

Business Organization of Dairy Farms

The 1992 Census of Agriculture categorizes the business organization of the 113,412 dairy farms as follows:

Individual/family dairy farms	80.43%
Partnership dairy farms	15.54%
Corporate dairy farms:	
a. Family held	3.54%
b. Other than family held	
1. Fewer than 10 stockholders	0.13%
2. More than 10 stockholders	0.02%
Not classified	0.35%

Clearly, while many dairy farms are large, most are family owned and operated. Dairying is not dominated, in any sense of the word, by corporate ownership. The fundamental observation that can be made relative to the dairy farm organization data is that family dairy farms continue to be the basic production unit in the milk industry.

Productivity Forces Structural Change

Various hypotheses have been advanced attempting to explain why the structure of dairy farming is so diverse across different regions of the United States. Factors such as differences in topography, climate, history, cultural base, complementary and alternative farm enterprises, and resource endowments and economies of size have generally been identified as explanations for the differences.

A number of factors have combined to bring about the changes in structure of the milk producer sector that have been noted. The over-riding factor can simply be described as the increased productivity of milk cows.

Table 5. Milk Production Values, Costs, and Returns per cwt., by Regions, Three Year Average, 1990-92.

Item	----- region -----							
	United States	Appalachian	Corn Belt	Northeast	Pacific	Southeast	Southern Plains	Upper Midwest
Output per cow (pounds) ¹	14,975	13,140	14,181	15,074	18,096	13,932	14,492	14,155
Cost & returns per cwt.								
Milk price	\$13.03	\$13.97	\$12.92	\$13.73	\$11.79	\$15.46	\$13.70	\$12.88
Cull cows value	1.35	1.30	1.60	1.25	.97	1.10	1.29	1.64
Other income ²	.14	.18	.15	.11	.14	.04	.06	.18
Total value	14.52	15.46	14.63	15.10	12.91	16.60	15.05	14.70
Total cash expenses	\$10.40	\$10.95	\$10.46	\$10.51	\$10.49	\$12.84	\$11.54	\$9.71
Cash receipts less cash expenses	4.12	4.51	4.17	4.59	2.42	3.76	3.51	4.99
Net cash returns ³	2.68	2.90	2.40	2.85	1.69	2.68	2.25	3.37
Total economic cost	14.27	15.41	16.49	15.37	11.68	14.73	13.62	14.28
Capital replacement	1.44	1.61	1.77	1.74	.73	1.08	1.26	1.62
Returns to management & risk	.17	.05	-1.86	-.27	1.22	1.86	1.42	.41

¹Regional average calculated from individual state data.

²Includes the dairy enterprise share of receipts from cooperative patronage dividends, assessment refunds, renting or leasing of dairy animals, manure sales, and insurance indemnity payments.

³Value of production minus cash expenses and capital replacement.

Source: USDA. *Economic Indicators of the Farm Sector: Costs of Production — Major Field Crops & Livestock and Dairy, 1992*. ECIFS 12-3, Economic Research Service, Washington, D.C. (August 1994).

Increased production per cow has meant that fewer milk cows were needed to supply the market. Given the increase in average herd size, it is likely that fewer dairy farms are needed to sustain the dairy enterprise.

In 1994, milk production per cow in the United States reached a record 16,128 pounds. The 1994 level represented a 204 percent gain over the 5,314 pounds per cow average achieved in 1950. On the average, production per cow increased by 246 pounds each year through the 1950-1994 period.

The primary impact of these increases in production per cow, given the fact that aggregate demand has increased at a slower pace (up by 32 percent, from 114 billion pounds to 150.6 billion pounds over the 44 years from 1950 to 1994) has been the requirement for fewer milk cows. Between 1950 and 1994, milk cow numbers decreased by 12.4 million head, or by 57 percent. Yet, total production increased due to the increase in production per cow. In effect, where two cows milked before, only one is needed now.

Obviously, other factors have entered the picture, especially the substitution of capital for labor. But productivity as measured by production per cow, has been the fundamental factor pushing the changing structure of dairy farming.

The Next Ten Years

Two basic questions need to be addressed regarding future structural change:

- Are technology and competitive forces going to continue or even accelerate productivity gains such that concentration of the milk producer sector will move at an even faster rate into the next century?
- Should dairy price-income policy be designed to preserve a certain structure of dairying; or should policy be more concerned with providing alternatives for dairy farms that are no longer competitive in the milk industry?

The evidence with respect to continued productivity gains seems clear. The 1992 report on agricultural

technology of the Office of Technology Assessment includes the following comment:

The dairy industry will most likely be the first to adopt technologies from the biotechnology era of the 1990's, and also will feel the first profound impacts of the emerging technologies. Biotechnology advances in reproductive technologies, animal health technologies, and growth promotants will make major contributions to the sector. In particular, bovine somatotropin (bST) ... will significantly increase milk production. Bovine somatotropin ... will increase milk yield per cow in 1 year to what it would take 10 to 20 years to achieve with current reproductive technologies.²

While the productivity gains projected by OTA, may be high, most agree that substantial increases will occur. With the anticipated large gain, average production per cow could reach 19,000 pounds in only a few years after adoption and would continue the competitive squeeze across the milk producer sector. Demand projections for the year 2000 indicate that the market will approximate 170 billion pounds of milk at that time. A national dairy herd of only 8.95 million cows averaging 19,000 pounds of milk per cow would produce the required 170 billion pounds of milk. A national dairy herd of 8.95 million milk cows represents an 11 percent reduction from the present herd of 9.5 million milk cows.

Given these generally accepted observations regarding key market forces affecting the U.S. milk industry in the next ten years, including the wide variability in farm size and profitability, it is evident that in pursuing the more market-oriented dairy price-income policy begun in the early 1980s and accelerated in the dairy title of the Food, Agriculture, Conservation, and Trade Act of 1990, the number of dairy farms will continue to decrease at a significant rate.

² *A New Technological Era for American Agriculture*, Office of Technology Assessment, U.S. Congress, OTA-F-474, August, 1992, p. 141.