

**Regional Structural Change
in the
U.S. Dairy Industry: A Basebook**

Fahri Yavuz, Carl R. Zulauf, and Gary Schnitkey*

February 1995

Department of Agricultural Economics and Rural Sociology
The Ohio State University
Columbus, Ohio 43210

* The authors are assistant professor, Ataturk University, and associate professors, Ohio State University, respectively.

REGIONAL STRUCTURAL CHANGE IN THE U.S. DAIRY INDUSTRY: A BASEBOOK

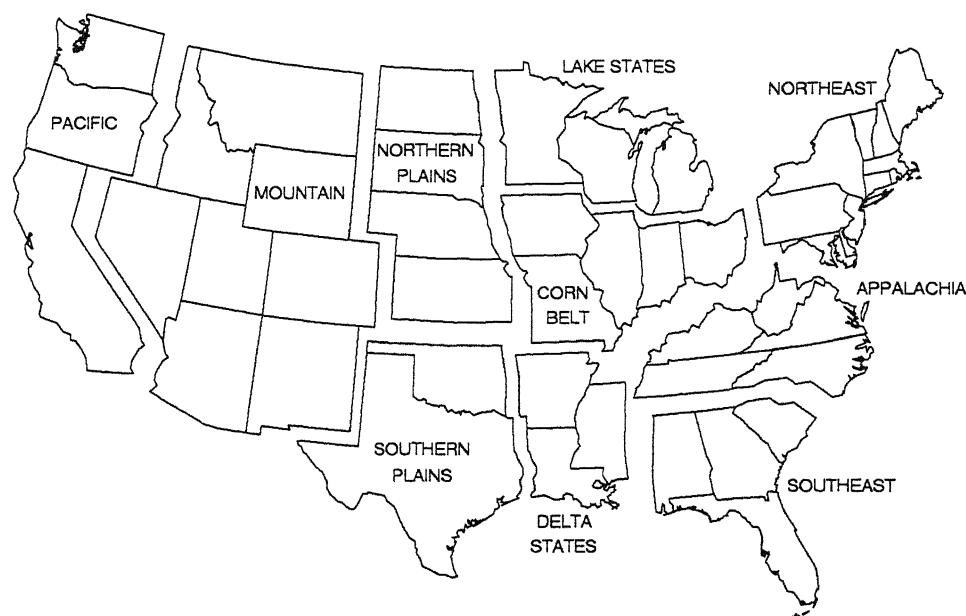
INTRODUCTION

Within the past decade, large shifts in the regional shares of milk production have occurred. These shifts have caused considerable discussion within dairy circles, often fueling discord between individuals from different regions. Our purposes in preparing this paper are to describe the nature of shifts in milk production and to describe recent trends in key factors that contribute to regional structural change. Supply factors explored are milk per cow, cows per farm, and cost of milk production. Demand factors explored are population and per capita income.

REGIONS ANALYZED

We use U.S. Department of Agriculture (USDA) production regions to define regions for the geographical analysis. We choose the 10 USDA production regions because the contiguous states in these regions generally have similar production characteristics and changes in population. These 10 regions are depicted in Figure 1. Since data on most of the characteristics analyzed in this paper are available only on a state level, the regional data presented in this paper are obtained by aggregating the data across the states which compose the region.

Figure 1. USDA Farm Production Regions



OVERVIEW OF REGIONAL CHANGE, 1930 - 1991

Two distinct periods of regional change occurred. From 1930 to 1960, the major shift in U.S. production was from the Northern Plains and Corn Belt (decline of 4.5 and 3.0 percentage points, respectively) to the Lake States and Northeast (increase of 4.2 and 3.1 percentage points, respectively) (Table 1). Since 1960, however, the major shift has been from the Ohio and upper Mississippi River Valleys to the West. Share of U.S. production accounted for by the Corn Belt, Northern Plains, and Appalachia has declined by 10.8 percentage points, while the share accounted for by the Mountain and Pacific regions has increased by 10.6 percentage points. Furthermore, since 1980, the share of U.S. milk produced in the Lake States and Northeast, the two largest milk producing regions, has declined by 2.4 and 1.8 percentage points, respectively.

The rest of the paper focuses on the trends since 1960. This decision reflects (1) the difference in trends before and after 1960 and (2) the larger magnitude of change after 1960. To facilitate comparisons among the regions and factors analyzed, the tables are constructed so that the regions are ordered from the lowest to highest change in regional shares between 1960 and 1991.

TABLE 1. REGIONAL SHARE OF MILK PRODUCTION, U.S., 1930-91

Region	----- Year -----						
	1930	1940	1950	1960	1970	1980	1991
	----- Percent of Milk -----						
Corn Belt	21.1	21.0	20.0	18.1	14.8	12.4	11.3
N. Plains	10.2	8.5	6.8	5.7	5.1	4.1	3.5
Northeast	16.8	16.8	18.2	19.9	20.7	20.4	18.6
Lake States	22.8	23.8	24.3	27.0	27.9	28.7	26.3
Appalachia	6.4	6.6	7.8	7.3	7.0	6.6	5.5
Delta States	2.8	2.9	2.9	2.4	2.4	2.0	1.7
Southeast	2.9	2.8	3.0	3.1	3.6	3.5	3.3
S. Plains	5.8	6.0	4.7	3.5	3.7	3.7	4.5
Mountain	4.3	4.0	3.6	3.9	4.0	4.8	6.7
Pacific ^a	6.9	7.6	7.7	9.1	10.8	13.8	18.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

^a Pacific includes Hawaii and Alaska in 1970, 1980 and 1990.

Note: States in each region are: **Northeast:** Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland; **Lake States:** Michigan, Wisconsin, Minnesota; **Corn Belt:** Ohio, Indiana, Illinois, Iowa, Missouri; **Northern Plains:** North Dakota, South Dakota, Nebraska, Kansas; **Appalachian:** Virginia, West Virginia, North Carolina, Kentucky, Tennessee; **Southeast:** South Carolina, Georgia, Florida, Alabama; **Delta States:** Mississippi, Arkansas, Louisiana; **Southern Plains:** Oklahoma, Texas; **Mountain:** Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada; **Pacific:** Washington, Oregon, California, Alaska, Hawaii.

Source: USDA; *The Dairy Situation*, February 1961; and *Dairy Situation and Outlook Yearbook*, August 1992.

TRENDS IN MILK PRODUCTION BY REGION, 1960 - 1991

Since 1960, milk production has declined in the Northern Plains, Corn Belt, Delta States, and Appalachia. On the other hand, milk production has increased by 4.09% per year in the Pacific region, 3.11% per year in the Mountain region, and 0.95% per year in the Southern Plains. Furthermore, the growth rates accelerated in each of these regions during the 1980s.

Much is made of the regional shifts which occurred during the 1980s, making it easy to ignore that these shifts were already underway. The longer-term perspective suggests deep-seated factors are at work that will be difficult to turn around. This observation is particularly important for the Lake States and Northeast, which have had anemic growth rates in milk production of one-half a percent a year.

TABLE 2. MILK PRODUCTION AND RATE OF CHANGE BY REGION, U.S., 1960-91

Region	----- Year -----				----- Period -----	
	1960	1970	1980	1991	1960-91	1980-91
	----- million pounds -----				average annual percent change	
Corn Belt	24,433	17,335	15,910	16,807	-1.01	0.51
N. Plains	7,855	5,949	5,236	5,219	-1.08	-0.03
Northeast	25,121	24,225	26,127	27,558	0.31	0.49
Lake States	34,186	32,705	36,803	39,093	0.46	0.57
Appalachia	10,387	8,202	8,218	8,218	-0.67	-0.23
Delta States	3,678	2,823	2,504	2,455	-1.07	-0.18
Southeast	4,836	4,151	4,501	4,881	0.03	0.77
S. Plains	5,133	4,315	4,726	6,641	0.95	3.68
Mountain	5,054	4,662	6,114	9,926	3.11	5.67
Pacific ^a	12,208	12,674	17,891	27,680	4.09	4.97
U.S.	134,190	117,012	128,238	148,481	0.34	1.44

^a Pacific includes Hawaii and Alaska in 1970, 1980 and 1990.

Source: USDA, *Dairy Situation and Outlook Yearbook*, April 1961, 1988, and 1993.

TREND IN NUMBER OF COWS BY REGION, 1960 - 1991

Since 1960, number of milk cows has declined by more than 2% percent annually in the Corn Belt, Northern Plains, Appalachia, Southeast, and Delta States, with the latter having the fastest rate of decline (Table 3). The only region where number of cows has increased since 1960 is the Pacific. Increases also have occurred in the Mountain region since 1970 and in the Southern Plains since 1980.

Throughout the 1960-91 period, the largest number of cows were in the Lake States followed by the Northeast. The Pacific region took fourth place from Appalachia by 1970, and third place from the Corn Belt by the mid-1980s.

The annual rate of decline in number of milk cows in the U.S. has slowed dramatically, from 4.6% during the 1960s to 1.0% during the 1970s and 0.7% since 1980. The slower rate of decline in cow numbers mirrors a slower rate of increase in milk per cow: 3.9% during the 1960s compared with 2.2% since 1970 (see next section - Table 4).

The slower rate of decline nationally masks the fact that during the 1980s most regions continued to lose cows at a rate which exceeded 1% percent per year. In contrast, three regions (Pacific, Mountain, and Southern Plains) experienced over a 1% per year expansion in cow numbers. These divergent trends are highly related to the changing regional distribution of milk production (Table 1), and clearly underscore the current regional disparity in economic health of the dairy industry.

TABLE 3. COW NUMBERS AND RATE OF CHANGE BY REGION, U.S., 1960-91

Region	----- Year -----				----- Period -----	
	1960	1970	1980	1991	1960-91	1980-91
	----- 1000 head -----				average annual percent change	
Corn Belt	3,517	1,814	1,434	1,205	-2.12	-1.45
N. Plains	1,325	682	496	415	-2.22	-1.48
Northeast	3,188	2,306	2,170	1,855	-1.34	-1.32
Lake States	4,190	3,196	3,072	2,738	-1.11	-0.99
Appalachia	2,018	1,044	798	651	-2.19	-1.67
Delta States	996	440	286	208	-2.55	-2.48
Southeast	967	523	430	361	-2.02	-1.46
S. Plains	981	497	428	479	-1.65	1.08
Mountain	680	454	479	579	-0.52	1.90
Pacific ^a	1,331	1,043	1,206	1,504	0.42	2.25
U.S.	19,159	12,000	10,799	9,992	-1.54	-0.68

^a Pacific includes Hawaii and Alaska in 1970, 1980 and 1990.

Source: USDA, *Dairy Situation and Outlook Yearbook*, April 1961, 1988, and 1993.

TREND IN MILK PER COW BY REGION, 1960 - 1991

In 1960, the Northeast and Lake States were producing 876 and 1,155 more pounds of milk per cow than the U.S. average (Table 4). By 1991, the Northeast had fallen to the national average while the Lake States had fallen more than 500 pounds per cow under the national average. In fact, over both 1960-91 and 1980-91, the Lake States had the slowest growth in production per cow. As a comparison, the highest growth rates were in the non-traditional production regions of the Delta States, Southeast, Southern Plains, and Appalachia. Despite high growth rates, their level of milk production per cow still remains below the national average. Last, while the Pacific region has had the largest increase in share of U.S. milk production since 1960, its productivity growth has only matched the national average.

Two conclusions can be drawn from these observations. First, high growth rates in milk production per cow are not sufficient to explain regional shifts in milk production. Second, relative level of productivity at the beginning of a period is important. This is most easily seen for the Pacific region, which had the highest level of productivity in 1960 (1980) and highest growth in regional share of milk production since 1960 (1980). This last conclusion is ominous for the future of milk production in the Northeast and Lake States, which have now fallen to or below average U.S. milk production per cow. It probably will take several years before these regions once again see their share of U.S. production increase.

TABLE 4. MILK PER COW AND RATE OF GROWTH BY REGION, U.S., 1960-91

Region	----- Year -----				----- Period -----	
	1960	1970	1980	1991	1960-91	1980-91
	----- pounds of milk per cow -----				average annual percent change	
Corn Belt	6,947	9,556	11,095	13,948	3.25	2.34
N. Plains	5,928	8,723	10,557	12,576	3.62	1.74
Northeast	7,880	10,505	12,040	14,856	2.85	2.13
Lake States	8,159	10,233	11,980	14,278	2.42	1.74
Appalachia	5,147	7,856	10,563	12,624	4.69	1.77
Delta States	3,693	6,416	8,754	11,803	7.08	3.17
Southeast	5,001	7,937	10,467	13,521	5.50	2.65
S. Plains	5,232	8,682	11,042	13,864	5.32	2.32
Mountain	7,432	10,269	12,763	17,143	4.21	3.12
Pacific ^a	9,172	12,151	14,835	18,404	3.25	2.19
U.S.	7,004	9,751	11,875	14,860	3.62	2.29

^a Pacific includes Hawaii and Alaska in 1970, 1980 and 1990.

Source: USDA, *Dairy Situation and Outlook Yearbook*, April 1961, 1988, and 1993.

REGIONAL POPULATION SHIFTS, 1960 - 1991

Since 1960, U.S. population has shifted south and west (Table 6). The highest annual growth rate occurred in the Mountain region (3.42%), while the slowest growth rate occurred in the Corn Belt (0.46%). All regions experienced slower growth during the 1980s, but the decline was largest in the southern and western regions. Thus, the shift south and west slowed during the 1980s.

Over the 1960 - 1991 period, milk production grew faster than population only in the Pacific region (Table 2). In other words, production grew slower than population in all other regions, particularly the Corn Belt, Northern Plains, Appalachia, Delta States, and Southeast. If the focus is narrowed to the 1980s, a different picture emerges: milk production grew faster than population in order of descending differential in the Mountain region (3.6%), Pacific (2.6%), Southern Plains (1.9%), Corn Belt (0.4%), Lake States (0.3%), and Northeast (0.1%)

At first examination, it is easy to conclude that changes in milk production and population should be interrelated. For example, the four regions with the highest population growth since 1960 experienced an increase in their share of U.S. milk production (Table 1). However, closer examination suggests the relationship may not be so definitive. For example, the increasing concentration of milk production in the south and west during the 1980s greatly exceeded population growth.

TABLE 6. POPULATION AND RATE OF GROWTH BY REGION, U.S., 1960-91

Region	----- Year -----				----- Period -----	
	1960	1970	1980	1991	1960-91	1980-91
	----- million -----				average annual percent change	
Corn Belt	31.5	34.5	35.5	36.0	0.46	0.13
N. Plains	4.9	5.0	5.3	5.4	0.33	0.17
Northeast	49.0	54.3	54.6	57.1	0.53	0.42
Lake States	14.2	17.1	18.0	18.8	1.05	0.31
Appalachia	17.0	18.6	21.4	23.5	1.22	0.89
Delta States	7.2	7.8	9.0	9.3	0.90	0.30
Southeast	14.5	17.4	22.2	27.5	2.89	2.17
S. Plains	11.9	13.6	17.2	20.5	2.33	1.74
Mountain	6.8	8.3	11.4	14.0	3.42	2.07
Pacific ⁴	21.2	26.5	31.8	40.0	2.86	2.34
U.S.	178.2	203.1	226.4	203.1	1.34	1.04

⁴ Pacific includes Hawaii and Alaska in 1970, 1980 and 1990.

Source: U.S. Department of Commerce, *Statistical Abstract of the United States*, 1991.

TREND IN PER CAPITA INCOME BY REGION, 1960 - 1991

Throughout the 1960-91 period, real (i.e. deflated) per capita personal income was lowest in the Delta States and highest in the Pacific and Northeast regions (Table 7). However, the income differential between these regions has narrowed. In 1960, per capita income of the Delta States was 54% of the per capita income of the Pacific region. By 1991, this ratio had risen to 71%.

Demand for milk and milk products is positively related to the level of per capita income. However, there is no apparent positive relationship between the share of U.S. milk production and both the level and rate of growth in per capita income. For example, the Northeast had the second highest level of per capita income in 1980 and the fastest growth in income during the 1980s. In contrast, its share of U.S. milk production declined by 1.8 percentage points (Table 1). In addition, the three regions with the slowest growth in per capita income during the 1980s, Southern Plains, Mountain, and Pacific; were also the only regions whose share of U.S. milk production increased.

TABLE 7. PER CAPITA INCOME IN CONSTANT (1987) DOLLARS & GROWTH BY REGION, U.S., 1960-91

Region	Year				Period	
	1960	1970	1980	1991	1960-91	1980-91
	\$				average annual percent change	
Corn Belt	9,032	11,280	13,682	15,619	2.35	1.29
N. Plains	7,710	10,043	12,870	14,836	2.79	1.39
Northeast	9,782	12,283	14,647	18,473	2.87	2.37
Lake States	8,496	10,949	13,854	15,549	2.68	1.11
Appalachia	6,252	9,110	11,650	14,289	4.15	2.06
Delta States	5,386	7,881	10,857	12,144	4.05	1.08
Southeast	6,366	9,351	12,052	14,684	4.21	1.99
S. Plains	7,300	9,722	13,398	14,266	3.08	0.59
Mountain	7,934	10,033	13,010	14,124	2.52	0.78
Pacific ^a	10,008	12,207	15,624	17,160	2.31	0.89
U.S.	8,490	10,961	13,663	15,942	2.83	1.52

^a Pacific includes Hawaii and Alaska in 1970, 1980 and 1990.

Source: U.S. Department of Commerce, *Statistical Abstract of the United States*, 1982 and 1992.

TREND IN COST OF PRODUCTION BY REGION, 1975 - 1991

USDA uses different regions when reporting milk production costs (Figure 2, page 11). For example, Ohio is in the Northeast cost-of-production region for milk, but in the Corn Belt region for USDA's general farm production regions (used in all previous tables). Also, some states are not assigned to a region. Because milk production is relatively small, USDA does not include them in the survey of milk production costs. Production costs are available since 1975. The specific cost discussed in this paper are termed total economic cost by USDA, even though a charge for management is not included.

In 1975, the Pacific's cost of production was \$1.13 per hundredweight (cwt.) below the next lowest region, the Northeast (Table 8). By 1991, the Pacific's advantage had widened to \$2.26/cwt. below the next lowest region, the Southern Plains. Highest cost of production were in Appalachia in 1975 and 1980, and the Corn Belt in 1985 and 1991. Cost of production in the Upper Midwest remained at the U.S. average throughout this period, but the Northeast went from being at the national average to being more than \$1.00/cwt. higher than the national average, with all the increase coming after 1985.

Regional differences in milk productivity per cow and number of cows per farm correspond to some extent with the variation in milk production cost. For example, the Pacific has the lowest cost, in part due to its high productivity per cow and large farm size. Other possible factors contributing to its low cost advantage are favorable climate; use of high quality hay; and progressive dairy farmers.

A negative relationship can be observed between both the level and change in cost of production and the change in regional share of milk production. For example, the decline in the Corn Belt's and Appalachia's share is not surprising given their significant cost disadvantage.

TABLE 8. COST OF PRODUCING MILK AND RATE OF CHANGE BY REGION, U.S., 1960-91

Region	----- Year -----				----- Period -----	
	1975	1980	1985	1991	1975-91	1985-91
	----- \$ per hundredweight -----				average annual percent change	
Corn Belt	9.45	13.67	14.88	16.41	4.60	1.71
Northeast	8.71	12.51	12.98	15.48	4.86	3.21
Upper Midwest	8.96	12.43	13.41	13.99	3.51	0.72
Appalachia	10.03	13.72	13.20	15.36	3.32	2.73
Southeast ^a	----	----	13.64	15.11	----	1.80
S. Plains	9.21	12.72	13.91	13.70	3.05	-0.25
Pacific	7.58	11.23	11.56	11.44	3.18	-0.17
U.S.	8.89	12.64	13.07	14.14	3.69	1.36

^a Southeast was not included in the surveys for cost estimation before 1985.

Source: USDA, *Dairy Situation & Outlook Report*, March 1986; *Cost of Production - Major Crops, Livestock, Dairy*, 1991

TREND IN GROSS RETURN PER HUNDREDWEIGHT OF MILK BY REGION, 1975 - 1991

It is instructive to compare the regional changes in cost of production identified on the preceding page with the regional changes in milk prices. To insure data comparability over time, gross returns per hundredweight (cwt.) are used, instead of milk price. Gross returns include not only the price received for milk, but also the prorated value of cull cows and other miscellaneous returns. The dominant component of gross returns is the price of milk. For example, in 1991 the price of milk accounted for 90% of the gross returns to milk for the U.S. Furthermore, this ratio varied little by region.

Somewhat surprisingly given its increase in share of U.S. production since 1975, the Pacific region had the smallest annual rate of increase in gross returns/cwt. of any region. As a result, the Pacific went from having a gross return which was \$0.43 per cwt. above the national average in 1975 to having a gross return which was \$1.30 per cwt. below the national average in 1991.

Since 1975, gross returns/cwt. increased at least 40% faster in the Upper Midwest, Corn Belt, and Northeast than in the Pacific. Furthermore, since 1985, the two regions whose share of production increased, the Pacific and Southern Plains; experienced approximately a \$1.00/cwt. decline in their gross returns. In contrast, gross returns/cwt. in the Corn Belt, Northeast, and Upper Midwest remained essentially constant.

These observations strongly suggest that changes in regional production shares are much more closely related to regional changes in the cost of producing milk than to regional changes in the price of milk.

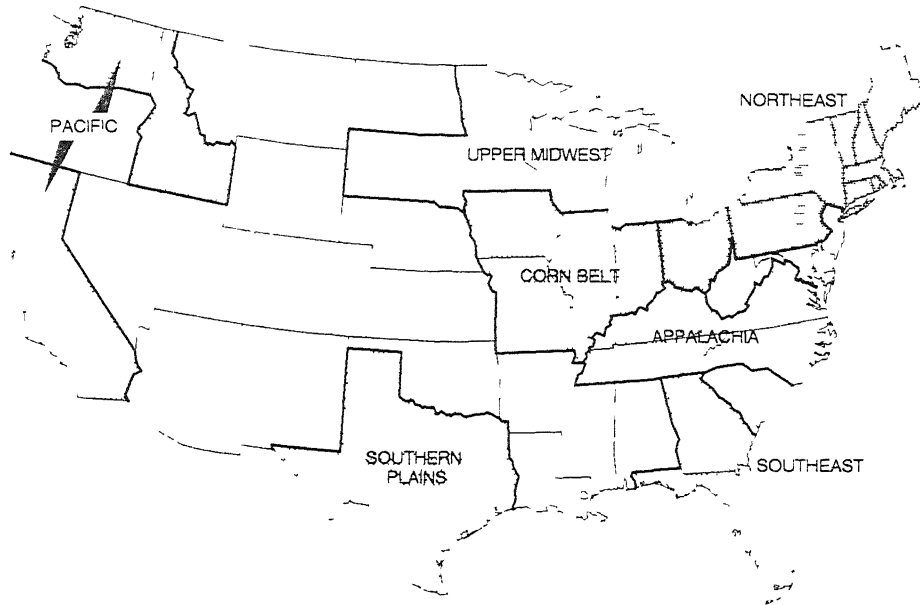
TABLE 9. GROSS RETURN PER HUNDREDWEIGHT AND RATE OF CHANGE BY REGION, U.S., 1975-91

Region	----- Year -----				----- Period -----	
	1975	1980	1985	1991		
	----- \$ per hundredweight -----				average annual percent change	
Corn Belt	8.78	14.08	13.88	13.63	3.45	-0.30
Northeast	9.64	14.62	13.98	14.10	2.89	0.14
Upper Midwest	8.82	14.24	13.40	13.67	3.44	0.34
Appalachia	9.70	14.53	14.19	14.30	2.96	0.13
Southeast ⁴	---	---	16.57	15.59	---	-0.99
S. Plains	9.95	15.02	14.95	14.02	2.56	-1.04
Pacific	9.66	13.89	13.14	12.30	1.71	-1.07
U.S.	9.23	14.33	13.74	13.60	2.96	-0.17

⁴ Southeast was not included in cost of production surveys before 1985.

Source: USDA, *Dairy Situation & Outlook Report*, March 1986; *Cost of Production - Major Crops, Livestock, Dairy*, 1991

Figure 2. Regions Used by USDA to Estimate Milk Production Costs Since 1985



CONCLUSIONS

Since 1960, the major shift in U.S. milk production has been from the Ohio and upper Mississippi River Valleys to the west and south. Furthermore, during the 1980s, share of U.S. milk produced in the Northeast and Lake States, the two largest milk producing regions, has declined.

Changes in the regional distribution of production appears to be most closely related to regional changes in supply-related factors, such as farm size, production per cow, and cost of production. The initial level of milk per cow and cost of production also appear to be important in determining subsequent regional shifts in milk production. This finding suggests that improving a region's (state's) competitiveness today is critical for future growth, but is unlikely to have immediate payoffs to the region (state) because of the momentum of past changes.

Within the context of these findings, it is striking that the Northeast and Lake States went from having above average milk per cow and farm size in 1960 to being below the national average in 1991. Thus, it will be difficult for these regions to regain lost ground. The traditional way of dairy life, with all of its appeal, probably is no longer an option. This is painful, but states need to make a hard decision: are they willing to foster a modern dairy industry and retain jobs or are they willing to continue to lose ground to western and southern states. If the first option is selected, a coordinated effort must be made now among the industry, the university, and state government. In addition, a healthy dose of patience will be needed to overcome lost momentum.

