

the characteristics of the farm, the enterprise, and the operator. Once the functional relationships between profitability measures and the  $k$  independent variables are estimated, hypotheses tests concerning estimated parameters are utilized to isolate the variables deemed important to the profitability of the dairy farm. Having fitted these regressions and having obtained the prediction equations based on the estimated parameters, these prediction equations allow for the imputation of farms' potential or expected financial performance in the absence of any statistical noise.

Two subsidiary issues are also investigated: (1) The question of how much variation in profitability is explained by the  $k$  independent variables, and (2) how much variation in States' financial performance is explained by the level of concentration of capital in farming and in the resource base, namely, debt capital, farm assets, farm equity, and cow inventory and its proxy milk sales. These issues will be investigated using the concepts of the coefficients of separate determination, and the coefficient of determination, respectively.

The third and final objective is to determine, based on expected financial performance, which management practices are employed by the top 20 percent of commercial dairy operations. Such determination is carried using a statistical test commonly known as the  $F$ -test of independence.

The report, which builds on the work by Haden and Johnson (1989), and Kauffman and Tauer (1986), among others uses standard econometric methods to identify important factors in financial performance of dairy farm businesses. However, unlike in Haden and Johnson and in Kauffman and Tauer, where data from individual milk-producing States were used (Tennessee and New York, respectively), the report uses representative and probability-based data collected by the Economic Research Service (ERS) from multiple milk-producing States.

## **Data Source and Delineation of Milk-Producing Areas**

The report draws on data from the Dairy Cost of Production version (COP) of the 1993 Farm Costs and Returns Survey (FCRS). The FCRS, which has a complex stratified, multiframe design, is a national

annual survey of farms conducted by ERS and the National Agricultural Statistics Service (NASS). Because of survey costs, ERS and NASS collect detailed surveys on a specific commodity only once every 4 years. The FCRS fully integrates information about the production practices and inputs used in the farm's dominant dairy enterprise with structural information about the farm's financial position, organization, and performance and demographic attributes of the operator.

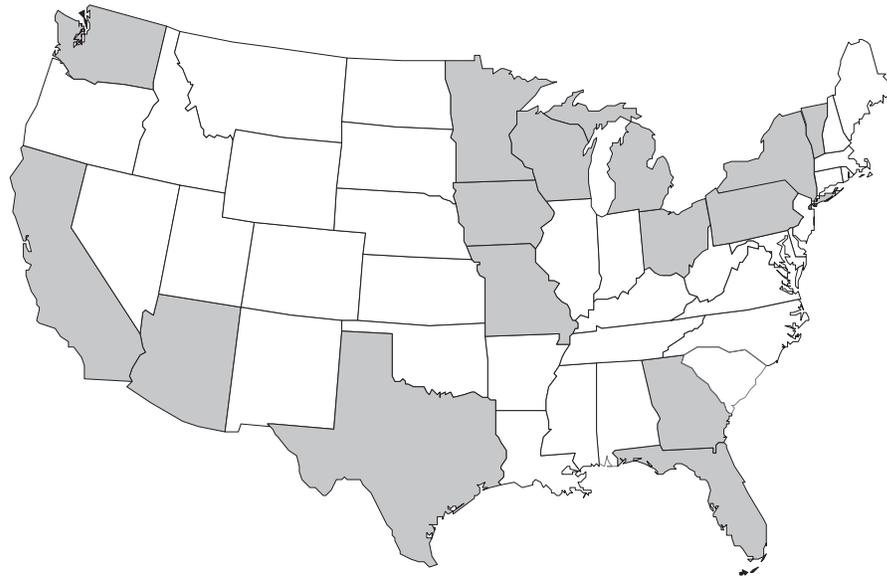
ERS uses four general approaches to estimate commodity production costs: direct and indirect costing, valuing of input quantities, and allocation of whole-farm costs (Short and McBride, 1996). Direct costing involves summarizing survey responses to questions about the total amount paid for selected inputs and is especially suited for estimating variable cost components. Indirect costing involves the combination of survey information and engineering formulas and is used in estimating machinery, building, and equipment replacement costs; fuel, lubrication, and electricity costs; and repair costs. Valuing quantities of inputs requires survey data of the physical quantities of inputs used in production (e.g., quantities of homegrown feed, hours of unpaid labor, etc.). Allocating whole-farm expenses occurs for inputs that are not specifically associated with production of a certain commodity such as general farm overhead, interest, property taxes, and insurance. For dairy farmers, expenses incurred by the farm business for these items are allocated to the milk enterprise based on the share of total value of farm production attributed to milk sales.

Figure 1 highlights the 1993 FCRS sample coverage of milk production. Figures 2 and 3 show the ranking of sampled milk-producing States based on changes in milk production (1977-93) and in number of milk cows (1978-92). By comparing the ranking of each sampled milk-producing area in both figures, evidence emerges that, with the exception of Pennsylvania, the traditional milk-producing States of the Northeast and Lake States are becoming stagnant in increases in milk output and number of milking cows.

Fallert and Blayney (1990) and Perez (1994) point to factors that may have contributed to shifts in milk production from traditional milk-producing States to those of the Southeast, Southern Plains, Pacific, and, to some extent, Mountain States, namely: (1) rapid

Figure 1

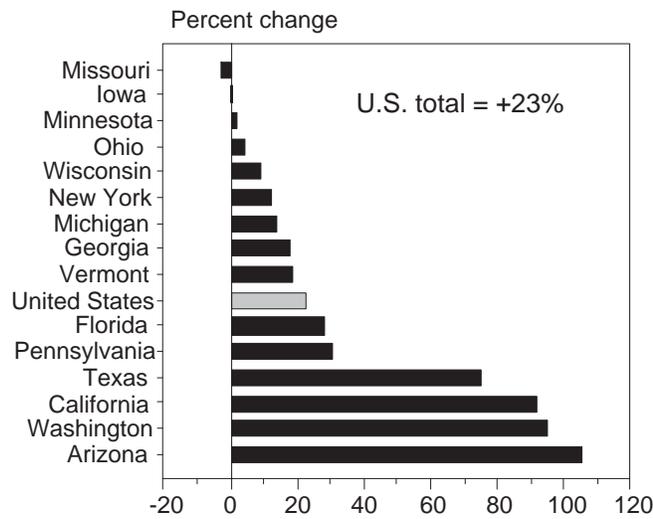
**1993 Farm Costs and Returns Survey's sampling coverage of milk production**



Producers in the States shaded were surveyed about production practices and costs of production.  
Source: USDA, Economic Research Service.

Figure 2

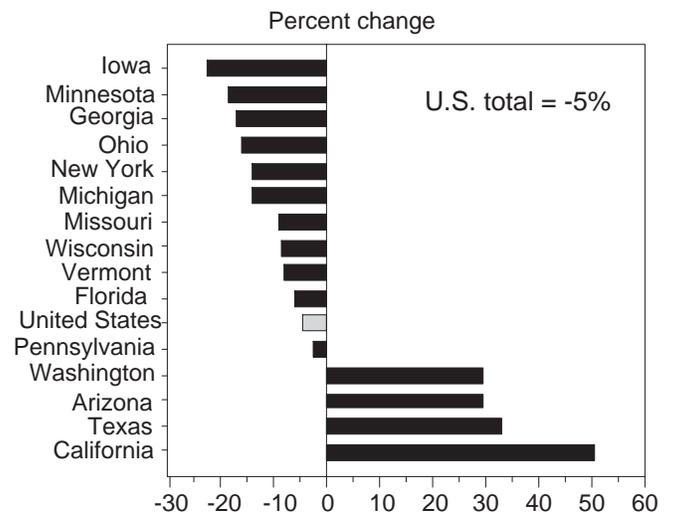
**Percentage change in milk production in 1977-93 in areas sampled by the 1993 Farm Costs and Returns Survey**



Source: Perez, Agnes. 1994. Changing Structure of U.S. Dairy Farms. AER-690. U.S. Department of Agriculture, Economic Research Service.

Figure 3

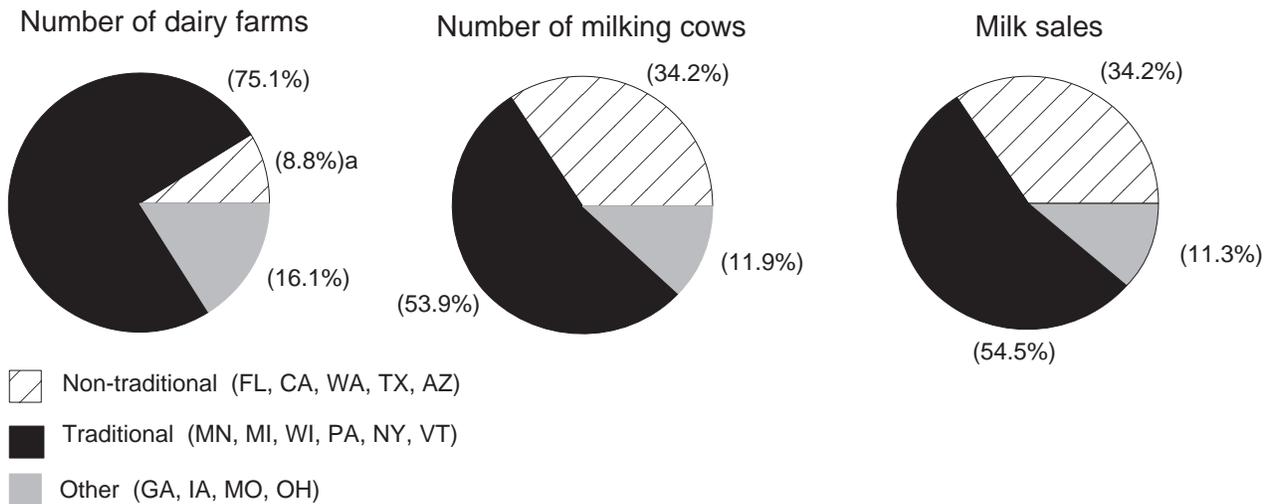
**Percentage change in number of milk cows, 1978-92, in areas sampled by the 1993 Farm Costs and Returns Survey**



Based on dairy farms with sales of \$10,000 or more by Standard Industrial Code (SIC) 024, U.S. Department of Commerce, Census of Agriculture, 1982 and 1992 issues.  
Source: USDA, Economic Research Service.

Figure 4

**Distribution of commercial dairy farms, number of milking cows, and milk sales, by selected milk-producing States, 1993**



Source: USDA, Economic Research Service, Farm Costs and Returns Survey, 1993.

population growth, particularly in the West and Southwest, with its accompanying demand for locally produced milk; and (2) the milder climate in much of the West and Southwest, which is more conducive to the production of high-quality irrigated forage and where there is less need for expensive housing facilities or heated or insulated barns. Weersink and Tauer (1991) found that dairy operations in the Western and Southern States have become larger because of the exploitation of size economies.

In the context of FCRS-sampled milk-producing States, the importance of Florida, California, Washington, Texas, and Arizona as a leading group of non-traditional milk-producing States is emphasized in figure 4. For example, while commercial dairy farms in these five milk-producing States constituted only about 9 percent of all the commercial dairy farms, their milk cow inventories and milk sales stood at about one-third of all cows and all milk sold. This was in stark contrast to the six sampled traditional milk-producing States (Minnesota, Michigan, Wisconsin, Pennsylvania, New York, and Vermont). Together, these States accounted for about 75 percent of all commercial dairy farms, yet their cow inventory and milk sales stood at about 55 percent.<sup>2</sup> Figure 4 also shows that while

Georgia, Iowa, Missouri, and Ohio accounted for 16 percent of the total number of commercial dairy farms, as a group they provided only 11 percent of all milk sold, thereby diminishing their importance relative to that of the other two groups of milk-producing States.

Based on the 1993 FCRS, 76,401 commercial dairies together sold 1 billion hundredweight of milk produced by about 7 million cows. For this report, we examined the levels of concentration in the financial and the resource base and the determinants of financial performance of commercial dairy farms for a sample of 503 commercial dairy farms from the traditional and the non-traditional milk-producing States. This sample, when expanded using the survey expansion factor, represents a population of 65,112 dairy farms, with the majority (almost 90 percent) located in the traditional milk-producing States.<sup>3</sup>

reviewer remarked, a better delineation of these States would have excluded Texas from the group of non-traditional milk-producing States since the factors that characterize its dairy production are common to those in both organizational types. Similarly, although Florida is organizationally similar to the Western States, it could be excluded because of the unique features that characterize its production methods. Both Texas and Florida are kept in the analysis to save on degrees of freedom.

<sup>3</sup>Each observation in the FCRS, which is a multiframe stratified survey, represents a number of similar farms, the particular number being the survey expansion factor. Each expansion factor, which is the inverse of the probability of the particular farm being selected, is used to expand the FCRS sample to represent the population of all farms.

<sup>2</sup>The division between traditional and non-traditional milk-producing States is intended to separate those States dominated by traditional-style farms from those dominated by farms that are large, specialize in dairy production, rely more on purchased inputs, and have industrial-style division of labor. To this extent, as one