

**Structure, Management, and Performance Characteristics of Specialized Dairy Farm Businesses in the United States.** By Sara D. Short. Resource Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Handbook Number 720.

## **Abstract**

The U.S. dairy industry faces a changing government policy environment in the year 2000. Milk producers are struggling, and will continue to struggle, to adjust to markets that are more dependent on the forces of supply and demand. Data from the 1993-95 Farm Costs and Returns Surveys and the 1996 Agricultural Resource Management Study show that dairy farm businesses in general did a fairly good job of meeting short-term debt, generating returns, and meeting long-term debt from 1993 to 1996. The analysis indicates that farm management strategies will play an important role in determining the overall profitability of a dairy farm business as Government supports decline. However, the 1996 data suggest that changes in management techniques are adopted slowly.

**Keywords:** Dairy farm businesses, structure, management, performance, characteristics.

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## Summary

With a changing policy environment requiring more adjustment to forces of supply and demand, dairy managers can improve the business decisions they make by knowing the financial strengths and weaknesses of their businesses. Measures of productivity, liquidity, financial efficiency, solvency, and profitability are examined here for U.S. farm production regions and various sizes of dairy farms. These measurements can help dairy farmers isolate their businesses' strengths and weaknesses.

In 1993, average milk production per farm in the Pacific, Southeast, and Southern Plains regions was at least three times as great as in the other three regions. However, in terms of total acres operated, specialized dairy farms in the Pacific region were much smaller than in the other five regions, primarily because these operations purchased most, if not all, of the inputs used. Management skills in the Pacific region were focused on milk production. Feed and labor efficiency among milk producers in the Pacific, Southeast, and Southern Plains regions improved significantly with increased size of the operation. Greater feed and labor efficiency by larger producers may be due to herd composition, better genetics, ration composition, more intensive feed management, newer, more modern facilities, and a better climate.

All six regions posted a current ratio value greater than 1 in 1993, indicating that, on average, all dairy businesses were meeting short-term demands for cash from existing liquid assets—an important factor when obtaining credit from lending institutions. The same held true for 1996.

The efficiency and flexibility of dairy businesses in meeting interest payments showed no change during the 1993-96 period. The interest to gross cash income ratio was the same in each year. In each year, dairy businesses committed similar shares of gross cash farm income to interest payments.

The income generated per dollar of assets used in production increased significantly between 1993 and 1994. Commercial milk-fat use reached a record in 1994 as economic growth continued, and retail prices of dairy products remained relatively favorable.

By 1996, the burden placed on net farm income to retire outstanding debt had increased significantly from 1993. Reflecting 1995's reduced corn and soybean crops, higher concentrate prices for feed squeezed returns for dairy businesses in 1996.

On average, solvency ratios for dairy farm businesses changed little during 1993-96. However, these results mask the fact that, on a regional basis, the use of debt capital was a crucial factor affecting the expansion of dairy businesses.

Profitability ratios for U.S. dairy businesses, in general, did not change significantly during 1993-96. Significant differences were posted in the Pacific region for the period 1993-95, indicative of the farm size expansion that was taking place.

The common size income statement shows the trends for expenses, net cash farm income, and net farm income for an average dairy business. The Upper Midwest was the least profitable region in 1993. The floods of 1993 were to blame for rapidly rising input costs. However, in 1996, poor weather conditions affected all regions but the Upper Midwest.

Dairy businesses in the Pacific, Southeast, and Southern Plains regions are larger in terms of herd size, and they have higher variable costs, but they generate larger net farm incomes. These businesses are more efficient and productive in terms of feed fed, milk produced, labor employed, and capital invested than farms in the Corn Belt, Northeast, and Upper Midwest regions.

The income statement shows a steady upward movement in net farm income generated by an average dairy business in the United States between 1993 and 1996. The balance sheet indicates that although total liabilities increased, a steady upward movement in total assets owned by a dairy business led to improved business net worth.

Use of risk management strategies is correlated with the income received from farming. On average, dairy producers who used management strategies had higher net incomes resulting from larger volumes of production and management of the risk associated with farming.

Dairy businesses that generated high net farm income were significantly larger than businesses with low net farm income. Milk cow inventory on operations with high net farm income was more than twice that of operations with low net farm income. More than 90 percent of high net farm income businesses were classified as being in a favorable financial position, compared with 20 percent of low net farm income businesses. Output per cow on high net farm income farms averaged 17,210 pounds, versus 14,984 on low net farm income farms. Greater feed efficiency by high net farm income producers resulted from both more output per cow and less feed fed per cow.

Regression analysis indicated that size (in terms of cow numbers) had the greatest individual effect on net farm income, accounting for 90 percent of the variation in net farm income. Size, output per cow, and debt-to-asset ratio together accounted for 95 percent of total variance effects on net farm income. Labor efficiency had the greatest effect on economic profit per hundredweight (cwt) of milk sold and on economic profit per cow, accounting for 39 and 16 percent of the variance effects. Labor efficiency, specialization in milk production, the keeping of farm and cost of production records, feed efficiency, output per cow, and the value of land, equipment, and buildings accounted for over 95 percent of the total variance effects on economic profit per cwt of milk sold and on economic profit per cow. This implies that big does not necessarily mean successful.

# Structure, Management, and Performance Characteristics of Specialized Dairy Farm Businesses in the United States

Sara D. Short

## Introduction

U.S. farming is changing in several important ways. Farms have become more industrial in character, with output becoming more concentrated on larger farms. Use of contracts and other arrangements has become much more prevalent, changing how farms are organized. Farmers have become more attuned to participation in global markets. Meanwhile, emerging technologies such as computerized planting and input application, bio-engineered and other inputs, and management information systems have had an impact on how farmers conduct business activities.

Dairy farming and milk production, in particular, have undergone dramatic structural changes in the last 50 years. Three forces that have been at work are technological innovations, changes in the production system, and specialization. Substituting capital in the form of machinery and equipment for labor has greatly increased efficiency in milk production. Dairy farmers could redirect their energy toward milk production when farm machinery freed them for other tasks such as crop or forage production. Mechanical milking machines, feeding systems, and waste handling equipment have also led to efficiencies. Electrification brought refrigeration and bulk tank storage, with associated improvements in health and sanitary conditions. On-going design changes in milking parlors and animal housing, development of computerized monitoring tools, and further refinements in existing technologies continue to change milk production.

The second change that occurred was a widespread shift from pasture/forage-based milk production systems to confinement feeding systems that freed up labor and, in some cases, capital (including human capital) for other

uses such as focusing on cow management. Increases in milk per cow were achieved as the change was made. Expanding production provided a means to reduce costs and take advantage of existing economies of size.

Finally, forces promoting specialization have been at work. Milk production has changed from one of several activities on a farm with milk cows to an activity on an operation where milk production is the sole or the most important activity. Specialized milk production has changed the farmer to a more specialized worker. Farmers may not be in the barn at all; they may function as buyers of inputs (like feed), managers of inputs (labor and cows, for example), or financial managers.

Accompanying these structural changes have been recent changes in legislation that will affect farmers' decisions with regard to how they will allocate resources both within the farm unit and among farm and other competing interests. The 1996 Federal Agriculture Improvement and Reform Act phases out dairy price supports and provides for reform of the Federal milk marketing order system. Eliminating the guarantee of a floor under milk prices changes the magnitude and character of the risk dairy farmers face. Since 1940, policy has allowed dairy farmers in most of the country to produce whatever quantities they wished and pass them on to their cooperatives (see glossary) for marketing. Cooperatives could take almost unlimited quantities and sell excess output to the U.S. Department of Agriculture's (USDA) Commodity Credit Corporation (CCC). With price supports gone in the near future, the supply-balancing function of CCC purchases of butter, cheese, and nonfat dry milk will disappear. In addition, as a participant in the General Agreement on Tariffs and Trade (GATT) Uruguay Round, the United States is committed to reducing border protection and to increasing access of dairy imports to the U.S. market. Consequently, milk producers will have to adjust to markets that are more dependent on the forces of supply and

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demand. That being the case, milk producers' business structure, management, and performance have become major issues.

This report provides a review of structural, financial, and managerial strategies used by both successful and not so successful specialized dairy farm businesses. The analysis provides some insights into how dairy farm businesses can continue to be viable in the new millennium.

## Related Studies

This report builds primarily on the work by Short and McBride (1996) and El-Osta and Johnson (1998), both of which used data from the USDA's 1993 Farm Costs and Returns Survey (FCRS). In their analysis of enterprises, Short and McBride examined the structure and economics of U.S. milk production by comparing production costs and selected production and farm characteristics among U.S. milk producers. They used distributional analysis to identify and measure sources of cost variation. They showed that, while low-cost milk producers are distinguished from high-cost producers by size of operation, animal performance, and production methods, differences in feed and labor efficiency have the greatest influence on milk production costs.

El-Osta and Johnson used multivariate analysis to determine factors associated with the financial performance of commercial dairy farm operations. They showed that, regardless of the location of the farm business, size of operation contributed the most to variability in net farm income. Factors found most important in explaining the variation in net returns per hundredweight (cwt) of milk sold were: (1) cow productivity, (2) per-cow forage production, and (3) purchased feed costs.

The analysis provided in this report broadens the scope of the previous work of Short and McBride and El-Osta and Johnson in two ways: (1) it looks beyond the milk production enterprise to focus on the structure, management, and performance of the whole dairy farm business, and (2) it provides a look at dairy farm businesses over a period of time.

The analysis of total farm businesses is the subject of numerous studies. Financial ratio analyses are used in this report as a basis for comparing the financial strength

of dairy farm businesses across regions and time (USDA's Economic Research Service (1997); Morehart, Nielsen, and Johnson (1988); James and Stoneberg (1986); Fraser (1988); and Plumley and Hornbaker (1991)). Ratio analysis shows the relationships between financial performance elements (solvency, liquidity and coverage, efficiency, and profitability) and various farm characteristics. Ratio analysis can give farmers/ranchers, lenders, investors, analysts, and policymakers a more complete perspective on the performance of a farm/ranch or group of farms/ranches and may help identify actions to modify their performance.

Common size financial statements (Fraser, 1988) are used here to compare dairy businesses with different levels of sales or total assets. These statements facilitate the evaluation of the financial condition and performance of dairy businesses over time simply by introducing a common denominator. Common size income statements are income statements with each line expressed as a percentage of sales. Common size balance sheets are balance sheets with each line expressed as a percentage of total assets.

The comparative analysis approach, for a single farmer and similar farms, used by Harsh, Connor, and Schwab (1981) is the basis for comparing determinants of regional productivity. This report focuses on six milk production regions (see glossary) and the United States. Determinants of productivity included are size indicators; profit measures; income statement factors; and various efficiency and productivity measures per cow, per cwt of milk sold, and per hour of labor used.

Trend analysis is used here to compare dairy businesses' performance indicators. This type of analysis is very useful when an operator is considering expansion because lenders can, at a glance, get an idea of the business' financial progress (Harsh, p.146).

Using the approach developed by Perry and Johnson (1996) for U.S. farmers, this report evaluates the management decisionmaking process of dairy farm businesses. Management decisions by dairy farmers dealing with the risk associated with milk production are classified into three categories: production, financial, and marketing.

## Approach to Analysis

The analysis of the total dairy farm business is presented in four parts: economic structure, financial structure, management strategies, and factors affecting the performance of the dairy business.

The economic structure of the dairy business is examined for 1993 (the last year for which survey-based data are available) to provide an overview of the farms included in the analysis and of the factors that determine profitability for the dairy farm business. Characteristics of farm operations with at least \$50,000 in dairy-related sales (specialized dairy farms) are presented, along with efficiency and productivity indicators for the dairy enterprise.

The analysis of the financial structure of the business involves the preparation of balance sheet and income statements. Financial ratios developed from the financial and income statements are used to evaluate regional differences in the financial structure of the total dairy farm business for 1993 and 1996. At the U.S. level, financial ratios were developed for 1993, 1994, 1995, and 1996.

Management strategies used by dairy farmers in 1993 and 1996 are identified. Risks are widespread in agriculture. Unexpected climatic, biological, economic, and political events pose hazards to the viability of farm businesses. One way to categorize farm risk management is to independently consider the production, financial, and marketing strategies used.

Factors affecting the performance of dairy businesses are examined by analyzing the distribution of farm profits in 1993. The cumulative distribution of net farm income for the dairy business at the national level is divided into quartiles, with the bottom quartile representing the least profitable farms and the top quartile representing the most profitable farms. Various structural and performance characteristics of farms with low and high net farm income are tested statistically. Regression analysis is used to determine the influence of farm structural and performance characteristics on three measures of profit for the dairy business: net farm income, economic returns per hundredweight of milk sold, and economic returns per cow.

## Data Sources

Data used in this report are obtained from the U.S. Department of Agriculture's (USDA) Farm Costs and Returns Survey (FCRS) for 1993, 1994, and 1995 and the 1996 Agricultural Resource Management Study (ARMS). These surveys of farmers and ranchers are conducted jointly by the Economic Research Service and the National Agricultural Statistics Service (NASS). The surveys cover farm and ranch operations in the 48 contiguous States.

The FCRS and the ARMS are multiframe, probability-based surveys in which sample farms are randomly selected from groups of farms stratified (sorted into groups) by attributes such as economic size, type of production, and land use. Each selected farm represents a known number of farms with similar characteristics. Weighing the data for each surveyed farm by the number of farms it represents is the basis for calculating estimates for all U.S. farms.

The surveys are designed to collect data to measure the financial condition and operating characteristics of farm businesses, the costs of producing agricultural commodities, and the well-being of farm operator households. Several versions of the survey questionnaire are used in a given year, one whole-farm version and several rotating commodity-specific versions. For example, in 1993, two questionnaires were used, the Farm Operator Resource (FOR or whole-farm) version, and the dairy cost-of-production (COP) version. The FOR version provided

greater detail on some survey items and included unique questions on farm operator household characteristics. The COP version contained in-depth questions on production practices for the selected commodity but has less detailed information about the farm business.

Each version of the survey has sample weights that allow the data to be expanded to the U.S. population in two ways: along with all other versions of the survey or, independently, with only the data from that version. Because of survey costs, USDA cannot undertake a detailed survey of all major field crops and livestock enterprises each year. Hence, each surveyed commodity is covered on a rotating basis about every 5 years. Dairy was last covered in 1993. Dairy will be covered again in 2000.

This report concentrates on specialized dairy farms. A specialized dairy farm is defined as an establishment which had at least 50 percent of cash receipts coming from dairy product sales. Farms included in this study are legally organized as proprietorships, partnerships, or family corporations.

The survey questions are asked of one operator per farm—the senior farm operator. A senior farm operator is the one who makes most of the day-to-day decisions. When management is equally shared, the oldest person is asked the questions. This survey design provides good financial information for the farm business but limits information about the people who farm when more than one family is involved.



## Economic Structure

The support price has underpinned the entire price structure for milk sold by farmers, either directly to processors or through cooperatives, since World War II. Technological developments, in conjunction with this Federal dairy policy that reduced milk price variability, have changed farming techniques over the last 50 years. Dairy farming has changed from depending heavily on human and animal labor to one where most operations are mechanized. Farms with 100 cows were considered large in 1950. Economies of scale and a guarantee of a minimum price for milk have led to fewer, more efficient (in terms of quantities and quality of input use), larger operations.

The dairy price support program was changed in 2000, effectively eliminating the support price as a major factor in economic decisions. Federal milk market order prices will remain, but the system will be streamlined by merging orders. While conclusions on the effects of policy changes would be speculative at this point, this section provides a broad overview of production, efficiency, and productivity characteristics that have a positive effect on the overall performance of the dairy farm business.

### Production Characteristics

Specialized dairy farms were 94 percent of the dairy farms surveyed in 1993 (app. table 1). The majority of specialized dairy farms in the Northeast, Upper Midwest, and Corn Belt milk production regions had fewer than 60 cows (app. table 2). The largest dairy operations (300 or more milk cows) were located in the Pacific and Southeast regions (see glossary). These two regions had the greatest number of large producers, an indication of the recent growth in milk production that characterized the Pacific and parts of the South. Economies of size (the costs in large-scale operations versus smaller-scale ones) have played an important role in making these areas fast-growing milk production centers (Manchester and Blayney, 1997). Larger farms also appeared in traditional dairy areas such as New York, Michigan, and Wisconsin.

In 1993, average milk production per farm in the Pacific, Southeast, and Southern Plains regions was at least three times as great as in the other three regions. However, in terms of total acres operated, specialized dairy farms in the Pacific region were much smaller than in the other five regions, primarily because these operations purchased most, if not all, of the inputs used. Management skills were focused on milk production.

On average, specialized dairy businesses used close to 5,000 hours of labor in 1993. Total labor used was great-

est in the Southeast region, about twice as much as in the Pacific and Southern Plains and four times as much as in the Corn Belt, Northeast, and Upper Midwest regions. Farms in the Southeast hired the most paid workers to do some farmwork. Businesses in the Pacific and Southern Plains also depended more heavily on paid labor. Unpaid labor (operator and other) was prevalent in the smaller farms in the Corn Belt, Northeast, and Upper Midwest.

Most of the feed fed on farms with under 60 cows was homegrown. Smaller farms in the Corn Belt, Northeast, and Upper Midwest devoted labor and management, capital, and land to feed production. Because dairy farms tend to be highly specialized in milk production, few other crops were grown. Farms that did produce other crops did so, for the most part, to feed the dairy cow herd.

More modern milking facilities (primarily herringbone parlors) were used in about 60 percent of all businesses in the Pacific and South. Barns with pipelines were more common in the once 'traditional' dairy areas, the Northeast and Upper Midwest regions. The relatively more modern businesses of the Pacific and South also made more use of automatic takeoffs, udder washers, and computerized milking and feeding systems.

### Efficiency and Productivity of Dairy Enterprises

Dairy cows on farms in the Pacific region produced an average of about 2,400 pounds more milk per year in 1993 than dairy cows on farms in the other five regions (app. table 3). Feed and labor efficiency among milk producers in the Pacific, Southeast, and Southern Plains regions were much higher than in the other regions. Producers in these three regions required nearly 50 pounds less feed and half the labor for each 100 pounds (cwt) of milk sold than did producers in the Corn Belt, Northeast, and Upper Midwest. Corn Belt, Northeast, and Upper Midwest dairy businesses were substantially smaller. Short and McBride (1996) have shown that feed and labor efficiency among milk producers improved significantly with increased size of the operation. Greater feed and labor efficiency by larger producers may be due to herd composition; better genetics; ration composition; more intensive feed management; newer, more modern facilities; and a better climate.

Producers in the Pacific region received lower milk prices, partly as a result of Federal and/or State pricing policies. Operations in this region had higher milk per cow, primarily due to the greater productivity of the milking herd. In addition, capital investment per cow and per cwt of milk sold was much lower in the Pacific region because of the larger herds.

## Financial Structure

As Federal programs to remove excess milk supplies are eliminated, dairy farm managers must more than ever have detailed, reliable financial information on which to base production decisions. Ratio analyses provide a basis for monitoring and comparing the financial strength of farm businesses (Harsh et al., 1981).

The financial performance of the farm business is evaluated by using financial ratios (see appendix A) that show various relationships between income and balance sheet statements in percentage terms (Farm Financial Standards Council, 1995). Income statements are for the responding farm operation prior to income taxes and exclude any nonfarm expenses and off-farm income attributable to household members associated with the farm business. The farm business balance sheets provide the basis for assessing financial position at a point in time.

### Liquidity

Liquidity is measured using information from a balance sheet and measures the ability of the farm to meet financial obligations at a given point in time. The current ratio (see appendix A) indicates the extent to which the sale of all current assets (including livestock and crop inventories, purchased inputs, cash invested in growing crops, and prepaid insurance) would be sufficient to cover current liabilities (notes payable within 1 year, current portion of term debt, accrued interest, and accounts payable). The value of this ratio will vary throughout the production cycle. Greater liquidity is indicated by higher ratio values.

In 1993, the current ratio for dairy farm businesses in the Northeast region was the highest among the production regions (table 1). Nevertheless, all six regions posted a current ratio value greater than 1, indicating that, on average, all dairy businesses were meeting short-term demands for cash from existing liquid assets—an important factor when obtaining credit from lending institutions—and were not facing serious financial problems. The same held true for 1996 (table 2).

The current ratio is limited by the balance sheet date; the actual assets that can be sold may vary considerably from the date of preparation. Some accounts receivable and inventories may not be very marketable. Therefore, four other liquidity ratios are presented in table 1 as measures of short-run solvency.

The quick ratio excludes inventories from the numerator of the current ratio because they are considered to be the

least liquid asset and most probably a source of losses (Fraser, p.131). The quick ratio also indicates that for the most part, dairy businesses in 1993 and 1996 were in a relatively good position to meet short-term debt.

The farm business debt service coverage ratio measures the farm business' ability to repay both interest and principal. In 1993 and 1996, dairy businesses in all six milk production regions were able to cover the farm's interest and principal strictly from net cash farm income.

The debt servicing ratio measures the share of the farm business' gross income needed to service debt. In 1993, dairy businesses in the Upper Midwest region needed 21 percent of gross cash farm income to service debt, while businesses in the Southeast region needed only 12 percent. The Upper Midwest region felt the effects of the 1993 midwestern flood and the corresponding higher input costs. In 1996, higher concentrate feed prices and continued high prices for dairy-quality hay contributed to dairy businesses' in the Pacific region using 27 percent of gross cash farm income to service debt.

The times interest ratio measures the farm business' ability to service debt out of net farm income earned. On average, dairy businesses in the Upper Midwest were not able to service their debt level in 1993. In 1996, businesses in the Corn Belt faced a similar situation.

**1993-96.** In general, the ability of dairy businesses to cover current liabilities from the sale of current assets changed little during the 1993-96 period (table 3). The current ratio declined significantly only between 1994 and 1995, as notes payable within 1 year increased (app. table 5). The 1995 returns over feed costs were the lowest since 1991, as milk prices decreased more than feed prices. Consequently, many businesses had to obtain extra cash to meet operating expenses.

The quick ratio declined significantly between 1994 and 1995 and between 1994 and 1996. Because of lower returns over feed costs, dairy businesses in 1995 and 1996 were in a less favorable position to meet short-term debt than in 1994.

The ability of farm businesses to repay interest and principal from net cash farm income was mostly unchanged during the 1993-96 period. The farm business debt service coverage ratio declined significantly between 1993 and 1995, as notes payable in 1995 increased (app. table 5). However, increases in net cash farm income were smaller (app. table 6).

The share of the dairy business' gross income needed to service debt increased significantly between 1993 and 1995 and between 1994 and 1995. Gross farm income in 1995 did not increase enough to service new debt (app. table 7).

The dairy business' ability to service debt out of net farm income was similar in each year from 1993 through 1996. The times interest ratios were not significantly different from one another. Large increases in feed costs in 1994, 1995, and 1996 eroded advances in gross cash income (app. table 6).

## Efficiency

Four ratios are calculated to measure a farm business' financial efficiency—gross ratio, interest to gross cash income ratio, asset turnover ratio, and debt-burden ratio. The gross ratio measures the extent to which the cash income generated by the farm business is absorbed by the annual costs of production. The lower the ratio, the more effective the farm operation is in generating returns.

Gross ratios in 1993 hovered around 77 percent for specialized dairy businesses (table 1). Dairy farms in the Southeast region had a gross ratio over 80 percent. Costs of production in this area were relatively high (<http://www.ers.usda.gov/briefing/farmincome/data.htm>). In 1996, gross ratios were still around 77 percent (table 2).

The interest to gross cash income ratio measures the share of gross cash farm income committed to interest payments. In 1993, this ratio ranged from 3 percent in the Southeast region to 7 percent in the Upper Midwest region. Lower values of the ratio indicate greater efficiency and flexibility in meeting interest payments. In 1996, this ratio ranged from 4 percent in the Pacific and Southern Plains regions to 7 percent in the Corn Belt and Northeast regions.

The asset turnover ratio measures the income generated per dollar of assets used in production. This ratio increases with farm size (*Financial Performance of U.S. Commercial Farms, 1991-94*, USDA, ERS, June 1977, p.16). In 1993, dairy businesses in the Pacific, Southeast, and Southern Plains regions had ratios about twice as large as businesses in the other three regions (table 1). Similar differences in ratios were posted in 1996 (table 2).

The debt-burden ratio measures the burden placed on net cash farm income to retire outstanding debt. As net cash farm income increases relative to the farm business debt,

the smaller the burden and visa versa. In 1993, dairy businesses in the Upper Midwest region found themselves in the least favorable position, in part because of adverse weather conditions that placed considerable stress on input costs (table 1). In 1996, dairy businesses in the Corn Belt region were in the least favorable position (table 2).

**1993-96.** Dairy businesses in 1993 were significantly more effective in generating returns than in 1994 (table 3). In 1994, increases in gross cash income were not enough to compensate for increases in cash expenses, especially feed costs (app. table 6).

The efficiency and flexibility of dairy businesses in meeting interest payments showed no change during the 1993-96 period. The interest to gross cash income ratio was the same in each year. In each year, dairy businesses committed similar shares of gross cash farm income to interest payments.

The income generated per dollar of assets used in production increased significantly between 1993 and 1994. Commercial milk-fat use reached a record in 1994 as economic growth continued, and retail prices of dairy products remained relatively favorable.

By 1996, the burden placed on net farm income to retire outstanding debt increased significantly from 1993. Reflecting 1995's reduced corn and soybean crops, higher concentrate feed prices squeezed returns for dairy businesses in 1996.

## Solvency

The debt/asset ratio is one measure of solvency. This ratio is defined as total liabilities divided by total assets, indicating the amount of risk embedded in an operation's financial structure. Associated with debt is an obligation to pay principal and interest. While debt increases a farm's financial risk, benefits may accrue to owners using the debt if debt service commitments are met by earnings.

In 1993, the Pacific region posted a debt/asset ratio of 0.31, suggesting greater use of debt capital than in the other regions, which likely was needed for the continuing expansion of dairy businesses in the region (table 1). In 1996, this ratio was also higher for the Pacific region than for the other regions (table 2).

The debt to equity ratio measures the relative proportion of funds invested by creditors and owners. As expected,

the Pacific region had the highest value for this ratio in both 1993 and 1996 (tables 1 and 2).

**1993-96.** On average, solvency ratios for a dairy farm business changed little during 1993-96 (table 3). None of the calculated U.S. debt/asset and debt/equity ratios were statistically different from one another. However, these results mask the fact that, on a regional basis, the use of debt capital has been a crucial factor affecting the expansion of dairy businesses (app. tables 7-12).

## Profitability

Two measures of returns (rate of return on assets and rate of return on equity), the profit margin ratio, and an economic profit margin ratio are used to assess profitability of the farm business (table 1). The rate of return on assets is defined as net farm income plus interest expenses minus estimated charges for operator labor and management, divided by total assets. This ratio measures the per-dollar return on farm assets from current income only. The rate of return on equity equals net farm income minus estimated charges for operator labor and management, divided by equity per farm. This ratio indicates the relationship between net profits and equity of the farm business. A negative return on equity is a relative measure of financial stress. The absolute size of the ratio roughly measures the rate at which a farm business is adding to, or consuming from, its own capital stock.

In 1993, dairy businesses in the Pacific, Southeast, and Southern Plains regions earned a rate of return on assets of 5 to 6 percent (table 1). On the other hand, the smaller businesses (in terms of dairy cow numbers) in the Corn Belt, Northeast, and Upper Midwest earned a rate of return of only 2 to 3 percent. In 1996, this rate of return dropped to 2 percent in the Pacific region as weather problems affected the availability of dairy-quality (e.g., top quality alfalfa hay) inputs (table 2).

In 1993, dairy businesses in the Pacific region had the highest rate of return on equity (6 percent) (table 1). This was not the case in 1996 (table 2), when the Southern Plains had the highest rate of return on equity (5 percent).

The profit margin indicates the farm operator's ability to control the level of farm business costs relative to the volume of revenues generated. All six regions posted average profit margins of 17 percent or greater in 1993 (table 1). Only the Pacific region failed to post an average profit margin of at least 14 percent in 1996 (table 2).

An economic profit margin ratio is calculated to provide a more precise measure of an operator's profitability.

Imputed values for non-operator unpaid labor and returns to owned assets are subtracted from net farm income. The result is then divided by the gross cash farm income. The imputed value for non-operator unpaid labor is calculated as the product of surveyed non-operator unpaid labor and reported wages. A return to owned assets is calculated as the product of surveyed net worth and long-term interest rate for investments. Table 1 shows that, with the exception of the Corn Belt region, dairy farm businesses throughout the United States posted positive economic profits in 1993. As expected, significant differences existed between the relative smaller farms of the Corn Belt, Northeast, and Upper Midwest regions and the relatively larger farms in the Pacific, Southeast, and Southern Plains regions. Smaller farms tend to be more dependent on unpaid labor. In 1996, the Corn Belt region once again failed to post an economic profit (table 2).

**1993-96.** Profitability ratios for U.S. dairy businesses, in general, did not change much during 1993-96 (table 3). Significant differences were posted in the Pacific region for the period 1993-95 (app. table 9), indicative of the farm size expansion that was taking place.

## Common Size Financial Statements

The common size income statement (app. tables 13 and 14) reveals the level of expenses and profits relative to sales. The common size balance sheet (app. tables 15 and 16) shows the distribution of farm assets (fixed relative to current); the capital structure of the business (debt relative to equity); and the business' debt structure (long-term relative to short-term). Common size financial statements are another form of financial ratio analysis (Fraser, p. 125).

As expected, non-current assets across milk production regions accounted for 75 percent or more of all farm assets owned by dairy businesses. Investment in land and buildings (such as milking parlors and animal housing), farm equipment, and breeding animals was by far the largest component of non-current assets of dairy producers. Changes in investment are attributable to changes in such factors as milk prices, input costs, market value of assets, interest rates, and government farm policy. Investments have been financed primarily by long-term debt.

The common size income statement shows the trends for expenses, net cash farm income, and net farm income for an average dairy business. Not surprisingly, the Upper Midwest region was the least profitable region in 1993. The floods of 1993 were to blame for rapidly rising input costs. However, in 1996, poor weather conditions affect-

**Table 1—Financial ratios for specialized dairy farms, by region, 1993**

Item	Corn Belt (1)	North-east (2)	Pacific (3)	South-east (4)	Southern Plains (5)	Upper Midwest (6)
<b>Liquidity ratios:</b>						
Current	2.67 (t12**)	4.04 (t23**) (t25**) (t26**)	2.43	3.37	1.49	2.33
Quick	1.25	1.43 (t26**)	0.83	1.51	0.62	0.95
Farm business debt service coverage	1.55 (t15**)	2.03 (t23**) (t25**) (t26**)	1.30 (t35*)	1.83 (t45**)	0.39 (t56**)	1.58
Debt servicing	0.18 (t14**) (t15*)	0.14 (t23*) (t25**) (t26**)	0.20 (t34**)	0.12 (t45**) (t46**)	0.26	0.21
Times interest	2.33	2.58 (t26*)	2.89 (t36*)	3.96 (t46**)	3.33	1.47
<b>Efficiency ratios:</b>						
Gross	0.76 (t14*) (t15**)	0.77 (t25**)	0.78 (t35**) (t36*)	0.81 (t45*) (t46**)	0.93 (t56**)	0.74
Interest to gross cash income	0.05 (t14**) (t15*) (t16**)	0.05 (t24**) (t26**)	0.04 (t34**) (t35**) (t36**)	0.03 (t46**)	0.04 (t56**)	0.07
Asset turnover	0.25 (t13**) (t14**)	0.23 (t23**) (t24*) (t26**)	0.60 (t34**) (t35**) (t36**)	0.46 (t46**)	0.35	0.26
Debt-burden	0.42 (t15*)	0.38 (t25*)	0.45 (t35**)	0.51 (t45**)	0.05	0.36
<b>Solvency ratios</b>						
Debt to assets	0.14 (t13**) (t15**) (t16**)	0.14 (t23**) (t25**) (t26**)	0.29 (t34**) (t35**) (t36**)	0.17 (t45**)	0.52 (t56**)	0.19
Debt to equity	0.16 (t13**) (t15**) (t16**)	0.16 (t23**) (t25**) (t26**)	0.41 (t34**) (t35**) (t36**)	0.20 (t45**)	1.09 (t56**)	0.24
<b>Profitability ratios:</b>						
Rate of return on assets— Current income	0.03 (t13*)	0.03 (t23*)	0.06	0.05	0.03	0.04
Rate of return on equity— Current income	0.02	0.03	0.05	0.04	0.04	0.02
Profit margin	0.18	0.21	0.18	0.18	0.17	0.20
Economic profit margin	-0.01 (t13**) (t14**) (t16**)	0.03 (t23**) (t24**)	0.15 (t36**)	0.13	0.12	0.05

Note: txy indicates t-statistic between two regions. \* Significantly different at the 10-percent level. \*\* Significantly different at the 5-percent level.

Source: Compiled by the Economic Research Service from the 1993 Farm Costs and Returns Survey, USDA.

**Table 2—Financial ratios for specialized dairy farms, by region, 1996**

Item	Corn Belt (1)	North-east (2)	Pacific (3)	South-east (4)	Southern Plains (5)	Upper Midwest (6)
<b>Liquidity ratios:</b>						
Current	2.03	3.86 (t23**) (t26**)	1.60	na	1.55	1.91
Quick	1.00	1.82	0.76	na	0.83	0.48
Farm business debt service coverage	1.06 (t12*) (t15*)	1.88 (t23**)	0.80 (t35*) (t36*)	na	1.25	1.42
Debt servicing	0.25 (t12**) (t15**)	0.16 (t25*)	0.27 (t35**)	na	0.21 (t56**)	0.23
Times interest	0.83 (t15*)	1.19 (t25*)	1.47 (t35*)	na	4.06	1.67
<b>Efficiency ratios:</b>						
Gross	0.81 (t16*)	0.77	0.83 (t36**)	na	0.77 (t56*)	0.73
Interest to gross cash income	0.07 (t13**) (t15**)	0.07	0.04 (t36*)	na	0.04 (t56**)	0.06
Asset turnover	0.30 (t13**)	0.30 (t23**)	0.55 (t36**)	na	0.48	0.31
Debt-burden	0.25 (t15**)	0.37	0.35	na	0.57	0.40
<b>Solvency ratios:</b>						
Debt to assets	0.23	0.18 (t23*)	0.27	na na	0.20	0.20
Debt to equity	0.29	0.22 (t23*)	0.37	na na	0.25	0.25
<b>Profitability ratios:</b>						
Rate of return on assets— Current income	0.02	0.03	0.02	na	0.05	0.04
Rate of return on equity— Current income	0.00	0.01	0.00	na	0.05	0.02
Profit margin	0.14	0.17	0.11	na	0.18	0.18
Economic profit margin	0.00	0.05	0.08	na	0.14	0.06

Note: txy indicates t-statistic between two regions. \* Significantly different at the 10-percent level. \*\*Significantly different at the 5-percent level. na = not available, legal disclosure edit required.

Source: Compiled by the Economic Research Service from the 1996 Agricultural Resource Management Study, USDA.

**Table 3—Financial ratios for specialized dairy farms, 1993-96**

Item	1993	1994	1995	1996	t-statistics					
					93-94	93-95	93-96	94-95	94-96	95-96
<b>Liquidity ratios:</b>										
Current	2.50	2.64	2.02	2.11	0.42	1.55	0.02	1.83*	1.62	0.30
Quick	1.02	1.24	0.76	0.79	1.07	1.55	0.02	3.15**	2.22**	0.21
Farm business debt service coverage	1.45	1.31	1.16	1.31	0.79	2.07**	0.01	0.91	0.03	1.17
Debt servicing	0.20	0.20	0.24	0.21	0.00	2.07**	0.00	1.95*	0.79	1.53
Times interest	2.20	1.57	1.41	1.78	1.26	1.53	0.03	0.28	0.35	0.61
<b>Efficiency ratios:</b>										
Gross	0.77	0.80	0.78	0.78	1.73*	0.62	0.00	0.85	0.61	0.05
Interest to gross cash income	0.05	0.05	0.06	0.05	0.11	0.90	0.00	0.83	1.32	1.61
Asset turnover	0.30	0.32	0.35	0.35	1.53	1.81*	0.01	0.87	1.20	0.02
Debt-burden	0.36	0.33	0.36	0.38	0.87	0.06	0.00	0.77	1.18	0.31
<b>Solvency ratios:</b>										
Debt to assets	0.19	0.20	0.21	0.20	0.80	1.41	0.00	0.50	0.15	0.55
Debt to equity	0.24	0.26	0.27	0.26	0.79	1.35	0.01	0.48	0.12	0.27
<b>Profitability ratios:</b>										
Rate of return on assets— Current income	0.04	0.03	0.03	0.03	1.05	0.50	0.00	0.23	0.12	0.09
Rate of return on equity— Current income	0.03	0.01	0.01	0.02	1.20	0.90	0.00	0.02	0.72	0.51
Profit margin	0.19	0.16	0.16	0.16	1.61	1.30	0.01	0.01	0.16	0.14
Economic profit margin	0.06	0.06	0.07	0.07	0.20	0.26	0.02	0.38	2.08**	2.09**

\* Significantly different at the 10-percent level.

\*\* Significantly different at the 5-percent level.

Source: Compiled by the Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and the 1996 Agricultural Resource Management Study, USDA.

## Regional Comparative Analysis

Various factors that affect regional productivity were analyzed for 1993 (table 4). Specialized dairy businesses across six milk production regions and the United States were used to make the comparisons more meaningful.

Dairy businesses in the Pacific, Southeast, and Southern Plains regions are larger in terms of herd size, and they have higher variable costs, but they generate larger net farm incomes. These businesses are more efficient and productive in terms of feed fed, milk produced, labor employed, and capital invested than farms in the Corn Belt, Northeast, and Upper Midwest regions. Short and McBride (1993, p.21) have shown that milk producers have some control over several variables that affect the dairy business' productivity and efficiency. This suggests that measures to improve smaller farm operators' management skills in the Corn Belt, Northeast, and Upper Midwest regions should be explored.

Another factor of importance in a comparative analysis is the relative balance between operating expenses and fixed expenses (Harsh et al., p.145). The Pacific, Southeast, and Southern Plains regions once again appear to be in a better position than the other three regions. While their operating ratios were somewhat higher than dairy farms in other regions, their fixed ratios were lower. This

implies that dairy business operators in the Pacific, Southeast, and Southern Plains regions are able to expand their operations more quickly.

## Trend Analysis

The income statement shows a steady upward movement in gross farm income generated by an average dairy business in the United States between 1993 and 1996 (table 5). Operating and fixed expenses also increased. However, the overall trend in net farm income was in a positive direction, and the fixed ratio did not trend upward (app. tables 7 and 8). Farm businesses with relatively small fixed ratios and large operating ratios are generally less vulnerable to cash-flow problems since fixed expenses must be paid regardless of the gross farm income generated.

The balance sheet indicates that, on average, over the period 1991-96, total assets owned by a dairy business posted a steady upward movement. Even though total liabilities also increased, the net effect is improved business net worth. The rate of growth in assets was greater than that of debt. The movement in the current ratio and the capital ratio (which show the relative balance among current and non-current assets in relation to current and non-current liabilities) supports this conclusion (app. tables 9 and 10).



**Table 4—Determinants of regional profitability of specialized dairy farms, 1993**

Item	Unit	Corn Belt	North-east	Pacific	South-east	Southern Plains	Upper Midwest	U.S.
Number of farms		17,259	26,702	5,536	856	2,018	45,351	97,721
Size indicators								
Total acres operated		275	335	153	684	378	356	328
Cow numbers		52	61	348	411	183	58	80
Total labor used	hours	4,437	4,847	8,138	16,677	8,249	4,402	4,928
Profit measure								
Net farm income	dollars	21,078	30,538	141,442	185,119	61,725	19,715	32,126
Income statement factors								
Operating ratio		0.61	0.60	0.68	0.70	0.70	0.60	0.63
Fixed ratio		0.11	0.11	0.08	0.06	0.06	0.16	0.12
Efficiency and productivity								
Per cow								
Milk production	cwt	14,876	16,085	17,462	14,531	14,452	15,570	15,964
Milk sales value	dollars	1,824	2,056	2,020	2,134	1,905	1,960	1,984
Feed fed	pounds	26,877	32,065	27,247	24,561	19,730	33,204	29,740
Labor hours		85	80	23	41	45	76	62
Average machinery investment	dollars	1,673	1,400	266	538	702	1,880	1,242
Average total investment	dollars	8,250	9,307	2,944	4,437	3,609	8,590	6,882
Per cwt of milk sold								
Value	dollars	12.87	13.33	11.74	14.98	13.30	12.89	12.77
Feed fed	pounds	189.65	207.90	158.29	172.45	137.74	218.47	191.38
Labor hours		0.60	0.52	0.14	0.29	0.31	0.50	0.40
Average machinery investment	dollars	11.80	9.08	1.55	3.78	4.90	12.37	7.99
Average total investment	dollars	58.22	60.34	17.11	31.15	25.19	56.52	44.29
Per labor hour								
Average machinery investment	dollars	19.60	17.49	11.36	13.25	15.59	24.82	20.10
Average total investment	dollars	96.64	116.28	125.78	109.22	80.16	113.40	111.40
Milk sold	dollars per cwt	1.66	1.93	7.35	3.51	3.18	2.01	2.52

Source: Compiled by the Economic Research Service from the 1993 Farm Costs and Returns Survey, USDA.

**Table 5—Trend analysis for specialized dairy farms, 1993-96**

Item	1993	1994	1995	1996
<i>Dollars per farm</i>				
Balance sheet				
Current assets	79,689	92,952	96,900	97,814
Non-current assets	528,342	528,392	549,318	620,515
Total assets	608,031	621,344	646,218	718,329
Current liabilities	31,924	35,236	47,939	46,310
Non-current liabilities	83,954	91,214	89,410	99,871
Total liabilities	115,878	126,449	137,349	146,181
Net worth	492,153	494,895	508,870	572,148
Current ratio	2.50	2.64	2.02	2.11
Net capital ratio	5.25	4.91	4.70	4.91
Income statement				
Gross farm income	181,464	201,310	226,630	249,376
Operating expenses	117,918	136,310	150,014	166,271
Fixed expenses	21,556	23,833	26,492	27,233
Net farm income	34,047	31,304	35,200	40,698
Gross ratio	0.65	0.68	0.66	0.67
Fixed ratio	0.12	0.12	0.12	0.11

Source: Compiled by the Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and the 1996 Agricultural Resource Management Study, USDA.

## Dairy Farm Management Decisions

A principal effect of the milk price support program was to reduce one element of risk for dairy farmers, extremely low milk prices. It did not remove other risks, such as high feed prices, loss of market for the individual producer, drought, floods, or disease. And it did not guarantee profits on milk production, as shown by the out-of-pocket losses of many dairy farmers during 1973-75 (Blayney, Miller, and Stillman 1995). Data from farm surveys allow for the description of farm management decisions that dairy farmers made to manage risk in agricultural production. Farmers can and do adjust their management decisions to changes in their working environment (e.g., a change in Federal policy). Previous decisions impact the farm's current physical, financial, and human capital stocks, and influence or even restrict the set of future decisions.

In 1993, operators were given lists of production, financial, and marketing strategies (fig. 1) and were asked to identify up to three strategies used in managing their farm. Strategies were not ranked by the respondent, and the list was not intended to be exhaustive. For some farmers the use of a strategy was not deemed important enough to list as one of the three choices, but elsewhere in the survey they may have indicated use of that strategy. As an example, a farmer may have participated in Government commodity programs, but did not identify Government programs as a production strategy. Provisions were made to include these operators in the summarized data.

In 1996, dairy operators were asked which of nine strategies they would likely use, consider, or not use to

### Figure 1—Management decisions

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#### Production decisions:

- Diversification
- Commodities with stable or low variability of income
- Leasing/contracting inputs
- Non-farm uses of land

#### Financial decisions:

- Maintain borrowing capacity
- Match maturity of loans to the time income is expected
- Renegotiate or pre-pay loans
- Insurance
- Participate in Government programs

#### Marketing decisions:

- Hedge or use futures markets
- Contract the sale of commodities
- Spread sales over year

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improve the financial condition of their business if faced with financial difficulties (table 6). Forty-four percent of operators said they would restructure debt by lengthening the term or reducing the interest rate. Almost 57 percent indicated they would adjust the farm business' operating costs. Thirty-six percent would improve their marketing skills.

In 1996, operators also indicated that their management style had changed little from 1995. In addition, more than 50 percent of operators said that what changes they did incorporate in 1996 were not due to changes in farm programs.

Farmers can control exposure to risk by altering their business plans. In 1993, almost 62 percent of dairy farm operators said that they used a strategy to manage risk of production. About 56 percent indicated that they employed at least one financial strategy, and about 52 percent also used some marketing strategy.

Farmers use a variety of strategies to reduce the variability of risk in production of agricultural products, financial needs of the business, and marketing of the crops or livestock. Use of risk management strategies is correlated with the incomes received from farming. On average, farmers who used any of the strategies listed in the surveys had higher net incomes resulting from larger volumes of production and management of the risk associated with farming (Perry et al.).

### Production Decisions, 1993

Production decisions center on product production given a limited resource base, on the production or cultural practices used, and on which (if any) crops or livestock to produce (fig. 2). Long-term decisions may include the production practices used, the production technologies adopted, or changes in the mix of crops produced (Perry et al.).

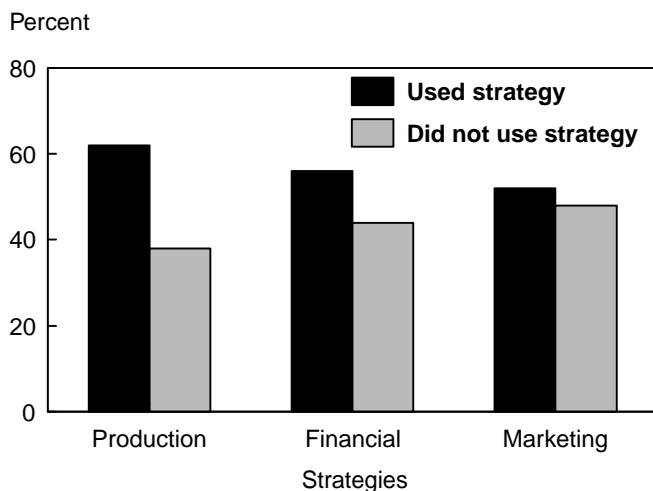
Dairy farm operators used a variety of production strategies in 1993 (fig. 3). Seventy percent of farm operators used at least one production strategy. About 28 percent of dairy farmers using at least one production strategy said that they participated in Government commodity programs (app. tables 17-23). For example the relatively smaller farms in the Corn Belt, Northeast, and Upper Midwest regions that tend to grow their own feed likely depended on Federal feed grain programs to reduce the risks involved in feed grain production. Operators in regions like the Pacific purchased most, if not all, of their

**Table 6—Use of management strategies by specialized dairy farms, 1996**

Item	Would do	Would consider	Would not do					
<i>Percent of farms</i>								
If faced with financial difficulties which would operator do:								
Restructure debt	44	35	13					
Sell assets	20	44	27					
Increase use of custom or leasing services	14	42	36					
Scale back farm business	14	38	39					
Diversify	17	39	37					
Spend more time on management	47	33	12					
Use advisory services	38	38	16					
Adjust operating costs	57	29	7					
Improve marketing skills	36	41	15					
	Used more	First time	Used same	Used less	Never, but considering	Never, not considering	Change due to farm program changes	
							yes	no
<i>Percent of farms</i>								
Change in use last year:								
Contract sales	6	2	15	3	16	50	7	52
Spread sales	6	1	34	2	9	40	5	54
Diversification	5	3	21	3	18	42	8	56
Contract inputs	7	2	19	3	16	45	7	54
Keep credit lines open	11	4	55	5	4	7	12	60
Maintain cash on hand or assets that can be converted into cash	10	2	60	5	6	10	12	60
Hire work to be custom done	10	3	44	6	10	20	10	62
Hedge or use futures/options	2	2	7	3	19	60	6	50

Source: Compiled by the Economic Research Service from the 1996 Agricultural Resource Management Study, USDA.

Figure 2  
**Production strategies used most often**



Source: Compiled by the Economic Research Service from the 1993 Farm Costs and Returns Survey, USDA.

production inputs and thus did not depend as heavily on Federal programs to lower production risks.

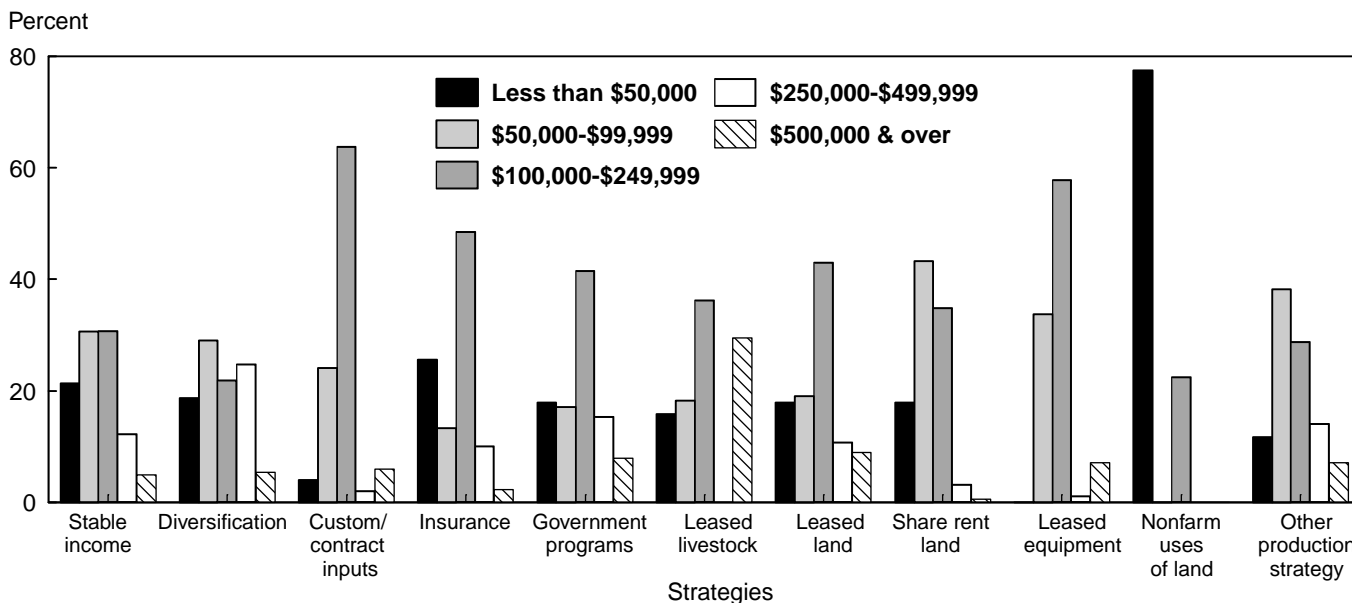
The next most often cited strategy was leasing land, followed by choosing to produce a commodity that results in a relatively stable income. Dairy businesses often derive income from producing and selling commodities other than milk (e.g., corn, soybeans, oats, etc.). Production strategies were most popular with operators of farms with sales of \$250,000 to \$499,999, with more than three-quarters of operators in this group indicating use of at least one production strategy.

### Financial Decisions, 1993

Financing the farm involves decisions about the sources of and terms under which resources are acquired for production, including debt capital used to purchase operating and capital inputs. Financial decisions determine the commitments made by the farm to service outstanding debt or to pay the fixed costs of leases. Financial commitments, whether for the purchase of operating inputs or of

Figure 3

**Production strategies used, by size of dairy farm, 1993**



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

longer term assets such as machinery and equipment, are somewhat difficult to adjust in the short term.

Financial strategies were employed by 56 percent of dairy farmers. Keeping an open line of credit was the most frequently cited financial strategy, followed by maintaining equity in cash. Over 80 percent of farmers with gross sales of \$250,000 to \$499,999 indicated that they used financial strategies (app. tables 17-23) (fig. 4). Farms with sales of \$250,000 and over were more likely to have renegotiated a loan. Survey data for 1993 indicate that financial strategies were most often employed by farm operators who specialized in cash grains (64 percent), followed by dairy farmers (Perry et al).

**Marketing Decisions, 1993**

Marketing decisions focus on buying the farm’s inputs and selling its products. These functions establish the farm’s terms of trade, that is, the prices it pays for production inputs relative to the prices it receives for the sale of its products. As a result of changes in these prices, farmers may try different approaches to marketing or identifying new markets. Marketing decisions affect profitability and risk.

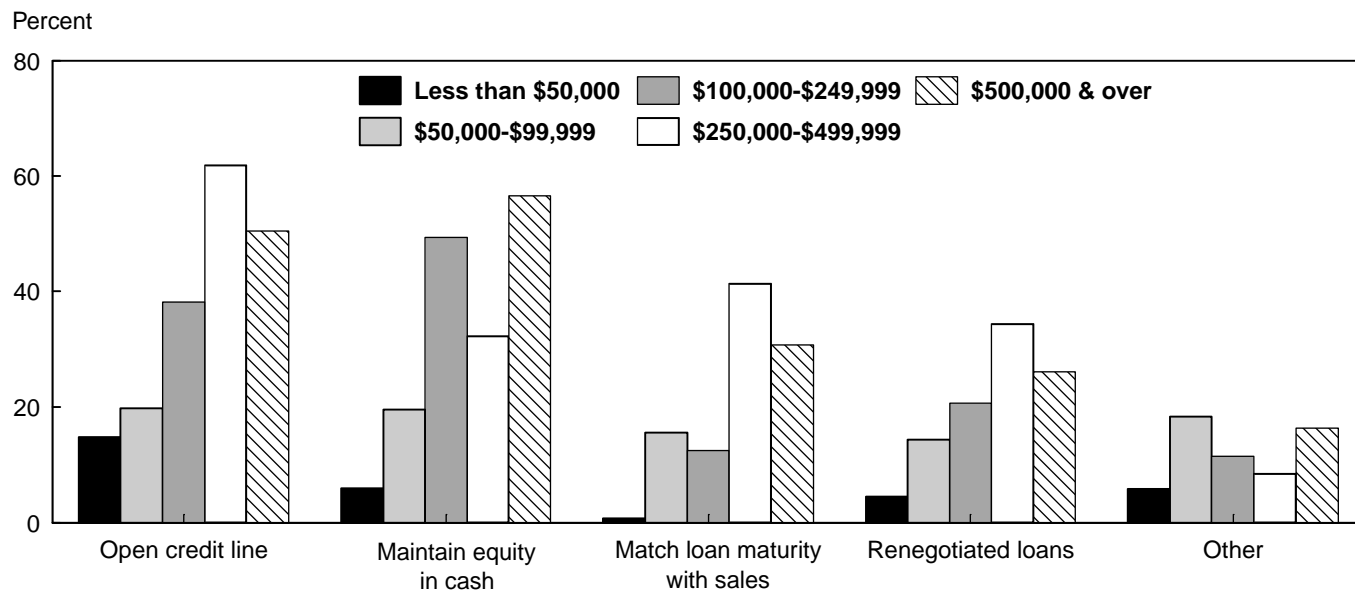
Marketing strategies (hedging, contracting the sales of crops or livestock, spreading sales over the year, contract-

ing or agreeing on prices for inputs to be delivered in the future, etc.) are commonly used by specialized dairy businesses (app. tables 17-23) (fig. 5). Farmers with sales in the two larger sales classes used marketing strategies more often than others. Spreading sales of farm products over the year was the most frequently cited marketing strategy. Hedging was the least used strategy, probably because of its speculative nature, and the size and type of contracts. Fifty percent of the farm operators in the largest sales class indicated that they contracted the sale of their products as a marketing strategy. As expected, these patterns were fairly consistent across the six milk production regions.

A relatively large share of the milk produced in the United States is moved through marketing channels by cooperatives (Manchester and Blayney). There are two basic types of dairy cooperatives today—bargaining-only and manufacturing/processing. The bargaining-only cooperatives negotiate prices and terms of trade for their members’ milk. These cooperatives rarely take title to members’ milk and do not own manufacturing or processing plants. Manufacturing/processing cooperatives market some or all of their members’ milk through their own processing and manufacturing facilities, and/or bargain for prices.

Figure 4

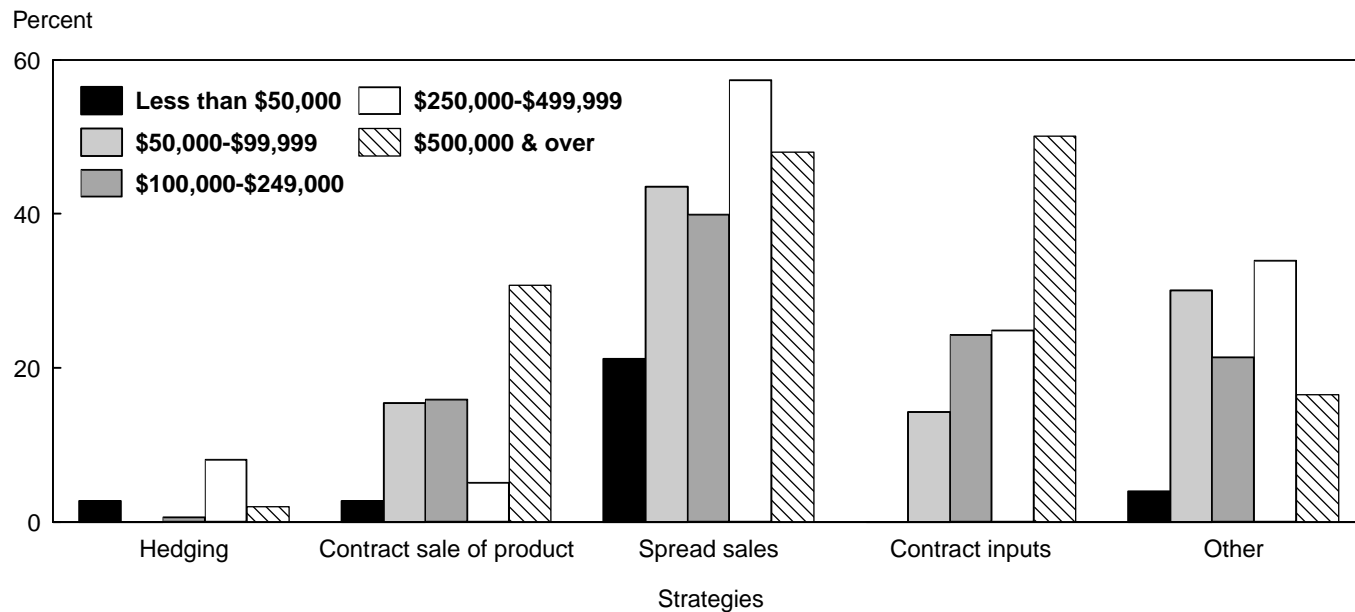
**Financial strategies used, by size of dairy farm, 1993**



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

Figure 5

**Marketing strategies used, by size of dairy farm, 1993**



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

## Distribution of Profits

Two procedures are used to examine the distribution of 1993 profits and gain an insight into which businesses may fare better as the dairy industry adjusts to the different economic climate of 2000 and beyond. First, estimated net farm income (NFI) (see glossary) per farm is ranked from lowest to highest to form a weighted cumulative distribution at the national level. The cumulative distribution is divided into quartiles, with the bottom quartile representing the least profitable businesses and the top quartile representing the most profitable. Sources of income differences among businesses are identified by comparing the business structural and performance characteristics of low- and high-income operations. The statistical difference in mean estimates for low- and high-income producers is tested using a t-statistic (see appendix B). Discussions emphasize comparisons among groups only when means are significantly different at the 90-percent level.

The relationship between NFI and farm structural and performance characteristics is further examined using regression analysis. Multivariate regression analysis is used to examine the combined effect of key variables on NFI. To measure the extent to which each characteristic influenced production costs, the sample variation of net

farm income is decomposed into the portion attributable to each characteristic (see appendix B). Because herd size is known to explain most of the variation in NFI, the same procedure is applied to estimated economic profit (see glossary) per cwt of milk sold (EPM) and to economic profit per cow (EPC) to look for other variables critical to financial performance. NFI is an accounting measure that does not address an opportunity cost for owned assets and a return to non-operator unpaid labor. Using EPM and EPC, the analysis can concentrate on factors that are affected by management decisions (Haden and Johnson).

## Low- and High-NFI Businesses

Twenty-five percent of dairy businesses surveyed had NFI of \$5,746 or less in 1993 (table 7). These relatively low-NFI businesses accounted for over 20 percent of total milk production. Businesses that generated high NFI, \$42,733 or more, accounted for more than 50 percent of total milk production.

Businesses that generated high NFI were significantly larger operations than low-NFI businesses (app. table 24). Milk cow inventory on high-NFI operations was more than twice that of low-NFI operations. Farm acres operated were lower for low-NFI operations, and the average

**Table 7—Characteristics of specialized dairy businesses with low and high NFI, 1993**

Item	Unit	Low-NFI businesses	High-NFI businesses	t-statistic
NFI	dollars per farm	<=5,746	>=42,733	na
Share of FCRS dairy:				
Farms	percent	25	25	na
Milk sales	percent	21	51	na
Output per cow	pounds	14,984	17,210	3.03**
Average milk cow inventory	head	69	152	3.14**
Feed efficiency	pounds per cwt of milk sold	217	167	3.27**
Labor efficiency	hours per cwt of milk sold	0.45	0.27	3.46**
Financial position:				
Favorable	percent of farms	20	91	12.45**
Marginal income	percent of farms	64	0	na
Marginal solvency	percent of farms	1	9	2.29**
Vulnerable	percent of farms	15	0	na
Housing facilities:				
Stanchion/tie stall barns	percent of capacity	30	14	4.07**
Drylot corrals	percent of capacity	13	37	2.58**
Milking facilities:				
Herringbone parlors	percent of capacity	27	41	1.70*
Barns with pipeline	percent of capacity	46	41	0.48
Total feed cost	dollars per cwt of milk sold	7.62	6.52	1.41
Total economic costs	dollars per cwt of milk sold	18.50	13.95	2.16**

\*\* Significantly different at the 5-percent level. \* Significantly different at the 10-percent level. na=Not applicable.

Source: Compiled by the Economic Research Service from 1993 Farm Costs and Returns Survey, USDA.

farm value of production was about one-third that of high-NFI operations. Both low- and high-NFI producers were highly specialized in milk production, with almost 90 percent of the value of farm products derived from milk production. More than 40 percent of producers located in the Southeast, Southern Plains, and Pacific regions were in the high-NFI group. These are regions with larger enterprises.

The overall financial condition of high-NFI dairy businesses was better than that of low-NFI businesses. More than 90 percent of high-NFI businesses were classified as being in a favorable financial position (see glossary), compared with 20 percent of low-NFI businesses. Many low-NFI dairy businesses are in the marginal income category, indicating that while their debt/asset ratio is less than 0.40, net farm income during 1993 was negative (see glossary).

Most operator characteristics were similar between low- and high-NFI dairy businesses. Operators of farms in both groups were experienced producers with (in 1993) at least 22 years spent as the operator of the dairy business. The operators' age and education and the type of farm organization were also similar between these groups. Nearly all producers in both groups considered farming their major occupation.

Differences in animal performance were critical in determining whether businesses generated low- or high-NFI (app. table 25). Output per cow on high-NFI farms averaged 17,210 pounds, versus 14,984 on low-NFI farms. As a result, high-NFI producers averaged some \$300 more in annual cash receipts from the sale of milk for each cow in the milking herd. High-NFI producers fed 167 pounds of feed per hundredweight of milk sold, compared with 217 pounds by low-NFI producers. Greater feed efficiency on the part of high-NFI producers resulted from both more output per cow and less feed fed per cow. Low-NFI producers fed 31,189 pounds of feed per cow, compared with 28,262 pounds for high-NFI producers. The general ration formulation fed by low- and high-NFI producers was much the same. Thus, differences in feed efficiency can likely be attributed to better management of feeding systems and higher performance genetics. High-NFI producers were also more labor-efficient than low-NFI producers, using 0.27 total labor hour per hundredweight of milk sold and 45 hours per cow, compared with 0.45 total hour per hundredweight of milk sold and 64 hours per cow on low-NFI operations. Low-NFI operations used more hired labor.

High-NFI producers more often used drylot corrals for housing milk cows. Thirty-seven percent of the housing

capacity on high-NFI operations was in drylot corrals compared with only 13 percent on low-NFI farms. More of the housing capacity on low-NFI operations was in various types of barns. Although drylot corrals are generally less expensive to build, dairy operations in the Upper Midwest and Northeast must invest in facilities that protect the herds from winter temperatures. Drylot corrals are more prominent in States where temperatures remain relatively warm all year.

Forty-one percent of the milking capacity on high-NFI operations was in herringbone parlors, compared with only 27 percent on low-NFI farms. More of the milking capacity on low-NFI operations was in barns with pipelines. High-NFI producers operated their milking facilities significantly longer than low-NFI producers. High-NFI producers also made more use of newer technology, including automatic takeoffs and udder washers.

The per hundredweight value of milk sold was significantly higher on low-NFI operations. However, because high-NFI operations were significantly more efficient, their net cash income was significantly higher.

Variable cash expenses averaged about \$10 per hundredweight of milk sold for high-NFI producers, \$2 less than for low-NFI producers. The majority of cost savings was attributed to lower feed costs. In addition to lower variable costs, significantly lower machinery and equipment costs for capital replacement accounted for most of the economic cost savings on high-NFI operations. Total economic costs were almost \$5 less per hundredweight of milk sold for high-NFI producers. Furthermore, high-NFI operations were the only ones to achieve positive residual returns to management and risk (\$0.08 per hundredweight of milk sold).

### **Influence of Farm Structural and Performance Characteristics**

The influence of selected variables on the NFI, EPM, and EPC of U.S. milk producers was analyzed using regression analysis. Decomposing the sample variation of NFI, EPM, and EPC into the portion attributable to each explanatory variable provides a measure of each variable's influence.

One expects the size of a dairy business, as measured by the number of dairy cows, to be directly related to farm profits. Larger operations typically are more efficient. Milk production per cow is used as a measure of animal performance. Operations that have higher levels of output per cow are expected to have higher profits as well.



Farm profits are expected to increase as feed and labor use decrease. Feed cost accounts for the largest share of milk production costs, and operations with high profits are expected to have a relatively high feed efficiency.

The effect of the farm's financial condition on farm profits was examined by including the farm debt-to-asset ratio. Farms with more debt relative to assets may have lower profits than others due to greater interest payments. However, dairy farms with more debt relative to assets are often larger operations and may have higher profits than others because of the size advantages.

Farm operator characteristics considered include major occupation, education, and experience. Major occupation is defined as that job, farming or otherwise, on which the farm operator spent the majority of time during 1993. Farm operators whose major occupation is farming are expected to have higher farm profits than others. Higher education levels are likewise expected to be associated with higher profits. Education is measured using binary variables for each of three groups: (1) operators who did

not graduate from high school; (2) operators who completed high school, but not college; and (3) operators who completed college. Experience is measured as the number of years the operator has operated the dairy farm. Farm profits are expected to increase with experience as producers learn and develop managerial skills. Likewise, profits are expected to be higher for producers who keep detailed records for both the milk enterprise and whole farm than for other producers.

**Results of the regression analysis.** Regression coefficients and t-statistics for variables included in the analysis of milk producers are presented in table 8. The estimated coefficients describe the change in NFI, EPM, and EPC from a unit change in each of the structural and performance variables. The t-statistics indicate which of the estimated coefficients are significantly different from zero at the selected level of significance. Alternative functional forms of the profit-size relationship were estimated using the dairy data, and the linear form was found to best describe the relationship (see appendix B).

**Table 8—Regression estimates of profit for dairy businesses, 1993**

Variable	Unit	Coefficient estimate		
		NFI	EPM	EPC
Intercept	na	244,123.38 (2.27**)	37.47 (2.84**)	3,140.30 (1.64)
Size	average number milk cows	460.69 (3.77**)	-0.001	na (-1.39)
Feed efficiency	pounds fed	-73.67 (-3.34**)	-0.01 (-2.59**)	-0.01 (-2.46**)
Labor efficiency	hours	5,907.84 (1.16)	-4.19 (-3.12**)	-3.69 (-2.39**)
Output per cow	pounds	3.07 (2.82**)	0.0002 (0.92)	0.10 (2.19**)
Specialization in milk production	percent of total value of production	-3,071.42 (-2.68**)	-0.02 (-2.14**)	-44.39 (-2.30**)
Major occupation	1=farming; 0=otherwise	3,680.71 (0.36)	1.97 (0.99)	272.67 (1.03)
Education	1=less than high school; 0=otherwise	13,985.92 (0.76)	-0.21 (-0.13)	169.57 (0.66)
	1=high school graduate; 0=otherwise	8,469.63 (0.49)	-0.88 (-0.83)	-8.75 (-0.09)
Experience	years operator of dairy operation	-245.03 (-0.65)	0.02 (0.50)	4.18 (1.10)
Cost of production records	1=kept; 0=not kept	-11,117.11 (-1.11)	3.42 (1.20)	308.78 (1.28)
Farm records	1=kept; 0=not kept	6,663.10 (0.47)	-4.63 (-1.42)	-348.24 (-1.25)
Farm debt-to-assets	ratio	-69,878.41 (-1.92**)	-2.43 (-1.19)	-431.11 (-1.32)
Value of land, equipment, and buildings	dollars	12.72 (0.35)	-0.02 (-2.14**)	-0.02 (-2.07**)
F	na	3.81**	5.06**	4.09**
R2	na	0.41	0.32	0.21

\*\* =Significant at 5% level. na=not applicable. Source: Economic Research Service, USDA.

Feed efficiency is significant and has the expected sign across the three profit measures. The negative sign on the feed efficiency variable indicates that profits decline as more units of feed are required. Each additional 100 pounds of feed subtracts about \$72 from NFI and \$0.01 for both EPM and EPC.

As cow numbers increase, so does NFI. Each cow added to the milking herd has the potential of increasing net farm income by some \$460 a year. However, cow numbers do not significantly affect EPM. Success is influenced by more than size. Managerial decisions, particularly feed and labor use, play a significant role in a dairy business' profitability.

The sign for output per cow was positive in each of the three profit measures. This result can very well be due to the use of herd management decisions which are cost-effective (Haden and Johnson, 1989). Increasing the productivity of cows significantly increases NFI and EPC. Profits increase by about \$3 and \$0.10, respectively, for each additional 100 pounds of milk produced per cow.

The negative sign on the debt-to-asset ratio variable shows that NFI, EPM, and EPC decline as debt rises relative to assets and interest expenses increase. However, the coefficient on the debt-to-asset ratio was significantly different from zero only in the NFI measure. This result highlights the importance of production and input-specific decisions made by the operator.

**Results of the decomposition-of-profit measures.** NFI, EPM, and EPC variations can be decomposed into the variance effects of each explanatory variable (table 9). Variance effects indicate the amount of variation in each profit measure that can be attributed to each explanatory variable. The percent of total variance effects for each explanatory variable indicates the extent to which each variable alone contributes to variation in profits, relative to other variables.

Among all variables, size had the greatest individual effect on NFI, accounting for 90 percent of the variance effects. Size, output per cow, and debt-to-asset ratio together accounted for 95 percent of total variance effects. Besides specialization in milk production, the other variables contributed little to total variance effects.

Labor efficiency had the greatest effect on EPM and EPC, accounting for 39 and 16 percent of the variance effects. Labor efficiency; specialization in milk production; keeping farm and cost of production records; the value of land, equipment, and buildings; feed efficiency; and output per cow accounted for over 95 percent of the total variance effects. This again implies that big does not necessarily mean successful.

**Table 9—Contribution of factors to profit variation for dairy businesses, 1993**

Variable	Unit	Variance effect		
		NFI	EPM	EPC
			Percent	
Size	average number of milk cows	90.47	0.20	na
Feed efficiency	pounds fed	0.87	6.18	9.17
Labor efficiency	hours	0.20	38.82	16.41
Output per cow	pounds	2.02	2.73	42.40
Specialization in milk production	percent of total farm value of production	3.16	19.26	14.37
Major occupation	1=farming; 0=otherwise	0.01	0.87	0.93
Education	1=less than high school; 0=otherwise	0.47	0.04	1.49
	1=high school graduate; 0=otherwise	0.19	0.82	0.00
Experience	years as operator of dairy operation	0.11	0.19	0.72
Cost-of-production records	1=kept; 0=not kept	0.21	7.80	3.54
Farm records	1=kept; 0=not kept	0.05	10.04	3.18
Farm debt to assets	ratio	2.23	1.05	1.85
Value of land, equipment, and buildings	dollars	0.01	12.00	5.93

Source: Economic Research Service, USDA.

## Conclusions

With a changing policy environment requiring more adjustment to forces of supply and demand, dairy managers can improve their business decisions by knowing the financial strengths and weaknesses of their businesses. Analysis of data contained in income and financial statements facilitates the identification of the business' strengths and weaknesses. Calculated measures of liquidity, financial efficiency, solvency, and profitability help to isolate a business' strong features and problem areas. "As a general rule, managers who carefully analyze their business also make better management decisions." (Harsh, p. 149.)

From 1993 to 1996, dairy farm businesses in general did a fairly good job of meeting short-term debt, generating returns, and meeting long-term debt. However, smaller dairy farm businesses, like those in the Corn Belt, Northeast, and Upper Midwest regions, earned a lower rate of return on assets. Expansion in milk production has taken place primarily in the western and southern regions of the United States.

Farm management strategies will play an important role in determining the overall profitability of a dairy farm business as the role of Government supports declines. This is particularly the case for dairy businesses that up to this point have depended heavily on the Federal dairy price support program.

The 1993 data show that as dairy farms become larger, farmers use more strategies to manage the riskiness of

farming. More than 70 percent of farms with sales of \$250,000 and above indicated using at least one management strategy. Large farm operators may feel a stronger need to manage the risk associated with their larger investments. Yet, at least 50 percent of farms in each sales class category used at least one management strategy. However, the 1996 data suggest that changes in management techniques are adopted slowly.

The explanatory variables included in the regression models that are used to examine profit variation among a cross-section of U.S. milk producers explain 41 percent of the variation in net farm income per farm, 32 percent of the variation in economic profit per cwt of milk sold, and 21 percent of the variation in economic profit per cow. Those results suggest that profits in dairy operations are influenced by several variables that can be controlled by operators. Improving operators' management skills can have a strong, positive influence on their dairy businesses, particularly improvements in the areas of efficient input use, the financial needs of the business, and the marketing of products.

Size is the most significant factor influencing net farm income among dairy businesses. Improving animal productivity also increases net farm income. Continued genetic improvement can be used to increase productivity. However, because herd size does not significantly influence estimated economic profit per cwt of milk sold and economic profit per cow, the efficient management of all resources is key to success.

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## Glossary

**Cooperative** is a firm owned by its farmer-members, operated for their benefit, that distributes earnings on the basis of patronage (volume of milk).

**Economic profit** measures the return to operator labor and management.

**Federal milk marketing order** is a regulation issued by the Secretary of Agriculture specifying minimum prices and conditions under which regulated milk handlers must operate within a specified geographic area. Handlers generally refer to fluid milk processors but can include manufacturing plants that also supply fluid markets.

**Financial position** describes the financial health of a farm business from a combination of income (net farm income) and solvency (debt/asset ratio) measures. Farms are categorized into one of four classes:

**Favorable**-positive income and debt/asset ratio less than 0.40. These farms are generally considered financially stable.

**Marginal income**-negative income and a debt/asset ratio less than 0.40. Periods of negative income may not pose financial difficulties if these farms are carrying a low debt load and can either borrow against equity or obtain income from off-farm sources.

**Marginal solvency**-positive income and a debt/asset ratio above 0.40. A high debt/asset ratio may be acceptable if these farms can generate enough income to service their debt and meet other financial obligations.

**Vulnerable**-negative income and a debt/asset ratio above 0.40. These farms are generally considered financially unstable.

**High-NFI businesses** are the 25 percent of dairy businesses with the highest net farm income. Included are businesses with net farm income of \$42,733 or more.

**Low-NFI businesses** are the 25 percent of dairy businesses with the lowest net farm income. Included are businesses with net farm income of \$5,746 or less.

**Major occupation** is that occupation in which the operator reported the majority of his/her time spent.

### **Milk production regions:**

**Northeast** includes New York, Pennsylvania, and Vermont.

**Corn Belt** includes Iowa, Missouri, and Ohio.

**Upper Midwest** includes Wisconsin, Minnesota, and Michigan.

**Southeast** includes Florida and Georgia.

**Southern Plains** includes Texas.

**Pacific** includes Arizona, California, and Washington.

**Net farm income** measures the accounting profit from the current-year production of commodities.

**Price support program** is a Federal program aimed at supporting the price dairy farmers receive for their milk by offering to purchase any butter, nonfat dry milk, and Cheddar cheese at announced prices.

**Production specialty** is the farm production classification that represents the largest portion of gross commodity receipts from the farm operation.

**Specialized dairy farm businesses** represent operations with at least 50 percent of receipts coming from dairy product sales.

**Value of production** is an estimate of the total value of all farm products produced on a farm, excluding the value of intermediate products such as corn fed to livestock.

## Appendix A: Definition of Financial Ratios

Ratio	Computation method	Significance
Liquidity:		
Current	Current assets/Current liabilities	Measures the farm business' ability to pay its debts as they come due.
Quick	Current assets-Inventory/Current liabilities	Eliminates source of likely loss from current ratio.
Net capital	Total assets/Total liabilities	Measures the farm business' ability to cover all debt.
Farm business debt service coverage	Net farm income+interest/ Interest+principal payment	Measures the farm business' ability to repay both interest and principal.
Debt servicing	Interest+principal payments/ Gross cash farm income	Measures the share of the farm business' gross income needed to service debt.
Times interest	Net farm income before interest and taxes/Interest payments	Measures the farm business' ability to service debt out of net income earned.
Efficiency:		
Gross	Cash operating expenses/ Gross cash farm income	Measures the proportion of gross cash farm income absorbed by cash operating expenses.
Fixed	Total fixed expenses/ Gross cash farm income	Measures the proportion of gross cash farm income absorbed by fixed expenses.
Interest to gross cash income	Interest/Gross cash farm income	Measures the share of gross cash farm income committed to interest payments.
Asset turnover	Gross cash farm income/ Farm business assets	Measures the gross farm income generated per dollar of farm business assets.
Debt-burden	Net cash farm income/ Farm business debt	Measures the burden placed on net cash farm income to retire outstanding debt.
Leverage	Total liabilities/Net worth	Measures the proportion to which debt is used, as related to equity capital, to finance the total farm business.
Solvency:		
Debt to assets	Farm business debt/ Farm business assets	Measures debt pledged against farm business assets, indicating overall financial risk.
Debt to equity	Farm business debt/ Farm business equity	Measures the relative proportion of funds invested by creditors and owners.

Profitability:

Rate of return on assets Current income	Returns to farm assets from current income/ Farm business assets	Measures how efficiently the farm business uses its assets; the per-dollar return on farm assets.
Rate of return on equity Current income	Returns to farm assets from current income-interest/ Farm business equity	Measures the returns to equity capital employed in the farm business from current income.
Profit margin	Net farm income/ Gross cash farm income	Measures profits earned per dollar of the value of farm production.
Economic profit margin	Net farm income minus an imputed value for non-operator unpaid labor and a return to owned assets/ Gross cash farm income	Measures 'net' profits earned per dollar of the value of farm production.



## Appendix B: Statistical Procedures Testing for Statistical Differences

The statistical difference between mean estimates is tested using a t-statistic. The null and alternative hypotheses to be tested are:

$$H_0: \mu_1 = \mu_2$$

$$H_A: \mu_1 \neq \mu_2$$

where  $\mu_1$  is the population mean of group 1 and  $\mu_2$  is the population mean of group 2. Evidence allowing rejection of the null hypothesis indicates a significant difference between population means of farms in the two groups. The t-statistic used for hypothesis testing is (see Kmenta, 1986, p. 137 and 145):

$$t \sim \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\text{VAR}(\bar{X}_1) + \text{VAR}(\bar{X}_2)}}$$

where  $X_1$  and  $X_2$  are sample means, and  $\text{VAR}(X_1)$  and  $\text{VAR}(X_2)$  are variance estimates of the sample means. If the estimated t-statistic exceeds the critical-t value for the chosen level of significance then the null hypothesis can be rejected and the group means are deemed significantly different. At a 5-percent level of significance, this means that from infinite samples of both populations, only 5 percent of the time would the estimates lead to an incorrect rejection of the null hypothesis.

### Decomposing Profit Variation

The statistical association between farm profits and several farm structural and performance characteristics is tested using a regression equation. The empirical model for farm profits is:

$$y_i = \alpha + X_i \beta' + \varepsilon_i$$

where  $y_i$  is the farm profit of the  $i^{\text{th}}$  individual, and  $x_i$  is a vector of farm structural and performance characteristics assumed to influence farm profits. The error term,  $\varepsilon_i$ , is assumed to have the usual desirable properties. Parameters of the model,  $\alpha$  and  $\beta'$ , are estimated using weighted least squares.

The measure of profit variation is the variance of profits,  $y_i$ . The variance of farm profits can be expressed as the sum of the variation explained by the model and the variation in the error term:

$$\sigma_y^2 = \beta' \Sigma \beta + \sigma_\varepsilon^2$$

where  $\beta'$  is a vector of parameter estimates,  $\Sigma$  is the variance-covariance matrix of explanatory variables, and  $\sigma_\varepsilon^2$  is the residual variation. To measure the extent to which each explanatory variable influences the variation of profits, the sample variation can be decomposed into its various components (Kmenta, 1986, p.410). Consider a partition of  $x_i = [x_{1i} \ x_{2i}]$ , with the corresponding partition  $\beta = [\beta_1 \ \beta_2]$ . The variance of profits can be written as:

$$\sigma_y^2 = \beta_1' \Sigma_{11} \beta_1 + \beta_2' \Sigma_{22} \beta_2 + 2\beta_1' \Sigma_{12} \beta_2 + \sigma_\varepsilon^2$$

where  $\Sigma_{11}$  and  $\Sigma_{22}$  are matrices of variances for  $x_{1i}$  and  $x_{2i}$ , and  $\Sigma_{12}$  is the matrix of covariances between  $x_{1i}$  and  $x_{2i}$ . The first term on the right-hand side represents the amount of variation in profits that can be attributed solely to  $x_{1i}$ ; the sec-

ond term is the variation in profits explained solely by  $x_{2i}$  (variance effects). The third term arises from the covariance of  $x_{1i}$  and  $x_{2i}$  and cannot be separated into parts due only to  $x_{1i}$  or only to  $x_{2i}$ , but is attributed to the influence of the two groups of variables together (covariance effects).

### **Alternative Specifications of the Regression Equations**

Three alternative specifications of regression equations are used to examine the various relationships presented in this report—linear, reciprocal, and quadratic.

The most commonly used and easiest to interpret is the linear form:

$$Y = \alpha + \beta X$$

Estimated parameters of this equation,  $\alpha$  and  $\beta$ , indicate the intercept and slope, respectively, of the estimated equation. The estimate of  $\beta$  describes the unit change in Y with a unit change in X.

The reciprocal form is expressed as:

$$Y = \alpha + \beta \frac{1}{X}$$

The intercept estimate of the reciprocal form,  $\alpha$ , represents the value of Y that is approached as X grows infinitely large. The estimate of  $\beta$  describes the unit change in Y with a unit change in  $1/X$ . If  $\beta$  is negative,  $\alpha$  represents a maximum value that is approached from below but never reached. Conversely, a positive value of  $\beta$  implies that  $\alpha$  is a minimum that is approached from above but never reached.

The quadratic form includes the linear term plus a squared term:

$$Y = \alpha + \beta X + \delta X^2$$

The estimated value of  $\alpha$  represents the intercept. The estimate of  $\beta$  describes the unit change in Y with a unit change in X and  $\delta$  describes the unit change in Y with a unit change in  $X^2$ . If both  $\beta$  and  $\delta$  are positive (negative), Y increases (decreases) at an increasing rate with X. If  $\beta$  is positive and  $\delta$  is negative, Y increases at a decreasing rate and eventually reaches a maximum. Likewise, if  $\beta$  is negative and  $\delta$  is positive, Y decreases at a decreasing rate and eventually reaches a minimum. The level at which a maximum or minimum occurs can be identified by setting the first derivative of the estimated equation to zero and solving for the value of X.

**Appendix table 1—Production characteristics of specialized dairy farms, by region, 1993**

Item	Unit	Corn Belt	Northeast	Pacific	Southeast	Southern Plains	Upper Midwest	U. S.
Number of farms		17,259	26,702	5,536	856	2,018	45,351	97,721
Total acres operated	per farm	275	335	153	684	378	356	328
Total pasture acres used	per farm	54	51	50	236	266	32	49
Cow numbers	per farm	52	61	348	411	183	58	80
Milk produced	cwt per farm	7,732	9,741	60,701	59,653	26,481	9,048	12,735
Total labor used	hours per farm	4,437	4,847	8,138	16,677	8,249	4,402	4,928
Hired	hours per farm	954	1,185	4,358	13,517	3,739	1,029	1,412
Unpaid	hours per farm	3,484	3,662	3,780	3,160	4,511	3,373	3,516
Operator	hours per farm	2,310	2,142	2,653	2,328	3,352	2,274	2,289
Other	hours per farm	1,173	1,520	1,127	832	1,158	1,099	1,227
Total feed fed	1,000 lbs per farm	1,397	1,942	9,471	10,083	3,615	1,930	2,372
Homegrown	1,000 lbs per farm	1,077	1,578	2,154	2,739	667	1,621	1,533
Purchased	1,000 lbs per farm	320	364	7,318	7,344	2,949	309	839
Technology used								
Milking facilities								
Herringbone parlors	percent of capacity	40.33	26.61	61.23	74.31	59.02	13.10	29.64
Parallel parlors	percent of capacity	3.97	2.21	15.25	9.03	10.41	2.13	4.51
Polygon parlors	percent of capacity	0.00	0.00	1.28	0.00	0.00	0.24	0.26
Carousel parlors	percent of capacity	1.33	0.00	0.00	0.00	0.00	0.00	0.22
Other parlors	percent of capacity	12.62	5.16	20.10	2.08	16.97	2.60	7.45
Barns with pipeline	percent of capacity	27.38	48.88	2.13	14.58	13.59	73.76	48.14
Pail/buckets	percent of capacity	14.36	17.13	0.00	0.00	0.00	8.18	9.78
Automatic takeoffs	percent of farms	10.97	10.36	46.63	49.17	34.65	8.59	12.54
Udder washer	percent of farms	0.19	0.05	44.72	56.18	9.06	0.00	3.26
Computerized milking systems	percent of farms	3.37	0.20	4.30	10.16	0.00	1.33	1.60
Computerized feeding systems	percent of farms	14.38	4.50	5.50	14.57	0.00	4.50	6.30
Diversification								
Corn	acres harvested per farm	56	61	25	71	9	88	70
Barley	acres harvested per farm	0	1	1	0	0	3	2
Hay	acres harvested per farm	67	89	48	77	72	73	75
Oats	acres harvested per farm	6	4	0	3	0	14	9
Sorghum/milo	acres harvested per farm	0	0	0	30	8	1	1
Soybeans	acres harvested per farm	16	2	0	5	0	11	8
Wheat	acres harvested per farm	3	2	3	0	2	3	3
Other crops	acres harvested per farm	16	37	39	36	4	55	41
Replacement heifers sold	number per farm	1	2	5	5	3	3	3
Replacement heifers purchased	number per farm	1	1	25	18	22	1	3
Calves sold	number per farm	11	23	97	142	78	14	23
Milk cows sold	number per farm	1	1	15	0	2	1	2
Bulls sold	number per farm	0	1	11	1	1	0	1

Source: Compiled by Economic Research Service from 1993 Farm Costs and Returns Survey.

**Appendix table 2—Production characteristics of specialized dairy farms, by herd size, 1993**

Item	Unit	Fewer than 60 cows	60-119 cows	120-299 cows	300 cows or more	All farms
Number of farms		59,499	26,305	9,346	2,571	97,721
Total acres operated	per farm	219	448	623	555	328
Total pasture acres used	per farm	33	64	82	129	49
Cow numbers	per farm	35	78	165	821	80
Milk produced	cwt per farm	5,222	11,748	27,865	141,705	12,735
Total labor used	hours per farm	3,789	5,043	8,189	18,272	4,928
Hired	hours per farm	385	1,633	3,667	14,736	1,412
Unpaid	hours per farm	3,404	3,410	4,522	3,535	3,516
Total feed fed	1,000 lbs per farm	1,058	2,437	5,013	22,538	2,372
Homegrown	1,000 lbs per farm	873	1,957	3,298	6,056	1,533
Purchased	1,000 lbs per farm	184	481	1,715	16,481	839
Technology used						
Milking facilities						
Herringbone parlors	percent of capacity	5.29	36.63	51.49	73.46	29.64
Parallel parlors	percent of capacity	4.59	3.59	4.57	6.62	4.51
Polygon parlors	percent of capacity	0.00	0.00	0.59	1.46	0.26
Carousel parlors	percent of capacity	0.51	0.00	0.00	0.00	0.22
Other parlors	percent of capacity	5.93	4.89	11.66	14.00	7.45
Barns with pipeline	percent of capacity	61.78	53.54	31.69	4.45	48.14
Pail/buckets	percent of capacity	21.90	1.35	0.00	0.00	9.78
Automatic takeoffs	percent of farms	2.01	15.39	52.63	81.24	12.54
Udder washer	percent of farms	0.03	1.26	10.87	70.69	3.26
Computerized milking systems	percent of farms	0.24	2.83	3.38	13.84	1.60
Computerized feeding systems	percent of farms	2.08	14.91	10.31	1.26	6.30
Diversification						
Corn	acres harvested per farm	44	88	165	140	70
Barley	acres harvested per farm	2	2	2	3	2
Hay	acres harvested per farm	54	104	116	103	75
Oats	acres harvested per farm	8	11	13	2	9
Sorghum/milo	acres harvested per farm	0	2	1	15	1
Soybeans	acres harvested per farm	8	6	19	15	8
Wheat	acres harvested per farm	2	3	6	10	3
Other crops	acres harvested per farm	24	52	110	67	41
Replacement heifers sold	number per farm	1	2	11	11	3
Replacement heifers purchased	number per farm	0	1	5	64	3
Calves sold	number per farm	10	22	45	257	23
Milk cows sold	number per farm	0	1	4	27	2
Bulls sold	number per farm	0	1	1	21	1

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

**Appendix table 3—Efficiency and productivity of specialized dairy farms, by region, 1993**

Item	Unit	Corn Belt	Northeast	Pacific	Southeast	Southern Plains	Upper Midwest	U. S.
Per cow								
Milk production	pounds	14,876	16,085	17,462	14,531	14,452	15,570	15,964
Value of milk sold	dollars	182,427	205,649	202,029	213,400	190,507	195,955	198,437
Total labor used	hours	85	80	23	41	45	76	62
Hired	hours	18	20	13	33	20	18	18
Unpaid	hours	67	60	11	8	25	58	44
Operator	hours	44	35	8	6	18	39	29
Other	hours	23	25	3	2	6	19	15
Total feed fed	pounds	26,877	32,065	27,247	24,561	19,730	33,204	29,740
Homegrown	pounds	20,716	26,054	6,196	6,671	3,638	27,890	19,221
Purchased	pounds	6,160	6,011	21,050	17,890	16,091	5,314	10,519
Machinery investment	dollars	1,673	1,400	266	538	702	1,880	1,242
Total investment	dollars	8,250	9,307	2,944	4,437	3,609	8,590	6,882
Per cwt of milk sold								
Value milk sold	dollars	12.87	13.33	11.74	14.98	13.30	12.89	12.77
Total labor used	hours	0.60	0.52	0.14	0.29	0.31	0.50	0.40
Hired	hours	0.13	0.13	0.07	0.23	0.14	0.12	0.11
Unpaid	hours	0.47	0.39	0.06	0.05	0.17	0.38	0.28
Operator	hours	0.31	0.23	0.04	0.04	0.13	0.26	0.18
Other	hours	0.16	0.16	0.02	0.01	0.04	0.12	0.10
Total feed fed	pounds	189.65	207.90	158.29	172.45	137.74	218.47	191.38
Homegrown	pounds	146.18	168.92	36.00	46.84	25.40	183.51	123.69
Purchased	pounds	43.47	38.97	122.29	125.61	112.34	34.97	67.69
Machinery investment	dollars	11.80	9.08	1.55	3.78	4.90	12.37	7.99
Total investment	dollars	58.22	60.34	17.11	31.15	25.19	56.52	44.29

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

**Appendix table 4—Efficiency and productivity of specialized dairy farms, by herd size, 1993**

Item	Unit	Fewer than 60 cows	60-119 cows	120-299 cows	300 cows or more	U.S.
Per cow						
Milk production	pounds	14,885	15,065	16,842	17,263	15,964
Value of milk sold	dollars	188,712	188,532	210,489	208,855	198,437
Total labor used	hours	108	65	49	22	62
Hired	hours	11	21	22	18	18
Unpaid	hours	97	44	27	4	44
Operator	hours	62	31	15	3	29
Other	hours	35	13	12	1	15
Total feed fed	pounds	30,146	31,253	30,302	27,456	29,740
Homegrown	pounds	24,896	25,088	19,936	7,378	19,221
Purchased	pounds	5,250	6,165	10,366	20,078	10,519
Machinery investment	dollars	1,846	1,626	1,186	311	1,242
Total investment	dollars	10,279	7,526	6,788	2,966	6,882
Per cwt of milk sold						
Value of milk sold	dollars	13.04	13.01	12.91	12.25	12.77
Total labor used	hours	0.75	0.45	0.30	0.13	0.40
Hired	hours	0.08	0.14	0.14	0.11	0.11
Unpaid	hours	0.67	0.30	0.17	0.03	0.28
Operator	hours	0.43	0.21	0.09	0.02	0.18
Other	hours	0.24	0.09	0.07	0.01	0.10
Total feed fed	pounds	208.30	215.60	185.90	161.00	191.38
Homegrown	pounds	172.02	173.07	122.31	43.26	123.69
Purchased	pounds	36.28	42.53	63.59	117.74	67.69
Machinery investment	dollars	12.76	11.22	7.28	1.82	7.99
Total investment	dollars	71.02	51.92	41.65	17.39	44.29

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

**Appendix table 5—Balance sheet for specialized dairy farms, 1993-96**

Item	1993	1994	1995	1996
Number of farms	125,408	115,271	107,458	96,823
	<i>Dollars per farm</i>			
Farm assets	608,031	621,344	646,219	718,328
Current assets	79,689	92,952	96,900	97,814
Livestock inventory	26,764	25,501	28,996	33,165
Crop inventory	20,307	23,621	31,706	28,294
Purchased inputs	7,583	9,717	3,519	6,833
Cash invested in growing crops	480	630	704	808
Prepaid insurance	740	840	821	919
Other assets	23,815	32,642	31,155	27,796
Non-current assets	528,342	528,392	549,318	620,515
Investment in cooperatives	2,324	3,154	2,107	5,773
Land and buildings	350,366	321,278	356,180	406,160
Operators dwelling	45,459	44,703	48,199	54,646
Farm equipment	88,618	99,427	94,246	109,426
Breeding animals	87,034	104,532	96,785	99,156
Farm liabilities	115,878	126,449	137,349	146,181
Current liabilities	31,924	35,236	47,939	46,310
Notes payable within one year	13,349	13,223	27,992	25,274
Current portion of term debt	12,634	15,525	13,245	14,144
Accrued interest	3,298	3,599	3,919	4,179
Accounts payable	2,642	2,888	2,782	2,713
Noncurrent liabilities	83,954	91,214	89,410	99,871
Nonreal estate	23,563	32,999	24,228	24,386
Real estate	60,391	58,215	65,182	75,485
Farm equity	492,152	494,894	508,870	572,147
Debt/asset ratio	0.19	0.20	0.21	0.20

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA and 1996 Agricultural Resource Management Study, USDA.

**Appendix table 6—Income statement for specialized dairy farms, 1993-96**

Item	1993	1994	1995	1996
Number of farms	125,408	115,271	107,458	96,823
	Dollars per farm			
Farm assets	608,031	621,344	646,219	718,328
Gross cash income	181,464	201,310	226,630	249,376
Livestock sales	166,733	185,207	210,331	233,266
Crop sales (incl. net CCC loans)	5,579	5,718	7,512	7,100
Government payments	4,035	2,784	2,407	2,477
Other farm-related income	5,118	7,601	6,380	6,533
Less: Cash expenses	139,474	160,144	176,506	193,503
Variable	117,918	136,310	150,014	166,271
Livestock purchases	509	843	559	742
Feed	52,598	61,716	70,809	80,773
Other livestock-related	9,127	7,792	9,467	9,017
Seed and plants	2,862	2,983	2,831	3,584
Fertilizer and chemicals	7,112	8,340	8,625	9,787
Labor	14,178	17,410	18,396	20,195
Fuels and oils	4,110	4,801	4,795	5,304
Repairs and maintenance	9,519	11,160	11,420	13,318
Machine-hire and custom work	7,695	7,788	8,277	8,346
Utilities	5,219	5,433	6,027	6,304
Other variable expenses	4,989	8,043	8,808	8,901
Fixed	21,556	23,833	26,492	27,233
Real estate and property taxes	3,391	3,707	3,698	3,982
Interest	9,594	10,718	13,078	13,214
Insurance premiums	2,958	3,358	3,284	3,675
Rent and lease payments	5,613	6,050	6,432	6,362
Equals: Net cash farm income	41,990	41,166	50,124	55,873
Less:				
Depreciation	16,397	20,214	20,716	23,399
Labor, non-cash benefits	726	896	1,216	906
Plus:				
Value of inventory change	4,145	6,113	1,859	3,087
Nonmoney income	5,034	5,134	5,149	6,043
Equals: Net farm income	34,047	31,304	35,200	40,698

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and 1996 Agricultural Resource Management Study, USDA.

**Appendix table 7—Financial ratios for specialized dairy farms, Corn Belt, 1993-96**

Item	1993	1994	1995	1996	t-statistics					
					93-94	93-95	93-96	94-95	94-96	95-96
Liquidity ratios										
Current	2.67	3.41	2.33	2.03	0.64	0.49	0.04	0.90	0.39	0.22
Quick	1.25	1.73	0.74	1.00	0.59	1.30	0.02	1.27	0.69	0.32
Farm business debt										
service coverage	1.55	1.68	1.30	1.06	0.23	0.53	0.04	0.62	1.13	0.52
Debt servicing	0.18	0.17	0.20	0.25	0.26	0.32	0.02	0.53	1.53	1.03
Times interest	2.33	2.11	1.74	0.83	0.12	0.46	0.10	0.18	0.72	0.73
Efficiency ratios										
Gross	0.76	0.76	0.80	0.81	0.04	0.78	0.01	0.68	1.09	0.24
Interest to gross										
cash income	0.05	0.05	0.05	0.07	0.50	0.65	0.01	0.12	1.33	1.23
Asset turnover	0.25	0.23	0.29	0.30	0.45	1.18	0.01	1.75*	1.18	0.08
Debt-burden	0.42	0.39	0.31	0.25	0.18	0.81	0.03	0.45	0.92	0.49
Solvency ratios										
Debt to assets	0.14	0.14	0.19	0.23	0.01	1.41	0.02	1.21	1.68*	0.68
Debt to equity	0.16	0.16	0.24	0.29	0.01	1.37	0.03	1.23	1.51	0.59
Profitability ratios										
Rate of return on assets										
Current income	0.03	0.03	0.03	0.02	0.14	0.02	0.00	0.09	0.42	0.48
Rate of return on equity										
Current income	0.02	0.02	0.01	0.00	0.16	0.24	0.01	0.09	0.70	0.57
Profit margin	0.18	0.18	0.16	0.14	0.08	0.28	0.01	0.27	0.66	0.40
Economic profit margin	-0.01	0.03	0.02	0.00	0.67	0.77	0.00	0.01	0.35	0.37

\* significantly different at the 10-percent level.

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and 1996 Agricultural Resource Management Study, USDA.

**Appendix table 8—Financial ratios for specialized dairy farms, Northeast, 1993-96**

Item	1993	1994	1995	1996	t-statistics					
					93-94	93-95	93-96	94-95	94-96	95-96
Liquidity ratios										
Current	4.04	4.58	na	3.86	0.70	na	0.01	na	0.75	na
Quick	1.43	2.55	na	1.82	2.63**	na	0.03	na	0.71	na
Farm business debt										
service coverage	2.03	1.84	na	1.88	0.80	na	0.01	na	0.11	na
Debt servicing	0.14	0.14	na	0.16	0.07	na	0.01	na	0.82	na
Times interest	2.58	1.47	na	1.19	1.75*	na	0.09	na	0.33	na
Efficiency ratios										
Gross	0.77	0.79	na	0.77	1.19	na	0.00	na	0.59	na
Interest to gross										
cash income	0.05	0.05	na	0.07	0.19	na	0.01	na	0.73	na
Asset turnover	0.23	0.27	na	0.30	1.58	na	0.01	na	0.63	na
Debt-burden	0.38	0.39	na	0.37	0.06	na	0.00	na	0.19	na
Solvency ratios										
Debt to assets	0.14	0.15	na	0.18	0.23	na	0.01	na	0.78	na
Debt to equity	0.16	0.17	na	0.22	0.23	na	0.01	na	0.79	na
Profitability ratios										
Rate of return on assets										
Current income	0.03	0.02	na	0.03	1.22	na	0.00	na	0.29	na
Rate of return on equity										
Current income	0.03	0.01	na	0.01	1.48	na	0.01	na	0.02	na
Profit margin	0.21	0.15	na	0.17	2.24**	na	0.01	na	0.32	na
Economic profit margin	0.03	0.02	na	0.05	0.31	na	0.01	na	0.93	na

na = not available, legal disclosure edit required.

\*significantly different at the 10-percent level.

\*\*significantly different at the 5-percent level.

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and 1996 Agricultural Resource Management Study, USDA.



**Appendix table 9—Financial ratios for specialized dairy farms, Pacific, 1993-96**

Item	1993	1994	1995	1996	t-statistics					
					93-94	93-95	93-96	94-95	94-96	95-96
Liquidity ratios										
Current	2.43	1.08	1.78	1.60	3.19**	1.32	0.05	1.80*	2.13**	0.51
Quick	0.83	0.73	0.62	0.76	0.41	1.06	0.01	0.56	0.14	1.10
Farm business debt service coverage										
Debt servicing	1.30	0.61	0.78	0.80	2.72**	1.95*	0.04	1.03	0.78	0.08
Times interest	0.20	0.29	0.28	0.27	1.79*	1.73*	0.02	0.09	0.26	0.19
	2.89	1.29	0.17	1.47	1.69*	3.23**	0.08	1.61	0.13	0.94
Efficiency ratios										
Gross	0.78	0.88	0.85	0.83	3.03**	2.20**	0.01	0.93	1.32	0.58
Interest to gross cash income										
Asset turnover	0.04	0.05	0.07	0.04	0.98	1.00	0.00	0.71	1.90*	1.18
Debt-burden	0.60	0.54	0.57	0.55	0.87	0.51	0.01	0.44	0.13	0.41
	0.45	0.17	0.31	0.35	3.32**	1.45	0.01	1.99**	2.47**	0.45
Solvency ratios										
Debt to assets	0.29	0.38	0.27	0.27	1.51	0.33	0.00	1.91*	1.90*	0.09
Debt to equity	0.41	0.62	0.38	0.37	1.54	0.32	0.01	1.93*	1.95*	0.09
Profitability ratios										
Rate of return on assets										
Current income	0.06	0.03	0.01	0.02	1.73*	2.57**	0.02	0.87	0.15	0.30
Rate of return on equity										
Current income	0.05	0.00	-0.04	0.00	1.80*	2.69**	0.02	1.20	0.08	0.86
Profit margin	0.18	0.12	0.09	0.11	1.49	2.57**	0.02	1.06	0.23	0.36
Economic profit margin	0.15	0.09	0.06	0.08	1.33	2.56**	0.02	1.07	0.25	0.44

\* significantly different at the 10-percent level.

\*\* significantly different at the 5-percent level.

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and 1996 Agricultural Resource Management Study, USDA.

**Appendix table 10—Financial ratios for specialized dairy farms, Southeast, 1993-96**

Item	1993	1994	1995	1996	t-statistics					
					93-94	93-95	93-96	94-95	94-96	95-96
Liquidity ratios										
Current	3.37	na	2.44	na	na	1.02	na	na	na	na
Quick	1.51	na	0.73	na	na	1.84*	na	na	na	na
Farm business debt service coverage										
Debt servicing	1.83	na	1.13	na	na	1.36	na	na	na	na
Times interest	0.12	na	0.16	na	na	1.11	na	na	na	na
	3.96	na	2.36	na	na	0.87	na	na	na	na
Efficiency ratios										
Gross	0.81	na	0.84	na	na	0.80	na	na	na	na
Interest to gross cash income										
Asset turnover	0.03	na	0.03	na	na	0.89	na	na	na	na
Debt-burden	0.46	na	0.43	na	na	0.33	na	na	na	na
	0.51	na	0.32	na	na	1.32	na	na	na	na
Solvency ratios										
Debt to assets	0.17	na	0.20	na	na	0.80	na	na	na	na
Debt to equity	0.20	na	0.26	na	na	0.80	na	na	na	na
Profitability ratios										
Rate of return on assets										
Current income	0.05	na	0.01	na	na	1.33	na	na	na	na
Rate of return on equity										
Current income	0.04	na	0.00	na	na	1.24	na	na	na	na
Profit margin	0.18	na	0.11	na	na	1.42	na	na	na	na
Economic profit margin	0.13	na	0.05	na	na	1.43	na	na	na	na

na = not available, legal disclosure edit required.

\* significantly different at the 10-percent level.

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and 1996 Agricultural Resource Management Study, USDA.

**Appendix table 11—Financial ratios for specialized dairy farms, Southern Plains, 1993-96**

Item	1993	1994	1995	1996	t-statistics					
					93-94	93-95	93-96	94-95	94-96	95-96
Liquidity ratios										
Current	1.49	na	1.44	1.55	na	0.05	0.01	na	na	0.15
Quick	0.62	na	0.43	0.83	na	0.49	0.03	na	na	1.28
Farm business debt service coverage										
Debt servicing	0.39	na	0.93	1.25	na	1.08	0.14	na	na	0.46
Times interest	0.26	na	0.25	0.21	na	0.34	0.01	na	na	0.33
	3.33	na	0.74	4.06	na	0.57	0.04	na	na	1.22
Efficiency ratios										
Gross	0.93	na	0.82	0.77	na	1.75*	0.02	na	na	0.94
Interest to gross cash income										
Asset turnover	0.04	na	0.04	0.04	na	1.27	0.00	na	na	0.16
Debt-burden	0.35	na	0.60	0.48	na	1.95*	0.02	na	na	0.89
	0.05	na	0.44	0.57	na	1.80*	0.25	na	na	0.47
Solvency ratios										
Debt to assets	0.52	na	0.25	0.20	na	2.34**	0.04	na	na	0.61
Debt to equity	1.09	na	0.33	0.25	na	3.05**	0.08	na	na	0.61
Profitability ratios										
Rate of return on assets										
Current income	0.03	na	0.01	0.05	na	0.36	0.01	na	na	1.05
Rate of return on equity										
Current income	0.04	na	-0.03	0.05	na	0.69	0.00	na	na	1.35
Profit margin	0.17	na	0.08	0.18	na	0.53	0.13	na	na	0.60
Economic profit margin	0.12	na	0.04	0.14	na	0.49	0.30	na	na	1.02

na = not available, legal disclosure edit required.

\*significantly different at the 10-percent level.

\*\*significantly different at the 5-percent level.

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and 1996 Agricultural Resource Management Study, USDA.

**Appendix table 12—Financial ratios for specialized dairy farms, Upper Midwest, 1993-96**

Item	1993	1994	1995	1996	t-statistics					
					93-94	93-95	93-96	94-95	94-96	95-96
Liquidity ratios										
Current	2.33	3.00	2.11	1.91	1.57	0.69	0.03	2.12**	2.45**	0.57
Quick	0.95	1.10	0.66	0.48	0.65	1.66*	0.05	2.16**	3.28**	1.45
Farm business debt service coverage										
Debt servicing	1.58	1.59	1.32	1.42	0.05	1.49	0.01	1.29	0.66	0.43
Times interest	0.21	0.21	0.25	0.23	0.05	1.77*	0.00	1.52	0.52	0.63
	1.47	1.61	1.90	1.67	0.25	0.85	0.02	0.48	0.07	0.29
Efficiency ratios										
Gross	0.74	0.73	0.73	0.73	0.31	0.30	0.00	0.06	0.00	0.04
Interest to gross cash income										
Asset turnover	0.07	0.07	0.07	0.06	0.32	0.19	0.00	0.15	0.53	0.60
Debt-burden	0.26	0.27	0.29	0.31	0.54	1.74*	0.01	0.85	0.44	0.24
	0.36	0.35	0.34	0.40	0.20	0.33	0.01	0.11	0.25	0.28
Solvency ratios										
Debt to assets	0.19	0.21	0.23	0.20	0.67	1.49	0.00	0.56	0.35	0.87
Debt to equity	0.24	0.27	0.30	0.25	0.65	1.47	0.00	0.55	0.36	0.96
Profitability ratios										
Rate of return on assets										
Current income	0.04	0.04	0.05	0.05	0.25	1.23	0.00	0.72	0.09	0.29
Rate of return on equity										
Current income	0.02	0.03	0.03	0.02	0.29	1.11	0.00	0.61	0.31	0.74
Profit margin	0.20	0.20	0.22	0.18	0.12	0.81	0.00	0.52	0.55	1.08
Economic margin profits	0.05	0.08	0.11	0.06	0.87	2.25**	0.00	0.89	0.47	1.45

\* significantly different at the 10-percent level.

\*\* significantly different at the 5-percent level.

Source: Compiled by Economic Research Service from 1993-95 Farm Costs and Returns Surveys, USDA, and 1996 Agricultural Resource Management Study, USDA.

**Appendix table 13—Common size income statement for specialized dairy farms, by region, 1993**

Item	Corn Belt	Northeast	Pacific	Southeast	Southern Plains	Upper Midwest	U. S.
	Percent						
Sales	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Livestock	95.91	98.08	99.72	99.32	98.62	97.04	97.99
Crop (incl. net CCC loans)	4.09	1.92	0.28	0.68	1.38	2.96	2.01
Cash expenses	80.28	78.08	79.71	86.65	78.38	83.65	81.04
Variable	68.11	66.28	70.95	79.61	72.10	66.02	68.45
Livestock purchases	0.85	0.45	0.00	0.48	0.18	0.19	0.28
Feed	26.66	24.47	46.06	44.17	45.79	22.12	31.26
Other livestock-related	6.30	7.53	5.09	6.43	4.25	7.31	6.50
Seed and plants	2.22	1.84	0.27	0.39	0.78	2.86	1.71
Fertilizer and chemicals	6.10	4.69	0.66	1.98	1.35	5.87	3.95
Labor	6.19	8.06	8.39	13.01	6.91	7.89	8.06
Fuels and oils	3.01	2.63	0.76	1.06	1.22	3.13	2.23
Repairs and maintenance	7.06	6.83	2.30	3.94	3.00	7.70	5.69
Machine-hire and custom work	4.06	4.56	3.79	4.56	5.10	2.70	3.70
Utilities	2.84	3.27	2.41	1.68	2.54	3.28	2.90
Other variable expenses	2.82	1.97	1.22	1.91	0.99	2.98	2.17
Fixed	12.17	11.79	8.76	7.03	6.28	17.62	12.58
Real estate and property taxes	1.47	2.87	0.74	1.26	0.44	3.43	2.19
Interest	5.14	5.04	4.49	3.57	3.82	7.87	5.75
Insurance premiums	1.67	1.96	0.77	1.59	0.64	2.40	1.70
Rent and lease payments	3.89	1.92	2.77	0.61	1.38	3.92	2.95
Net cash farm income	26.29	25.93	23.06	16.32	22.45	23.31	23.75
Depreciation	12.24	10.68	7.57	6.51	8.50	12.31	10.32
Labor, non-cash benefits	0.40	0.49	0.29	0.92	0.94	0.23	0.38
Value of inventory change	0.71	3.23	1.05	9.52	1.66	0.21	1.59
Nonmoney income	4.23	3.94	0.79	0.62	1.12	3.61	2.78
Net farm income	18.60	21.94	17.03	19.02	15.80	14.58	17.42

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

**Appendix table 14—Common size income statement for specialized dairy farms, by region, 1996**

Item	Corn Belt	Northeast	Pacific	Southeast	Southern Plains	Upper Midwest	U. S.
	Percent						
Sales	100.00	100.00	100.00	na	100.00	100.00	100.00
Livestock	93.22	98.02	98.29	na	99.85	95.22	97.55
Crop (incl. net CCC loans)	6.78	1.98	1.71	na	0.15	4.78	2.45
Cash expenses	84.71	80.31	84.57	na	84.35	78.35	81.27
Variable	72.96	68.61	76.41	na	77.36	64.06	72.00
Livestock purchases	0.01	0.65	0.42	na	0.17	0.21	0.62
Feed	29.43	28.27	48.86	na	47.99	21.29	37.66
Other livestock-related	5.11	5.38	3.14	na	1.99	5.22	3.89
Seed and plants	2.37	1.62	0.41	na	0.46	2.44	1.07
Fertilizer and chemicals	6.70	4.40	1.34	na	2.81	6.49	3.17
Labor	8.97	11.02	9.92	na	10.08	9.19	10.26
Fuels and oils	2.48	2.28	0.96	na	1.57	2.71	1.70
Repairs and maintenance	6.23	6.01	3.07	na	2.88	7.30	4.59
Machine-hire and custom work	5.31	3.02	3.18	na	4.31	2.61	3.49
Utilities	2.23	2.50	2.78	na	2.58	2.54	2.42
Other variable expenses	4.12	3.45	2.33	na	2.49	4.08	3.14
Fixed	11.75	11.71	8.16	na	7.00	14.29	9.27
Real estate and property taxes	1.32	1.91	0.59	na	0.62	1.87	1.01
Interest	5.47	5.76	3.96	na	4.30	6.81	4.50
Insurance premiums	1.38	1.59	1.31	na	1.01	1.86	1.31
Rent and lease payments	3.57	2.44	2.30	na	1.07	3.74	2.45
Net cash farm income	19.21	22.92	18.61	na	18.63	26.55	21.94
Depreciation	10.53	10.88	7.14	na	6.31	12.05	8.52
Labor, non-cash benefits	0.63	0.53	0.52	na	0.51	0.23	0.44
Value of inventory change	-0.77	2.53	1.43	na	-1.01	0.69	1.55
Nonmoney income	2.97	2.05	0.63	na	0.77	2.46	1.27
Net farm income	10.25	16.10	13.01	na	11.58	17.41	15.80

na = not available, legal disclosure edit required.

Source: Compiled by Economic Research Service from 1996 Agricultural Resource Management Study, USDA.

**Appendix table 15—Common size balance sheet for specialized dairy farms, by region, 1993**

Item	Corn Belt	Northeast	Pacific	Southeast	Southern Plains	Upper Midwest	U. S.
	Percent						
Farm assets	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Current assets	10.86	10.46	24.60	18.50	9.06	10.60	12.52
Livestock inventory	2.11	2.68	9.48	8.96	1.19	2.63	3.57
Crop inventory	4.01	3.62	5.16	2.15	2.01	4.05	3.96
Purchased inputs	0.79	0.94	2.57	1.35	1.12	0.95	1.14
Cash invested in growing crops	0.03	0.12	0.14	0.12	0.02	0.05	0.08
Prepaid insurance	0.10	0.11	0.12	0.17	0.09	0.15	0.12
Other assets	3.82	3.00	7.12	5.75	4.64	2.78	3.65
Non-current assets	89.14	89.54	75.40	81.50	90.94	89.40	87.48
Investment in cooperatives	0.00	0.00	0.01	0.00	0.01	0.00	0.00
Land and buildings	57.01	64.47	36.70	52.37	43.37	55.29	55.38
Operator's dwelling	9.97	7.65	4.79	2.86	7.19	7.53	7.40
Farm equipment	18.07	13.47	6.81	9.88	17.68	19.56	15.78
Breeding animals	13.98	11.15	30.99	18.75	29.31	14.21	15.90
Farm liabilities	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Current liabilities	27.95	19.82	37.27	28.09	25.45	22.83	26.02
Notes payable within one year	12.24	2.13	18.59	10.21	7.98	6.59	8.97
Current portion of term debt	10.47	12.15	13.85	13.11	13.33	10.74	11.76
Accrued interest	2.84	2.83	2.86	2.86	2.88	2.84	2.84
Accounts payable	2.40	2.70	1.97	1.92	1.26	2.67	2.44
Noncurrent liabilities	72.05	80.18	62.73	71.91	74.55	77.17	73.98
Nonreal estate	18.69	22.84	35.73	29.59	29.61	18.06	23.35
Real estate	53.36	57.35	27.00	42.32	44.94	59.11	50.63

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

**Appendix table 16—Common size balance sheet for specialized dairy farms, by region, 1996**

Item	Corn Belt	Northeast	Pacific	Southeast	Southern Plains	Upper Midwest	U. S.
				Percent			
Farm assets	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Current assets	14.82	15.84	21.94	na	19.13	13.86	16.47
Livestock inventory	1.42	3.63	9.30	na	6.84	3.59	5.62
Crop inventory	4.84	5.48	2.95	na	2.03	6.24	4.14
Purchased inputs	0.70	0.72	2.49	na	0.59	1.30	1.46
Cash invested in growing crops	0.16	0.08	0.11	na	0.16	0.15	0.12
Prepaid insurance	0.09	0.15	0.19	na	0.11	0.15	0.15
Other assets	7.61	5.78	6.89	na	9.40	2.44	4.97
Non-current assets	85.18	84.16	78.06	na	80.87	86.14	83.53
Investment in cooperatives	0.00	0.01	0.01	na	0.01	0.01	0.01
Land and buildings	55.59	53.30	48.11	na	49.81	51.94	51.76
Operators dwelling	6.16	5.47	3.01	na	3.25	6.90	4.81
Farm equipment	15.05	15.26	7.12	na	11.77	18.60	12.90
Breeding animals	14.12	14.77	21.50	na	18.68	14.38	17.91
Farm liabilities	100.00	100.00	100.00	na	100.00	100.00	100.00
Current liabilities	25.21	22.01	49.79	na	50.43	28.95	36.42
Notes payable within one year	11.53	6.45	36.70	na	37.17	13.82	22.16
Current portion of term debt	8.89	10.88	8.57	na	9.45	10.53	9.62
Accrued interest	2.86	2.86	2.86	na	2.89	2.86	2.86
Accounts payable	1.94	1.82	1.66	na	0.92	1.73	1.79
Noncurrent liabilities	74.79	77.99	50.21	na	49.57	71.05	63.58
Nonreal estate	11.26	18.38	18.28	na	22.08	19.28	18.05
Real estate	63.52	59.61	31.93	na	27.50	51.77	45.53

na = not available, legal disclosure edit required.

Source: Compiled by Economic Research Service from 1996 Agricultural Resource Management Study, USDA.

**Appendix table 17—Use of marketing, financial, and production strategies for specialized dairy farms, by size of farm, 1993 1/**

Item	Economic size of farm				
	\$50,000- \$99,999	\$100,000- \$249,999	\$250,000 \$499,999	\$500,000 and over	All farms
<b>Production strategies</b>					
Number of farms	19,988	30,087	9,890	5,548	79,528
Percent of farms	67.88	61.95	76.83	71.49	61.85
For those using production strategies, percent that used:					
Stable income	29.68	18.05	27.29	18.12	22.08
Diversification	18.70	8.57	36.56	13.11	14.65
Custom/contract inputs	10.77	17.33	2.11	10.28	10.20
Insurance	10.37	22.86	17.99	6.92	17.70
Government programs	20.77	30.48	42.62	36.14	27.55
Leased livestock	0.83	1.00	0.00	5.08	1.03
Leased land	19.65	26.87	25.56	35.22	23.46
Share rent land	7.68	3.75	1.30	0.46	4.04
Leased equipment	4.44	4.62	0.37	3.58	3.00
Nonfarm use of land	0.00	0.50	0.00	0.00	0.84
Other	22.95	10.50	19.43	16.11	13.68
<b>Financial strategies</b>					
Number of farms	14,811	34,108	10,336	6,000	72,108
Percent of farms	50.30	70.23	80.30	77.31	65.50
For those using financial strategies, percent that used:					
Open credit lines	19.83	38.24	61.88	50.51	31.61
Maintain equity in cash	19.60	49.35	32.31	56.63	31.05
Match loan maturity with sales	15.58	12.49	41.40	30.76	14.40
Renegotiated loans	14.37	20.71	34.43	26.11	17.12
Other	18.38	11.47	8.55	0.98	11.71
<b>Marketing strategies</b>					
Number of farms	16,795	29,532	8,651	5,239	67,529
Percent of farms	57.03	60.81	67.21	67.50	52.26
For those using marketing strategies, percent that used:					
Hedging	0.00	0.62	8.14	1.97	1.81
Contract sale of product	15.42	15.99	5.14	30.77	12.53
Spread sales	43.57	39.89	57.42	47.96	38.53
Contract sales	14.33	24.28	24.91	50.07	17.88
Other	30.08	21.44	34.00	16.54	20.25

1/ Legal disclosure edit required for economic size of less than \$50,000 in gross farm income.

Source: Compiled by Economic Research Service from 1993 Farm Costs and Returns Survey, USDA

**Appendix table 18—Use of marketing, financial, and production strategies for specialized dairy farms, by size of farm, Corn Belt, 1993**

Item	Economic size of farm				
	\$50,000- \$99,999	\$100,000- \$249,999	\$250,000 \$499,999	\$500,000 and over	All farms
<b>Production strategies</b>					
Number of farms	5,070	1,997	511	173	7,750
Percent of farms	55.22	49.75	46.79	100.00	45.22
For those using production strategies, percent that used:					
Stable income	28.12	36.63	0.00	0.00	23.64
Diversification	0.00	8.38	46.79	32.47	5.27
Custom/contract inputs	14.70	0.00	0.00	0.00	7.88
Insurance	3.48	25.35	44.61	0.00	10.64
Government programs	33.89	2.90	44.61	100.00	22.68
Leased livestock	2.30	0.00	0.00	0.00	1.23
Leased land	12.39	13.14	0.00	32.47	10.04
Share rent land	24.64	0.00	0.00	0.00	13.20
Leased equipment	0.00	0.00	0.00	0.00	0.00
Nonfarm use of land	0.00	0.00	0.00	0.00	0.00
Other	17.84	28.23	0.00	25.18	16.42
<b>Financial strategies</b>					
Number of farms	5,070	2,675	604	173	8,522
Percent of farms	55.22	66.63	55.39	100.00	49.72
For those using financial strategies, percent that used:					
Open credit lines	15.88	30.21	53.21	100.00	19.98
Maintain equity in cash	5.78	42.43	25.67	32.47	15.00
Match loan maturity with sales	27.10	29.90	30.66	0.00	23.47
Renegotiated loans	3.48	36.41	0.00	0.00	10.39
Other	39.34	15.11	0.00	0.00	24.61
<b>Marketing strategies</b>					
Number of farms	7,888	1,820	811	130	10,649
Percent of farms	85.92	45.32	74.33	74.82	62.13
For those using marketing strategies, percent that used:					
Hedging	0.00	0.00	0.00	0.00	0.00
Contract sale of product	30.70	36.63	0.00	74.82	25.78
Spread sales	55.22	30.21	74.33	32.47	41.71
Contract sales	0.84	8.38	44.61	42.35	5.68
Other	41.64	23.81	27.54	32.47	29.96

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

**Appendix table 19—Use of marketing, financial, and production strategies for specialized dairy farms, by size of farm, Northeast, 1993**

Item	Economic size of farm				
	\$50,000- \$99,999	\$100,000- \$249,999	\$250,000 \$499,999	\$500,000 and over	All farms
<b>Production strategies</b>					
Number of farms	4,720	8,095	1,099	1,017	18,464
Percent of farms	67.96	83.82	69.09	94.05	80.00
For those using production strategies, percent that used:					
Stable income	17.60	29.10	0.82	5.95	33.12
Diversification	15.97	14.42	1.18	0.00	26.23
Custom/contract inputs	5.81	30.98	0.00	0.00	14.71
Insurance	4.64	3.59	0.00	0.00	2.90
Government programs	17.60	3.42	0.00	88.11	10.86
Leased livestock	0.00	0.00	0.00	0.00	0.00
Leased land	8.13	65.04	30.09	82.34	35.59
Share rent land	0.00	6.80	0.00	0.00	2.85
Leased equipment	18.82	0.20	0.00	10.06	6.22
Nonfarm use of land	0.00	0.00	0.00	0.00	0.00
Other	18.29	17.39	37.00	2.57	15.45
<b>Financial strategies</b>					
Number of farms	3,763	7,960	1,079	1,017	17,351
Percent of farms	54.17	82.42	67.83	94.05	75.18
For those using financial strategies, percent that used:					
Open credit lines	17.80	51.40	37.73	94.05	49.18
Maintain equity in cash	26.26	71.32	37.73	68.03	43.54
Match loan maturity with sales	4.43	8.29	36.92	67.29	10.50
Renegotiated loans	15.97	16.29	0.82	10.06	12.15
Other	5.81	11.22	30.09	21.74	9.53
<b>Marketing strategies</b>					
Number of farms	1,198	7,360	480	963	13,533
Percent of farms	17.25	76.21	30.18	89.02	58.64
For those using marketing strategies, percent that used:					
Hedging	0.00	0.00	0.00	0.00	0.00
Contract sale of product	4.65	12.47	0.09	0.00	6.62
Spread sales	10.29	60.88	0.00	87.37	47.97
Contract sales	2.85	52.19	0.00	88.11	26.82
Other	6.96	17.85	30.09	6.68	11.95

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



**Appendix table 20—Use of marketing, financial, and production strategies for specialized dairy farms, by size of farm, Pacific, 1993**

Item	Economic size of farm				
	\$50,000- \$99,999	\$100,000- \$249,999	\$250,000 \$499,999	\$500,000 and over	All farms
<b>Production strategies</b>					
Number of farms	0	0	15	1,806	2,347
Percent of farms	0.00	0.00	4.04	67.07	45.76
For those using production strategies, percent that used:					
Stable income	0.00	0.00	0.00	23.63	12.41
Diversification	0.00	0.00	0.00	14.64	7.69
Custom/contract inputs	0.00	0.00	0.00	12.99	17.07
Insurance	0.00	0.00	0.00	0.00	0.00
Government programs	0.00	0.00	0.00	1.72	0.90
Leased livestock	0.00	0.00	0.00	14.64	7.69
Leased land	0.00	0.00	0.00	18.67	20.05
Share rent land	0.00	0.00	0.00	0.00	0.00
Leased equipment	0.00	0.00	0.00	0.00	0.00
Nonfarm use of land	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	4.04	30.46	16.29
<b>Financial strategies</b>					
Number of farms	49	510	172	2,133	2,864
Percent of farms	100.00	34.24	46.30	79.19	55.83
For those using financial strategies, percent that used:					
Open credit lines	100.00	30.51	27.03	57.67	42.05
Maintain equity in cash	100.00	0.00	0.00	53.26	28.92
Match loan maturity with sales	0.00	0.00	19.26	30.59	17.46
Renegotiated loans	0.00	3.74	4.04	47.53	26.34
Other	0.00	0.00	15.84	19.52	11.40
<b>Marketing strategies</b>					
Number of farms	49	355	172	1,187	1,762
Percent of farms	100.00	23.81	46.30	44.06	34.35
For those using marketing strategies, percent that used:					
Hedging	0.00	20.07	0.00	0.87	6.29
Contract sale of product	0.00	3.74	27.03	43.19	25.72
Spread sales	100.00	3.74	31.07	27.63	18.79
Contract sales	0.00	0.00	15.84	39.75	22.02
Other	0.00	0.00	4.04	10.41	5.76

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

**Appendix table 21—Use of marketing, financial, and production strategies for specialized dairy farms, by size of farm, Southeast, 1993**

Item	Economic size of farm				
	\$50,000- \$99,999	\$100,000- \$249,999	\$250,000 \$499,999	\$500,000 and over	All farms
<b>Production strategies</b>					
Number of farms	0	223	74	63	360
Percent of farms	0.00	88.85	50.00	17.26	47.06
For those using production strategies, percent that used:					
Stable income	0.00	43.56	0.00	0.00	14.31
Diversification	0.00	43.56	0.00	0.00	14.31
Custom/contract inputs	0.00	43.56	0.00	0.00	14.31
Insurance	0.00	45.29	0.00	0.00	14.88
Government programs	0.00	45.29	0.00	17.26	23.15
Leased livestock	0.00	100.00	100.00	100.00	100.00
Leased land	0.00	0.00	0.00	17.26	8.27
Share rent land	0.00	100.00	100.00	100.00	100.00
Leased equipment	0.00	0.00	0.00	8.63	4.14
Nonfarm use of land	0.00	100.00	100.00	100.00	100.00
Other	0.00	0.00	50.00	0.00	9.61
<b>Financial strategies</b>					
Number of farms	0	223	147	32	402
Percent of farms	0	88.85	100.00	8.63	52.53
For those using financial strategies, percent that used:					
Open credit lines	0.00	88.85	0.00	8.63	33.32
Maintain equity in cash	0.00	0.00	50.00	0.00	9.61
Match loan maturity with sales	0.00	0.00	50.00	0.00	9.61
Renegotiated loans	0.00	45.29	50.00	8.63	28.62
Other	0.00	100.00	100.00	100.00	100.00
<b>Marketing strategies</b>					
Number of farms	0	223	74	63	361
Percent of farms	0	88.85	50.00	17.26	47.06
For those using marketing strategies, percent that used:					
Hedging	0.00	100.00	100.00	100.00	100.00
Contract sale of product	0.00	43.56	50.00	8.63	28.05
Spread sales	0.00	0.00	50.00	8.63	13.74
Contract sales	0.00	0.00	0.00	8.63	4.14
Other	0.00	88.85	0.00	0.00	29.19

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

**Appendix table 22—Use of marketing, financial, and production strategies for specialized dairy farms, by size of farm, Southern Plains, 1993**

Item	Economic size of farm				
	\$50,000- \$99,999	\$100,000- \$249,999	\$250,000 \$499,999	\$500,000 and over	All farms
<b>Production strategies</b>					
Number of farms	0	307	0	294	602
Percent of farms	0.00	46.31	0.00	80.55	22.46
For those using production strategies, percent that used:					
Stable income	0.00	46.31	0.00	0.00	11.47
Diversification	0.00	0.00	0.00	9.72	1.33
Custom/contract inputs	0.00	0.00	0.00	0.00	0.00
Insurance	0.00	0.00	0.00	0.00	0.00
Government programs	0.00	0.00	0.00	9.72	1.33
Leased livestock	0.00	0.00	0.00	0.00	0.00
Leased land	0.00	46.31	0.00	70.83	21.13
Share rent land	0.00	0.00	0.00	9.72	1.33
Leased equipment	0.00	0.00	0.00	0.00	0.00
Nonfarm use of land	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00
<b>Financial strategies</b>					
Number of farms	0	307	231	107	645
Percent of farms	0	46.31	100.00	29.17	24.07
For those using financial strategies, percent that used:					
Open credit lines	0.00	0.00	100.00	19.45	11.27
Maintain equity in cash	0.00	0.00	100.00	19.45	11.27
Match loan maturity with sales	0.00	0.00	100.00	9.72	9.95
Renegotiated loans	0.00	46.31	0.00	19.45	14.13
Other	0.00	0.00	0.00	0.00	0.00
<b>Marketing strategies</b>					
Number of farms	0	307	0	142	450
Percent of farms	0	46.31	0.00	38.90	16.78
For those using marketing strategies, percent that used:					
Hedging	0.00	0.00	0.00	9.72	1.33
Contract sale of product	0.00	0.00	0.00	29.17	3.98
Spread sales	0.00	46.31	0.00	0.00	11.47
Contract sales	0.00	0.00	0.00	19.45	2.65
Other	0.00	0.00	0.00	0.00	0.00

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

**Appendix table 23- Use of marketing, financial, and production strategies for specialized dairy farms, by size of farm, Upper Midwest, 1993**

Item	Economic size of farm				
	\$50,000- \$99,999	\$100,000- \$249,999	\$250,000 \$499,999	\$500,000 and over	All farms
<b>Production strategies</b>					
Number of farms	7,037	13,075	6,185	1,003	34,324
Percent of farms	83.07	61.12	100.00	91.44	70.07
For those using production strategies, percent that used:					
Stable income	26.53	10.24	26.31	25.68	14.67
Diversification	21.86	7.64	41.51	0.00	12.36
Custom/contract inputs	10.44	22.10	0.00	17.12	11.84
Insurance	28.48	32.04	29.58	46.69	33.74
Government programs	20.49	52.33	68.68	74.32	49.36
Leased livestock	0.00	0.00	0.00	0.00	0.00
Leased land	47.83	16.85	28.33	65.76	30.72
Share rent land	0.00	0.00	1.80	0.00	0.23
Leased equipment	0.00	9.28	0.00	0.00	4.05
Nonfarm use of land	0.00	0.00	0.00	0.00	1.71
Other	14.84	8.04	26.31	8.56	11.30
<b>Financial strategies</b>					
Number of farms	5,437	16,169	6,185	1,003	29,949
Percent of farms	64.18	75.58	100.00	91.44	61.14
For those using financial strategies, percent that used:					
Open credit lines	34.36	45.11	80.95	72.37	37.53
Maintain equity in cash	36.55	48.19	26.50	74.32	34.09
Match loan maturity with sales	19.10	9.46	44.55	17.12	13.44
Renegotiated loans	32.14	21.60	62.39	8.56	25.38
Other	14.84	12.85	6.29	38.13	11.54
<b>Marketing strategies</b>					
Number of farms	4,410	13,831	4,969	1,097	26,857
Percent of farms	52.06	64.65	80.34	100.00	54.83
For those using marketing strategies, percent that used:					
Hedging	0.00	0.00	1.80	8.56	2.13
Contract sale of product	16.50	17.64	6.29	46.69	14.11
Spread sales	44.22	38.80	79.53	44.75	39.13
Contract sales	16.50	22.83	26.31	72.37	17.76
Other	22.02	22.13	45.95	19.07	19.70

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

**Appendix table 24—Characteristics of specialized dairy businesses with low, mid, and high-NFI, 1993**

Item	Unit	Low-NFI businesses	Mid-NFI businesses	High-NFI businesses
Share of FCRS dairy:				
Farms	percent	25	50	25
Milk sales	percent	21	29	50
Operated acres	acres	335	281	416
Milk production value	dollars	128,688	92,417	323,548
Farm production value	dollars	143,860	103,217	361,147
Average milk cow inventory	head	69	49	152
Financial position:				
Favorable	percent of farms	20	87	91
Marginal income	percent of farms	64	0	0
Marginal solvency	percent of farms	1	13	9
Vulnerable	percent of farms	15	0	0
Farm debt-to-asset	ratio	0.17	0.15	0.21
Milk production regions:				
Northeast	percent of farms	21	55	24
Southeast	percent of farms	27	26	47
Upper Midwest	Percent of farms	28	48	24
Corn Belt	percent of farms	24	59	17
Southern Plains	percent of farms	34	23	43
Major occupation:				
Farming	percent of farms	89	96	97
Other	percent of farms	11	4	3
Farm organization:				
Individual	percent of farms	87	88	68
Partnership	percent of farms	12	10	27
Corporations or cooperatives	percent of farms	1	2	5
Operator age:				
Less than 35 years	percent of farms	8	11	9
35 to 49 years	percent of farms	44	44	45
50 to 64 years	percent of farms	35	40	35
65 years or more	percent of farms	13	5	11
Experience in milk production:				
Operator of 1993 operation	years	21	21	22
Work on any operation	years	33	32	32
Operator education:				
Less than high school	percent of farms	27	25	25
Completed high school	percent of farms	48	49	48
Attended college	percent of farms	22	20	14
Completed college	percent of farms	3	6	13

Source: Compiled by Economic Research Service from 1993 Farm Costs and Returns Survey, USDA

**Appendix table 25—Performance and production practices of specialized dairy businesses with low, mid, and high-NFI, 1993**

Item	Unit	Low-NFI businesses	Mid-NFI businesses	High-NFI businesses
Output per cow	pounds	14,984	14,785	17,210
Feed efficiency:				
Concentrates and grains	pounds per cwt of milk sold	56	51	49
Hay and straw	pounds per cwt of milk sold	40	42	33
Silage	pounds per cwt of milk sold	108	112	78
Other	pounds per cwt of milk sold	13	11	7
Total	pounds per cwt of milk sold	217	216	167
Feed efficiency	pounds per cow	31,189	30,935	28,262
Feed ration:				
Roughage	percent	68	71	66
Concentrates	percent	26	24	29
Pasture	percent	1	3	1
Other	percent	5	2	4
Homegrown feed:				
Grain	percent of grain fed	58	75	58
Hay and straw	percent of hay and straw fed	64	84	50
Silage	percent of silage fed	86	97	79
Labor efficiency:				
Paid labor	hours per cwt of milk sold	0.14	0.11	0.11
Unpaid labor	hours per cwt of milk sold	0.31	0.49	0.16
Total	hours per cwt of milk sold	0.45	0.60	0.27
Labor efficiency	hours per cow	64	85	45
Housing facilities:				
Stanchion/tie stall barns	percent of capacity	30	40	14
Loafing barns/loose housing	percent of capacity	20	18	11
Freestall barns	percent of capacity	17	15	20
Calf barns	percent of capacity	15	12	10
Dry lot corrals	percent of capacity	12	10	37
Other	percent of capacity	6	5	8
Milking facilities:				
Herringbone parlors	percent of capacity	27	20	41
Parallel parlors	percent of capacity	6	4	4
Polygon parlors	percent of capacity	0	0	0
Carousel parlors	percent of capacity	0	0	1
Other parlors	percent of capacity	7	7	9
Barns with pipeline	percent of capacity	46	56	41
Pail/buckets	percent of capacity	14	13	4
Times cows milked	times/day	2	2	2
Hours milking system operational	hours	5	4	6
Times milk picked up:				
Once a day	percent of farms	18	17	35
Every other day	percent of farms	82	82	62
More than once a day	percent of farms	0	1	3
Capacity of milk tanks/silos	gallons	865	784	1,649

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