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