

Characteristics of Structural Change in Hog and Milk Production

The remaining sections of this report extend the previous analysis by more closely examining the process of structural change in hog and milk production. Characteristics of hog and dairy operations are compared among the various structural change areas to identify factors causing change and to explore results of this change. The hog and milk production sectors are chosen because of the significant structural and regional shifts observed in these industries during the 1969-92 period, and also because of the availability of a national database with detailed farm-level information on these operations. Data are from a special version of USDA's 1992 Farm Costs and Returns Survey (FCRS) that focused on hog production, and a special version of the 1993 FCRS that focused on milk production. These data include information on farm production practices, operator characteristics, and enterprise production costs.

Hog producers in 20 States,⁸ mainly in the North Central and Southeast regions, were surveyed using

the 1992 FCRS hog questionnaire. Because USDA did not survey using the 1992 FCRS hog questionnaire in every State, the hog data are not available for some counties (fig. 17). For example, States in the West and Northeast were not surveyed with the hog version. However, respondents in the surveyed States represent about 94 percent of 1992 U.S. hog and pig sales (U.S. Dept. of Commerce, *Census of Agriculture*). Milk producers in 15 States,⁹ mainly in the Upper Midwest, Northeast, West, and South, were surveyed using the 1993 FCRS dairy questionnaire. The survey of milk producers was also not conducted in every State; thus, the dairy data are not available for some counties (fig. 18). Respondents in the surveyed States represent about 75 percent of 1993 U.S. milk production (USDA/NASS, 1994) and about 85 percent of the 1993 milk cow inventory (USDA/NASS, 1995).

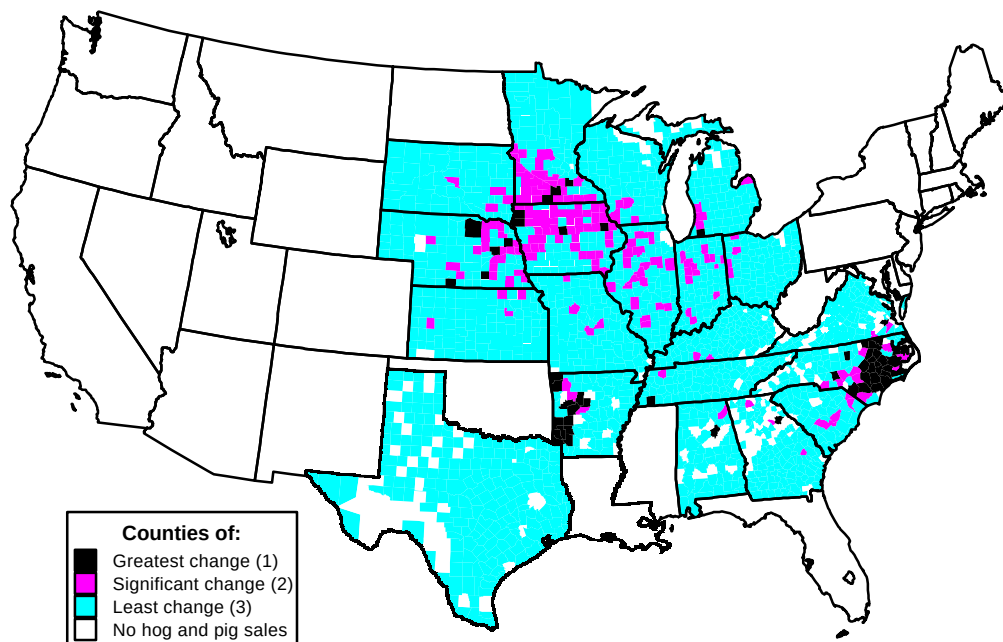
Each farm in the hog and dairy versions of the FCRS is classified into a specific structural change area according to its county of origin. Characteristics of farms in counties of greatest structural change, other counties of significant structural change, and counties of least structural change are compared. These char-

⁸States included in the hog version of the 1992 FCRS were AL, AR, GA, IL, IN, IA, KS, KY, MI, MN, MO, NE, NC, OH, SC, SD, TN, TX, VA, and WI.

⁹States included in the dairy version of the 1993 FCRS were AZ, CA, GA, FL, IA, MI, MN, MO, NY, OH, PA, TX, VT, WA, and WI.

Figure 17

Structural change in hog and pig sales in States included as part of the 1992 FCRS



Source: Compiled by ERS using census of agriculture data and 1992 Farm Costs and Returns Survey data.

acteristics should provide some information about the process and results of change in each area. To facilitate the discussion of structural change areas, farms in those counties with the greatest change (significantly above average, highest quartile) are referred to as being from area 1, while farms in other counties with significant structural change are said to be from area 2. Farms in counties of least structural change are designated as from area 3. The statistical difference of means estimated for producers in each structural change area are tested using a t-statistic (Kmenta, pgs. 137 and 145—see appendix).

Characteristics and Performance of Hog Operations

Farms in area 1 have fewer farm acres but larger hog operations and greater farm sales than producers in other areas (table 5). Average farm acreage in area 1 is about half that in the other areas, while average hog and pig sales/removals are about 2,000 head compared with around 1,000 head in area 2 and less in area 3. Also, significantly more farms in areas 1 and 2 have sales of \$250,000 or more than do farms in

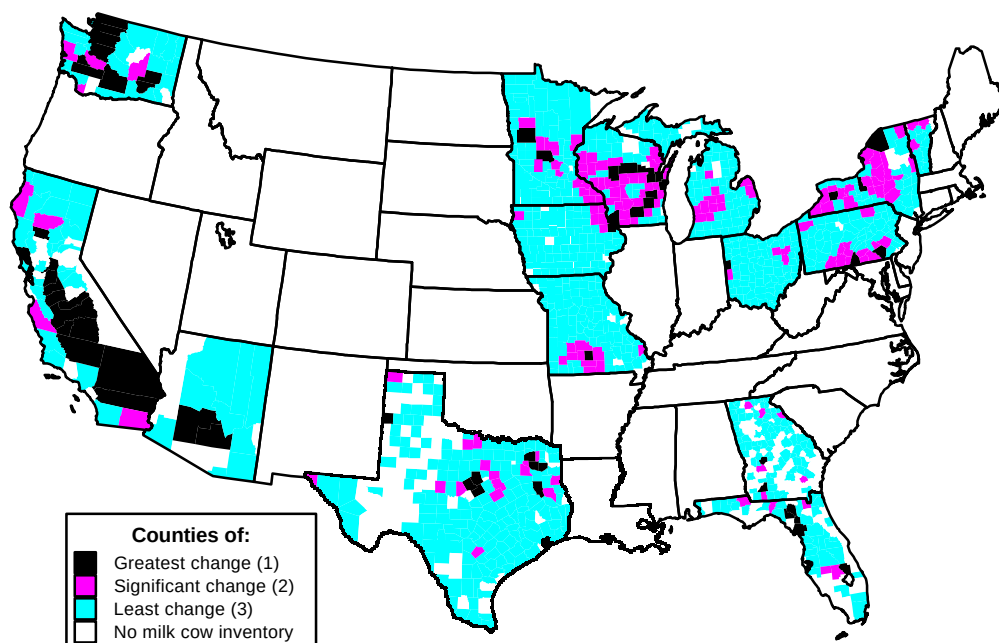
area 3. The larger hog operations in area 1 result from expansion financed through debt as apparent by the significantly higher debt-to-asset ratio of producers in area 1.

Production contract activity is more important in area 1 where contract removals account for 16 percent of total feeder pig and market hog sales/removals. Smaller hog operations in the other areas have only 5 percent or less of total sales and removals from contract removals. Hog producers in area 1 more often sell hogs directly to packing plants. Sixty-seven percent of hogs are marketed directly to packing plants, compared with 40 percent or less in other areas. More packer direct marketing suggests that producers in these counties may be in a closer proximity to packing plants, have marketing arrangements to provide a constant uniform supply and quality to packers, and/or have lower per-unit marketing costs due to greater production that can be hauled a longer distance to the packing plant.

Producers in area 1 are also more likely to specialize in split-phase production, especially finishing feeder

Figure 18

Structural change in the milk cow inventory in States included as part of the 1993 FCRS



Source: Compiled by ERS using census of agriculture data and 1993 Farm Costs and Returns Survey data.

Table 5—Characteristics of FCRS hog farms in each structural change area

Item	Unit	Counties of greatest structural change (area 1)	Other counties of significant structural change (area 2)	Counties of least structural change (area 3)
Share of FCRS hog:				
Farms	Percent	8	30	63
Sales or contract removals	Percent	14	34	52
Acreage operated	Acres	273	516	597
t-stat (area 1)		-	(4.45**)	(5.92**)
t-stat (area 2)		-	-	(1.67*)
Sales class:				
\$250,000 or more	Percent of farms	34	27	18
t-stat (area 1)		-	(0.79)	(1.86*)
t-stat (area 2)		-	-	(2.23**)
Debt-to-asset ratio	Ratio	0.24	0.18	0.15
t-stat (area 1)		-	(1.72*)	(1.85*)
t-stat (area 2)		-	-	(1.42)
Hog and pig sales and removals	Head	1,997	1,134	726
t-stat (area 1)		-	(1.84*)	(2.25**)
t-stat (area 2)		-	-	(2.99**)
Hog and pig contract removals	Percent of sales and removals	16	5	2
t-stat (area 1)		-	(3.39**)	(5.75**)
t-stat (area 2)		-	-	(1.90*)
Hog sales directly to packer	Percent of sales and removals	67	40	34
t-stat (area 1)		-	(1.80*)	(2.25**)
t-stat (area 2)		-	-	(0.78)

**significantly different at the 5-percent level; *significantly different at the 10-percent level.

Source: Compiled by ERS using 1992 Farm Costs and Returns Survey data.

pigs, than are producers in other areas (fig. 19). A third of producers have specialized feeder pig-to-finish¹⁰ operations compared with little more than 20 percent in other areas. A majority of producers in other areas produce hogs in farrow-to-finish operations. Finishing hogs under contract appears to be a common strategy for increasing the size of operation in area 1.

Farrow-to-Finish Operations

To compare input, output, and cost efficiency among hog producers in the structural change areas, farrow-to-finish producers are separated from other producer types. Farrow-to-finish production is most common and, unlike other types of producers, involves the entire hog production process. Because these operations produce a common output, a 200-to-250-pound

market hog, measures of efficiency can be compared among these producers.

Farrow-to-finish producers in both areas 1 and 2 have larger hog operations than in area 3, with about 200-400 head more sales and removals (table 6).

Operations in areas 1 and 2 also produce more pigs per litter. More than 7 pigs are sold or removed per litter on operations in areas 1 and 2, compared with only about 6.5 pigs in area 3.

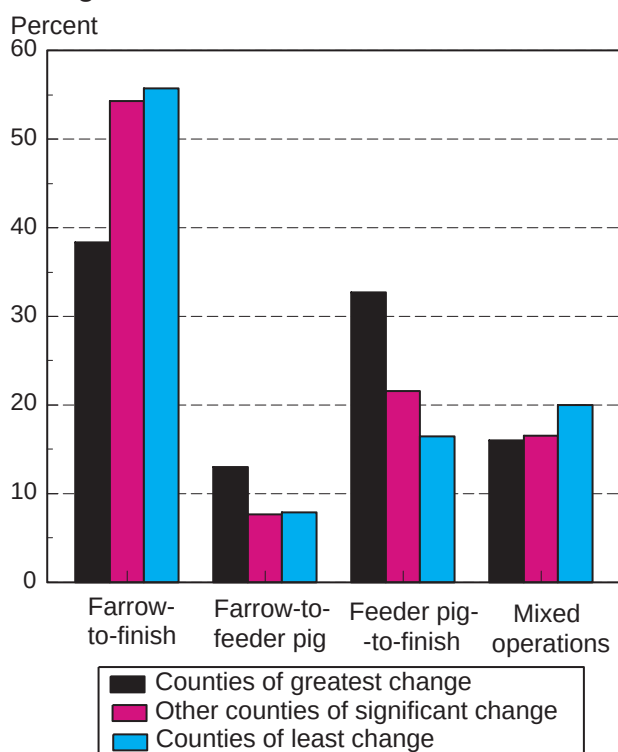
Death rates from weaning to market are lower among farrow-to-finish producers in area 1 (3.8 vs 4.4 percent). Likewise, feed efficiency is better in area 1 (table 7). Producers feed 379 pounds per cwt gain, significantly lower than the 395 and 433 pounds fed in areas 2 and 3. Labor efficiency is much the same in areas 1 and 2, but is significantly better than in area 3. Hog operations in both areas 1 and 2 use about 30 percent less labor than in area 3.

Feed and labor efficiency, weaning performance, and death rates are likely related to the facility types and

¹⁰Specialized feeder pig-to-finish operations are defined as farms on which more than 75 percent of the pigs came from feeder pig purchases or contract placements and more than 75 percent of hogs and pigs left the operation through market hog sales or removals (see McBride, 1995 for detail on the definition of each producer type).

Figure 19

Distribution of hog producer types by structural change area



Source: Compiled by ERS using Farm Costs and Returns Survey data.

facility ages that characterize each area. More of the hog building capacity on farrow-to-finish operations in area 1 is in total confinement, environmentally controlled structures that ease animal stress and improve performance. Also, newer buildings in this area suggest that more advanced hog production management practices are used. In other areas, fewer of the facilities are total confinement and more older buildings suggest that less advanced management practices are used.

Despite the greater feed efficiency achieved by producers in area 1, feed costs are not significantly lower (table 8). Higher feed prices due to lower feedgrain production in these counties likely raised feed costs and offset the technical advantage. Other production costs of farrow-to-finish producers in each area are also much the same. Neither cash nor economic costs are significantly different among producers in each of the structural change areas.

Characteristics and Performance of Dairy Operations

Average farm acreage does not vary by structural change area, but dairy operations in area 1 milk more cows and have higher farm sales than producers in

other counties (table 9). The average milk cow inventory in area 1 (140 cows) is nearly three times that in the other areas. Significantly more farms in area 1 have sales of \$250,000 or more than in areas 2 and 3. As with hogs, larger dairy operations in area 1 result from expansion financed through debt, as reflected in the significantly higher debt-to-asset ratio.

Per cow milk production is significantly higher in area 1. Milk production is nearly 17,000 pounds per cow in these counties compared with around 15,000 pounds in the other counties. Producers in area 1 are also more feed and labor efficient than producers in areas 2 and 3 (table 10). Dairy operations in area 1 use almost 30 percent less feed and only half the labor per cwt of milk sold as used in the other areas. Also, much more of the feedgrain and forage fed in area 1 is purchased, rather than produced on-farm as in the other areas. Given the location of counties in area 1, it is likely that much of the feedgrain and forage fed is produced outside and imported for use on the dairy operations. Dairy operations in many Western and Southwestern counties are designed to be highly specialized in milk production and rely on grain and forage produced elsewhere. In contrast, operations in the Upper Midwest and Northeast tend to be diversified and produce much of the grain and forage required for dairy feed.

Milking facilities on dairy operations in area 1 are characterized by a higher degree of technical sophistication. Over half of the milking capacity in area 1 is in parlors compared with less than 30 percent in area 2. A majority of the milking capacity in area 2 is in barns with pipelines to transport milk to a holding tank. The milking capacity in area 3 is more evenly distributed among various technologies, but producers in these counties have significantly more of their milking capacity in lower tech facilities, such as pail or bucket systems. Milking facilities are also used more intensely area 1. Average daily use is about 5.6 hours in area 1, compared with less than 4.5 hours in the other areas.

Producers in area 1 house more of their cattle with less shelter in dry lot corrals than do producers in the other areas. More than half of the cattle housing capacity in area 1 is in dry lot corrals compared with 12 percent or less in the other areas. Dry lot corrals are only feasible in areas with a mild climate, such as in counties of Southern and Western States.

Table 6—Characteristics of FCRS farrow-to-finish hog farms in each structural change area

Item	Unit	Counties of greatest structural change (area 1)	Other counties of significant structural change (area 2)	Counties of least structural change (area 3)
Share of FCRS hog:				
Farms	Percent	5	30	65
Sales or contract removals	Percent	8	33	60
Hog and pig sales and removals	Head	1,201	1,059	781
t-stat (area 1)		-	(0.77)	(2.39**)
t-stat (area 2)		-	-	(2.15**)
Pigs sold/removed per litter	Pigs	7.16	7.28	6.50
t-stat (area 1)		-	(0.27)	(1.67*)
t-stat (area 2)		-	-	(2.71**)
Death loss	Percent of pigs weaned	3.81	4.41	4.40
t-stat (area 1)		-	(2.31**)	(2.10**)
t-stat (area 2)		-	-	(1.39)

**significantly different at the 5-percent level; *significantly different at the 10-percent level.

Source: Compiled by ERS using 1992 Farm Costs and Returns Survey data.

Table 7—Feed, labor, and facility use on FCRS farrow-to-finish hog farms in each structural change area

Item	Unit	Counties of greatest structural change (area 1)	Other counties of significant structural change (area 2)	Counties of least structural change (area 3)
Feed efficiency	Pounds of feed per cwt gain	379	395	433
t-stat (area 1)		-	(1.71**)	(2.27*)
t-stat (area 2)		-	-	(2.01**)
Labor efficiency	Hours worked per cwt gain	0.94	0.98	1.25
t-stat (area 1)		-	(0.37)	(2.92*)
t-stat (area 2)		-	-	(3.03**)
Breeding and gestation facilities:				
Total confinement	Percent of facility capacity	75	32	18
t-stat (area 1)		-	(2.64**)	(4.83**)
t-stat (area 2)		-	-	(0.96)
Average age	Years	12	26	21
t-stat (area 1)		-	(3.54**)	(2.96**)
t-stat (area 2)		-	-	(1.58)
Farrowing facilities:				
Total confinement	Percent of facility capacity	87	63	55
t-stat (area 1)		-	(2.49**)	(3.74**)
t-stat (area 2)		-	-	(1.24)
Average age	Years	13	24	19
t-stat (area 1)		-	(4.22**)	(2.38**)
t-stat (area 2)		-	-	(3.09**)
Finishing facilities:				
Total confinement	Percent of facility capacity	57	37	33
t-stat (area 1)		-	(2.26**)	(2.58**)
t-stat (area 2)		-	-	(0.70)
Average age	Years	13	24	20
t-stat (area 1)		-	(2.58**)	(1.72*)
t-stat (area 2)		-	-	(2.23**)

**significantly different at the 5-percent level; *significantly different at the 10-percent level.

Source: Compiled by ERS using 1992 Farm Costs and Returns Survey data.

Table 8—Production costs of FCRS farrow-to-finish hog farms in each structural change area

Item	Counties of greatest structural change (area 1)	Other counties of significant structural change (area 2)	Counties of least structural change (area 3)
Dollars per cwt gain			
Feed cost	25.82	24.99	25.83
t-stat (area 1)	-	(0.40)	(0.01)
t-stat (area 2)	-	-	(0.59)
Variable cash expenses	31.31	31.84	33.50
t-stat (area 1)	-	(0.25)	(1.08)
t-stat (area 2)	-	-	(1.01)
Fixed cash expenses	3.82	4.00	4.60
t-stat (area 1)	-	(0.35)	(1.52)
t-stat (area 2)	-	-	(1.75*)
Total cash expenses	35.13	35.84	38.09
t-stat (area 1)	-	(0.30)	(1.36)
t-stat (area 2)	-	-	(1.29)
Total economic costs	50.62	51.26	54.54
t-stat (area 1)	-	(0.18)	(1.24)
t-stat (area 2)	-	-	(1.52)

**significantly different at the 5-percent level; *significantly different at the 10-percent level.

Source: Compiled by ERS using 1992 Farm Costs and Returns Survey data.

Table 9—Characteristics of FCRS dairy farms in each structural change area

Item	Unit	Counties of greatest structural change (area 1)	Other counties of significant structural change (area 2)	Counties of least structural change (area 3)
Share of FCRS dairy:				
Farms	Percent	23	45	33
Milk cow inventory	Percent	42	34	24
Acreage operated				
t-stat (area 1)	Acres	290	347	334
t-stat (area 2)		-	(1.62)	(1.23)
		-	-	(0.45)
Sales class:				
\$250,000 or more	Percent of farms	27	9	10
t-stat (area 1)		-	(3.65**)	(3.29**)
t-stat (area 2)		-	-	(0.38)
Debt-to-asset ratio				
t-stat (area 1)	Ratio	0.25	0.15	0.13
t-stat (area 2)		-	(2.08**)	(2.65**)
		-	-	(1.42)
Average milk cow inventory				
t-stat (area 1)	Head	140	59	56
t-stat (area 2)		-	(2.94**)	(3.04**)
		-	-	(0.70)
Output per milk cow				
t-stat (area 1)	Pounds of milk	16,893	14,859	15,556
t-stat (area 2)		-	(3.98**)	(2.66**)
		-	-	(1.44)

**significantly different at the 5-percent level; *significantly different at the 10-percent level.

Source: Compiled by ERS using 1993 Farm Costs and Returns Survey data.

Table 10—Feed, labor, and facility use on FCRS dairy farms in each structural change area

Item	Unit	Counties of greatest structural change (area 1)	Other counties of significant structural change (area 2)	Counties of least structural change (area 3)
Feed efficiency	Pounds of feed	166	219	207
t-stat (area 1)	per cwt of milk sold	-	(5.14**)	(4.23**)
t-stat (area 2)		-	-	(1.10)
Homegrown feed:				
Feedgrain	Percent of	34	82	75
t-stat (area 1)	feedgrains fed	-	(4.75**)	(3.87**)
t-stat (area 2)		-	-	(1.26)
Hay and straw	Percent of	36	88	81
t-stat (area 1)	hay and straw fed	-	(9.18**)	(6.65**)
t-stat (area 2)		-	-	(1.49)
Silage	Percent of	70	97	96
t-stat (area 1)	silage fed	-	(3.40**)	(3.37**)
t-stat (area 2)		-	-	(0.03)
Labor efficiency	Hours worked	0.19	0.39	0.39
t-stat (area 1)	per cwt of milk sold	-	(9.11**)	(8.52**)
t-stat (area 2)		-	-	(0.04)
Milking system use	Hours operated	5.62	4.30	4.45
t-stat (area 1)	per day	-	(2.97**)	(2.57**)
t-stat (area 2)		-	-	(0.72)
Milking facilities:				
Parlors	Percent of	53	29	46
t-stat (area 1)	facility capacity	-	(4.22**)	(1.04)
t-stat (area 2)		-	-	(2.88**)
Barns with pipeline	Percent of	41	61	37
t-stat (area 1)	facility capacity	-	(3.28**)	(0.72)
t-stat (area 2)		-	-	(3.73**)
Pail units/bucket milkers	Percent of	5	10	17
t-stat (area 1)	facility capacity	-	(1.73*)	(3.92**)
t-stat (area 2)		-	-	(2.42**)
Milk cow housing facilities:				
Dry lot corrals	Percent of	54	12	9
t-stat (area 1)	facility capacity	-	(6.36**)	(6.00**)
t-stat (area 2)		-	-	(0.59)

**significantly different at the 5-percent level; *significantly different at the 10-percent level.

Source: Compiled by ERS using 1993 Farm Costs and Returns Survey data.

While feed costs are not significantly different among the structural change areas, most other production costs are significantly lower for producers in area 1 (table 11). As with hogs, lower feed supplies in many of these counties likely contributed to higher feed prices. Thus, higher feed prices appeared to offset the technical advantage of greater feed efficiency in area 1. Variable costs are lower in area 1 mainly due to lower fuel, repair, and hired labor costs. Fixed and economic costs are spread over more units of output on larger dairy operations in area 1. Facility costs are also less in area 1 because of the more temperate climate. In contrast, none of the production costs of producers in area 2 are significantly different than those in area 3.

Characteristics of Structural Change: Conclusions

Hog and dairy farms have many similarities among the structural change areas. First, the areas themselves are similar. Traditional areas of hog and milk production developed largely because of their proximity to abundant feed supplies. Hog production was established in Iowa, Illinois, Indiana, and other North Central States because of substantial corn production in these areas. Milk production was centered in Wisconsin, Minnesota, Pennsylvania, and New York because of feedgrain and forage supplies. However, structural change in hog and milk production during 1969-92 was most often greatest in nontraditional production areas, such as hog production in the South

Table 11—Production costs of FCRS dairy farms in each structural change area

Item	Counties of greatest structural change (area 1)	Other counties of significant structural change (area 2)	Counties of least structural change (area 3)
Dollars per cwt of milk sold			
Feed cost	6.79	7.34	7.04
t-stat (area 1)	-	(1.55)	(0.73)
t-stat (area 2)	-	-	(1.02)
Variable cash expenses	9.99	11.58	11.75
t-stat (area 1)	-	(3.63**)	(4.22**)
t-stat (area 2)	-	-	(0.45)
Fixed cash expenses	1.25	1.69	1.51
t-stat (area 1)	-	(3.55**)	(2.31***)
t-stat (area 2)	-	-	(1.47)
Total cash expenses	11.24	13.27	13.26
t-stat (area 1)	-	(4.28**)	(4.49**)
t-stat (area 2)	-	-	(0.02)
Total economic costs	13.65	17.35	17.63
t-stat (area 1)	-	(5.37**)	(5.91**)
t-stat (area 2)	-	-	(0.48)

**significantly different at the 5-percent level; * significantly different at the 10-percent level.

Source: Compiled by ERS using 1993 Farm Costs and Returns Survey data.

and milk production in the West. Both hog and dairy industries exhibited substantial development in non-traditional areas despite the disadvantage of lower feed supplies, and consequently higher feed prices, than in traditional areas.

Hog and milk production industries have developed in counties of greatest change through larger operations that utilize much newer types of production methods. This technological advantage has improved input and output efficiency among farms in these counties. Labor use per unit of production is lower in counties of greatest change for both hog and milk production. Feed efficiency is also improved in these counties. Hog producers in counties of greatest change produce more pigs per litter and have lower death losses. Dairy operations produce more milk per cow. Improved efficiency and productivity have lowered production costs. Thus, hog producers in these counties can compete with those in traditional areas, while milk producers in these counties have lower costs.

Production contract arrangements are more common for hog production in the counties of greatest change. Hog producers enter into a contract arrangement with a contractor to provide hog production services in exchange for a fee, via a production contract. The contract effectively transfers most, if not all, of the production and price risk from the producer to the contractor. Milk producers most often enter into contractual arrangements with cooperatives or other local buyers to sell milk at a price set according to a predetermined formula, using a marketing contract. These marketing contracts, along with Federal price supports for milk, have protected producers from significant fluctuations in milk prices. Both production and marketing contracts have the effect of reducing the price and income risk faced by producers. With reduced income variability, hog and milk producers can accumulate and invest capital in larger production units with modern facilities.