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Farm Growth, Consolidation, and Diversification: Washington Dairy Industry

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The shrinking number of farms in the United States is well-documented. Between 1974 and 2002, the total number of farms in the United States declined by 21%. While this represented a large drop in the overall number of farms, the number of farms with milk cows declined much more dramatically, falling by 79% during this period (USDA/NASS, 2002). With four times as many milk cows per farm in 2002 than in 1974, it is obvious that the dairy industry has become much more concentrated. Further, the entire decline in number of farms with milk cows occurred in size categories with fewer than 500 cows. The number of farms with 500-999 milk cows grew by 36% and the number with 1,000 or more milk cows more than doubled. Changes in the State of Washington generally followed those of the Nation.

The growth in the number of the largest-sized farms creates the most intrigue for economists and policymakers alike. As one of the last bastions of nearly perfectly competitive production, does this growth in farm size hint at a major change in the historically competitive nature of agricultural commodity supplies? For example, in 2002, more than 30% of milk sales came from just 1.5% of dairy farms. This situation warrants careful attention since adverse environmental effects often accompany increases in farm sizes, particularly for confined animal operations.

While we know that significant changes are occurring in farm size, no one has yet identified which farms are growing or shrinking in size. Nor has anyone documented the extent of commodity diversification on farms of different size. Which farms grow? Do farms in the larger size categories actually grow the most rapidly? Or do medium-sized farms combine with other farms of comparable size to create new large organizations? Do farms in different size categories increase or decrease their levels of diversification over time?

To answer these questions, we examined longitudinal data from the Census of Agriculture in 1992, 1997, and 2002 for dairy farms in Washington. This is an important industry in both the state and Nation. In the United States, dairy products rank second among all agricultural commodities in value of production (USDA/NASS, 2006a). Washington ranks 10th in the nation in milk production and first in milk production per cow, while the value of milk production in the state also ranks it second in importance among all agricultural commodities (USDA/NASS, 2006b). The state's dairy industry is highly concentrated, but geographically divided. More than half the milk cows are located in two counties; Whatcom on the west of the Cascades and Yakima on the east. The demographics are changing with rapid movement of cows to the east side of the Cascades. Cow numbers in Yakima County grew by more than 30% between 1997 and 2002, while those in Whatcom County declined.

Sample Selection and Information Collected

For our analysis, we included all farms for which the owner checked farming as his/her main occupation and for which at least 50% of all agricultural income (not including government payments) came from the sale of milk and dairy products. As a result, 781 farms are included in our sample, representing 65% of all Washington dairies in the 1992 census.[1] We ranked the farms from lowest to highest in terms of agricultural sales and then divided them into 10 equally sized cohorts. In other words, each cohort had the same number of farms in 1992 with the smallest 10% of dairy farms in the state in

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Table 1. 1992 agricultural sales.[a]

Cohort	Range		
1		<	95,000
2	95,000	–	155,000
3	155,000	–	215,000
4	215,000	–	270,000
5	270,000	–	325,000
6	325,000	–	405,000
7	405,000	–	505,000
8	505,000	–	685,000
9	685,000	–	1,085,000
10		>	1,085,000

[a] Because of data confidentiality conditions, these ranges are only approximate.

Cohort 1 and the largest 10% in Cohort 10. The approximate range of sales for each cohort is reported in Table 1. Where possible, we tracked individual farms in each cohort over the next two censuses. We also created new cohorts for entrants in 1997 and 2002, for a total of 12 cohorts.

We recorded each farm's tenure status, total agricultural sales (exclusive of government payments), and milk and dairy product sales in each census year that it appeared. Based on this information, we calculated the number of farms in production, the number that entered and exited, farm size distributional statistics (mean, median, standard deviation, skewness, kurtosis, and range of sales), and the percent of cohort farms in each of four diversification categories. The percent of total farm sales (exclusive of government payments) derived from milk and dairy product sales determined the diversification categories: (1) 90% or more, (2) 75 - 89.9%, (3) 50 - 74.9%, and (4) less than 50%.

1. *The remaining 35% of dairy farms consisted of retired and residential/lifestyle farmers.*

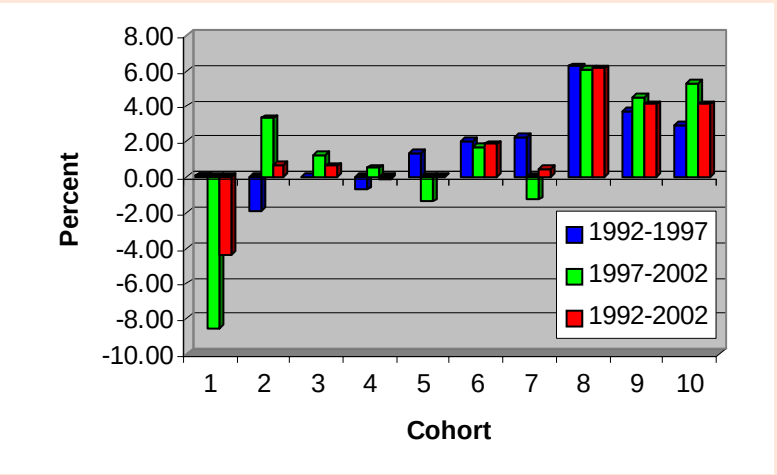

Figure 1. Annual growth rates.

Farm Growth

Mean growth rates of 1992 dairy farms that remained in production varied considerably both among cohorts and between censuses. After adjusting for inflation between the censuses, the dairy farms grew at an average compound rate of 1.6% per year between the 1992 and 1997 censuses and 1.1% per year between the 1997 and 2002 censuses, averaging 1.4% between 1992 and 2002.

Figure 1 shows the annual growth rates we computed for each cohort for the 5- and 10-year periods. The average size of the smallest cohort of dairy farms decreased over the 10-year period, while the average size of farms in the three largest cohorts increased substantially and steadily over time. Farms in the intermediate size ranges generally grew slowly and more erratically. Overall trends suggest that, as farm size increased, so did the corresponding growth rate.

Distribution of Farms within Cohorts

Farms were close to being uniformly distributed within most cohorts in 1992. Only in the largest cohort was the distribution of farms appreciably skewed. In this cohort, the majority of farms lay in the lower part of the range and only a small number of much larger farms resided in the upper end of the range. In successive censuses, as farms tended to grow in size, the surviving farms in all cohorts became positively skewed, similar to the largest cohort in 1992. This finding implies that a small number of farms in every cohort grew much more rapidly than others.

These results suggest that average cohort sales were particularly influenced by a small number of farms that grew rapidly within each cohort. In fact, in each of the five smallest cohorts, a majority of the surviving farms were smaller in each successive census than in 1992. Therefore, if used improperly, average farm size can result in very misleading conclusions.

Farm Size and Diversification

Because of the criteria used to select farms to include in the sample, no dairies in 1992 were in the most diversified sales class (with less than 50% of agricultural sales from milk and dairy products). As apparent from Figure 2, the smallest three

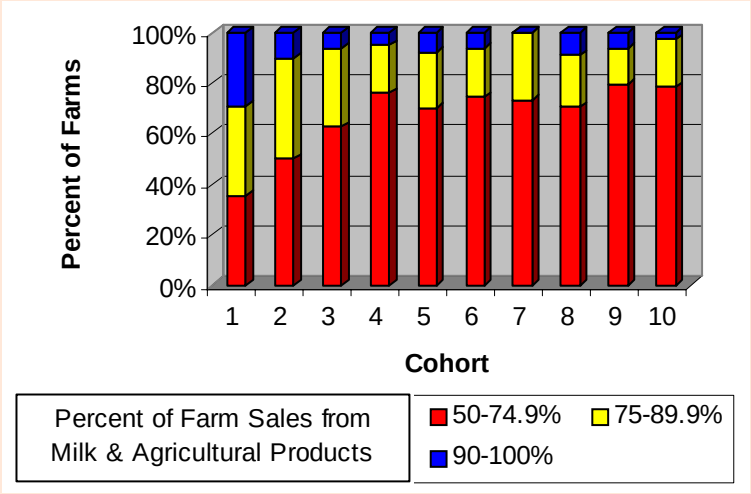

Figure 2. Farm diversification, 1992.

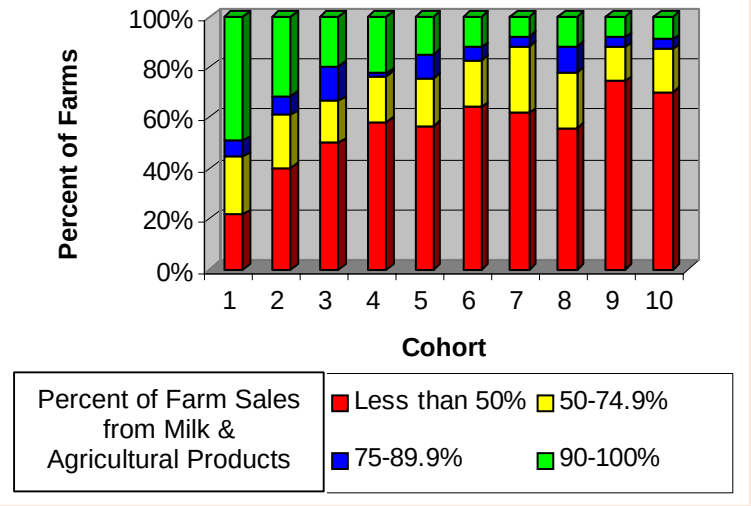

Figure 3. Farm diversification, 1997.

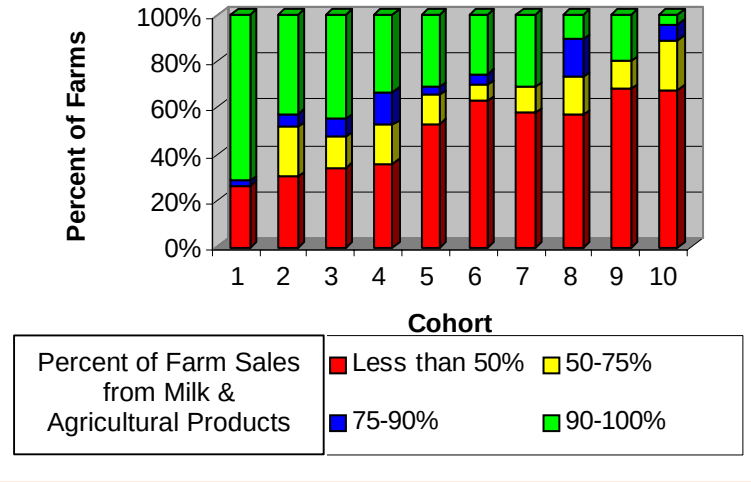

Figure 4. Farm diversification, 2002.

cohorts were the most diversified and all larger cohorts were more specialized.

In successive censuses, every cohort became more diversified. For example, the percent of farms that received 90% or more of their agricultural sales from milk and dairy products declined from 35% in 1992 to 27% in 2002 in Cohort 1 and from 78% in 1992 to 67% in 2002 in Cohort 10. Much more dramatic was the shift of farms to the most diversified sales class. By 2002, nearly 75% of farms in Cohort 1 received less than half of their agricultural sales from milk and dairy products, while none did in 1992.

Across cohorts, diversification followed roughly the same pattern in 1997 and 2002 as in 1992. The smallest cohorts were the most diversified and specialization increased with farm size (see Figures 2-4). We tested this graphical evidence by examining the correlation between farm size and level of diversification. Confirming our results, we found statistical evidence that as farm size increased, farms tended toward greater specialization. This tendency became stronger over time.

While the diversification trends between 1997 and 2002 followed those between 1992 and 1997, some caution should be exercised when interpreting the most recent statistics. Milk and dairy product sales do not include cull dairy cow or other cattle sales, and milk prices were lower in 2002 than in 1992 or 1997. Consequently, it is possible that part of the apparent increase in diversification in 2002 was due to a higher than normal culling rate induced by the lower milk price.

A further caution should be made about the diversification levels. We measure farm size by value of agricultural sales (exclusive of government

payments), and our sample was selected to include only those farms for which milk and dairy product sales accounted for at least 50% of agricultural sales. Consequently, the most diversified farms with milk cows did not enter our initial sample. If they had been included, the evidence of diversification within the dairy industry would be even greater.

Farm Entry and Exit

Between each pair of censuses, more than twice as many dairy farms exited the industry in Washington as new farms entered. Smaller dairy farms tended to exit at higher rates than did larger farms. In Cohorts 1-7, an average of 3.5 farms exited for each farm that entered between 1992 and 2002. In contrast, an average of just over one farm exited for every farm that entered in Cohorts 8-10, implying a very low net exit rate. Further, the largest farms (Cohort 10) had fewer exits than entrants, which resulted in positive growth in the number of largest dairy farms.

Farms of all sizes entered the marketplace. However, their distribution and behavior differed widely from incumbent farms. While their mean size was much larger than the incumbents, falling between the means of the two largest incumbent cohorts, their growth rates tended to be much slower than the growth rates of the largest incumbents. They averaged less than 1% growth per year. They also entered the marketplace with a higher average level of diversification than any of the large incumbent farm cohorts in the initial sample and continued to diversify at a much more rapid rate.

What Does All This Information Mean?

This analysis of longitudinal agricultural census data for the Washington dairy industry has produced important insights about the relationship between initial farm size and both subsequent growth rates and the tendency to diversify. The largest group of cohorts is growing the fastest, suggesting that, despite earlier evidence that economies of scale were largely exhausted by 750-cow farms (e.g., Matulich, 1978), dairy farms in the state are not yet converging toward a size that minimizes average cost within the current size range. However, the fact that it was Cohort 8 rather than Cohort 10 that grew at the fastest rate does suggest that economies of scale may be diminishing for the very largest farms.

Additionally, we found that the larger the farm, the greater the tendency to specialize. In other words, larger dairy farms derived more of their revenues from milk and dairy product sales, while smaller farms turned to a more diverse range of outputs to generate their agricultural revenue streams. The only exceptions applied to new entrants. While their average size was very large at entry, they were much more diversified than large incumbent farms and grew much more slowly. However, the average level of diversification in all cohorts has increased over the 10-year period examined. This finding is particularly surprising for an agricultural commodity that has been one of the last bastions of the single-product farm.

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For More Information

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