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Washington Farm Growth and Diversification

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Abstract

Growth and diversification patterns of size cohorts in four Washington state agricultural industries between the 1992 and 2002 agricultural censuses are examined. Three industries (wheat, apples, and beef) show similar growth patterns. Two (wheat and apples) show similar diversification patterns. Dairy is unique on both measures.

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As mergers, acquisitions, and other market forces continue to reduce the perfectly-competitive nature of industries of all types, the agricultural industry is one of the few remaining examples of a “nearly” perfectly competitive industry, where products are largely homogeneous and firms are price-takers. However, due to the rapid consolidation of agricultural firms, even the agricultural production industry is at risk of market-power imbalances which have plagued so many other industries. Two market forces, economies of scope and economies of scale, could be behind the increase in consolidation.

To exploit scale and scope economies, firms will increase their production and diversify their product mix. As a result, firms increase in size, creating the potential for the largest firms to exercise market power. Development of market power generates serious policy concerns since firms with market power can more easily influence the welfare of consumers. Industry consolidation also has the potential for negative side effects relating to the environment, especially in confined animal industries. To predict the probability of an increase in consolidation, the presence of scale and scope economies needs to be determined, as economic theory predicts that consolidation is likely to occur in industries where these economies exist over all firm sizes.

In order to determine whether further consolidation is likely, we inferentially determine whether firms of different sizes experience scale and/or scope economies. In addition to identifying scale and scope economies for existing firms, we explore whether entering firms have the same tendencies as their incumbent counterparts. We compare scope and scale characteristics for four major agricultural production industries. Finally, we compare scope and scale characteristics and trends from Washington State to national trends to see if our inferences

at the state level are applicable on the national level.

To answer these questions, we examine data from the U.S. Census of Agriculture. We include the dairy, beef, wheat, and apple industries. These four industries are consistently among the top five revenue-generating commodities in Washington (USDA/NASS 2006b). Our data consist of the three most recent agricultural censuses – 1992, 1997, and 2002. To omit hobby, recreational, and retired farmers, we only included those operators who selected “farming” as their main occupation.

Farms were ordered by size based on their agricultural sales (excluding government payments and subsidies) and divided into non-overlapping deciles (referred to as cohorts). Cohort 1 contained the smallest 10% of farms while cohort 10 contained the largest 10% of farms. Farms retained their original cohort assignment across censuses, regardless of whether they grew, shrank, or otherwise changed over time. This preservation of cohort assignment permits measurement of cohort-specific growth, which is essential in determining which farm size grows the fastest. Unfortunately, the difficulty in tracking farms over time could result in errors in the data. Arranging the data in this manner allows us to calculate growth rates and a variety of statistical moments by cohort, which facilitates comparison and analysis across census periods. Initially each cohort has the same number of firms, but firm exits cause these numbers to shrink unevenly across successive censuses.

To assess scale economies and calculate commodity-specific growth tendencies, compound growth rates were measured for the mean of each cohort in each industry. These growth rates measure the rate at which real sales increase, which is analogous to the rate at which output increases. To measure scope economies and calculate diversification tendencies, farms in each cohort were divided into five sales categories based on the percent of total agricultural sales

obtained from the sale of the main commodity group: (1) 90% or greater, (2) 75-89.9%, (3) 50-74.9%, (4) 25-49.9, and (5) less than 25%. For example, if a wheat farm in our sample derived 65% of its sales from grain and oilseeds and 35% of its sales from other products/services, then this farm would fall into diversification category three. By organizing farms in this manner, we are able to create a specialization index which measures the extent of specialization within each cohort for each census. This index simplifies the comparison of diversification tendencies between cohorts and industries. This index ranges from zero to one, with a score of one indicating complete specialization, and a score of zero indicating complete diversification to other products/services.

Growth by Industry

Of the four industries examined, wheat, apples, and beef exhibited a negative correlation (correlation coefficients of -0.83, -0.64, and -0.63 respectively) between firm size and growth rate while dairy exhibited a positive correlation with a correlation coefficient of 0.82 (see Figure 1, Panel A). Of the three industries showing a negative correlation, wheat farms tended to have the strongest negative correlation between firm size and growth rate.

Wheat farms were the only industry to have positive growth rates across the entire distribution of farms. For this industry, the smallest farms grew the fastest, and the largest farms were among the slowest-growing.

Like wheat farms, the smallest apple farms set the bar for growth. Beyond the smallest two cohorts, the relatively constant annual growth rates (0-2%) suggest that growth rate does not have a strong relationship to firm size in the mid-to-large cohorts.

The correlation between growth rates and firm size is also negative for beef farms but the cohort patterns are quite different. Specifically, growth rates have a negative near-linear

relationship with the exception of the fourth cohort, which grew at a rate of 25% over the ten year period.

The growth pattern of dairy farms differed in important ways from the first three industries. Besides having a strong positive correlation between farm size and growth rate, the smallest cohort actually shrank (4%) and shrank more than any other cohort among the four industries. Nearly all the growth of farms in this industry occurred in the largest three cohorts, but none grew as rapidly as some cohorts in each of the other industries.

Specialization

As was the case with growth patterns, wheat, apple, and beef farms tended to follow a specialization pattern that sharply contrasts the pattern exhibited by dairy farms. For wheat farms, the level of specialization was negatively related to farm size in all censuses, and the correlation decreased in strength over time (see Panel A of Figure 2). While the largest cohorts were the most diversified, the smallest cohorts tended to diversify more rapidly over time. The specialization scores in 1992 ranged from 0.86 for the first cohort to 0.31 for the tenth cohort, with an average specialization score of 0.75. In successive censuses, all but the largest cohort became more diversified. The average score dropped to 0.67 by 2002.

Apple farms also exhibited a negative relationship between farm size and level of specialization in all censuses, but the correlation was not as strong as for wheat farms (Panel B of Figure 2). The specialization scores in 1992 ranged from 0.92 for the third cohort to 0.73 for the tenth cohort, with an average specialization score of 0.88, so apple farms were more specialized than wheat farms. They also remained more specialized in successive censuses. Only the smallest two cohorts and the largest cohort became substantially more diversified by 2002, and

the average specialization score dropped only to 0.86.

Beef farms showed the strongest negative correlation between size and level of specialization. This can be seen in the near-linear relationship evident in Panel C of Figure 2 between cohort numbers 3-10 and specialization score. In addition to having the clearest relationship between firm size and index score, beef farms also exhibited the highest levels of diversification with average index scores close to 0.50 in all years. In half of the cohorts, index scores from the 2002 census were similar to those from the 1992 census, implying that ten years after the 1992 census was administered these cohorts were still operating at about the same level of diversification. In fact, beef farms showed only a trivial reduction in average specialization score between 1992 and 2002.

Diversification levels in the dairy industry contrasted sharply to those of the other three industries, which further demonstrates the large difference between the dairy industry and the other industries in the sample. Whereas specialization index scores were negatively correlated with cohort size in the wheat, apple, and beef industries, they were positively correlated in the dairy industry (Panel D of Figure 2). Thus, among the four industries examined, dairy is the only one in which diversification *decreases* with farm size. Also, on average, the dairy industry was the most specialized industry in the sample in 1992 but diversified more rapidly than any of the others. It experienced an average drop in specialization index score of 23% from 1992 to 2002.

One important insight gleaned from these results is that, in all industries, higher levels of specialization were generally associated with higher growth rates. Consequently, we infer that economies of scale, rather than economies of scope, appear to have driven farm growth.

Entrants and Exits

Most farms that entered the beef, wheat, and apple industries entered at sizes comparable

to the farms in the smallest incumbent cohorts. In the dairy industry, however, the majority of entrants were among the smallest firms or the largest firms, with the minority of firms entering at a size comparable to the mid-level cohorts. New farms in all industries entered with specialization levels higher than the average incumbent farm. Thus, beef, wheat, and apple farm entrants generally failed to capitalize on either economies of scale or economies of scope at the time of entry. In all but the beef industry, new farms tended to diversify at a more rapid rate than incumbent farms, which implies they quickly recognized and captured economies of scope after entering the industry.

Comparison to National Trends

Overall, trends in Washington growth rates were similar to national growth rates in each of these industries (Melhim, O'Donoghue, and Shumway 2008). Similarities are strongest between wheat, apple, and beef farms, with nearly identical state and national growth rates in most cohorts. Dairy farms in Washington were mostly similar to national dairy farms in terms of growth, with the exception of the smallest cohort which shrank by 4% in Washington but grew by 5% nationally.

While Washington diversification trends were similar to national trends for most industries. Washington farms were generally more specialized. Additionally, Washington beef farms did not appear to follow the national specialization trends over time.

The most striking difference between Washington state and national trends dealt with the size of entrants in the wheat, apple, and beef industries. Average sizes of national entrants exceeded the average size of their incumbent counterparts while average sizes of Washington entrants were smaller than incumbents. In addition, farms entering the national dairy industry were much larger than the average incumbent and did not follow the bimodal distribution of new

entrants in Washington. Diversification patterns of new entrants in most national industries did follow the pattern seen in Washington, i.e., farms entered the industry at a more specialized level than incumbents and they diversified more rapidly over time.

What Does All This Mean?

Census-documented changes between 1992 and 2002 imply that the wheat, apple, and beef industries in Washington, as in the nation, may be converging toward equilibrium firm sizes. While farms in all size cohorts are growing, the largest cohorts are growing at slower rates than the smaller cohorts. This could be the result of the largest farms facing diseconomies of scale (i.e., increasing average cost), or at least diminishing economies of scale, as they continue to expand output. In the dairy industry, however, the largest farms are among the fastest growing which shows clear evidence that economies of scale persist in the dairy industry, and that the largest farms can be expected to grow, likely bringing about an increase in consolidation.

With the exception of the apple industry, the more highly specialized farms have higher growth rates. This phenomenon suggests that it is economies of scale more than economies of scope that is driving firm growth in the wheat, beef, and dairy industries.

Entrants in each of the four industries at the Washington State level are concentrated in farm sizes that have the highest growth rates. This suggests that most entering farms enter the industry at a size where observable economies of scale are strong.

Washington trends generally coincide with national trends, especially where firm growth is concerned, and imply similar conclusions with respect to the future of consolidation, growth, and diversification. One exception was that the average new entrant at the national level is larger than the average of incumbent farms, whereas, except for the dairy industry, the average new entrant in Washington is smaller. Diversification trends are mostly similar, although it should be

noted that Washington farms are more specialized on average. Another notable exception is that at the national level, beef farms become more specialized with time, a trend not followed by Washington beef farms.

For More Information

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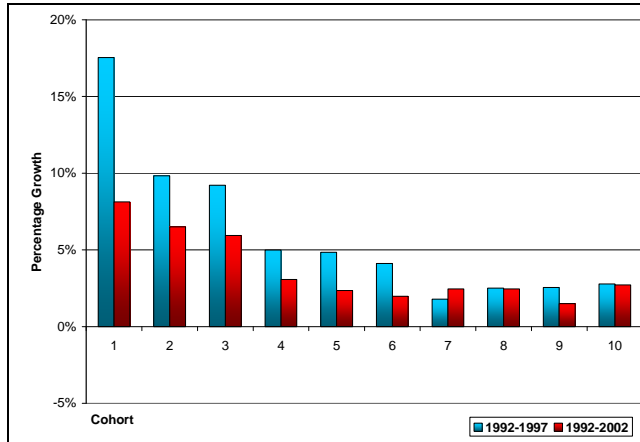
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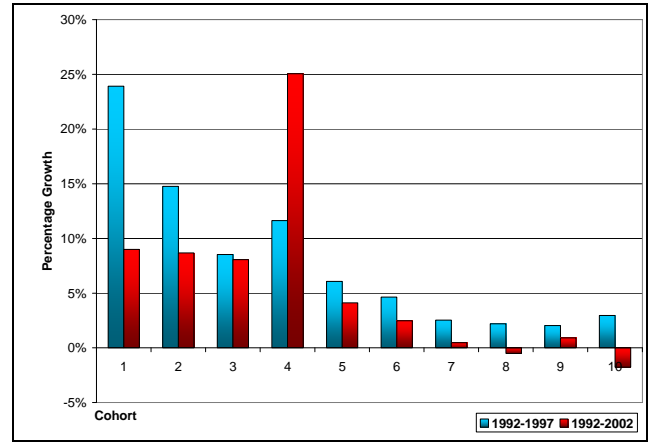
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Figure 1: Percent Growth in Real Sales (1992-2002)

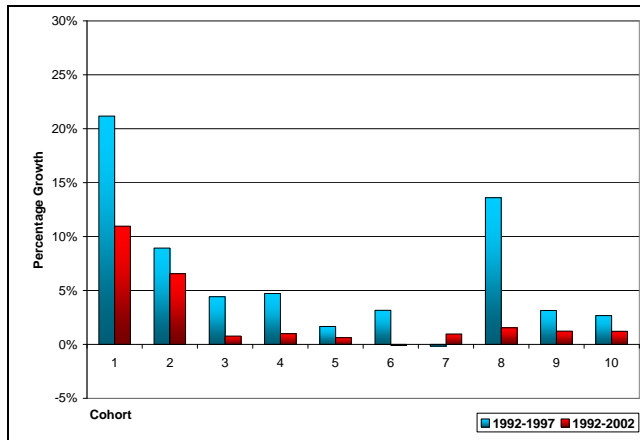
Panel A: Wheat



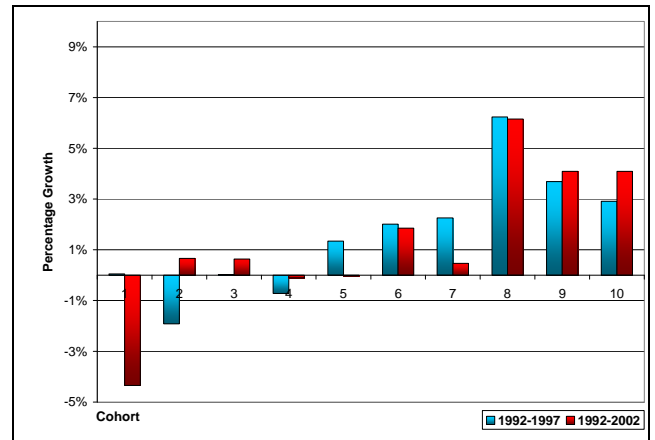
Panel C: Beef



Panel B: Apple



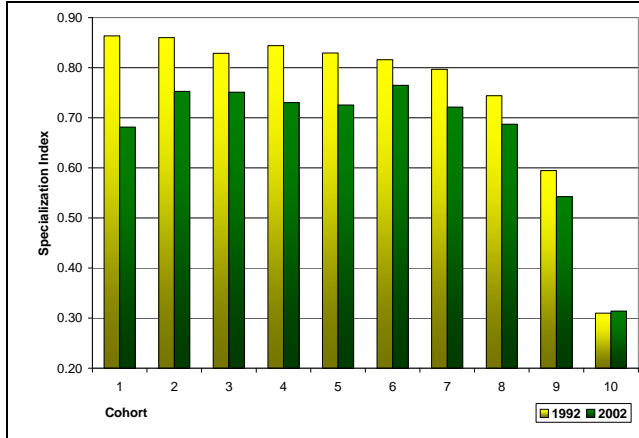
Panel D: Dairy



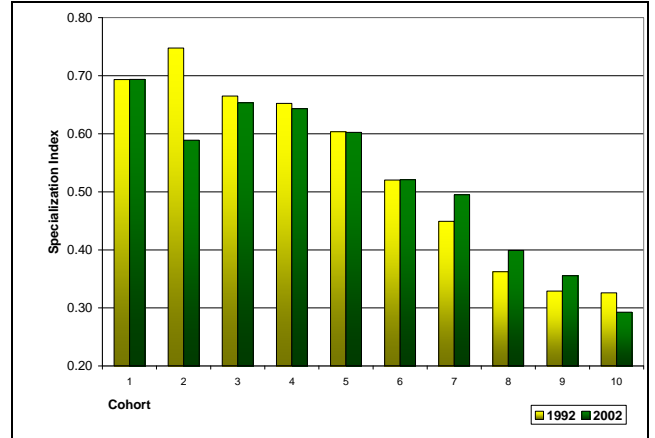
Data source: *Census of Agriculture* (USDA, 1992, 2002)

Figure 2:
Specialization Index Scores by Industry (1992-2002)

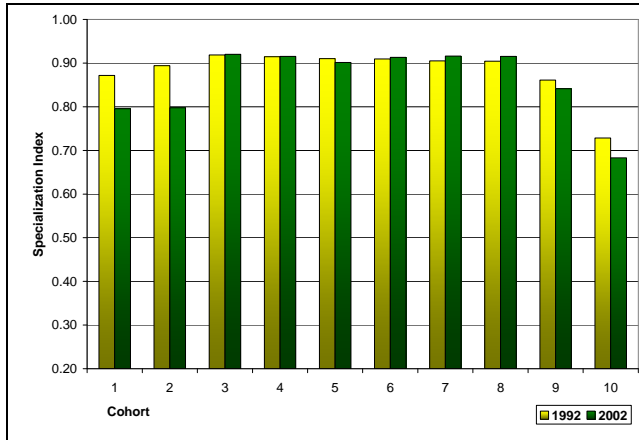
Panel A: Wheat



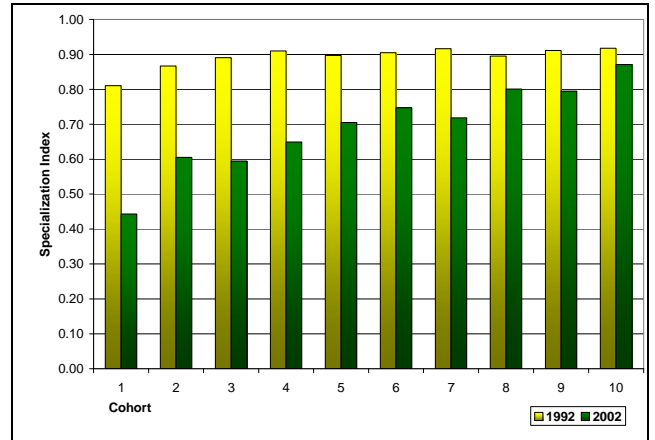
Panel C: Beef



Panel B: Apples



Panel D: Dairy



Data source: Census of Agriculture (USDA, 1992, 2002)