A farmer profitability question

Are the most profitable farms always the most profitable?

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Kansas State University Department of Agricultural Economics

Introduction

Every year, some farmers will do better than other farmers. Whether by luck, better management, more rainfall, a different enterprise mix, etc., a subset of farmers will be more profitable than another subset of farmers. This is even after accounting for farm type and farm size. However, over a period of years, is there consistency among the population of farmers for who is the most profitable. That is, are the most profitable farms in any given year also the most profitable farms over a long-term time horizon? This paper investigates a 15-year panel data set of similar farm from Kansas to determine if the most profitable farms are consistent across time. This paper should help show if there are such farms or if luck and weather variability have more to do with farm profitability than does management. If there is a consistent set of more profitable farms, then these farms can be examined in more detail to determine why they are more profitable.

Weather is certainly a major contribute for determining profitability in a given year. Rainfall can vary tremendously across a region resulting in higher yields for some farms and lower yields for others. However, over a period of years, these rainfall variations should tend to equal out. Thus, if a farmer is consistently more profitable than another across time, it is unlikely this profit difference is caused by weather or luck. This assumes of course that farms from similar geographical regions are compared. If there are more profitable farms consistently across time, then this difference can be attributed to some factor of management. Management could include the enterprise choice, the level of debt, the choice and amount of inputs, etc.

Data and methods

This paper uses a panel data set of 626 Kansas farms for the years 1997 through 2011. Complete whole farm financial data is available for these farms as well as the location of the farm and the type classification of the farm (i.e., livestock vs. crop). For each year of the data set, the farms were divided into 10 groups based on accrual net farm income. Each of these deciles contained either 62 or 63 farms. The top 10 percent of net farm income farms were assigned a value of "1", the next group of farms based on net farm income were assigned a value of "2" etc. Thus, all the farms in a given year had a ranking from 1 to 10 and given each group was the same size, this procedure resulted in a uniform distribution of farm rankings in a given year.

This same procedure of ranking farms was applied to the other years. The years were considered to be independent so that a farm's ranking one year had no effect on the next year. Thus, each farm ended up with 15 farm ranks over the 15 years of the data set. Since the yearly ranking produced a uniform distribution from 1 to 10, the average farm ranking in a given year was 5.5.

The next step was to average, for each farm, the yearly farm rankings. This gave a single average farm ranking for a particular farm. If weather or luck was totally accounting for the yearly variation in farm rankings, we would expect that over 15 years the farm ranking would average toward the mean (5.5). In fact, if weather or luck was the only factor affecting farm profitability, then all the farms should end up with an average ranking of 5.5. There would be no variation.

However, if management (or possibly farm size, farm type, or soil productivity) was a factor in the yearly ranking of net farm income, then some farms should have a higher 15-year average than other farms. If management was the only factor affecting the variation in yearly net farm income, then the top 10 percent of farms should be the same every year. The other ranking groups would be the same across time as well. The 15-year average of farm rankings

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would have 10 percent of the farms ranked as one, 10 percent ranked as two, etc. The overall average would still be a 5.5 but the overall average distribution would resemble an individual year distribution.

By examining the actual distribution of 15-year farm ranking averages, we can determine how much of the net farm income variation in any year is due to management. The flatter the distribution, the more likely management is to be a factor. In other words, if the actual distribution of average returns approaches the theoretical uniform distribution when management is the only factor, then management is more important. Conversely, the steeper the distribution, the more likely that luck or weather is a bigger factor in the variation in yearly net farm income. In this case, all the farms would converge to an average rating of 5.5 after 15 years.

Another way of examining the influence of management on net farm income is to count the number of farms that have an average rating either one standard deviation above or one standard deviation below the overall farm rating average (5.5 average rating for all farms). Because the farms are forced into a discrete uniform distribution each year, farms that have an average rating below 2.623 would be considered to be above average farms. Farms that have a rating above 8.372 would be considered to be below average farms.

If weather and luck were the only factors affecting differences in net farm income, then no farms would average above 2.623 or below 8.372. The farms would all average 5.5. The opposite situation is when management is the only factor affecting net farm income and farms consistently divide into the same ranking groups each year. In this case, we would expect 26.23 percent of the farms to be above average and 26.23 percent to be below average. With 626 farms in the initial analysis, this would result in 164 farms above average. By calculating the ratio of actual farms with a rating above 2.623 to the theoretical possible farms above average, we estimated a measure of management efficiency.

In addition to examining the entire state of Kansas and all farm types at once, various subsets of the data were also examined. The first subdivision was to divide farms into either crop only farms and farms that included livestock. This division resulted in 342 crop only farms and 67 livestock and crop farms. These two subgroups total less than 626 farms because some farms switch farm type over the period and were thus excluded in this particular subdivision analysis. Also, all farm types were subdivided into regional analysis.

Results

Figure 1 shows the distribution of average farm rankings over 15 years from using all 626 farms in the analysis. This distribution is shown with the solid colored bar graph. The gray crosshatched bar graph is the theoretical distribution of farm rankings if management was the only factor affecting net farm income (i.e., farm rankings would stay the same every year). By contrast, if net farm income was only a function of luck or weather then all farms would

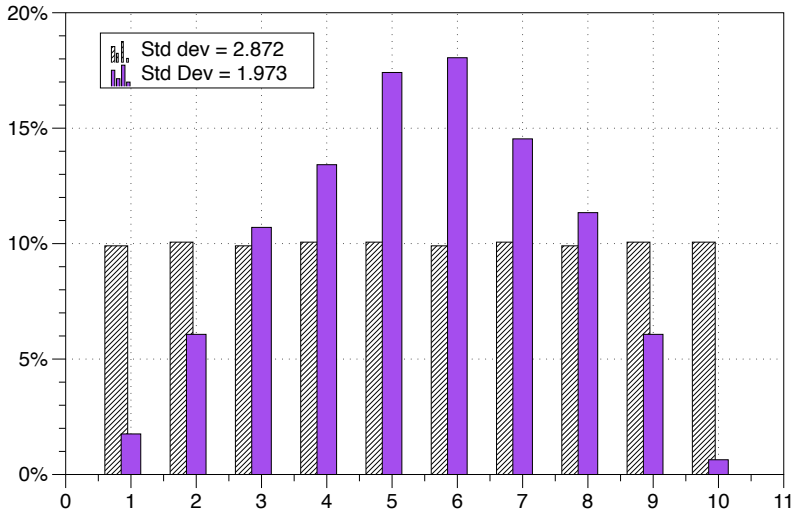

Figure 1. Distribution of average farm rankings – all farms

have an average rating of 5.5 and there would be no variation.

As this figure illustrates, there appears to be a cross between luck or weather and some management skill affecting the farm rankings. About 2 percent of the farms had an average rating of one. If management were the only factor, we would expect 10 percent of the farms to have an average rating of 1. Also, keep in mind that this first figure is based on Kansas farms with no allowance for farm size or farm type. These two factors would have some influence on net farm income as well.

Figure 2 shows the average net farm income by a particular decile for each year. Since the yearly numbers are recalculated each year and are independent of each other, there very are likely different farms in each decile each year. There are several observations worth noting from this figure. First the bottom 10 percent of farms each year lost money. Second, the next most profitable group (the group in the ninth decile) basically earned zero net farm income each year. All the other groups within a year usually earned some net farm income. In particular, the top 10 percent of farmers in a given year earned much more than the other groups.

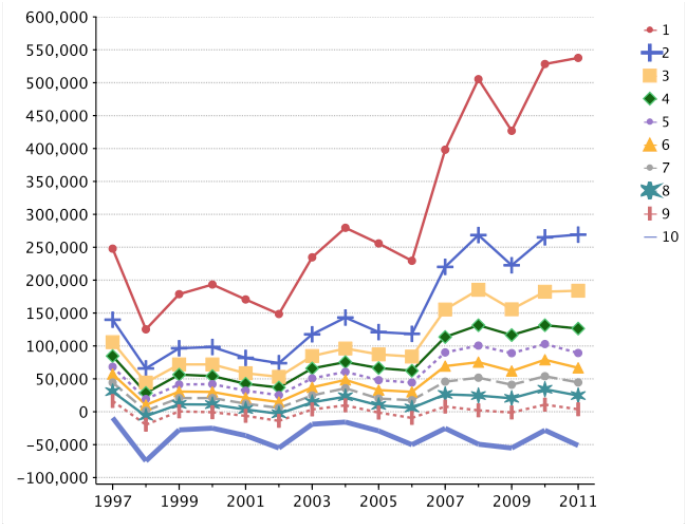

Figure 2. Average net farm income by decile per year – all farms

Table 1 shows the count of farms that are either one standard deviation above the mean or one standard deviation below the mean. The theoretical maximum is when a farm ranks the same every year. This number varies in the table, as the sample size is different for each subdivision. The ratio of the actual to the theoretical gives a number called percent management responsibility. The closer this number is to one, the more likely that some factor of management was responsible for the farm being consistently above or below average.

Table 1. Number of farms above or below a one standard deviation range

All farms	Actual count	Theoritical maximum	% mgmt responsibility
Above average	54	164	33%
Below average	52	164	32%
Non-crop			
Above average	8	18	45%
Below average	4	18	23%
Crop			
Above average	31	90	34%
Below average	30	90	33%
North Central			
Above average	9	28	32%
Below average	9	28	32%
South Central			
Above average	11	29	38%
Below average	12	29	42%
North East			
Above average	14	28	50%
Below average	9	28	32%
South East			
Above average	25	63	39%
Below average	15	63	24%

Conclusions

By ranking farms by decile each year and then averaging these yearly rankings, we can get some idea of whether management or luck and weather are more responsible for differences in net farm income. If luck and

weather are the main drivers of differences in yearly net farm income, then over time a farm's yearly ranking would vary and the overall average ranking for that farm should approach 5.5. Conversely, if management is more of a factor determining differences in net farm income, then a farm should consistently place in the same decile ranking year in and year out. Thus the overall 15-year average rankings of farms should be very widely distributed. That is, there would be no more farms ranked at the mean (5.5) than at the extremes.

The analysis from the 15 years of Kansas data shows that it appears that weather and luck as well as management influence a farm's year-to-year net farm income. Based on the management index calculated in Table 1, management might contribute from a third of the net income variation to perhaps up to 50 percent of the variation. Included in this management ranking would be factors that weren't controlled for in the analysis (i.e., farm size, farm type, etc.). Some of the regions show more management differences than others. The North East had a management responsibility calculation of 50 percent.

Even though the yearly deciles of net farm income consistently showed the bottom 10 percent of farms losing money, these were in many cases different farms each year. As can be seen in Figure 7 only 1 percent or so of farms consistently averaged in the bottom 10 percent of yearly net farm income. The same conclusion can be drawn about the top farms as well as only 2 to 3 percent of farms consistently averaged in the very top decile. Fortunately for farm viability, this bottom decile is the smallest one. Based on the regional analysis, the two southern regions did not have a farm that averaged in the bottom 10 percent of farms.