

## Top Farms and the Effect of Debt

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### Introduction

As shown in AgManager paper “What Makes a Top Farm? - Overview” (<https://www.agmanager.info/finance-business-planning/research-papers-and-presentations/what-makes-top-farm>), we explain the process of determining which farms are the most profitable over the last 10 years by ranking the net farm income per acre each year. In this earlier paper, we showed that there are clear difference among farms, especially at the top and bottom ends of the rankings. However, in this earlier paper, we did not attempt any analysis of why these differences might be happening. We showed in AgManager paper “Top Farms and the Effect of Farm Size” (<https://www.agmanager.info/finance-business-planning/research-papers-and-presentations/top-farms-and-effect-farm-size>) that farms don’t necessarily have to be big to big successful. This current paper and the papers to follow will continue to examine factors that might explain why some farms consistently rank higher than other farms.

The purpose of this paper is determine if farm debt is a factor explaining why some farms are consistently more profitable than other farms. Very few farms are totally debt free. However, the level of debt can vary considerably. The Farm Financial Standards Council has 6 of its recommended 21 farm ratios accounting for debt or the effects of using debt capital. In this paper we focus on the debt-to-asset ratio. The D/A ratio is one of three solvency ratios used by the Farm Financial Standards Council. However, all three ratios can be calculated if one of the ratios is known. The D/A ratio measures the percent of a producer’s farm assets that is owned by outside lenders.

In this paper, we examine data from the Kansas Farm Management Association (KFMA). The KFMA has been helping farmers since the 1930’s and actually has computerized farm records back to the early 1970’s. There are currently around

2,500 farms in the KFMA system and in any given year about 1,500 of those farms will have records that are useable for research, teaching, and Extension analysis. This is one of the best systems in the country and the data provided by the KFMA can help answer those questions of farmer profitability.

## **Methods**

As in the previous papers referenced above, we examine the debt level question in east, central, and western Kansas. The average 10-year farm ranking for each region was used as the dependent variable in a regression analysis where the debt-to-asset ratio is the independent variable. In addition to the regression analysis, we examine the distribution of debt-to-asset ratios when the farms are put into deciles of profitability rankings.

## **Results**

Figures 1, 2, and 3 show the trend lines predicting average farm rankings from the debt-to-asset ratio. The red line is the trend line while the red dotted lines represent the region of the 95 percent confidence band. The confidence band shows how accurate the trend line fits the data. The confidence band does not encompass 95% of the data like a prediction band. For both eastern and central Kansas the slope of the trend line is significantly different from zero. This says that debt is an important factor affecting the profitability ranking of a farm. The fit is still rather poor by itself as the R-squared is around 0.10 for these two regions. For western Kansas, the slope of the trend line is not significantly different from zero. Thus, debt may not be a factor predicting the profitability ranking in this region. However, the P value was 0.07 which indicates debt was nearly a significant factor ( $P=.05$  is necessary for a factor to be significant).

Figure 4 shows a cumulative distribution for the debt-to-asset ratios in the three regions of Kansas. At any given debt-to-asset ratio, the graph shows the percentage of farms that have that particular D/A ratio of lower. As indicated on the graph, all three region have nearly identical distributions of debt-to-asset ratios. Many economists consider a strong D/A to be 30% or less. Figure 5 shows that 70% of the KFMA farms fit into that category.

The rest of the analysis shows the effects of debt when the farms are grouped into deciles of profitability rankings. Each decile contains 10 percent of the farms for a region. Figure 5 shows the average D/A for each region for each decile. Figures 6, 7, and 8 use violin graphs to show the variation among farms within a decile. The width of each group is an indication of the number of farms with that particular D/A ratio. The solid red bar line in each violin is the mean for that group while the dotted red lines are the 25th and 75th percentiles. As the graphs indicate, there is a fairly wide range of D/A ratios for each decile of profitability ranking.

The violin graphs help point out that the extreme ends of the decile groups may be responsible for making the debt-to-asset ratio a significant factor in some of the regions. In eastern Kansas, Decile 1 has very low debt while decile 10 has high debt. The other deciles tend to jump around more. For example decile 6 has a lower mean debt level than decile 5 (although decile 6 has a wider range of values). In central Kansas, deciles 1, 2, and 3 have very similar D/A distributions and the progression of debt increases as the decile group gets bigger.

## **Conclusions**

This paper examining how the debt-to-asset ratios affects a farm's profitability rank shows that debt can be an important factor. Thus farmers should look carefully at any expansion plans that involve adding new debt. Getting larger may not be a way to solve a farm's financial problems, especially if getting larger involves adding more debt. As we showed in the paper on farm size, all farms within the KFMA program have the potential to be top farms based on farm size alone. Because interest rates have been historically low for a long time now, the effects of debt may be understated. This current study was based on the last 10 years of data. Future plans are to redo this analysis with other 10-year time periods.

# Scatterplot - D/A ratio (East)

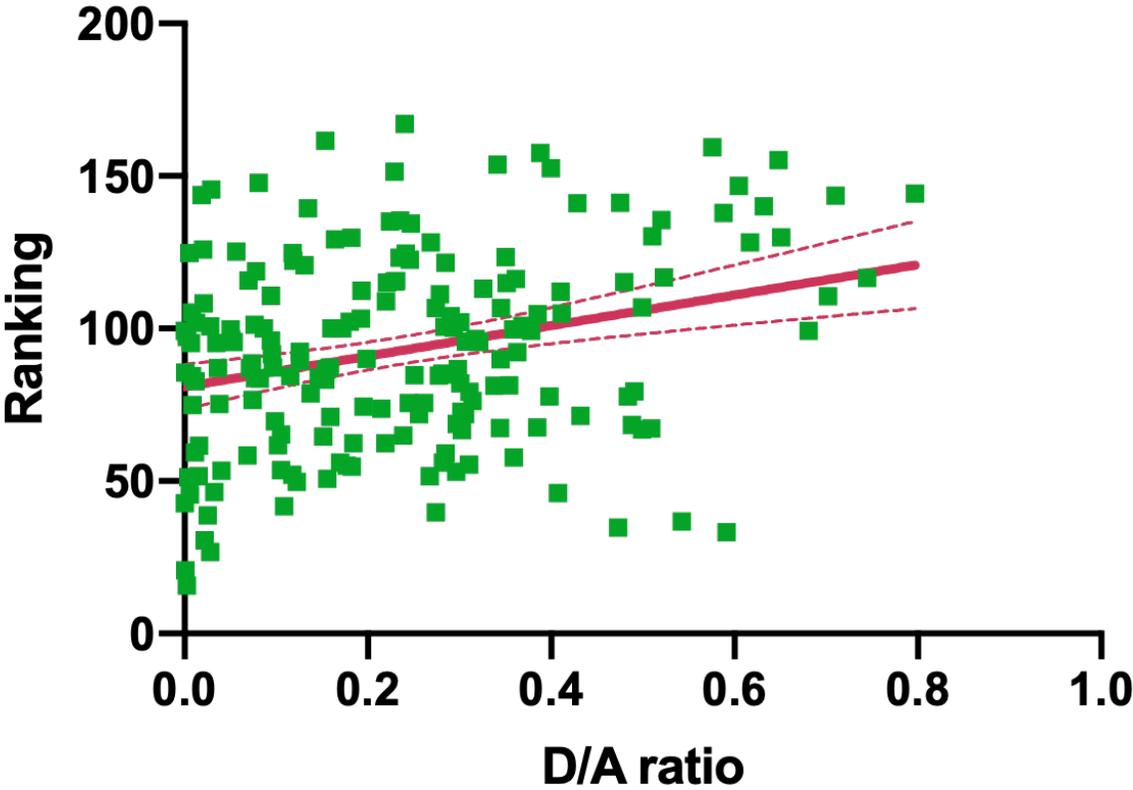


Figure1. Scatterplot of Farm Ranking by D/A Ratio for Eastern Kansas

## Scatterplot - D/A ratio (Central)

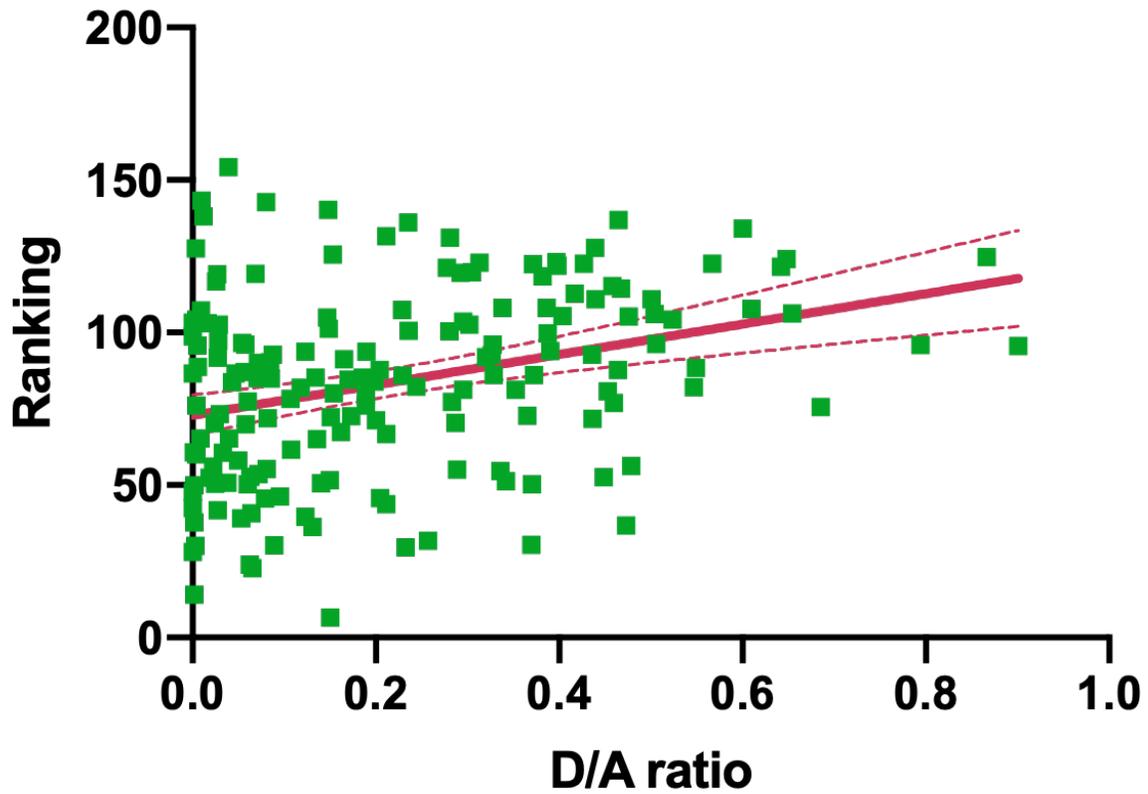


Figure 2. Scatterplot of Farm Ranking by D/A Ratio for Central Kansas

## Scatterplot - D/A Ratio (West)

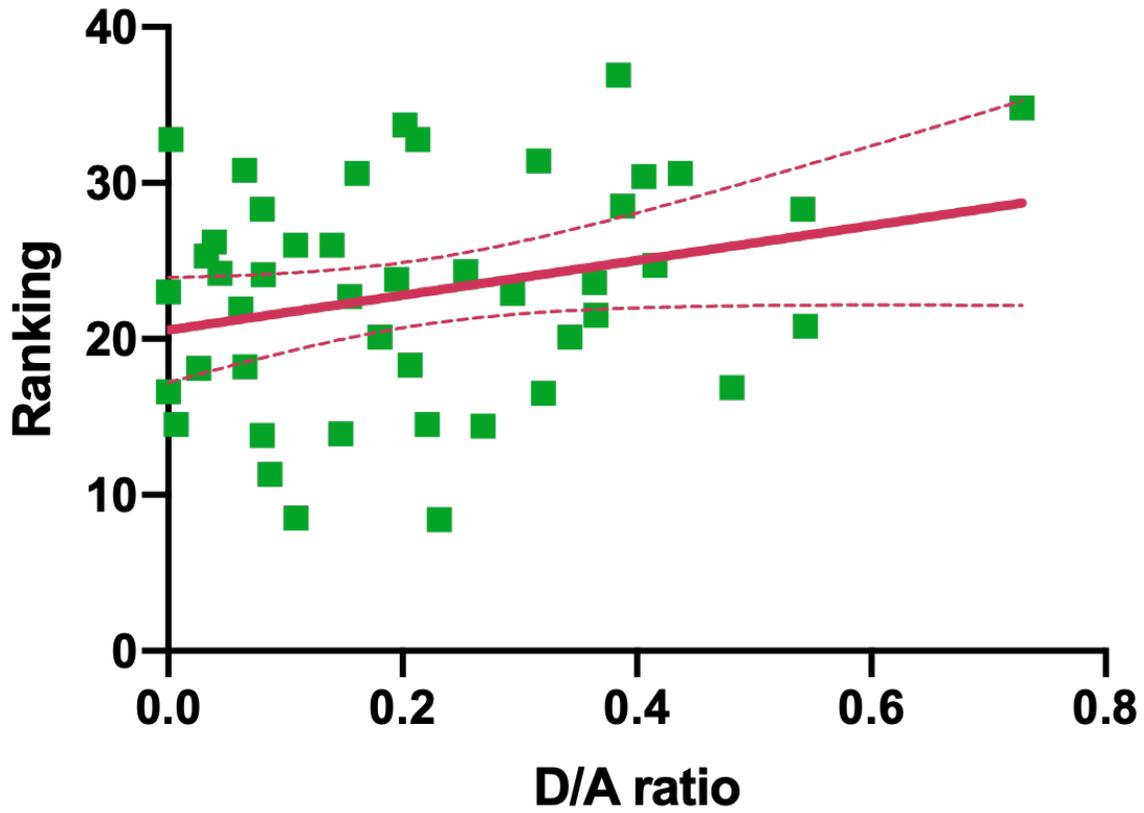


Figure 3. Scatterplot of Farm Ranking by D/ A Ratio for Western Kansas

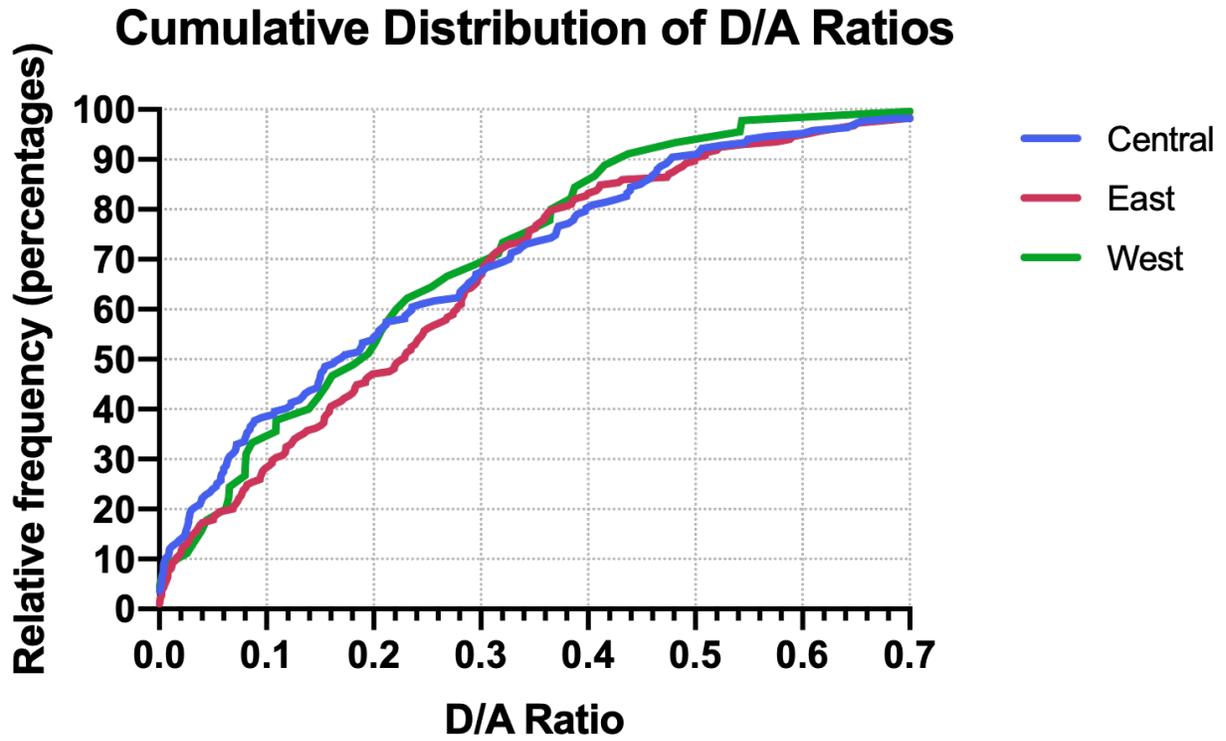
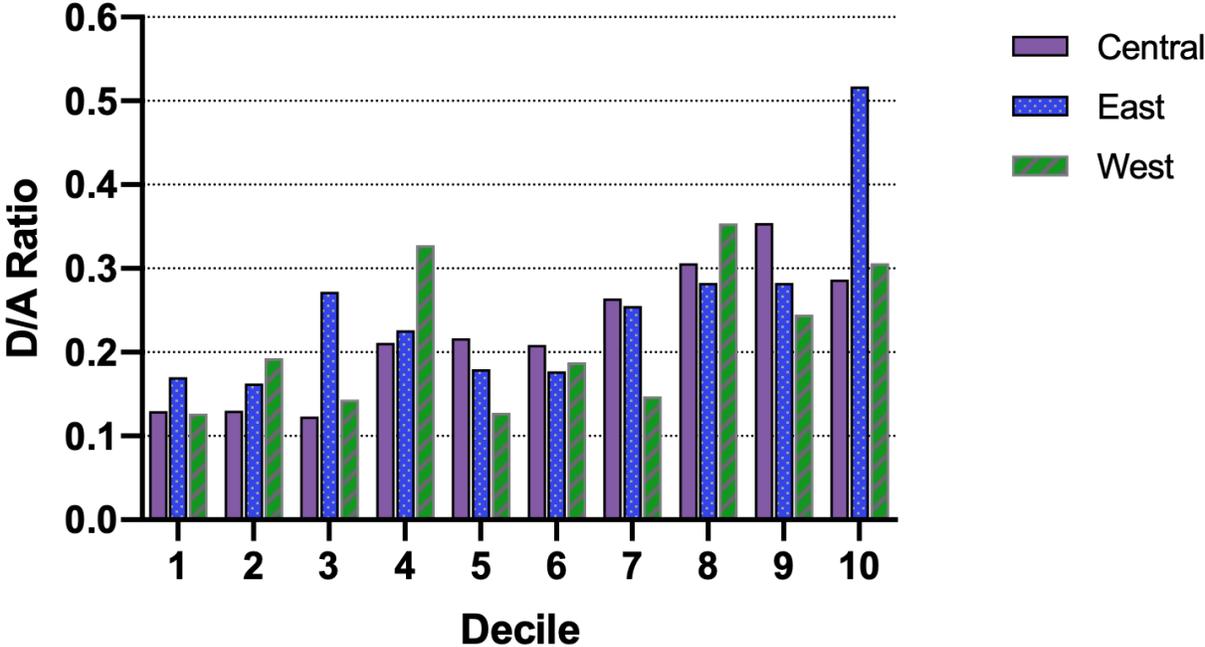


Figure 4. Cumulative Distribution of D/A Ratios by Region

### Ave Debt-to-Asset Ratio by Decile



**Figure 5.** Average Debt-to-Asset Ratio by Profitability Decile for Central, East, and Western Kansas

## Violin Plot of D/A Ratio by Decile (East)

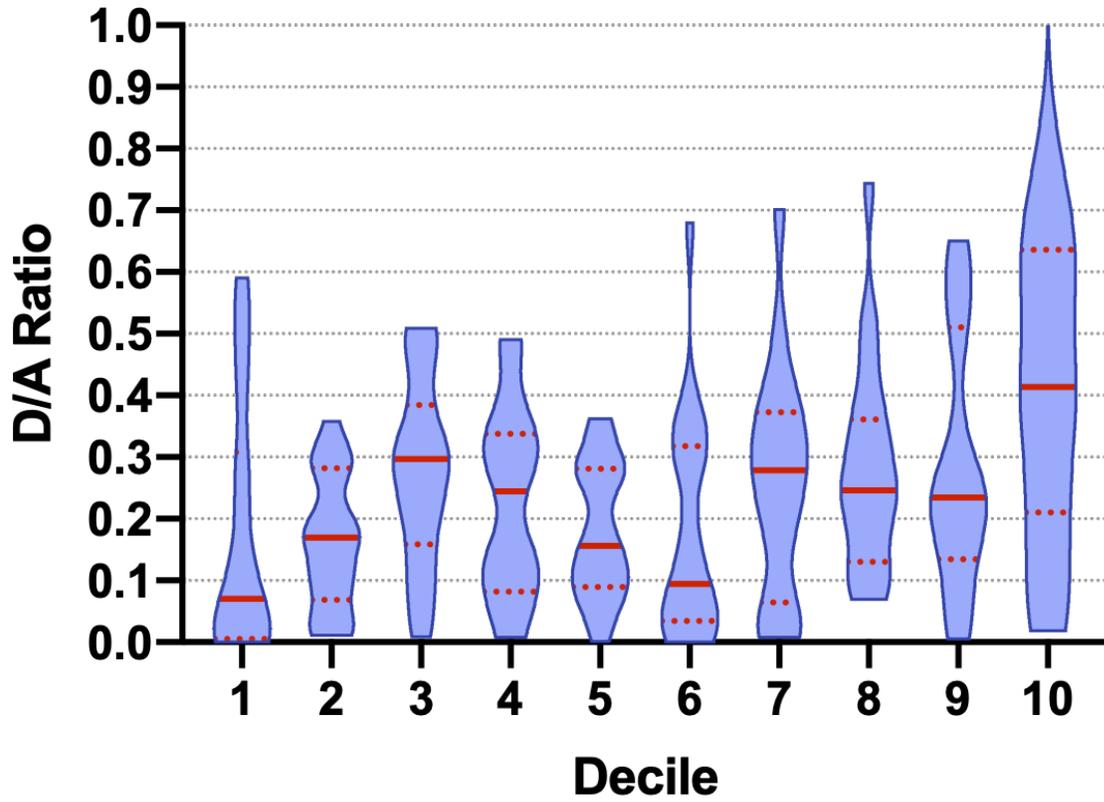


Figure 6. Violin Plot of the Distribution of D/ A Ratio for Each Profitability Decile (East)

# Violin Plot of D/A Ratio by Decile (Central)

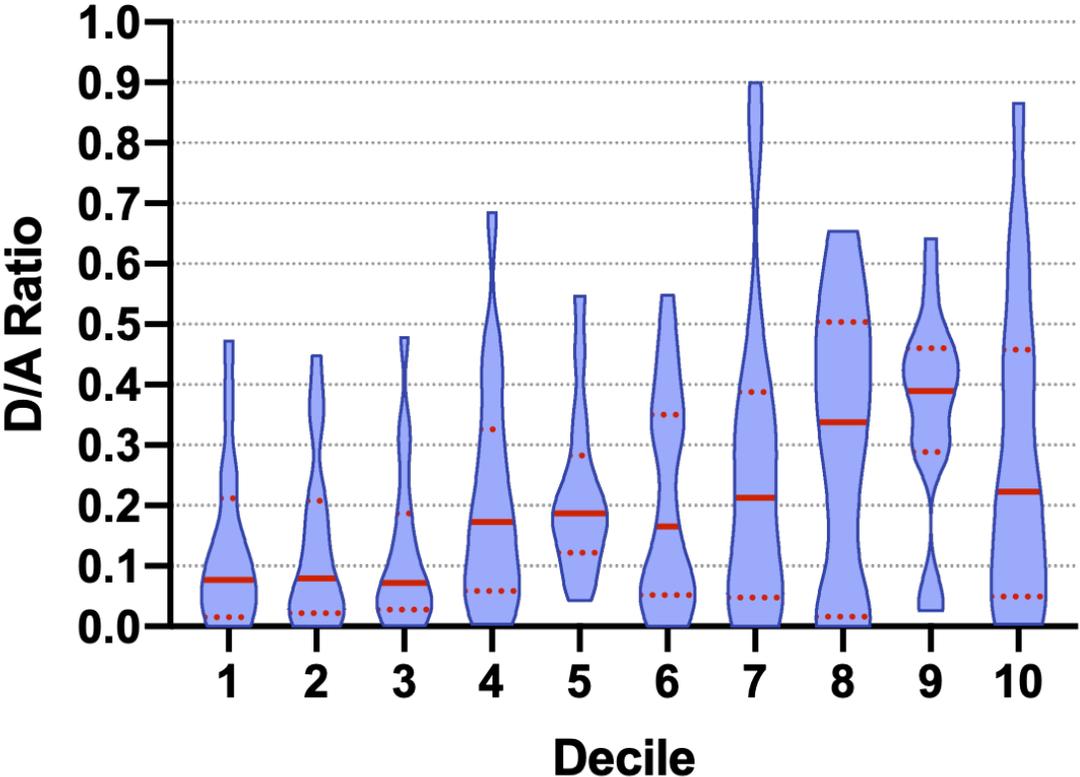


Figure 7. Violin Plot of the Distribution of D/A Ratio for Each Profitability Decile (Central)

## Violin Plot of D/A Ratio by Decile (West)

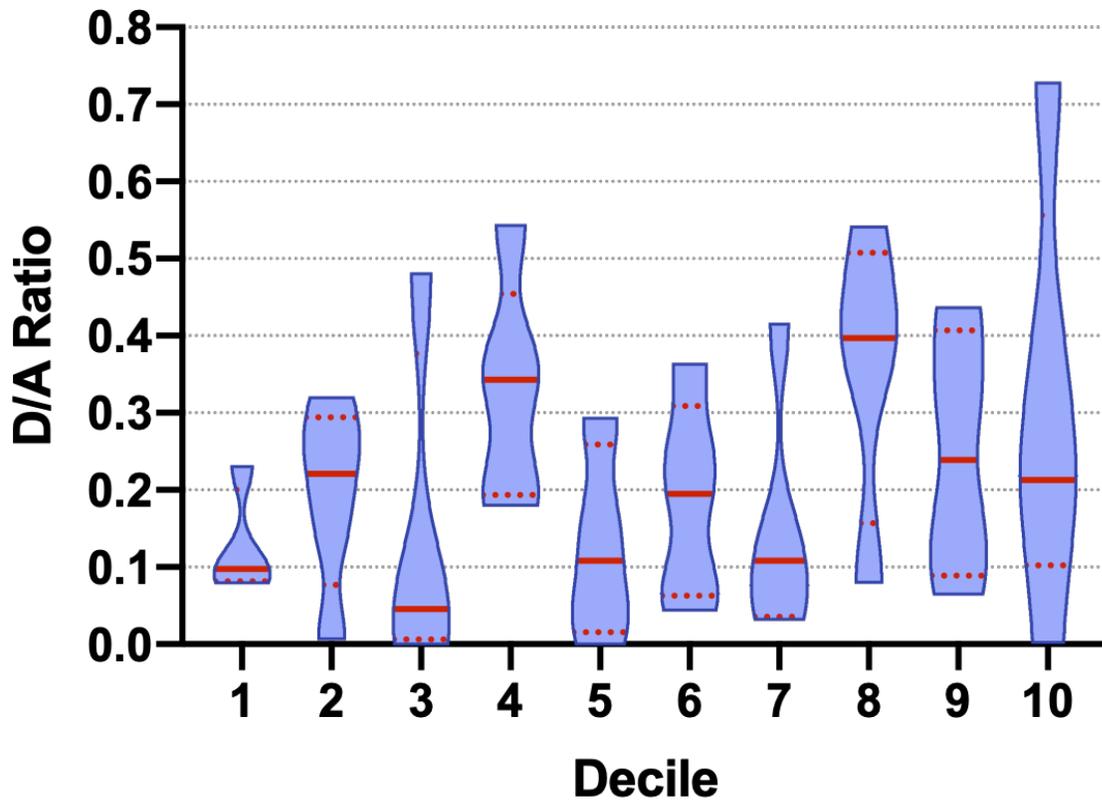


Figure 8. Violin Plot of the Distribution of D/A Ratio for Each Profitability Decile (West)

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