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Farm Values and Financial Performance of Diversified Farms

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Ani L. Katchova*

Abstract

Theoretical arguments suggest that diversification has both value-enhancing and value-reducing effects. Several finance studies have found that the average diversified firm is worth less than a portfolio of comparable single-segment firms. In agriculture, farms have different characteristics and diversification incentives than publicly-traded firms. This study examines the farm diversification discount using data from Illinois and the methodology developed by Burger and Ofek. The results show that, on average, a diversified crop/livestock farm has a lower value and lower return on equity than a portfolio of a specialized crop and livestock farm. The regression results examine the impact of various farm and operator characteristics on the level of diversification discount.

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Farm Values and Financial Performance of Diversified Farms

Many finance studies have examined the relationship between diversification and firm value. Theoretical arguments suggest that diversification has both value-enhancing and value-reducing effects on a firm's value. Some potential benefits include economies of scope, greater borrowing capacity, and less incentive to forego positive net present values. Potential costs include cross-subsidization of poorly performing segments at the expense of the better performing segments, increased resources allowing more opportunities for value-decreasing investments, and misalignment of managerial incentives. During the 1950s and 1960s many corporations diversified their assets. However, this diversification trend has reversed during the last two decades. Recent finance studies conclude that diversified firms waste resources and/or trade at a discount. Individual investors will not pay a premium for a diversified company because they can diversify their portfolios of company holdings through mutual funds and thus reduce risk.

In agriculture, however, farms are not traded and farmers usually do not hold a diversified portfolio of assets. Therefore, diversification is often recommended as a risk management strategy to cope with weather, production, and price risks. Diversification can also allow farmers to utilize time and machinery resources more efficiently. However, if economies of scale are present, specialization can utilize farmer's expertise more efficiently.

Several agricultural finance studies examined the effect of diversification on farm financial performance. Using data from the USDA's 1996 Agricultural Resource Management Study, Mishra, El-Osta, and Steele found that farm profitability depends on farm diversification and other farm characteristics such as operator's age, soil productivity, debt-to-asset ratio, farm size, and crop insurance. Purdy, Langemeier and Featherstone examined the impact of risk and specialization on mean financial performance using a sample of Kansas farms. They found that specializing in swine, dairy, or crop production increased mean financial performance, while specializing in beef production decreased mean financial performance. Other studies have examined the effects of personal and farm characteristics on farm diversification. Mishra and El-Osta examined the impact of various farm, operator, and household characteristics on the level of on-farm diversification. They found that smaller farms, farms that use crop/farm insurance, receive government payments, and have off-farm income are more likely to be diversified. The goal of this study is to measure the diversification discount/premium by comparing farm value and financial performance of diversified and specialized farms.

Several finance studies show that diversification has a negative impact on firm value [Berger and Ofek (1995 and 1996); Gillan, Kensinger, and Martin; Lamont and Polk (2001 and 2002); Whited; Rajan, Servaes, Zingales]. A firm diversification discount is present when firms operating in multiple lines of business tend to have lower values than a portfolio of similar focused firms. Berger and Ofek (1995) estimated diversification's effect on firm value by imputing stand-alone values for individual business segments of a diversified firm. Comparing the sum of these stand-alone values to a diversified firm's actual value implied a 13 percent to 15 percent average value loss from diversification during 1986-1991. Applications of the Burger and Ofek (1995) methodology include Burger and Ofek (1996) showing that diversified firms are more likely to be taken over; Rajan, Servaes, and Zingales and Whited showing that a firm diversification discount is caused by inefficient investment; and Lamont and Polk (2002) demonstrating that industry shocks causing diversification lead to reduction in value. This study uses the Burger and Ofek methodology to examine the effects of diversification on farm value and financial performance.

Empirical Models

The modeling approach compares farm value and financial performance of diversified and specialized farms. In this study, crop/livestock diversification is considered.[1] The excess value model imputes a theoretical value to the diversified farm as the sum of values of the stand-alone crop and livestock enterprises. The imputed value is compared with the actual value to determine the diversification discount/premium,

(1) $I(V) = \Sigma_i w_i (Ind_i (V))$

(2) $Excess\ value = V - I(V)$

where $I(V)$ is the imputed value, w_i is the percentage revenue for crop and livestock enterprises of a diversified farm, $Ind_i (V)$ is the mean value for single-enterprise farms (crop and livestock farms), V is total farm assets, *excess value* is the farm value premium if positive or farm value discount if negative, and i is an index for crop or livestock.

Similarly, the excess return model imputes a theoretical return on equity (ROE) to the diversified farm as the sum of the ROE for the stand-alone crop and livestock enterprises. The imputed ROE is compared with the actual ROE to determine the diversification discount/premium in returns,

(3) $I(ROE) = \Sigma_i w_i (Ind_i (ROE))$

(4) $Excess\ ROE = ROE - I(ROE)$

where $I(ROE)$ is the imputed ROE, w_i is the percentage revenue for crop and livestock enterprises of a diversified farm, $Ind_i (ROE)$ is the mean ROE for single-enterprise farms (crop and livestock farms), *excess ROE* is the farm ROE premium if positive or farm ROE discount if negative, and i is an index for crop or livestock. Equations (1)-(4) will be estimated for every diversified farm in the sample. The average excess value and ROE across diversified farms will be used to analyze the impact of diversification on the value and financial performance of diversified farms.

Mishra and El-Osta studied various factors affecting farm diversification. The goal of this study is to analyze the factors affecting the farm diversification discount, i.e., to analyze the factors making diversified farms underperform in comparison to specialized farms. Regression analysis that relates the farm excess ROE and excess values to farm and personal characteristics is used to determine the factors affecting the farm diversification discount.

Data and Descriptive Results

The data used for the farm values and returns equations are obtained from the Illinois Farm Business Farm Management Association for 1995-2001. Single enterprise crop farms and livestock farms are compared to diversified crop/livestock farms. Livestock farms, as defined in Ellinger et al., are farms where the value of feed fed to livestock is greater than 40 percent of the crop returns.[2] Crop farms are defined as farms where the value of feed fed to livestock is 0

[1] This method can also be applied to other types of diversification such as off-farm diversification.
[2] Most livestock farms in Illinois are not livestock-only farms, as they usually raise grain for feeding. livestock. The definition of livestock farms can bias the results against finding a diversification discount.

percent of crop returns. Diversified farms are defined as farms with a value of feed fed to livestock between 0 and 40 percent.

Table 1 shows the return on equity for crop, livestock, and diversified farms in Illinois. The mean ROE for crop farms was 4.94 percent, for livestock farms was 3.39 percent, and for diversified farms was 2.43 percent for 1995-2001. Using t-tests, the mean ROE for crop farms was significantly higher than the mean ROE for diversified farms and the mean ROE for livestock and diversified farms were not significantly different for the period 1995-2001. The mean ROE for crop farms was significantly higher than the mean ROE for diversified farms for all individual years 1996-2001 and not significantly higher for 1995. The mean ROE for livestock farms was significantly higher than the mean ROE for diversified farms in 1999 and 2001 and significantly lower in 1998. These results imply that the returns of diversified farms are more similar to the returns of livestock farms than to the returns of crop farms. The results also show that diversified farms generally have worse financial performance than crop farms and similar performance to livestock farms. Mean ROE are higher than the median ROE (also shown in table 1) due to the skewed distribution of returns and the effects of outliers.

Farm values, measured as total farm assets, are presented in table 2. The mean total assets are $1.052 million for crop farms, $0.995 million for livestock farms, and $1.023 million for diversified farms for the period 1995-2001. The mean total assets for livestock farms are generally lower than the mean total assets for crop farms (with the exception of year 2001). The mean total assets for diversified farms are not significantly different than the mean total assets for crop and livestock farms and fall generally between the crop and livestock values. The median values are lower than the mean values, however, the relationships between the crop, livestock, and diversified farm values remain similar.

The imputed returns on equity for diversified farms are shown in table 3. The imputed ROE for diversified farms are calculated as the weighted sum of the mean ROE for crop farms and the mean ROE for livestock farms with weights being the percentage of gross crop returns and the percentage of gross livestock returns, respectively. The imputed ROE are higher than the actual ROE for diversified farms for all years. The excess ROE is -2.47 percent for 1995-2001 and it ranges from -4.16 percent in 1998 to -2.16 percent in 2001. The excess ROE are significant at the 5 percent level for all years. These results suggest that diversified farms with both crop and livestock enterprises have lower financial performance than similar single-enterprise crop and livestock farms.

The imputed values for diversified farms are given in table 4. The imputed values for diversified farms are calculated as the weighted sum of the mean values for crop farms and mean values for livestock farms with weights being the percentage of gross crop returns and the percentage of gross livestock returns, respectively. The imputed values are higher than the actual values for all years. The excess values are only significant for the 1995-2001 combined years and are not significant for the individual years. Mean total assets of diversified farms are $26,000 lower when compared with mean total assets of single-enterprise crop and livestock farms. Therefore, the results show a farm diversification discount of $26,000 in farm assets and -2.47 percent in returns on equity.

Regression Results

Regression results for the farm characteristics affecting the excess ROE and values are shown in table 5. The regressions include data for 4,178 diversified crop/livestock farms in Illinois for 1995-2001. Since the excess ROE and values are generally negative, i.e., actual ROE

and values are below the imputed ROE and values, a negative significant coefficient will mean that farms lose more value as they become more diversified, which is equivalent to saying that the diversification discount is higher as an absolute value.

Farms with higher debt to asset ratios have higher ROE and value diversification discounts. From a lender's perspective, farms that are more diversified have lower values and returns than those that are specialized, however, these farms might have better chances of repaying their debt in case of a crop or livestock production shortfall in a given year. Farms with higher soil productivity, more tillable acres and higher tenure have lower diversification discounts. Ellinger and Barry found that farms with higher tenure have lower rates of return but these results show that these farms have a lower diversification discount. It is likely that farms with higher soil productivity tend to have larger crop enterprises and smaller livestock enterprises therefore they are more specialized, hence the small diversification discount. Mishra and El-Osta found that farms receiving more government payments are more diversified. The regression results show that their diversification discount is lower. Farms with more farm assets and higher ROE have a higher diversification discount, consistent with the hypothesis of wasting resources on less profitable enterprises. Older farmers have a lower diversification discount in values and higher diversification discount in ROE. This result is consistent with the life-cycle hypothesis of farmers acquiring more land as they age and therefore having more total assets and lower ROE due to the nondepreciability of land.

Dummy variables for different years are included in the regression. The results show that the farm values discount was lower in 1996 and higher in 1997-2001 in comparison with the farm values discount in 1995. The ROE discount was lower in 1996-1998 and higher in 1999-2001.

Conclusions

This study examines the farm diversification discount, i.e., the farm value and financial performance of diversified crop/livestock farms compared to those of single-enterprise crop and livestock farms. The model approach follows the methodology outlined in Berger and Ofek. The imputed values (financial performance) of diversified farms are calculated as the sum of the mean values (financial performance) for crop and livestock farms weighted by the percentage of crop and livestock returns for the diversified farms. Using Illinois farmer data, the results show that there is a farm diversification discount: on average, diversified farms have $26,000 less in farm assets and 2.47 percent lower return on equity than a portfolio of single-enterprise crop and livestock farms. The regression results examine the impact of various farm and operator characteristics on the level of the diversification discount.

The results in this study extend the findings in the finance literature to the agricultural sector. The results show that there is also a diversification discount in agriculture. However, the policy recommendations for firms and farms might still be different. Individual investors usually do not hold a significant proportion of their portfolio in a single firm whereas farm assets represent a significant proportion of a farmer's portfolio. Therefore, diversification in agriculture may still be beneficial as a risk-reduction strategy rather than a value-enhancing strategy.

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Table 1. Return on Equity (ROE) by Farm Type.

Year	All Farms	Crop Farms	Live-stock Farms	Diver-sified Farms	All Farms	Crop Farms	Live-stock Farms	Diver-sified Farms
	Median ROE				Mean ROE			
1995-2001	2.88	3.21	3.27	2.06	4.00	4.94 [a]	3.39	2.43
1995	8.63	9.11	8.76	7.84	10.57	11.13	11.81	8.87
1996	11.52	12.39	9.57	10.98	15.71	17.79 [a]	11.18	14.36
1997	4.28	5.18	1.69	3.73	5.87	7.65 [a]	2.06	4.19
1998	-2.21	-0.90	-8.33	-3.81	-5.08	-2.61 [a]	-12.92 [b]	-6.70
1999	1.02	1.45	1.93	0.02	0.31	0.91 [a]	2.67 [b]	-1.65
2000	2.84	3.02	2.54	2.58	3.53	4.21 [a]	4.09	2.05
2001	-0.26	0.03	0.50	-1.31	-1.21	-0.51 [a]	0.21 [b]	-3.20

Note: Returns are measured in percentages.
[a] The Mean ROE of diversified farms is significantly different than the mean ROE of crop farms at the 5% level.
[b] The Mean ROE of diversified farms is significantly different than the mean ROE of livestock farms at the 5% level.

Table 2. Farm Value (Total Assets) by Farm Type.

Year	All Farms	Crop Farms	Live-stock Farms	Diver-sified Farms	All Farms	Crop Farms	Live-stock Farms	Diver-sified Farms
	Median Values				Mean Values			
1995-2001	832	841	806	822	1036	1052	995	1023
1995	696	710	677	690	851	873	798	845
1996	758	780	758	736	929	950	899	908
1997	812	820	765	810	1007	1020	952	1009
1998	835	833	830	839	1051	1058	1038	1043
1999	873	873	853	878	1086	1098	1065	1069
2000	903	918	882	890	1120	1128	1126	1102
2001	943	933	997	941	1170	1161	1263	1158

Note: Values are measured in thousand dollars.

Table 3. Excess ROE for Diversified Farms.

Year	ROE (%)	Imputed ROE (%)	ROE – Imputed ROE (%)	T-stat for difference	Number of Farms
1995-2001	2.43	4.89	-2.47	-7.09*	4178
1995	8.87	11.15	-2.28	-2.21*	552
1996	14.36	17.71	-3.36	-3.27*	574
1997	4.19	7.50	-3.31	-4.04*	578
1998	-6.7	-2.54	-4.16	-5.41*	558
1999	-1.65	1.00	-2.66	-3.06*	657
2000	2.05	4.21	-2.16	-2.74*	654
2001	-3.2	-0.47	-2.73	-3.19*	605

Note: * means significant at the 5% level.

Table 4. Excess Value for Diversified Farms.

Year	Value	Imputed Value	Value – Imputed Value	T-stat for difference	Number of Farms
1995-2001	1023	1049	-26	-2.00*	4178
1995	845	871	-26	-0.85	552
1996	908	950	-42	-1.33	574
1997	1009	1018	-9	-0.25	578
1998	1043	1058	-15	-0.40	558
1999	1069	1097	-28	-0.79	657
2000	1102	1128	-26	-0.74	654
2001	1158	1166	-8	-0.24	605

Note: * means significant at the 5% level. Values are measured in thousand dollars.

Table 5. Regressions Results for Factors Affecting the Excess ROE and Excess Value for Diversified Farms.

Excess ROE Model			Excess Value Model		
Variables	Coefficient	Standard Error	Variables	Coefficient	Standard Error
Intercept	-2.634	3.085	Intercept	-2031.480	83.119*
Debt to Asset Ratio	-0.118	0.016*	Debt to Asset Ratio	-5.286	0.434*
Soil Rating	0.156	0.027*	Soil Rating	7.147	0.743*
Tillable Acres	0.006	0.001*	Tillable Acres	0.609	0.019*
Tenure	5.292	1.735*	Tenure	1385.564	42.454*
Government payments	6.55E-06	1.59E-05*	Government payments	0.009	0.000*
Farm Assets	-0.003	0.001*	ROE	-2.081	0.423*
Operator's Age	-0.137	0.035*	Operator's Age	9.895	0.941*
Year 96	5.961	1.259*	Year 96	111.067	34.519*
Year 97	-4.585	1.254*	Year 97	119.007	34.341*
Year 98	-16.102	1.273*	Year 98	32.215	35.507
Year 99	-12.583	1.325*	Year 99	-161.188	36.600*
Year 00	-9.628	1.360*	Year 00	-188.181	37.347*
Year 01	-14.607	1.368*	Year 01	-137.880	37.910*
Adj. R^2	0.13		Adj. R^2	0.54	
Number of Farms	4178		Number of Farms	4178	

Note: * means significant at the 5% level.