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Financial Performance, Risk, and Specialization

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ABSTRACT

A sample of Kansas farms was used to examine the impact of risk and specialization on mean financial performance. Mean financial performance was hypothesized to be influenced by risk, age of the operator, percentage of acres owned, financial efficiency, leverage, specialization, and farm size. Risk, age of operator, financial efficiency, and farm size had the largest impacts on mean financial performance. Specializing in swine, dairy, or crop production increased mean financial performance, while specializing in beef production decreased mean financial performance. Farms with both crops and a livestock enterprise (beef, swine, or dairy) tended to have less variability in financial performance.

Key Words: financial efficiency, return on equity, specialization.

The agricultural sector is facing a transitional period that is commonly referred to as the industrialization of agriculture. Boehlje describes this industrialization as "the application of modern industrial manufacturing, production, procurement, distribution, and coordination concepts to the food and industrial product chain" (p. 163). One of the characteristics of this industrialization is increased specialization or business focus. The impact of specialization on the mean and variability of financial performance is not well understood.

The impact of specialization on mean financial performance depends on the relative importance of economies of size and economies of scope. If economies of size for a particular enterprise are significant, specializing in the production of that enterprise would increase mean financial performance. However, if economies of scope are prevalent, an increase in specialization will result in a relative decrease in mean financial performance (Panzer and Willig; Jovanovic). For instance, diversification may be used to fully employ labor or to ensure the quality of crops or hay for livestock feed.

Specialization also may affect the variability of financial performance. Enterprise diversification can be an important tool for managing risk (Fleisher; Robison, and Barry; Sonka and Patrick). Enterprise diversification is particularly effective when the returns between two enterprises or groups of enterprises are uncorrelated or negatively correlated. Historically, many farms diversified their operations by producing both crops and livestock. By specializing, farms may be able to capture product-specific economies of size, but in the

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process may also reduce their ability to manage risk or capture economies of scope.

Recent studies have examined the importance of diversification in explaining nonagricultural corporate financial performance. Montgomery noted that firms have diversified into related industries to improve mean financial performance. However, other research (Wernerfelt and Montgomery; Lang and Stulz; Hoskisson and Hitt) found evidence that diversification reduces mean financial performance. Firms that are more specialized tend to improve strategic control.

Farm management research that has investigated the relationship between specialization and mean financial performance is limited. Haden and Johnson examined the relationship between farm income and milk sales as a percentage of total farm sales for a sample of Tennessee dairy farms. Milk sales as a percentage of total farm sales were negatively related to cash farm income, but were unrelated to net farm income or returns to operator labor and management. Kauffman and Tauer did not find a significant relationship between specialization and labor and management income or the rate of return on equity for a sample of New York dairy farms. However, neither of these studies addressed the potential impact of specialization on nondairy farms or included risk in the analysis.

The objective of this study is to investigate the impact of risk and specialization on mean financial performance. Specifically, the impact of specialization on the mean and variance of return on equity is examined.

Conceptual Framework

The relationship between risk and return has been studied extensively (Robison and Barry; Sonka and Patrick). Since its development by Markowitz, the E-V model has been a popular method to examine the relationship between risk and return. The E-V model typically is used as a method to approximate all risk-averse utility functions (Levy and Markowitz). The advantage of the E-V model is that all choices can be summarized by the first two moments (mean and variance). Tobin notes that expected utility-maximizing decisions are part of the E-V efficient set when choices involve a risky and a safe asset. As indicated by Robison and Barry, if choices can be represented by various combinations of a risky and a safe asset, the following linear relationship between risk and return can be specified:

$$E(y) = \alpha + \lambda/2 \ \mathrm{Var}(y), \tag{1}$$

where $E(y)$ is the expected or mean outcome, $\mathrm{Var}(y)$ is the variance of outcomes, α is the intercept, and λ is the Pratt-Arrow absolute risk aversion coefficient.

Specialization or diversification impact both the mean and variance of financial performance, or the dependent and independent variables in equation (1). A positive relationship between specialization and mean financial performance would indicate that specialization improves mean financial performance. Conversely, if economies of scope are relatively important, the degree of specialization could be negatively related to mean financial performance. To the extent that diversification reduces risk, the degree of specialization would be expected to be positively related to risk or the variance of financial performance.

In addition to risk and specialization, many other factors have been analyzed in previous farm success or financial performance studies (Fox, Bergen, and Dickson). These other factors include operator age (Haden and Johnson; Kauffman and Tauer; Tauer), land tenure (Ellinger and Barry; Plumley and Hornbaker), financial efficiency (Ford and Shonkwiler; Plumley and Hornbaker), leverage (Ford and Shonkwiler; Haden and Johnson; Plumley and Hornbaker), and farm size (Boessen et al.; Ford and Shonkwiler; Haden and Johnson; Kauffman and Tauer; Sonka, Hornbaker, and Hudson). Previous research suggests that operator age, land tenure, financial efficiency, and leverage are negatively related to mean financial performance.

Previous research addressing the impact of farm size on mean financial performance is inconclusive. Several different variables have been used to measure the impact of farm size on financial success or mean financial performance. When analyzing farms of a specific type (such as dairy farms), it is typical to use herd size or acres operated to measure size. When examining the performance for farms with several enterprises, it is typical to use either total acres operated or gross farm income to measure farm size. Both of these measures are problematic. It is difficult to use total acres operated to measure the performance of farms with a wide variation in land type or quality. However, there are even more problems associated with using gross farm income to measure size. Problems associated with using this measure of farm size include changing price levels across years, changing enterprise price relationships, and changing effects of weather across years (Stanton). Thus, in the current study, total acres operated was used as the measure of farm size. Furthermore, to capture the possibility of a nonlinear relationship between financial performance and farm size, linear and quadratic terms were used.

Using the variables described above, the following relationship was specified:

$$MROE = f(VROE, AGE, POWN, OER, DER, DTAR, SPEC, pACRES), \tag{2}$$

where *MROE* is the mean return on equity for each farm, *VROE* is the variance of return on equity for each farm, *AGE* is the age of the operator, *POWN* is the percentage of total acres owned, *OER* is the operating expense ratio, *DER* is the depreciation expense ratio, *DTAR* is the debt-to-asset ratio, *SPEC* is a measure or set of measures relating to specialization or diversification, and *ACRES* is the total number of acres operated.

Four different specifications of equation (2) were used to determine the impact of specialization on mean financial performance. Specialization measures used included a specialization of income index, interaction terms between crop and livestock income, percentage of income from crops, and percentage of income from livestock. The specialization of income index was used to examine the impact of whole-farm specialization on mean financial performance. The interaction terms were used to analyze the impact of crop and livestock diversification on mean financial performance. These interaction terms were computed by multiplying the percentage of income from crops by the percentage of income derived from beef, dairy, or swine production. The percentage of income from specific crop and livestock enterprises was used to examine the impact of specializing in crop or livestock production.

Equation (2) could be estimated with ordinary least squares. However, if *VROE* is a stochastic regressor, estimating equation (2) with ordinary least squares could result in inconsistent estimates (Judge et al.). To obtain consistent estimates, a separate equation was estimated for risk. Following Schurle and Tholstrup, the risk equation was specified as

$$VROE = f(AGE, DTAR, SPEC, GOVT, ACRES, REGION), \tag{3}$$

where *GOVT* is the percentage of gross farm income derived from government payments, *REGION* denotes a set of dummy variables indicating the Kansas Farm Management Association region in which the farm was located, and all other terms are as previously defined.

Four different specifications of equation (3), one for each of the specialization specifications, were estimated. Specialization (diversification) was expected to be positively (negatively) related to *VROE*. Age of operator, the debt-to-asset ratio, and total acres operated were expected to be positively related to *VROE* (Schurle and Tholstrup). Government payments as a percentage of gross farm income was expected to be negatively related to *VROE*. In other words, participation in government programs was expected to reduce risk or variability of financial performance. The regional dummy variables accounted for differences in weather and cropping practices among regions of Kansas.

To obtain consistent estimates, equations (2) and (3) could be estimated using an instrumental variable approach or as a system of equations (Kmenta). With the instrumental variable approach, the independent variables would be used as instruments to estimate equation (2). The systems approach would estimate both equations together and would result in estimates that were not only consistent, but also asymptotically efficient. A systems approach or three-stage least squares (3SLS) was used in this study, with all percentage variables expressed in decimal form.

Elasticities were computed using the regression coefficients in equations (2) and (3). The chain rule was used to calculate the elasticities for variables that appeared in both equations.

Kansas Farm Management Data

Data for 320 farms in the Kansas Farm Management Associations with continuous data from 1985 through 1994 were used in this study. These 320 farms represented about 12% of the total farms enrolled in the Kansas Farm Management Associations in 1994.[1]

Data from the Kansas Farm Management Associations are well suited for examining financial performance. Income, expense, and balance sheet information was available for each farm. Income was expressed on an accrual basis and could be separated into three categories: crop, livestock, and custom work. Livestock income was reported on a value-added basis. Each farm recorded both cash and noncash (e.g., depreciation) expenses. Assets and liabilities were broken down into enough detail so that current, intermediate, and long-term categories could be identified. In addition, the data were checked by area Association economists to improve accuracy and completeness.

Table 1 presents the averages and standard deviations of selected annual production and financial factors for the 320 farms used in this study. All financial variables are converted to 1994 dollars using the implicit price deflator for personal consumption expenditures (U.S. Department of Commerce). The financial ratios reported in table 1 were calculated using the *Recommendations of the Farm Financial Standards Council* (Farm Financial Standards Council). Market values for assets were used in the computations. The current ratio in table 1 was calculated by dividing current liabilities by current assets. Several of the farms had zero current liabilities. Thus, the current ratio was inverted so that this ratio could be calculated for each farm. The return on equity reported in table 1 accounts for unpaid operator labor and management as well as capital gains and losses on land. Data on capital gains for assets other than land were not available. Following the procedures of the Kansas Farm Management Associations, a flat labor charge per operator ($22,500 in 1994) and a management charge of 5% of gross farm income were used to compute unpaid operator labor and management charges. Nonfarm assets and liabilities were not included in any of the financial ratios.

Average gross farm income for the 320 farms over the 1985–94 period was $236,166, and ranged from $38,297 to $1,150,813. On average, 61.6% of gross farm income was derived from crop income (47.8% from corn, grain sorghum, wheat, and other small grains; 11.8% from soybeans and sunflowers; and 2% from hay and forage production). Livestock production accounted for 33.7% of gross farm income and was comprised of income from beef (20.1%), swine (8%), dairy (4.9%), and sheep and poultry (0.7%). The remaining 4.7% of gross farm income was derived from custom work.

Herfindahl indices (Greer) were computed to examine the extent to which the 320 farms were diversified or specialized. Using average income information for each farm, the Herfindahl index summed the squares of the percentage of income from crops, livestock, and custom work. The Herfindahl index for a specific farm depended on the percentage of income derived from each of the three sources. For example, a farm that reported 50% of its income from crops and 50% from livestock income had a specialization of income index of 0.50. A diversified farm had a low index (slightly above 0.33), while that for a specialized farm was close to 1.00. As shown in table 1, the specialization of income index averaged

[1] The 320 farms used in this study do not represent a random sample. Farms that left the Kansas Farm Management Associations because of retirement, bankruptcy, or for other reasons were not included in the analysis. Also, farms with one or more years of incomplete data were not included in the sample.

Table 1. Financial and Production Measures for a Sample of 320 Kansas Farms, 1985–94

Variable	Unit	Average	Std. Dev.
Profitability Measures:			
Gross Farm Income	$	236,166	176,958
Net Farm Income	$	52,423	45,515
Return on Assets	%	5.84	4.56
Return on Equity	%	3.95	11.09
Profit Margin Ratio	%	11.77	12.92
Liquidity Measure:			
Inverted Current Ratio	%	0.56	0.66
Solvency Measures:			
Debt-to-Asset Ratio	%	32.82	22.27
Total Assets	$	662,861	464,327
Net Worth	$	464,075	407,322
Financial Efficiency Measures:			
Asset Turnover Ratio	%	40.60	20.12
Operating Expense Ratio	%	59.51	10.04
Depreciation Expense Ratio	%	10.54	4.35
Interest Expense Ratio	%	8.00	6.29
Net Farm Income Ratio	%	21.78	11.11
Farm Characteristics:			
Age of Operator	Years	50.35	10.07
Percent Acres Owned	%	39.21	25.47
Specialization of Income Index	Index	0.6691	0.1537
Percent Income from Livestock	%	33.69	28.32
Percent Income from Crops	%	61.56	27.43
Percent Income from Gov't. Payments	%	12.76	8.14
Production Characteristics:			
Total Acres Operated	No.	1,634	1,072
Irrigated Crop Acres[a]	No.	104	266
Dryland Crop Acres[a]	No.	969	641
Pasture Acres	No.	517	796
Beef Cows	No.	37	59
Sows	No.	16	57
Dairy Cows	No.	6	28
Beef Feeders	No.	129	231

Notes: Data constructed from 1985–94 continuous data records maintained by sample farms participating in the Kansas Farm Management Associations program. All financial variables are converted to 1994 dollars.

[a] Includes acres cropped, fallow acres, annual set-aside acres, and CRP acres.

0.6691, and ranged from 0.3697 to 0.9781. The distribution of this index among the 320 sample farms was as follows: 44 farms had an index that was less than 0.50, 174 farms had an index between 0.50 and 0.75, and the remaining 102 farms had an index that was greater than 0.75. Thus, there was a wide range in the level of specialization among the farms in the sample.

Results

The econometric results are reported in tables 2 and 3.[2] The system R^2 measures for the four

[2] Multicollinearity tests were conducted using ordinary least squares regression for each equation. The condition indices for the *VROE* equations ranged from 20 to 22, while those for the *MROE* equations ranged

Table 2. Empirical Models Examining the Impact of Diversification on the Mean and Variance of Return on Equity

	Whole-Farm Specialization[a]		Crop and Livestock Diversification[a]	
Variable	*MROE*	*VROE*	*MROE*	*VROE*
Intercept	0.443756*** (0.078659)	−0.083379* (0.042710)	0.414963*** (0.065401)	0.007483 (0.038018)
Variance of Return on Equity	0.849491* (0.462859)		1.039313** (0.490081)	
Age of Operator	−0.001542** (0.000768)	0.000350 (0.000592)	−0.001501* (0.000828)	0.000390 (0.000585)
Percent Acres Owned	−0.058386*** (0.022226)		−0.060563*** (0.021909)	
Operating Expense Ratio	−0.454572*** (0.054365)		−0.469038*** (0.053690)	
Depreciation Expense Ratio	−0.366571*** (0.130832)		−0.337737*** (0.129819)	
Debt-to-Asset Ratio	−0.357157** (0.167245)	0.353640*** (0.026413)	−0.419366** (0.175736)	0.349122*** (0.026203)
Specialization of Income Index	−0.016128 (0.055003)	0.098477** (0.038283)		
Percent Income from Gov't. Payments		−0.213142*** (0.061189)		−0.198385*** (0.060240)
Beef/Crop Diversification			−0.006220 (0.119199)	−0.163804** (0.077114)
Swine/Crop Diversification			0.376582** (0.148835)	−0.216256** (0.104141)
Dairy/Crop Diversification			0.699088** (0.306515)	−0.553262*** (0.175250)
Total Acres Operated	5.5469E-05*** (1.3885E-05)	−3.2670E-06 (5.3390E-06)	6.4460E-05*** (1.4368E-05)	−4.5020E-06 (5.4060E-06)
Total Acres Operated Squared	−5.8257E-09** (2.3326E-09)		−6.5748E-09*** (2.3271E-09)	
Northeast Region		−0.008844 (0.012007)		−0.011425 (0.010950)

Table 2. (Continued)

Variable	Whole-Farm Specialization[a]		Crop and Livestock Diversification[a]	
	MROE	*VROE*	*MROE*	*VROE*
North Central Region		−0.018573 (0.013647)		−0.016708 (0.012444)
South Central Region		−0.026153* (0.015455)		−0.021830 (0.014863)
Southwest Region		0.009953 (0.016558)		0.009648 (0.014978)
Northwest Region		0.014201 (0.017912)		0.015037 (0.016174)
System R^2	0.3641		0.3741	

Notes: Numbers in parentheses are standard errors. Single, double, and triple asterisks (*) denote significance at the 10%, 5%, and 1% level, respectively.

[a] Definitions of dependent variables: *MROE* = mean return on equity, and *VROE* = variance of return on equity.

possible specifications of specialization ranged from 0.3641 to 0.3803. Most of the coefficients in the *MROE* equations were significant at the 10% level or lower. The coefficients on age of the operator, farm size, and region of the state (with the exception of the south central region in the second column of table 2) were not significant in any of the *VROE* equations. Positive (negative) parameter estimates indicate that the variable was mean or risk increasing (decreasing).

Financial performance elasticities were computed using the regression coefficients and variable means. Table 4 presents the elasticities for each variable. When interpreting the elasticities in table 4, note that all of the percentage variables were estimated in decimal form. The information provided in tables 2, 3, and 4 is used below to discuss the relative importance of each factor in explaining financial performance.

As expected, there was a positive relationship between *MROE* and *VROE*. Farms with higher mean financial performance tended to have a higher variance of financial performance. Furthermore, *VROE* was elastic in each of the *MROE* equations. Using the elasticity for *VROE* in the first column of table 4, a 10% increase in the mean of *VROE* (0.0765 to 0.0842) would result in an increase in *MROE* from 0.0395 to 0.0460, or a 16.47% increase.

As expected, age of operator was significant and negatively related to *MROE*. However, age of operator did not have a significant impact on *VROE*. Age of operator was elastic in each of the *MROE* equations, and mean financial performance was more responsive to this variable than it was to percentage of acres owned, the depreciation expense ratio, the debt-to-asset ratio, and specialization. Again, using the information in the first column of table 4, a 10% increase in mean operator age (50.35 to 55.39) would result in a decrease in

from 32 to 35. None of the variance decomposition proportions among two or more estimated coefficients were greater than 0.50. These results suggest that multicollinearity was not a serious problem.

Table 3. Empirical Models Examining the Impact of Crop and Livestock Specialization on the Mean and Variance of Return on Equity

	Crop Specialization[a]		Livestock Specialization[a]	
Variable	*MROE*	*VROE*	*MROE*	*VROE*
Intercept	0.470614*** (0.074092)	−0.071550* (0.037383)	0.413666*** (0.067720)	0.008756 (0.037612)
Variance of Return on Equity	0.853919 (0.529888)		1.138484** (0.481619)	
Age of Operator	−0.001614** (0.000771)	0.000477 (0.000585)	−0.001572* (0.000878)	0.000414 (0.000582)
Percent Acres Owned	−0.053536** (0.022422)		−0.055127** (0.022178)	
Operating Expense Ratio	−0.435604*** (0.056636)		−0.429529*** (0.055408)	
Depreciation Expense Ratio	−0.400437*** (0.134788)		−0.407080*** (0.134450)	
Debt-to-Asset Ratio	−0.358230* (0.188479)	0.347177*** (0.026203)	−0.458361*** (0.172954)	0.345249*** (0.026139)
Percent Income from Gov't. Payments		−0.253879*** (0.095257)		−0.234438*** (0.069997)
Percent Income from Grains	−0.073114** (0.032785)	0.086915** (0.034615)		
Percent Income from Soybeans/Sunflowers	−0.005244 (0.079331)	0.083458* (0.047406)		
Percent Income from Beef			0.014421 (0.045663)	−0.080465*** (0.029817)
Percent Income from Swine			0.105267** (0.048431)	−0.059571* (0.034669)
Percent Income from Dairy			0.144687** (0.057764)	−0.112749*** (0.032848)
Total Acres Operated	4.7207E-05*** (1.3721E-05)	2.9920E-06 (5.2690E-06)	5.3008E-05*** (1.4492E-05)	2.5720E-06 (5.5500E-06)
Total Acres Operated Squared	−4.4036E-09* (2.3230E-09)		−4.3812E-09* (2.2914E-09)	

Table 3. (Continued)

Variable	Crop Specialization[a]		Livestock Specialization[a]	
	MROE	*VROE*	*MROE*	*VROE*
Northeast Region		−0.010833 (0.011989)		−0.011212 (0.010314)
North Central Region		−0.012781 (0.014111)		−0.014087 (0.011450)
South Central Region		−0.018357 (0.016511)		−0.020588 (0.013617)
Southwest Region		0.018422 (0.018646)		0.009275 (0.014360)
Northwest Region		0.020223 (0.018913)		0.016934 (0.015379)
System R^2	0.3716		0.3803	

Notes: Numbers in parentheses are standard errors. Single, double, and triple asterisks (*) denote significance at the 10%, 5%, and 1% level, respectively.

[a] Definitions of dependent variables: *MROE* = mean return on equity, and *VROE* = variance of return on equity.

MROE from 0.0395 to 0.0332, or a 15.95% decrease.

The coefficient on percentage of acres owned had the expected negative sign and was significant in each of the *MROE* equations. This result is consistent with research by Ellinger and Barry, and Plumley and Hornbaker, who found that ownership of land decreased mean rates of return. Percentage of acres owned was inelastic for each of the *MROE* equations. Using the results in the first column of table 4, a 10% increase in the mean percentage of acres owned (0.3921 to 0.4313) would result in a decrease in *MROE* from 0.0395 to 0.0372, or a decrease of 5.82%.

The coefficients on the operating expense ratio and the depreciation expense ratio had the expected negative signs and were significant in each of the *MROE* equations. Thus, higher expense ratios reduce rates of return. Mean financial performance was more responsive to changes in the operating expense ratio than it was to any other independent variable. The depreciation expense ratio was less elastic than the operating expense ratio in each of the *MROE* equations. Based on the results in the first column of table 4, a 10% increase (0.5951 to 0.6546) in the mean of the operating expense ratio would result in a decrease in *MROE* of 0.0271 (0.0395 to 0.0124), or a decrease of 68.61%. Thus, controlling production costs, particularly operating costs, was critical to financial success. Given the relative importance of operating costs in profit and return calculations, this result was not surprising.

The debt-to-asset ratio was negatively related to *MROE* and positively related to *VROE*. Thus, on average, a decrease in leverage resulted in a decrease in mean financial performance and an increase in the variability of financial performance. The average return on equity for the sample of farms was 3.95%, while the average return on assets was 5.84%. Given this relationship between ROA and ROE, it was not surprising to find a negative relationship between leverage and the return on equity. The positive relationship between leverage and risk is consistent with the finding

Table 4. Financial Performance Elasticities for Mean Return on Equity Equations

	Equation Number[a]			
Variable	(1)	(2)	(3)	(4)
Variance of Return on Equity	1.647	2.015	1.655	2.207
Age of Operator	−1.587	−1.397	−1.539	−1.404
Percent Acres Owned	−0.580	−0.602	−0.532	−0.548
Operating Expense Ratio	−6.852	−7.070	−6.566	−6.475
Depreciation Expense Ratio	−0.979	−0.902	−1.069	−1.087
Debt-to-Asset Ratio	−0.472	−0.470	−0.514	−0.543
Specialization of Income Index	1.144			
Beef/Crop Diversification		−0.407		
Swine/Crop Diversification		0.111		
Dairy/Crop Diversification		0.345		
Percent Income from Grains			0.013	
Percent Income from Soybeans/Sunflowers			0.198	
Percent Income from Beef				−0.393
Percent Income from Swine				0.076
Percent Income from Dairy				0.020
Total Acres Operated	2.181	2.474	1.848	2.073

[a] Definitions of equations: (1) = empirical model examining whole-farm specialization, (2) = empirical model examining crop and livestock diversification, (3) = empirical model examining crop specialization, and (4) = empirical model examining livestock specialization.

of Barry and Baker that increased leverage resulted in higher risk.

Compared to other variables, mean financial performance was relatively unresponsive to changes in leverage. For instance, using the elasticity for the debt-to-asset ratio in the first column of table 4, a 10% increase in the mean leverage ratio (0.3282 to 0.3610) would result in a decrease in *MROE* from 0.0395 to 0.0376, or a decrease of 4.81%. Part of the reason for the relatively small impact of leverage on *MROE* was related to the opposite signs for this variable in the mean and variance equations. The impact of the negative sign on the leverage variable in the *MROE* equations was partially offset by the positive relationship between leverage and risk.

The coefficients on the total acres variable had the expected signs and were significant in the *MROE* equations. Farm size did not have a significant impact on the variability of financial performance. The coefficients on the total acres operated variable in the *MROE* equations can be used to examine optimal farm size. Depending on which set of equations was used, the return on equity peaked at a farm size of 4,761 to 6,049 total acres operated. The largest farm in the sample had 7,428 acres. The optimal farm size was substantially larger than the average farm size. These results suggest that strong overall economies of scale exist for this sample of farms. If these size advantages continue to exist in the future, farm size will increase and the industry will continue to consolidate. In addition, farm size was elastic in each of the *MROE* equations. From the results in the first column of table 4, a 10% increase in the mean of total acres operated (1,634 to 1,797) would result in an increase in *MROE* from 0.0395 to 0.0481, which represents a 21.77% increase in financial performance.

The coefficient on total acres operated was insignificant in each of the *VROE* equations. This result suggests that farm size does not change the slope of the risk/return tradeoff. Therefore, an increase in farm size results in an upward shift in the risk/return tradeoff.

Several alternative variables were used to estimate the impact of specialization and diversification on financial performance. Results differed among the alternative specifications. The coefficient on the specialization of income variable was positive and significant in the

VROE equations, but was insignificant in the *MROE* equations. This suggests that whole-farm specialization (diversification) increases (decreases) the variability of financial performance. Due to the positive relationship between whole-farm specialization and risk, the elasticity with respect to this variable was positive (table 4).

The coefficients for the crop and livestock diversification variables are reported in the third and fourth columns of table 2. The coefficients on the three diversification variables were significant and negative in the *VROE* equations. Thus, diversification between beef, swine, or dairy production and crop production decreased the variability of return on equity. In the *MROE* equations, the coefficients for the swine/crop and dairy/crop variables were significant and positive, while the coefficient for the beef/crop variable was insignificant.

The results for the three diversification variables reveal two notable implications. First, either scope economies were associated with producing swine or dairy and crops, or dairy and swine production were considerably more profitable than the other enterprises. The results discussed below for swine and dairy specialization support the latter explanation. Second, producing both beef and crops did not increase *MROE,* but did reduce risk. Over 80% of the farms in the sample had both beef and crop enterprises. The results suggest that the primary reason for producing these two enterprises together revolves around risk reduction.

The elasticities for the three diversification variables were relatively small in comparison to those for the other factors affecting financial performance. Thus, the impact of crop/livestock diversification on mean financial performance was relatively small compared to the impact of factors such as age of operator, financial efficiency, or farm size.

The impact on *MROE* and *VROE* of specializing in crop or livestock production can be found in table 3. The coefficients on the two crop variables in the *VROE* equations were significant and positive, while the coefficients on the three livestock variables were significant and negative. Specializing either in grain production (corn, grain sorghum, wheat, or other small grain production) or in soybeans and sunflowers increased the variability of financial performance. Conversely, specializing in livestock production (beef, swine, or dairy production) reduced the variability of financial performance. The results in table 4 indicate that specialization in swine, dairy, or crop production increased mean financial performance, while specialization in beef production decreased mean financial performance. The increase in mean financial performance associated with swine or dairy production was more likely due to product-specific economies of scale or the profitability of these two enterprises, while the increase in mean financial performance associated with crop production was more likely the result of an increase in risk. Obviously, there were large benefits associated with producing swine or dairy. These two enterprises were mean increasing and risk reducing. These results are consistent with the increases in farm size and consolidation that have taken place in these two industries.

The elasticities for the crop and livestock specialization variables in the third and fourth equations were relatively small compared to many of the other variables, suggesting that mean financial performance was not particularly responsive to changes in crop or livestock specialization. The impact of specialization on *VROE* tended to offset the direct relationship between specialization and *MROE.*

Conclusions and Implications

Industrialization of agriculture has resulted in an increased emphasis on business focus or specialization. The impact of specialization on the mean and variability of financial performance is not well understood. This study used a sample of Kansas farms to examine the impact of specialization on the mean return on equity per farm and the variance of return on equity per farm. An index for whole-farm specialization was computed using information on livestock income, crop income, and income from custom work. The impact of specializing in crop or livestock production also was studied. Other factors used in the analysis included age of operator, percentage of acres owned, financial efficiency ratios, leverage, and farm size.

Age of operator, percentage of acres owned, financial efficiency, and leverage were negatively related to financial performance, while farm size was positively related to financial performance. Unlike crop production, specializing in livestock production (beef, swine, or dairy production) reduced the variability of financial performance. Specializing in swine, dairy, or crop production increased mean financial performance, and specializing in beef production decreased mean financial performance. The increase in mean financial performance associated with swine and dairy production was more likely the result of product-specific economies of scale, while the increase in mean financial performance associated with crop production was more likely the result of an increase in risk.

The results have important implications for farm managers, analysts, and financial institutions. First, the relative importance of financial efficiency on mean financial performance suggests that industry benchmarks for these measures need to be computed and that managers should focus attention on these measures. Second, compared to many of the other factors, mean financial performance is quite responsive to increases in farm size. This, coupled with the fact that farm size does not impact the variability of financial performance, suggests that there are large benefits associated with increasing farm size. Further consolidation of farms will likely result. Third, specializing in swine and dairy production decreased the variability of financial performance and increased mean financial performance. This finding indicates that recent trends toward specialization in these two industries are likely to continue. Fourth, farms with both crop and beef enterprises tended to have less variability in financial performance, suggesting that these mixed crop/beef farms have reduced risk through diversification. If this advantage continues, this farm type will continue to be prevalent in the Great Plains.

Further research could investigate the robustness of the results of this study to other regions. Results may differ for farms in other geographical areas. Given the recent trend toward specialization, this additional research is important to our understanding of the effects of industrialization and should be given high priority.

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