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Abstract

This article utilizes a farmer survey to analyze the relationships between farm business structure and the importance farmers place on risk management practices. The strongest relationships occur between farm size and risk management, while rating differences across age of operator, tenure, and use of debt are less pronounced.

How Midwestern Farmers Rate Risk Management Practices

By Eric Micheels and Peter J. Barry

Introduction

Today's farmer must deal with many sources of risk including: price, production, financial, institutional, strategic, human failures, and operational risks. Some of these risks are dependent on the weather and other factors beyond one's control. Risk management is important because individual producers generally are price takers in the market. A decrease in an individual's production will likely cause a decrease in farm income (Harwood, et al). This loss of income could be offset, however, by price increases if production on regional or national levels fails to meet expectations. Many production shortfalls, however, are too localized to have much market effect.



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In order to manage these risks, it is important to determine their sources. Yield risk is largely a function of weather patterns, because precipitation levels and occurrence of severe weather can cause major changes in production. Price risk can also depend on the supply effects of weather, but price risk also comes from other factors affecting supply and demand. Institutional and political risks involve, for example, changing tax policies and government programs which can affect planting decisions, price support levels, and government payments. Differences among countries in trade, fiscal, and monetary policies may create uncertainties about exchange rates, imports and exports, and international competitiveness, further destabilizing farm income. Risk from failures in human performance and operational breakdowns can be significant, but difficult to measure. The overall importance of risk management to farmers can depend on their structural characteristics, risk attitudes, and levels of risk. Also important are the farmer's financial position and degree of dependence on farm versus non-farm income. If a producer's ability to repay debt and/or earn a living is compromised, he/she will experience high financial stress, recovery costs, and potential departure from farming.

The purpose of this study is to determine the strength of the relationships between farm size and other structural characteristics on the one hand, and the importance or use of various risk management practices by farmers. The study thus complements previous work on structural characteristics and levels of risk (Barry, Ellinger, and Bard), and extends the analysis by Sherrick, et al., on crop insurance and risk management.¹ Larger farms, for example, likely place more importance on risk management, and thus, use more extensive forms of protection. A survey of Midwestern farmers is used to measure their assessments of the relative importance of various methods of risk management and to determine how these importance assessments are influenced by the farm's size, tenure, age, and debt use. The article proceeds by describing the data source, identifying the risk management practices and their potential relationships to farm structure, and then presenting and discussing the results.

Data Source

The data for this study are taken from a previous survey focusing on farmers' uses of crop insurance (Sherrick, et al.,^{a,b}).

The survey was comprehensive in scope, asking about farm size in acres, age, education, experience, risk perceptions, risk management, and other variables. The survey was sent to 3,000 farmers in Indiana, Illinois, and Iowa, with 868 useable respondents, yielding a response rate of about 29 percent. The greatest number of respondents were from Iowa, followed closely by Illinois, and then by Iowa. Farm size averaged 757 acres. Corn and soybeans were the dominant enterprises, with about 15 percent of gross sales on average from livestock.

Key elements of the survey used in this study are the importance ratings farmers place on different risk management practices. Specifically, the farmers were asked to rate the importance of 15 risk management practices in marketing, production and financial categories on a 1 (lowest) to 7 (highest) Likert scale, and to indicate their use or non-use of each practice.

Risk Management in Marketing, Production, and Finance

Managing risk through marketing could use some or all of the following. Use of hedging or options can establish a price floor or the producer. Production contracts shift price and production risks to the owner of the commodity, but the producer has little input on factors affecting production. Forward contracting the output price before harvest is sold will protect producers from price downswings, but forego responding to price upswings. Enrollment in government programs will help to stabilize crop revenues in part through its effects on price variability.

Production responses to risk could entail diversifying among multiple crop and livestock enterprises. The lower the correlations among enterprise returns, the greater the potential reductions in risk from diversification, although the risk-return trade-off means that expected returns may decline as well. Use of multiple seed varieties, varying on day-length or special attributes of seed are other alternatives. Farming in multiple locations would also respond to different weather patterns which would affect production (e.g., rain on one location, dry on another location). Use of irrigation removes the risk of drought from some producers, but will incur higher investment and operating costs.

In managing financial risk, use of the contingent liquidity provided by yield or revenue insurance could ensure a more

stable level of financial performance for the operation. Greater reliance on leasing brings potential tenure risk, but using a share lease would shift some of the income risk away from the farmer to the owner of the land. Having financial savings, a back-up line of credit, and refinancing capacity would be helpful sources of liquidity for responding to new opportunities and covering downswings in income.

Risk Management and Farm Structure

As farm size increases, the chances of a producer using more extensive risk management alternatives likely increase. This reflects the greater absolute risk the producer is taking on. As a farm becomes larger, a producer might place greater importance on the use of marketing contracts, different seed varieties, and diversification.

Greater debt affects risk because of the farmer's fixed financial obligations in the face of varying farm income. With considerable debt, one might expect to see crop or revenue insurance used, for example, to ensure the capacity to meet these obligations (Sherrick, et al.). Also, the more leveraged a farm, the more likely the farm is to use other risk management practices.

The risk-shifting capacity of leasing farmland depends on the tenure levels (i.e., acres owned relative to total acres operated) and rental arrangements. Share leases in particular are less risky due to the sharing of costs and production with the land owner. Cash leasing is riskier than share leasing because of the fixed cash obligation to pay rent on the land, advance payments on part of the rent, and the farmer's responsibility for paying all of the production costs.

Age and experience in farming could both increase and decrease the use of risk management. As producers become older and more experienced, time tells them how the markets will play out, which would affect their risk management choices. Younger farmers who might have more formal education but less experience working with risk management, might be more inclined to make explicit use of these practices in their operations.

Rating Risk Management Practices

Table 1 reports the average importance ratings (1 lowest, 7 highest) and incidences of use given by the responding farmers

to 15 specific risk management practices and to groupings of the practices into marketing, production, and financial categories. Included in the marketing category are hedging, spreading commodity sales over time, participation in government price and income support programs, entering into production contracts, and forward contracting. The production practices category contains multiple crop enterprises, seed varieties, geographic location, and irrigation. Financial responses to risk are the various types of crop insurance, holding financial reserves, and unused credit lines. In general, above average (and equal) importance ratings were given to the marketing and production categories while the financial category received the lowest rating. Among the individual ratings, however, the top four practices came from each of the three categories.

For the 15 risk management practices addressed in the survey, the highest importance score (5.97) and incidence of use (62%) involved participation in government programs for price and income support. Multiple seed varieties, financial reserve, and spreading sales over time were ranked second, third, and fourth, respectively, followed by roughly similar ratings for forward contracting, farming in multiple locations, multiple crop enterprises, and yield and revenue insurance. Irrigation, catastrophic insurance, and hedging were ranked the lowest in importance. The average importance scores for the risk management options largely parallel the incidences of use although financial savings or reserves received higher importance ratings (5.16) than implied by the relatively lower user rate (31%).

In general, the results suggest that farmers tend to combine various risk management practices in the formulation of comprehensive strategies for responding to risk. Moreover, while not shown here, the results of the Sherrick et al. study clearly indicate that farmers who perceive greater risk from their crop enterprises will more highly value and employ a wider range of risk management practices.

Effects of Structural Characteristics

The farmers' average importance ratings for the respective risk management practices are reported in Tables 2-5 for alternative levels of farm size (acres operated), tenure ratio (ratio of acres owned to total acres operated), age of operator, and debt-to-asset ratio. The strongest relationships are evident for farm size

(Table 2). All of the risk management practices receive the lowest average importance ratings in the smallest acres-farmed class (0 to 300 acres). The average scores then increase consistently with farm size for the respective marketing practices. In some cases, the spreads in importance ratings between the 601 to 900 acres and the 901 to 1,200 acres categories are modestly greater than for other categories. The largest spread in average rating for marketing practices between the smallest and largest acreage classes occurred for forward contracting. Government programs were again rated of highest importance across all of the size classes. Moreover, while the importance of hedging increases with farm size, other practices consistently received higher average ratings.

Production responses to risk also increased in importance as farm size increased with a few minor exceptions. The largest spread between the smallest and largest size classes occurred with farming in multiple locations, reflecting the geographic dispersion of land and the unevenness in land coming available for sale or lease. Multiple seed varieties sustained the highest average rating across all the size classes, while irrigation remained the lowest rated, reflecting the relatively greater moisture availability in Midwestern agriculture compared to, for example, the Great Plains.

Greater irregularity in importance ratings across the size categories is evident for the financial responses to risk. Crop yield and revenue insurance both are highly valued and increase modestly in importance as size increases, while the importance of more specific CAT insurance follows a mostly declining pattern as size increases. Irregular rating patterns also characterize the relationships between share leasing, financial reserves, and credit lines, although financial reserves are consistently rated most important.

Table 3 indicates average ratings for five classes of the tenure ratio. In general, greater reliance on leasing is associated with greater importance placed on risk management, although several of the sets of ratings are not uniformly increasing or decreasing. The greatest changes in the importance ratings between the lowest and highest tenure ratio categories occur with share leasing, farming in multiple locations, and revenue or yield insurance, although the relative ratings over time remain the same.

Regarding age of operator in Table 4, the importance of the risk management practices is generally greatest among the younger classes of farmers, perhaps reflecting their higher reliance on debt and leased land, shorter experience, and recent education. The margins of decline in importance between the youngest and oldest farmers are especially high for forward contracting and hedging in the case of marketing responses, for multiple crops and locations in production responses, and for financial reserves and credit lines in financial responses. Crop revenue insurance is rated higher than yield insurance across all age categories, although the differences tend to narrow as age increases.

Table 5 indicates the relationships between the average importance ratings for four classes of the debt-to-asset ratio, and for use versus non-use of debt. Irregularity again characterizes the importance ratings for several of these classes. Only hedging and production contracts consistently increase in average importance as the debt-to-asset class increases. Between the lowest and highest debt-to-asset categories, only forward contracts, crop insurance, and credit lines, in addition to hedging and production contracts, show increased importance. Apparently, those farmers with the highest debt levels place greater importance on practices that provide price and yield protection.

Statistical Analysis

The visual comparisons in Tables 2-5 of relationships between importance of risk management practices and farm structure are supplemented by multiple regression analysis. The goal is to consider the combined effects of the four structural characteristics on the importance scores. The ordinary least squares regression model initially included the four structural characteristics as independent variables. Evidence of multicollinearity among the variables using Klein's criterion led, however, to the deletion of the age variable and to use of the yes-no debt use variable in place of the debt-to-asset ratio and in lieu of an intercept term. This adjustment is consistent with prior observations that older farmers tend to rely more on ownership, have lower debt ratios, and experience growth in farm size until age 60 or so, when acreages operated decline (Ellinger and Barry).

The importance ratings are also divided into the three categories specified earlier, marketing, production, and financial, with each

farmer's average importance rating for each category used as the dependent variable. Thus, three regression models are evaluated. The models were run without an intercept by use of debt capital (yes or no) as a dummy variable together with acres farmed and tenure level variables to explain the differences in the ratings.

The regression results reported in Table 6 indicate that the acres farmed and tenure level variables have positive and negative effects, respectively, and are both significant at the 95 percent level in the marketing and production models. Similarly, the importance of each set of risk management practices increases significantly for the use versus non-use of debt. The only insignificant relationship occurs with the acreage variable in the financial equation, although its sign is consistent with those in the marketing and production models. The tenure results could reflect the decrease in tenure risk between land owners and tenants as farmers own more of the land they operate, as well as the greater wealth and risk carrying capacity associated with land ownership. The low R2 values indicate that considerable variability in the importance ratings remains unexplained, although low R2 values are typical when analyzing cross sectional data. In general, the regression results are consistent with and confirm the patterns between the average importance ratings and structural characteristics reported in Tables 2-5 and discussed in the preceding section, although using average importance scores for the marketing, production, and financial categories tends to remove much of the differences among specific practices.

Concluding Comments

The farmers' importance ratings for risk management observed in this study indicate the tendency to use a combination of management practices that may differ with each farm's structural characteristics. Increases in farm size, in particular, lead to greater importance of risk management, especially in the cases of forward contracting and multiple locations of farming operations. While financial responses to risk are clearly regarded as important, no systematic relationships to farm size were evident. Differences in importance ratings across the farmers' ages and tenure categories are less pronounced than the farm size effects, while the ratings by debt-to-asset categories yield no clear pattern. Of course, larger farm farmers tend to use higher leverage so that the size effect may account for other relationships. Marketing and production responses to risk are

rated of equal importance on average, yielding a slight margin over financial responses to risk.

Finally, for smaller farm farmers, the more advanced risk management practices may be unnecessary or infeasible to use. Many small operators earn income from non-farm employment and/or investment, thus diversifying their income sources and adding the non-farm dimension to risk management. Nonetheless, they remain vulnerable to periodic shortfalls in prices and production. In contrast, larger farms apparently have comparative advantages in risk bearing that contribute to their long-term viability as agricultural producers.

Endnotes

- ¹ Sherrick, et al. focused on the use versus non-use and types of crop insurance relative to an extensive set of variables, including the importance ratings farmers place on risk management. Our study addresses how the importance ratings are influenced by farm characteristics.

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Table 1. Average Importance and Use Ratings for Risk Management Practices

Risk Management Practice	Type of Practice ^a	Average Rating	Use Rate
Government Programs	M	5.97	62%
Multiple Seed varieties	P	5.35	51%
Financial reserves	F	5.16	31%
Spread Sales	M	5.16	49%
Forward Contracts	M	4.83	38%
Multiple Crops	P	4.81	37%
Crop Revenue Insurance	F	4.66	31%
Crop Yield Insurance	F	4.4	32%
Share Lease	F	4.4	26%
Multiple Locations	P	4.33	38%
Production contracts	M	4.07	18%
Credit Lines	F	3.85	11%
Hedging	M	3.7	20%
CAT Insurance	F	3.24	16%
Irrigation	P	2.25	3%

^a Risk management practices are identified as marketing (M), production (P) and Financial (F). Average ratings are:

Overall	4.53
Marketing	4.82
Production	4.82
Financial	4.42

Table 2. Importance Ratings of Risk Management Practices by Acres Farmed

Practice	Acres Farmed				
	0-300	301-600	601-900	901-1200	1200
Marketing					
Hedging	3.25	3.53	3.77	4	4.16
Spread Sales	4.93	5.08	5.16	5.46	5.45
Markedly Government Programs	5.75	5.96	5.98	6.26	6.17
Production contracts	3.57	3.97	4.02	4.31	4.67
Forward contracts	4.27	4.76	4.76	5.27	5.43
Production					
Multiple Crops	4.46	4.7	4.87	5.14	5.07
Multiple Seed Vars.	5.03	5.26	5.37	5.62	5.64
Multiple locations	3.47	4.13	4.54	4.8	5.06
Irrigation	2.06	2.16	2.13	2.52	2.5
Financial					
Crop Yield Insurance	4.29	4.44	4.5	4.59	4.58
Crop Revenue Insurance	4.35	4.68	4.62	4.81	5.12
CAT Insurance	3.69	3.43	3.18	3.26	2.66
Share Lease	4.06	4.3	4.19	5.07	4.74
Financial reserves	5.14	5.33	4.76	5.35	5.29
Credit lines	3.4	3.89	3.91	5.24	4.16

Table 3. Importance Ratings of Risk Management Practices by Tenure Ratio

Practice	Tenure Ratio*				
	0-10	11-25	26-50	51-75	75
Marketing					
Hedging	3.6	3.91	3.9	3.68	3.5
Spread Sales	5.3	5.31	5.16	5.28	5
Government programs	6	5.91	6.14	6.13	5.8
Production Contracts	4.3	4.38	4.18	3.92	3.7
Forward Contracts	5	5.11	5.04	4.71	4.5
Production					
Multiple Crops	4.8	4.71	4.88	5.12	4.6
Multiple Seed Vars.	5.5	5.68	5.23	5.37	5.1
Multiple locations	4.5	4.63	4.51	4.62	3.7
Irrigation	2.3	2.19	2.39	2.19	2.1
Financial					
Crop Yield Insurance	4.7	4.26	4.54	4.52	4.2
Crop Revenue Insurance	5	4.82	4.78	4.74	4.3
CAT Insurance	3.3	3.14	2.93	3.38	3.6
Share Lease	5	4.48	5.61	4.22	3.8
Financial reserves	5.5	5.11	4.9	5.2	5.2
Credit lines	4	3.89	4.16	3.87	3.6

* Acres owned to total acres operated

Table 4. Importance Ratings of Risk Management Practices by Age of Operator

Practice	Age of Operator				
	< 30	30-39	40-49	50-59	60 +
Marketing					
Hedging	4.4	4.03	3.67	3.8	3.4
Spread Sales	5.47	5.03	5.22	5.16	5.18
Government programs	6.13	5.74	6	6.04	6
Production Contracts	5	4.36	4.24	4.04	3.76
Forward Contracts	5.13	5.13	4.93	4.97	4.52
Production					
Multiple Crops	6.07	5.02	4.75	4.83	4.66
Multiple Seed Vars.	6	5.42	5.51	5.25	5.19
Multiple locations	5.5	4.83	4.47	4.26	3.97
Irrigation	2.86	2.63	2.21	2.32	2.01
Financial					
Crop Yield Insurance	4.38	4.26	4.47	4.48	4.51
Crop Revenue Insurance	5.33	4.68	4.62	4.85	4.59
CAT Insurance	3.29	3.16	3.09	3.17	3.68
Share Lease	5.14	4.02	4.38	4.39	4.56
Financial reserves	6.5	5.56	5.03	5.06	5.27
Credit lines	4.21	3.91	3.85	4.07	3.69

Table 5. Importance Ratings of Risk Management Practices by Debt Characteristics

Practice	Debt-to-Asset Ratio				Debt Use, yes
	0-.2	.21-.4	.41-.6	> .6	
Marketing					
Hedging	3.59	3.78	3.92	4.44	3.83
Spread Sales	5.15	5.31	5.24	4.67	5.21
Government programs	5.91	6.12	6.1	5.5	6.04
Production Contracts	4.07	4.13	4.3	4.54	4.2
Forward Contracts	4.88	5.04	4.94	5.12	5.04
Production					
Multiple Crops	4.83	4.88	4.87	4.88	4.87
Multiple Seed Vars.	5.33	5.35	5.48	5	5.34
Multiple locations	4.42	4.43	4.73	3.5	4.45
Irrigation	2.22	2.19	2.4	2.22	2.25
Financial					
Crop Yield Insurance	4.38	4.56	4.52	5.2	4.55
Crop Revenue Insurance	4.58	5.06	4.82	4.92	4.87
CAT Insurance	3.31	3.13	3.28	3.39	3.27
Share Lease	4.39	4.6	4.27	3.56	4.35
Financial reserves	5.35	4.87	4.91	4.79	5.02
Credit lines	3.85	4.05	4.18	4	4.09

Table 6. Regression Results for Farmers' Average Importance Ratings of Marketing, Production, and Financial Responses to Risk

	Marketing Responses		Production Responses		Financial Responses	
	coef	t	coef	t	coef	t
Acres farmed	0.00099*	3.407	0.00013*	4.032	1.5E-05	0.4376
Tenure (acres owned to acres operated)	-0.4030*	-3.574	-0.4136*	-3.334	-0.5236*	-4.048
Debt yes	4.961*	67.095	4.4465*	54.881	4.644*	54.75
Debt no	4.776*	44.037	4.330*	36.28	4.628*	37.188
F	8.634		8.748		4.463	
R ²	0.048		0.049		0.026	