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Crop Insurance Use and Land Rental Agreements

Todd H. Kuethe and Nicholas D. Paulson¹

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¹ Todd H. Kuethe is a Clinical Assistant Professor and Nicholas D. Paulson is an Associate Professor, both in the Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign.

Introduction

In 2002, only 28% of US corn acreage was enrolled in federal crop insurance, but in 2012, the share of corn acreage enrolled in federal crop insurance ballooned to almost 84% (Ifft, Kuethe, and Morehart, 2013). Over the same period, crop insurance premium subsidies increased from \$1.74 billion to \$6.96 billion, an increase of 300%. As a result, crop insurance has become the primary component of the farm safety net (Zacharias and Collins, 2013). Crop insurance plays an important role in financial management of crop farms by allowing farms to mitigate a large share of production risk. However, economic theory suggests that increasing farm financial security may have unintended consequences if farmers adjust their behavior in response to the perceived reduction in risk. The concept of risk balancing suggests that policies that reduce farm risk exposure may encourage farmers to take on additional risk elsewhere in their business (Gabriel and Baker, 1980; Featherstone, et al., 1988). That is, if a policy reduces the production risk below a farmer's latent preferred risk level, farmers may "balance" total risk by increasing borrowing. For example, Gabriel and Baker (1980) demonstrate that as the variability of net cash flows decreases (business risk), farmers may increase borrowing (increase financial risk). More recently, Ifft, Kuethe, and Morehart (2013) demonstrate that farms with federal crop insurance have a greater average probability of default.

Viewed from a public policy perspective, this suggests that the availability of crop insurance may lead to riskier management behavior. Thus, at least a portion of the risk reduction gains resulting from crop insurance program subsidization could be mitigated by the resulting shift in other forms of risky behavior. In addition to increased borrowing activity, there are a number of ways farmers can take on riskier management behavior. For example, Turvey (2012)

finds that Canadian Agricultural Income Support Program (CAIS) create incentives for farmers to take on more risk in their crop diversification strategies.

This study explores the link between crop insurance and land rental agreements and demonstrates that, through risk balancing, farmers with crop insurance are more likely to take on risky land tenure positions. Recently, land rental agreements, particularly in the Corn Belt, have trended away from crop share agreements towards fixed cash leases (Paulson and Schnitkey, 2013; Barry et al., 2000; Barry, Sotomayer, and Moss, 2000; Sotomayer, Ellinger, and Barry, 2000; Paterson, Hanson, and Robison, 2000). A fixed cash rent agreement requires tenants to pay landlords a fixed rental rate and assume all the risks associated with production, but under a crop share agreement, both risk and returns are shared among the tenant and landlord. Fixed cash leases are relatively simple and provide more autonomy to the tenant operator in making management decisions. From the landowner's perspective, fixed cash rent contracts eliminate the time and effort required to make management decisions related to crop inputs and marketing while also providing a stable fixed return on their farm real estate assets. However, the fixed cash rent increases the risk exposure to the farm operator compared to the share rental agreement.

In addition, we explore the degree to which the benefits of crop insurance may be capitalized in cash rental rates. Previous studies have explored whether other forms of the farm safety net (i.e., government payments) are built into rental rates and passed from the tenant to the landowner, and the empirical findings are mixed with incidence rates falling within a wide range (Lence and Mishra, 2003; Goodwin, Mishra, and Ortalo-Magné, 2004 and 2011; Patton et al. 2008; Kirwan, 2009; Hendricks, Janzen, and Dhuyvetter, 2012). In addition, Ifft, Wu, and Kuethe (2014) demonstrate that the benefits of publicly subsidized insurance, namely the Pasture, Rangeland, and Forage (PRF) program, are capitalized in farmland values.

Methodology

We examine the factors impacting the fixed cash rent paid by and land tenure position of a grain farm operation. Specifically, we assume the model takes the following form:

$$Rent_{it} = g(Insurance_{it}, X_{it}, \alpha, \delta)$$

$$Tenure_{it} = f(Insurance_{it}, X_{it}, \beta, \theta).$$

The cash rent level and tenure position for the farm operation is assumed to be impacted by the amount of insurance coverage carried by the farm (Insurance) as well as the additional farm and farm operator characteristics.

Our empirical approach results in a panel regression model estimating the impact of crop insurance participation on the farm operator's tenure position and rental rate paid per acre. The general regression models are given below where the coefficients of interest (α_1 and β_1) measure the impact of crop insurance coverage on the proportion of acres rented under a fixed cash agreement and the average cash rent level paid by the farm operation.

$$Rent_{it} = \alpha_0 + \alpha_1 Insurance_{it} + X_{it}\delta + \varepsilon_{it}$$

$$Tenure_{it} = \beta_0 + \beta_1 Insurance_{it} + X_{it}\theta + \omega_{it}$$

Given that participation in the Federal crop insurance program in the U.S. is voluntary, the model must control for the endogeneity of the farmer's crop insurance program and coverage level choices. This endogeneity will be controlled using exogenous factors through an instrumental variables approach. There is an extensive literature which has examined farmers' preferences for crop insurance, showing that operator and operation characteristics (i.e. operator age, tenure position, leverage) impact the intensity of crop insurance use (Coble et al., 1996; Goodwin, 1993; Sherrick et al. 2004; Smith and Baquet, 1996; Velandia et al. 2009). Furthermore, previous work has shown that asymmetric information and the level of subsidization also play roles in

farmers' crop insurance choices (Just, Calvin, and Quiggin, 1999; Makki and Somwaru, 2001; Roberts, Key, and O'Donoghue, 2006). This study draws on these findings by defining a set of instruments from the IL FBFM and RMA SOB and ADM datasets. The first stage regression takes the following general form:

$$Insurance_{it} = X_{it}\varphi + Z_{it}\pi + \vartheta_{it},$$

where X_{it} is the vector of controls in the second stage regressions modeling the factors influencing cash rent levels and tenure position and Z_{it} is a vector of additional instruments influencing farmers' crop insurance decisions.

Data

The data used to estimate the regression models outlined in the previous section was obtained from the Illinois Farm Business Farm Management Association (IL FBFM), and the Risk Management Agency (RMA) and National Agricultural Statistics Service (NASS) of the USDA. The unbalanced panel covers a 15 year period from 1996 through 2012.

The IL FBFM data includes farm-level financial records from commercial grain operations located throughout the state of Illinois. Records used in the analysis come from the accrual based income statements and balance sheets which are certified by the field staff who work with the farmers in putting the records together for tax, credit, and budgeting purposes. Three different dependent variables – the percentage of total acres cash rented (*pctcashtot*), the percentage of rented acres cash rented (*pctcashrent*), and cash rent per acre (*rent*) - which provide measures of the farm operation's tenure position were examined.

The primary control variables were also obtained from the farm operations' FBFM records. These include operation-level and environmental characteristics such as insurance coverage (insurance), farm size as measured by total tillable acres, age of the primary operator, non-farm income, the operation's debt-to-asset ratio and soil productivity rating (SPR), and a county-level measure of expected revenue. The age, debt-to-asset ratio, and non-farm income are meant to proxy for the operator's time and risk preferences while farm size controls for scale effects. The county-level expected revenue and soil productivity measures are included as regional controls for the income generating potential of the land controlled by the farm operators. Expected revenues are defined as the product of the base insurance price and the county trend yield for corn.

The control variable of interest is the insurance coverage index. Data on the farm's insurance expenditure was used to create the index such that larger values indicate a greater level of insurance coverage for the farm, where more insurance coverage could be driven by a higher coverage level for a given plan of insurance (i.e. 85% revenue protection instead of 70% revenue protection) or a more comprehensive insurance plan at the same coverage level (i.e. revenue protection instead of yield protection). Specifically, we use the farmer-paid insurance premium observed in the FBFM data along with premium rate data from the RMA and historical insurance base prices to construct the insurance coverage index:

$$Insurance_{i,t} = \frac{FarmPremium_{i,t}}{BaseRate_{c,t} * Price_t * TrendYield_{c,t}}$$

The insurance index is the ratio of the farmer-paid premium by farm i in year t to the base insurance rate in county c and year t , the base insurance price in year t , and the county trend yield in county c and year t . This index accounts for the variation in premiums paid by farms due

to regional variation in base rates, and variation across time and space due to the liability effects associated with adjustments in insurance base prices and farm-level yield guarantees. Note that for the results provided in this paper, the base rate, insurance prices, and trend yields were based on corn production. Results were also generated where the insurance index was constructed with soybean base rates, insurance prices, and trend yields and the results are qualitatively similar to those presented here.

Since participation in the Federal crop insurance program is voluntary, we control for the endogeneity of the insurance coverage index by incorporating additional exogenous information which might impact a producer's insurance coverage choices. These instrumental variables are taken from data made available by the RMA in their county-level summary of business (SOB) and actuarial data master (ADM) files. The average subsidy rate and loss ratios at the county-level for all corn and soybean policies in Illinois were taken from RMA's SOB files and used as instruments in the first-stage regression.

Summary statistics for the variables used in the regression analyses are provided in table 1. The first column provides variable means across the entire sample period. The second and third columns provide variable means for the first and last years included in the data, 1996 and 2012. The summary statistics show the increase in use cash rental agreements as well as the increase in cash rental rates. Table 1 also illustrates in the general increase in insurance coverage over time. Other structural trends include a reduction in average leverage and a significant increase in expected revenues, due mostly to trend yield productivity improvements and higher commodity prices since 2006. The crop insurance instrumental variables indicate the small increase in total subsidy rate over time and the wide variation in crop insurance loss experience as measured by the county-level loss ratio.

Results

Table 2 reports the second stage regression results for three different specifications. The first column in table 2 provides results for factors influencing the percentage of total tillable acres under a cash rent agreement. The second column uses the percentage of rented acres under a cash rent agreement (versus a share rent agreement as the dependent variable). In both cases, the natural log of the insurance coverage index is shown to have a positive and statistically significant effect on the percentage of acres cash rented. This provides some evidence that the increase in crop insurance use over time has contributed to the shift away from share rent agreement towards fixed cash arrangements. Larger farms are associated with more cash rented acres, which is more likely due to larger farms controlling more land using rental agreements as opposed to land ownership which can be associated with significant capital requirements to obtain financing.

Operator age is also positively associated with the percentage of land controlled under a fixed cash rent. The effect of non-farm income is estimated to be positive, but only marginally significant at the 10% level. Finally, the leverage position of the farm is estimated to have a negative effect on the percentage of acres cash rented. This is perhaps evidence of a risk balancing effect between the business risk of farm debt and the revenue risk associate with the type of land rental agreement used by the operator.

The third column of table 2 summarized the second-stage results for the regression examining the factors influencing the average cash rental rate paid by the farm. The log of expected corn revenues and the farm's soil productivity (SPR) rating are both added as additional controls in this model. Farm size and operator age are estimated to have positive and significant

effects on the cash rent level paid by the farm. Soil productivity is also estimated to have a positive effect on the farm's average rental rate.

The coefficient estimates associated with the log of county-level expected revenues indicate that cash rent levels are impacted by the revenue generating potential of the land. The coefficient estimate of 0.65 indicates an elasticity of 0.65%, or that roughly 2/3 of every additional expected revenue dollar is passed through to land rental rates. The coefficient estimate for crop insurance of 0.786 indicates that for every 1% increase in the insurance coverage index, land rents may increase by approximately 0.79%.

To further interpret these results, consider that the insurance coverage index constructed from the FBFM data has increased by 15 to 20% over the 15 year period from 1996 to 2012. The regression results in table 2 would imply that this increase in insurance coverage has resulted in a 3 to 4% increase in acres controlled under a cash rental agreement. This represents 20 to 25% of the total shift towards cash rent agreements observed in the Illinois data over this time period. Furthermore, this average increase in insurance coverage would be estimated to increase cash rental rates by 12 to 16%.

The average cash rental rate in Illinois in 1996 was just over \$100/acre. The actual percentage increase in average cash rental rates in Illinois from 1996 to 2012 is roughly 100%, with the average rental rate in 2013 exceeding \$200. Thus, a 15% increase due to crop insurance accounts for about \$15/acre of the \$100/acre increase over the past 15 years. In central Illinois, the farmer-paid premium in 2014 for 85% revenue protection using enterprise units would be around \$14 to \$15 per acre, with an average subsidy rate exceeding 50%. Thus, the taxpayer subsist cost associated with this policy would be at least \$15/acre. This implies a fairly

considerable incidence rate for crop insurance subsidies in terms of their impact on land rental rates.

Conclusions

Recent trends in the Midwest show that land values and rental rates have increased considerably over time while farmers have also shifted towards fixed cash rent agreements. At the same time, crop insurance participation has continued to increase as subsidies have been increased and more types of coverage have become available. Participation has increased by virtually all metrics, including total acres insured and average coverage levels. This analysis attempts to determine whether there are linkages between these trends.

Conceptually, as crop insurance coverage increases the farm operator might be more willing to take on more risk via a cash rental agreement due to risk balancing effects. The same theoretical arguments can be used to justify higher bids for cash rents and upward pressure on the average rental rates paid by farm operations.

Using farm-level data from the Illinois Farm Business Management Association, county-level crop insurance program data from the USDA's Risk Management Agency, and production data from the USDA's National Agricultural Statistics Service, an instrumental variable regression approach was used to find empirical evidence of any linkages between crop insurance coverage, land tenure, and average rental rates. The results suggest that farms with more insurance coverage tend to control more land using a fixed cash rental agreement and also tend to have higher average cash rental rates.

These estimated effects control for other factors which might be associated with tenure position, such as farm and operator characteristics, and average rental rates, such as soil

productivity and the expected revenues from crop production. Furthermore, the endogeneity of the crop insurance coverage held by the farm operator is controlled for using county-level subsidy rate and loss ratio measures as additional instruments.

The interpretation of the coefficient estimates suggests a meaningful proportion of the shift towards cash rental agreements and increase in cash rental rates observed over time might be explained by increased insurance coverage. This suggests that the subsidy dollars and other taxpayer costs associated with the crop insurance program may impact producer management decisions which increase other sources of business risk- specifically those associated with land control and costs.

References

- Barry, P., L. Moss, N. Sotomayor, and C. Escalante. 2000. "Lease Pricing for Farm Real Estate." *Review of Agricultural Economics* 22: 2-16.
- Barry, P., N. Sotomayor, and L. Moss. 1999. "Professional Farm Managers' Views on Leasing Contracts and Land Control: An Illinois Perspective." *Journal of the American Society of Farm Managers and Rural Appraisers* 62: 15-19.
- Coble, K.H., T.O. Knight, R.D. Pope, and J.R. Williams. 1996. "Modeling Farm-Level Crop Insurance Demand with Panel Data." *American Journal of Agricultural Economics* 78: 439-447.
- Featherston, A.M., C.B. Moss, T.G. Baker, and P.V. Preckel (1988) "The Theoretical Effects of Farm Policies on Optimal Leverage and the Probability of Equity Losses" *American Journal of Agricultural Economics* 70 (3): 572-579.
- Gabriel, S.C. and C.B. Baker "Concepts of Business and Financial Risk" *American Journal of Agricultural Economics* 62 (3): 560-564.
- Goodwin, B.K. 1993. "An Empirical Analysis of the Demand for Multiple Peril Crop Insurance." *American Journal of Agricultural Economics* 75: 425-434.
- Goodwin, B., A.K. Mishra, F. Ortalo-Magné. 2011. "The Buck Stops Where? The Distribution of Agricultural Subsidies." Working paper 16693, National Bureau of Economic Research, Cambridge, MA. www.nber.org/papers/w16693
- _____. 2004. "Landowners' Riches: The Distribution of Agricultural Subsidies." *Working Paper*. School of Business, University of Wisconsin.
<http://www.bus.wisc.edu/realestate/documents/04LandownersRiches.pdf>
- Hendricks, N.P., J. P. Janzen, and K.C. Dhuyvetter. 2012. "Subsidy Incidence and Inertia in Farmland Rental Markets: Estimates from a Dynamic Panel." *Journal of Agricultural and Resource Economics* 37(3): 361-378.
- Ifft, J., T. Kuethe, and M. Morehart (2013) "Farm Debt Use by Farms with Crop Insurance" *Choices* 28 (3).
- Ifft, J., S. Wu, and T. Kuethe (2014) "The Impact of Pasture Insurance on Farmland Values" *Agricultural and Resource Economics Review* (forthcoming).

- Just, R., L. Calvin, and J. Quiggin. 1999. "Adverse Selection in Crop Insurance: Actuarial and Asymmetric Information Incentives." *American Journal of Agricultural Economics* 81: 834-849.
- Kirwan, B. 2009. "The Incidence of U.S. Agricultural Subsidies on Farmland Rental Rates." *Journal of Political Economy*. 117(1): 138-164.
- Lence, S.H. and A.K. Mishra. 2003. "The Impacts of Different Farm Programs on Cash Rents." *American Journal of Agricultural Economics* 85(3): 753-761.
- Makki, S.S. and A. Somwaru. 2001. "Evidence of Adverse Selection in Crop Insurance Markets." *Journal of Risk and Insurance* 68(1): 685-708.
- Paulson, N.D., and G.D. Schnitkey (2013) "Farmland Rental Markets: Trends in Contract Type, Rates, and Risk" *Agricultural Finance Review* 73 (1): 32-44.
- Paterson, B.J., S.D. Hanson, and L.J. Robison. 2000. "Characteristics of Farmland Leasing Practices in the North Central States." *Journal of the American Society of Farm Managers and Rural Appraisers* 63(1): 72-82.
- Patton, M., P. Kostov, S. McErlean, J. Moss. 2008. "Assessing the Influence of Direct Payments on the Rental Value of Agricultural Land." *Food Policy*. 33(5): 397-405.
- Roberts, M.J., N. Key, and E. O'Donoghue. 2006. "Estimating the Extent of Moral Hazard in Crop Insurance Using Administrative Data." *Review of Agricultural Economics* 28(3): 381-390.
- Sherrick, B.J., P.J. Barry, P.N. Ellinger, and G.D. Schnitkey. 2004. "Factors Influencing Farmers' Crop Insurance Decisions." *American Journal of Agricultural Economics* 86(1): 103-114.
- Smith, V.H. and A.E. Baquet. 1996. "The Demand for Multiple Peril Crop Insurance: Evidence from Montana Wheat Farms." *American Journal of Agricultural Economics* 78: 189-201.
- Sotomayor, N.L., P.N. Ellinger, and P.J. Barry. 2000. "Choice Among Leasing Contracts in Farm Real Estate." *Agricultural Finance Review* 60: 71-83.
- Turvey, C.G. (2012) "Whole Farm Income Insurance" *Journal of Risk and Insurance* 79 (2): 515-540.
- Velandia, M., R.M. Rejesus, T.O. Knight, and B.J. Sherrick. 2009. "Factors Influencing Farmers' Utilization of Agricultural Risk Management Tools: The Case of Crop

Insurance, Forward Contracting, and Spreading Sales.” *Journal of Agricultural and Applied Economics* 41(1): 107-123.

Zacharias, T.P., and K.J. Collins (2013) “Ten Considerations Regarding the Role of Crop Insurance in the Agricultural Safety Net” *Choices* 28 (3).

Table 1. Summary Statistics of Variables Used in Regression Analysis

	Overall	1996	2012
% Cash Rented (Total Tillable Acres)	35.29	21.95	40.80
% Cash Rented (Total Rented Acres)	45.33	28.33	52.93
Rent (\$/acre)	\$111	\$81	\$148
Log(Insurance)	0.853	0.539	0.689
Tillable Acres	10.33	8.91	10.99
Operator Age	58.12	60.64	57.22
Non-farm Income (\$1000)	\$36.03	\$24.64	\$39.54
D/A	28.9	34.4	20.9
Expected Revenue (\$/acre)	\$636	\$408	\$1,297
SPR	81.85	81.91	81.14
Loss Ratio	1.79	0.89	10.04
Subsidy Rate (%)	0.52	0.45	0.56

Table 2. Second Stage Regression Results

	% Cash Rented (Total Tillable)	% Cash Rented (Total Rented)	Log(Rent)
Log(Insurance) ¹	22.12*** (4.278)	23.17*** (4.857)	0.786*** (0.164)
Tillable Acres	0.876*** (0.071)	0.714*** (0.079)	0.030*** (0.003)
Operator Age	0.228*** (0.060)	0.263*** (0.068)	0.007** (0.002)
Non-farm Income	0.0007 (0.005)	0.013* (0.006)	0.0001 (0.0002)
D/A	-0.109*** (0.017)	-0.168*** (0.019)	0.0006 (0.0008)
Log(Expected Revenue)			0.651*** (0.034)
SPR			0.009* (0.004)
N	13,189	12,930	10,549
No. of Farms	2,793	2,739	2,369

*, **, and *** denotes statistical significance at 10%, 5%, and 1%.

¹The fitted values from the first stage regression are used in estimating the second stage. Instruments used in the first stage include the second-stage control variables and the county-level insurance subsidy rate and lagged loss ratio for corn and soybean policies.