Agricultural Risk, Policy, & Insurance Collaboratory

A working paper addressing:

Are Large Farms Less Risky to Insure?

Keith H. Coble and Brian Williams[1]

Introduction

Crop insurance has become the backbone of risk management protection afforded by USDA to crop farmers. This evidenced by the decreases in Title I of the 2014 Farm Bill and increase in Title XI funding (Shields 2015). Figure 1 illustrates the August 2016 CBO baseline estimates of annual cost of Crop Insurance, the Price Loss Coverage program, and the Agricultural Risk Coverage (ARC). The projected cost of ARC is declining rapidly while the crop insurance program is expected to cost approximately $8 billion per year for the foreseeable future. With the prominence of crop insurance, the debate on renewing the Farm Bill in 2018 will likely focus on the crop insurance program.

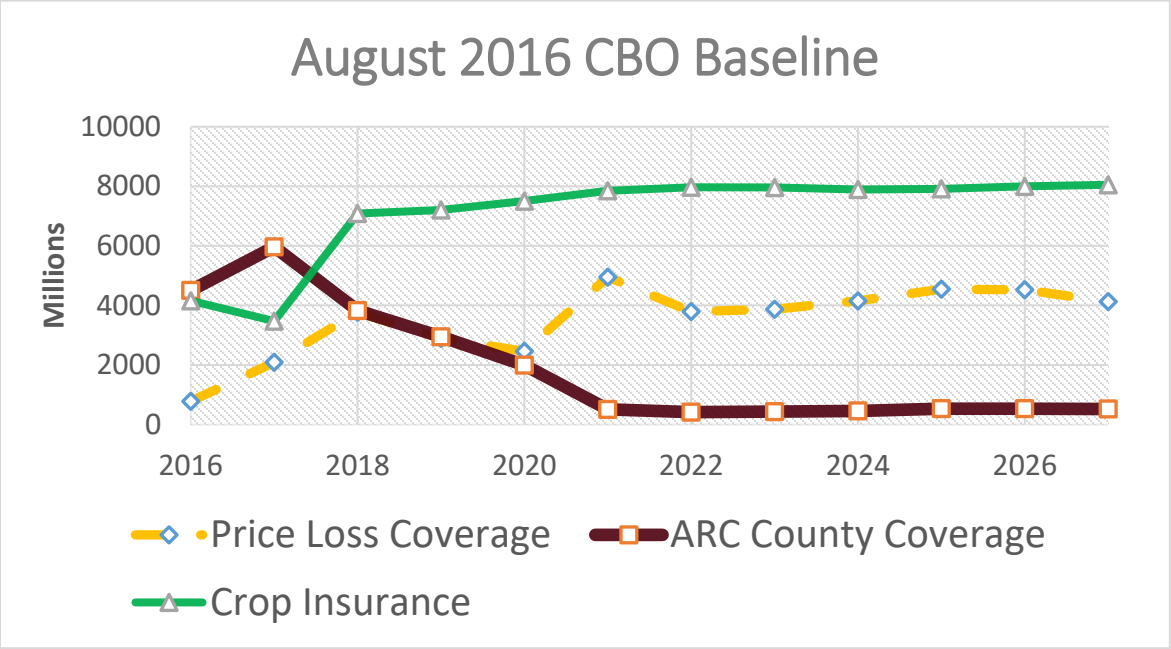

Figure 1

[1] Giles Distinguished Professor and Assistant Extension Professor at Mississippi State University

In fact, a common proposed cut to crop insurance is to impose caps on crop insurance subsidies per recipient per year. For example, the President's budget proposal in 2017 includes a $40,000 crop insurance subsidy cap. The implication of an effective premium cap would be to fully subsidize small farms while subsidizing larger farms up to a point and then all premium from that point on would be unsubsidized. Since subsidy is a function of risk, coverage levels, unit structure, and insurance plan chosen; subsidies per acre across all crops vary as shown in figure 2. Some have suggested that capping subsidies may either cause producers to evade the cap or that a cap will cause large producers to leave the crop insurance program. A further assertion is that larger farms are potentially less risky. For example an industry website (cropinsuranceinamerica.org) states:

> *"As support limits increase the cost of crop insurance, farmers will buy less crop insurance or not buy it at all. The impact would be largest for lower risk farmers, crops and regions. That would change the composition of the "risk pool," which in turn would increase the premiums for every farmer in that risk pool. (By statute, the premiums should be adequate to pay out the expected losses.)."*

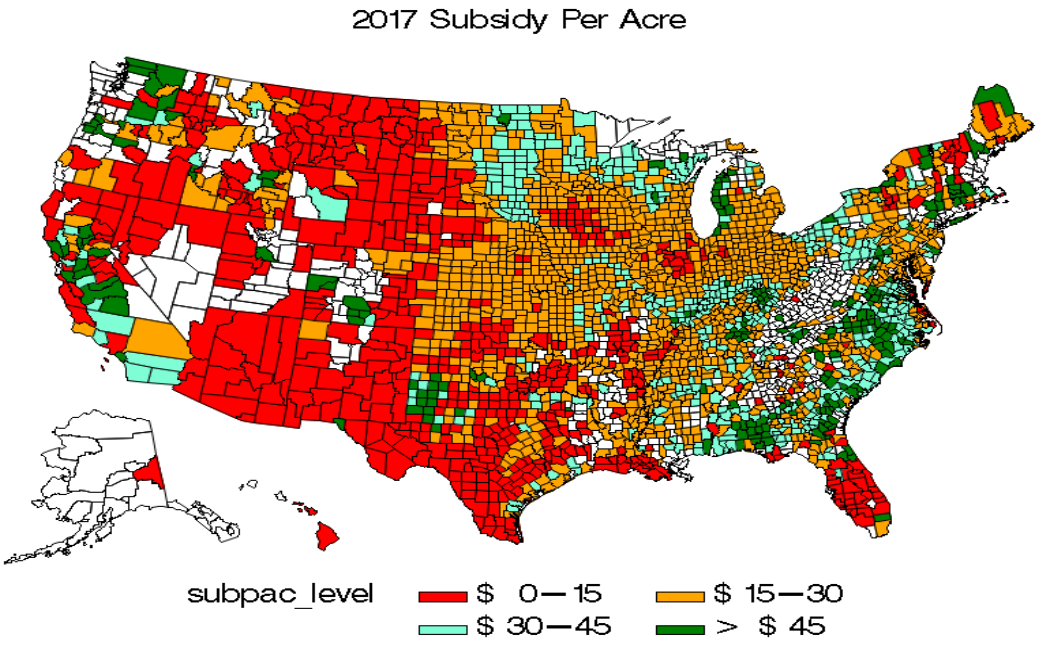

Figure 2

To our knowledge little evidence has been provided addressing whether or not large farms are less risky than smaller farms. That is the objective of this research – to test whether large farms do constitute a less risky sub-population in the insurance pool. We test this hypothesis for corn and soybeans while controlling for factors such as irrigated versus dryland production and regional effects.

However, before we conduct the analysis it merits carefully defining the problem. First, it is well documented in the literature that aggregating fields together into a larger insured units almost assuredly reduces risk. Numerous studies have shown that aggregated data will likely be less than perfectly positively correlated and some diversification of risk occurs (Cooper et al. and Knight et al. show this outcome). Coble et al. describes how RMA rates various unit structures

and sizes of units. Second, the U.S. crop insurance program does not typically insure entire farms in an insurance unit. Rather, producers opt for either optional, basic, or enterprise units.[2] In many cases a large farm may have ten or more insured units. Thus, the question relevant for the risk pool issue is best posed as follows: does an insured unit, all else being equal, have a lower expected indemnity if it is a unit in a large farm versus a small farm?

Data

The farm-level yield data used in this study were obtained from RMA. The data are 10-year yield histories from 1999 to 2008 that were used to establish APH yields for 2009 purchasers of unit-level yield and revenue insurance policies.[1] These records reflect data for either basic or optional units actually insured by RMA in 2009. We retained the records where there were 10 years of actual yields reported for the unit. All transition yields or other proxy yields were omitted. Also, duplicate records were removed. This resulted in 109,423 corn and 127,096 soybean insured units found in 29 states representing the Midwest, South, Eastern, and Plains regions of the U.S. The states included in each region are listed in Table 1.

Table 1

East	Midwest	Plains	South
Delaware	Illinois	Colorado	Alabama
Maryland	Indiana	Kansas	Florida
New York	Iowa	Montana	Georgia
Pennsylvania	Kentucky	Nebraska	Louisiana
Virginia	Michigan	North Dakota	Mississippi
	Minnesota	Oklahoma	North Carolina
	Missouri	South Dakota	South Carolina
	Wisconsin	Texas	Tennessee

Yields were linearly detrended to adjust for changes in yield expectations over time due to improved technology and production practices. Then for each unit, yield insurance indemnities were simulated for each of the 10 years using an assumed price of $4.00 corn and $8.00 for soybeans. Various coverage levels were assumed to test the robustness of the results, but the results shown here assume a 75% coverage level. Given the coverage level chosen, average indemnities per acre for the unit were computed over 10 years. Irrigation versus dryland practices were identified for each unit as well.

A key explanatory variable was constructed by aggregating acres from the insured unit level to the policy level. This subsumes all units for the crop in the policy. So if a policy had four corn units each with 200 insured acres, then the policy level acreage would be 800 acres.

[2] Basic unit - All insurable acreage of the crop in the county in which there is a 100 % share; or owned by one person and operated by another person on a share basis. Optional Unit – Subdivision of basic unit based on differing legal land sections or based on irrigated versus dryland production. Enterprise unit - All insurable acreage of the same crop or all insurable irrigated or non-irrigated acreage of the same crop in the county in which there is a share.

Thus, the regression data includes average yield insurance indemnity over 10 years as a dependent variable with a variable reflecting percent irrigated versus dryland acreage and regional dummy variables reflecting the region of the U.S. in which the policyholder is located.

Impact of farm size on mean crop insurance indemnity

We estimated impact that region, percent of acres under the policy that were irrigated, and a change in the total acreage under the insurance policy would have on the percent change in the average yield indemnity for a policy holder over a 10 year period. A double-log specification is used for the relationship between indemnity per acre and the total policy acres. All results discussed are statistically significant at the one percent level of significance. Midwestern states were found to have the lowest average yield indemnities when compared to other regions, while indemnities also declined rapidly as the percent of the acres under the policy that are irrigated increases. This suggests that Midwestern states tend to have less yield variability than other regions. Not surprisingly, irrigation also proves to be an effective tool for risk mitigations; a result that is widely supported by the literature.

As shown in figure 3, results from our estimation show that the average per acre yield indemnity declines exponentially from very small corn farms up until around 4,000 acres and continues to gradually decline for very large farms as farm size increases. Mean estimated indemnities for corn covered under a 75% coverage level yield insurance policy decline from $10.44 per acre for farms with policies consisting of 100 acres to less than $7.00 per acre for farms with over 4,000 acres of corn in the policy.

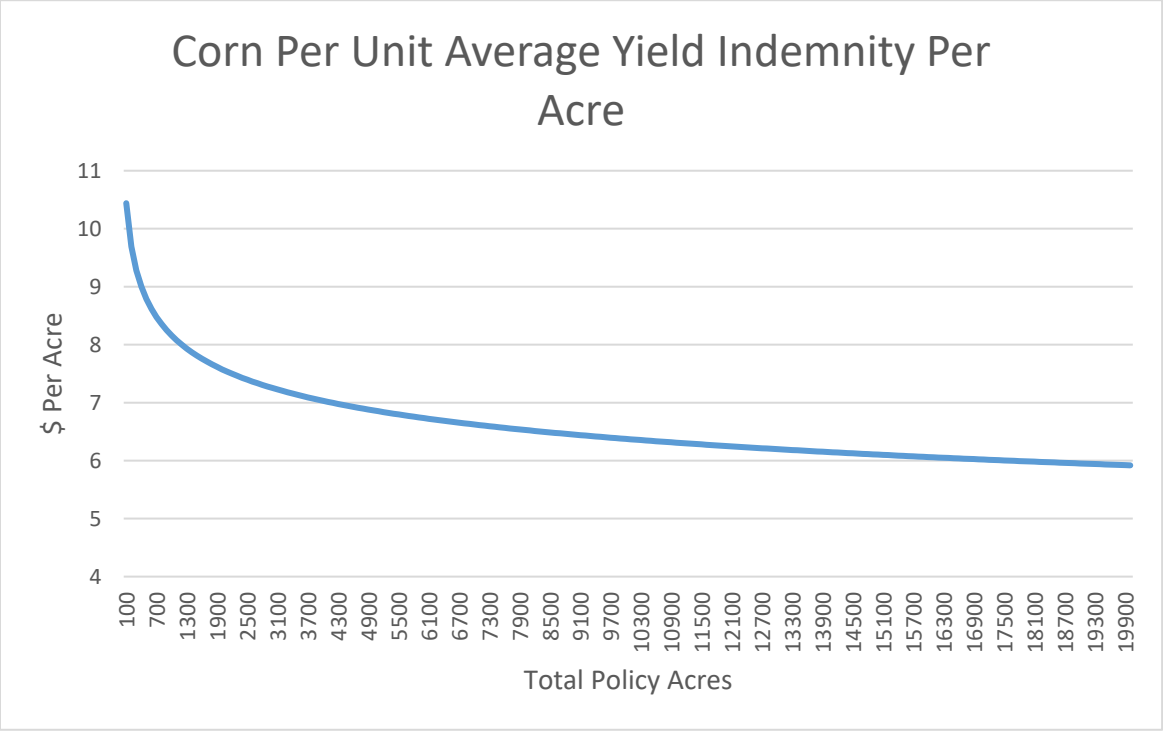

Figure 3

Similarly, the average per acre yield indemnity over ten years declines rapidly for very small soybean farms up until around 4,000 acres before leveling off and slowly declining as farm size continues to grow (figure 4). Mean estimated indemnities start at just over $4.00 per acre for policies of 100 acres, and declines to less than $3.25 per acre for policies covering more than 4,000 acres.

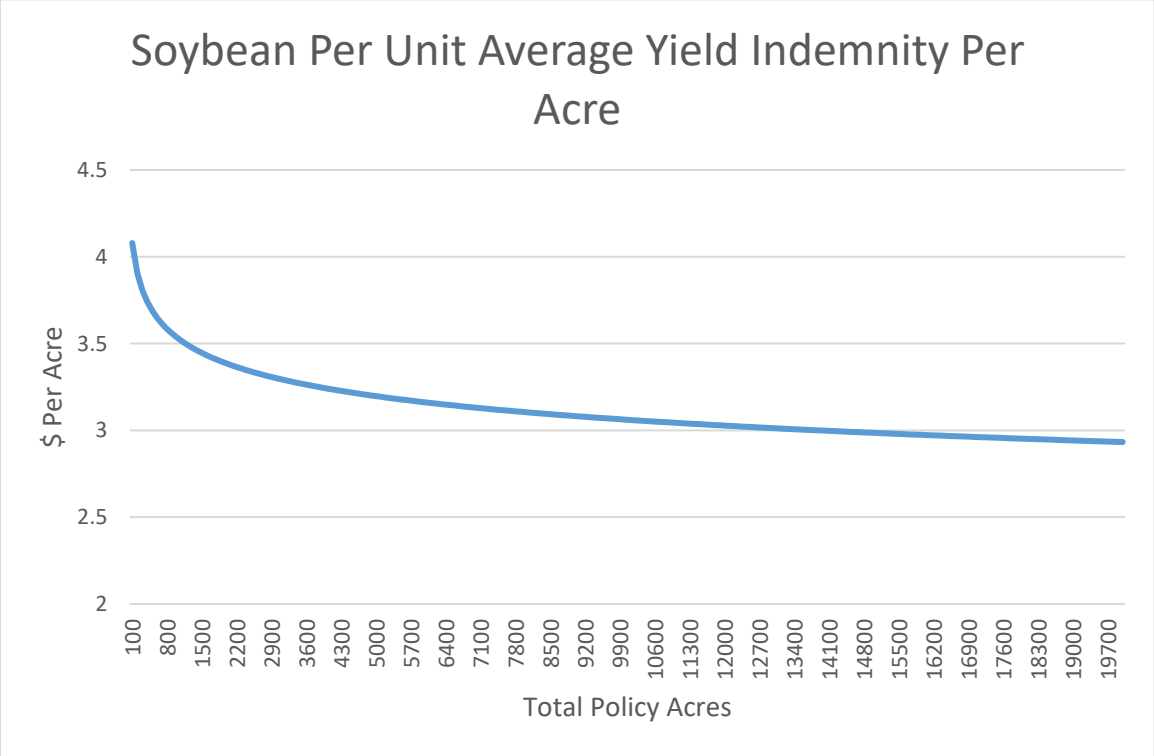

Figure 4

Implications for future policies related to crop insurance

As discussion about the federal budget continue and as debate over the next farm bill heats up, the future of crop insurance subsidies will be a widely discussed topic. As mentioned above, the cost of crop insurance programs are approximately $8 billion per year for the foreseeable future, which means that crop insurance is going to be the primary focus for potential farm program cuts.

However, many in the industry have argued that capping crop insurance subsidies could push some of the largest producers out of crop insurance programs. While this is possible it only becomes a problem if the larger producers who may exit the crop insurance programs are less risky than those who will remain. The objective of this study was to test whether the large farms who could exit the programs as a result of a subsidy cap do indeed constitute a less risky sub-population in the insurance pool. The results of this study confirm the hypothesis that large farms are a less risky sub-population in the insurance pool. Average per acre indemnities decline rapidly for both corn and soybean acres as the size of the insurance policy increases.

A recent study by Taylor and Barnaby (2017) suggests that it will take between 1,500 and 2,500 acres to reach the proposed $40,000 subsidy cap, depending on the state and the crop grown. Small and medium sized farms make up the vast majority of farms in the U.S. and will not be impacted, but in 2016 46 percent of the total crop insurance indemnities and 36 percent of harvested cropland was paid out to or under control of large or very large family farms. (USDA, ERS. 2016). Many of these farms would be impacted by the proposed cap, suggesting that a significant portion of insured cropland in the U.S. would fall under the proposed subsidy cap.

However, the behavior of large farms under a cap is not entirely clear. Presumably, a portion of their premium would be subsidized if they remain in the program. A second question is what would the large farms do if they left the program? Would they simply self-insure? Or would they perhaps seek private insurance that meet their needs? Another question is whether that protection be supplied by the private sector, and if so what would it constitute?

A caveat of this analysis is that we modeled yield insurance to investigate differences across all farm sizes, large and small. However, because the price risk component in crop insurance is based on futures markets, it would apply to all farm sizes equally. As most crop insurance sold in the U.S. is revenue insurance, the differences in revenue indemnities would be dampened relative to these results. We also note that these results do not prove that rates for either large farms or small farms are actuarially unsound. While the attribute investigated in this paper is not directly used in rating, it may be indirectly captured through other variables such as mean yields.

Finally, what we do not answer in this paper is why large farms are found to be less risky. Given these suggestive results, that is a worthwhile topic for further research. Short of further analysis, we can only speculate that larger farms are using superior production practices or that farm risk management is correlated with farm size.

References

Barnaby, G.A. and L.A. Russell. 2016. "Crop Insurance Will Be at the Center of the 2019 Farm Bill Debate." Choices. Quarter 3. Available online: http://www.choicesmagazine.org/choices-magazine/theme-articles/crop-insurance-in-the-20182019-farm-bill/crop-insurance-will-be-at-the-center-of-the-2019-farm-bill-debate

Coble, K. H., Knight, T. O., Goodwin, B. K., Miller, M. F., Rejesus, R. M., & Duffield, G. (2010). A Comprehensive Review of the RMA APH and Combo Rating Methodology: Final report. *https://www.rma.usda.gov/pubs/2009/comprehensivereview.pdf*

Cooper, J., Zulauf, C., Langemeier, M., & Schnitkey, G. (2012). Implications of within county yield heterogeneity for modeling crop insurance premiums. *Agricultural Finance Review*, *72*(1), 134-155.
https://cropinsuranceinamerica.org/what-would-means-testing-do-to-americas-crop-insurance-system/

Knight, T. O., Coble, K. H., Goodwin, B. K., Rejesus, R. M., & Seo, S. (2010). Developing variable unit-structure premium rate differentials in crop insurance. *American Journal of Agricultural Economics*, *92*(1), 141-151.

Shields, D. A. (2015). Federal crop insurance: Background. *Washington DC: Congressional Research Service, Report*, 7-5700.

Taylor, Mykel and G.A. Barnaby Jr. (2017) Impact of Subsidy and Income Limits on Farm Size Measured at the State, County, and Farm Level. *Kansas State University Department of Agricultural Economics Extension Publication.* http://www.agmanager.info/crop-insurance/crop-insurance-papers-and-information/impact-subsidy-and-income-limits-farm-size

United States Department of Agriculture, Economic Research Service. (2017). America's Diverse Family Farms 2017 Edition. https://www.ers.usda.gov/webdocs/publications/86198/eib-185.pdf?v=43083