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Is Loss Ratio a Sufficient Measure of Crop Insurance Performance?

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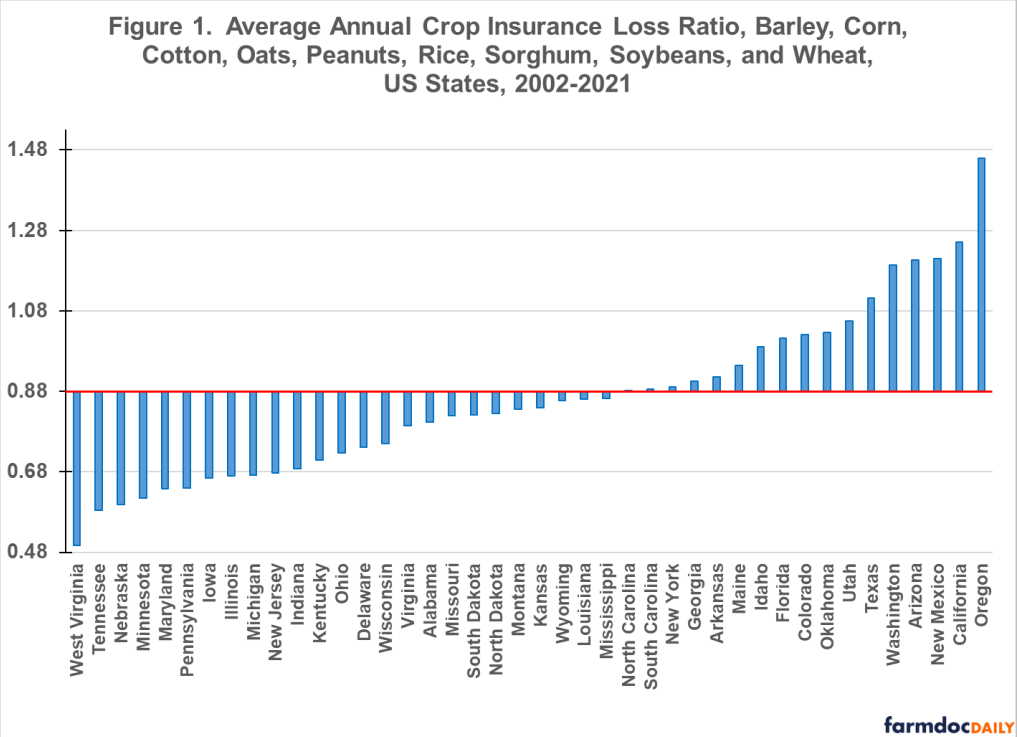
US crop insurance is a risk management program. It is also a public payment program since premiums are subsidized. Performance is thus examined using a common measure of insurance performance, the loss ratio or ratio of insurance indemnity payments to premiums, and a common measure of public payment performance, share of payments vs. share of income/revenue. Unit of analysis is US states. Period of analysis is 2002-2021. State loss ratios do not suggest a performance issue at the aggregate state level. However, state share of insurance indemnities net of farm-paid premiums differ notably from state share of market value of production, and the difference is consistent over the study period. These findings prompt this policy question, "Is the loss ratio a sufficient measure of crop insurance performance?"

Data and Methods

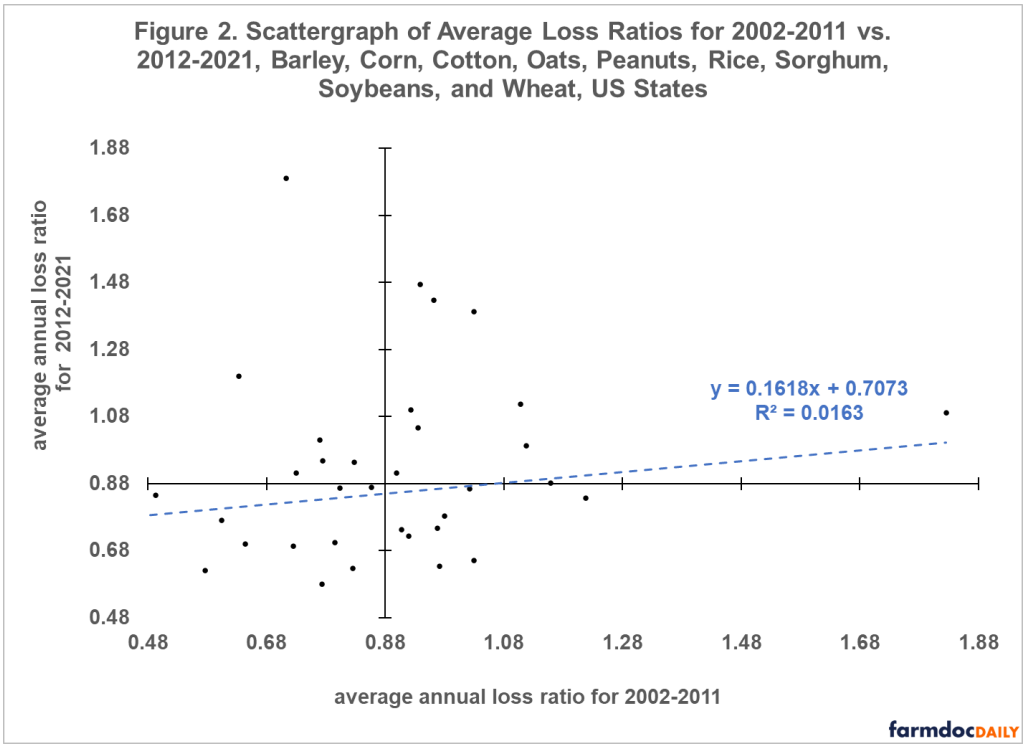
US crop insurance data are from USDA, RMA's (US Department of Agriculture, Risk Management Agency) *Summary of Business*. Value of production is from *Quick Stats* maintained by USDA, National Agricultural Statistical Service. Crops included are barley, corn, cotton, oats, peanuts, rice, sorghum, soybeans, and wheat. Each is a large acreage field crop that has had an insurance contract throughout the 2002-2021 study period. This period follows the *Agricultural Risk Protection Act of 2000*. It made numerous changes to crop insurance, including raising its premium subsidies. Alaska, Connecticut, Hawaii, Massachusetts, Nevada, New Hampshire, Rhode Island, and Vermont are not included in the study because value of production is unavailable for at least one year.

Insurance Loss Ratio

The loss ratio used for US crop insurance is insurance indemnities divided by total premiums. Total premiums equal farm-paid premiums plus public premium subsidies. The target loss ratio for the US crop insurance program is 0.88. Thus, over time total premiums should be 12% more than indemnities. The excess is a reserve for years when indemnities are large. Over the 20 years from 2002 through 2021, average annual loss ratio by state ranges from 0.50 for West Virginia to 1.46 for Oregon (see Figure 1). The average of all state loss ratios is 0.86, close to the 0.88 target.



Change in loss ratio over time is of interest. In particular, do large losses and gains (i.e. large and small loss ratios) for insured units remain consistent over time? This question was examined by comparing average loss ratios for the first half (2002-2011) and second half (2012-2021) of the study period. No relationship exists between these loss ratios (see Figure 2). State average loss ratio for 2002-2011 explained only 2% (i.e. R^2) of the variation in state average loss ratio for 2012-2021. Across the 42 states as a group, a high (low) loss ratio over 2002-2011 was not statistically associated with a continued high (low) loss ratio over 2012-2021.



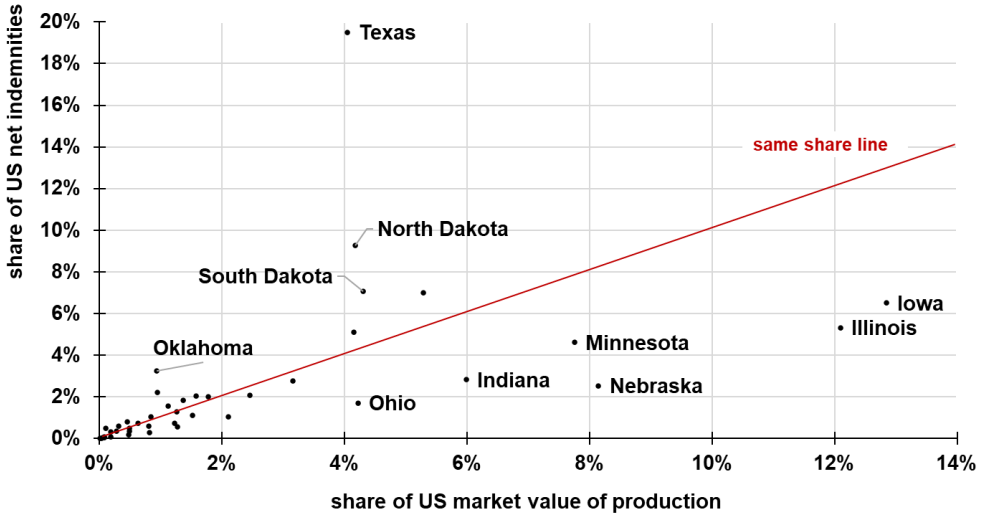
Net Insurance Payment

Since 2001, farmers have received $58 billion more in indemnities for the 9 crops than they paid in premiums. Farmers have paid 38% of premiums, with the Federal premium subsidy covering 62%. A common assessment of income payment programs is to compare payments to income/revenue. This analysis compares, for the 9 crops as a group, a state's share of US net indemnities with its share of US market value of production. Market value of production equals (quantity produced by a state times the state's average market year price paid to farmers for the crop).

Texas had the largest difference: a 19.5% share of US net indemnities vs. a 4.1% share of US market value of production over 2002-2021, a difference of 15.4 percentage points (pp). States with a share difference of 2.2 pp or more are identified in Figure 3. The 2.2 pp difference is the standard deviation of the difference in state shares excluding Texas as an outlier. Besides Texas, North Dakota (5.1), South Dakota (2.7), and Oklahoma (2.3) have net indemnity shares at least 2.2 pp larger than their market value of production shares. These states are in the US plains area. States with a net indemnity share at least 2.2 pp smaller than its market value share are Illinois (-6.8), Iowa (-6.4), Nebraska (-5.6), Indiana (-3.2), Minnesota (-3.2), and Ohio (-2.5). They are in the US Corn Belt area. The share difference for these Corn Belt states is consistent with the low loss ratio for soybeans (see *farmdoc daily*, January 17, 2023).

Unlike the insurance loss ratio, the state share differences for the first and second half of the analysis period are related with 99% statistical confidence (see Figure 4). The 2002-2011 share difference explains 81% (i.e. R^2) of the 2012-2021 share difference. Note, the states listed in Figure 3 are also listed in Figure 4 but state abbreviations are used to avoid crowding.

Figure 3. Share of US Net Crop Insurance Indemnities vs. Share of US Market Value of Production, Barley, Corn, Cotton, Oats, Peanuts, Rice, Sorghum, Soybeans, and Wheat, US states, 2002-2021



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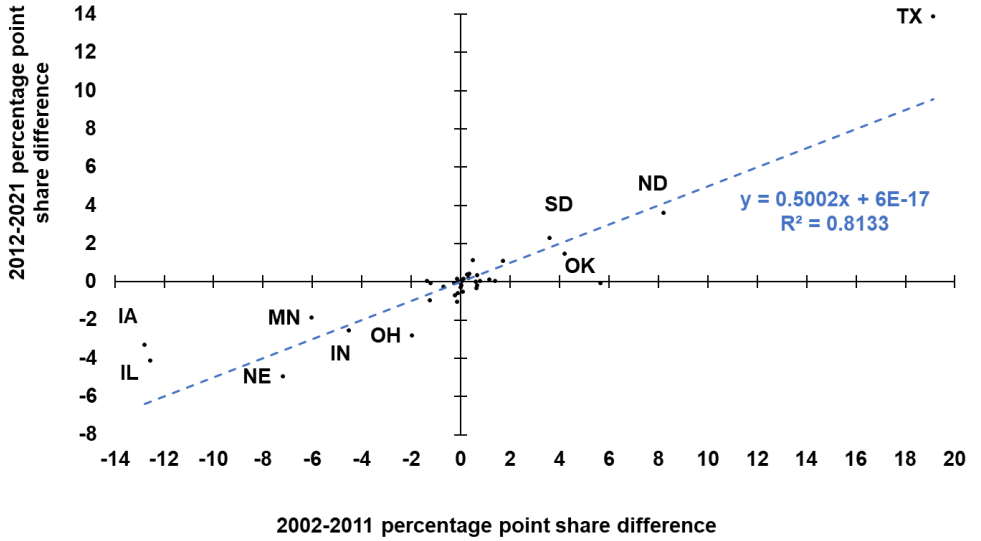
Because the regression equation intercept is zero, its slope (+0.50) reveals that, on average, a state's 2012-2021 share difference is 0.5, or 50%, of the state's 2002-2011 share difference. Although the 2012-2021 share difference is smaller on average, relative share difference is positively related. In other words, a relatively large or small share difference in 2002-2011 remained a relatively large or small share difference in 2012-2021.

Figure 4. Share of US Net Farm Indemnities minus Share of US Market Value of Production for 2002-2011 vs. 2012-2021, Barley, Corn, Cotton, Oats, Peanuts, Rice, Sorghum, Soybeans, and Wheat, US states



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Since loss ratio is a common measure of insurance performance, does it explain the difference between state shares of US net indemnities and US market value of production? A positive relationship is found: the higher a state's loss ratio, the higher its share of net indemnities vs. its share of market value of

production (see Figure 5). Statistical confidence is 99%, but explanatory power is only 15% (i.e. R^2). The limited explanatory power suggests that other variables are likely to be important in explaining the difference between state shares of net indemnities and value of production.

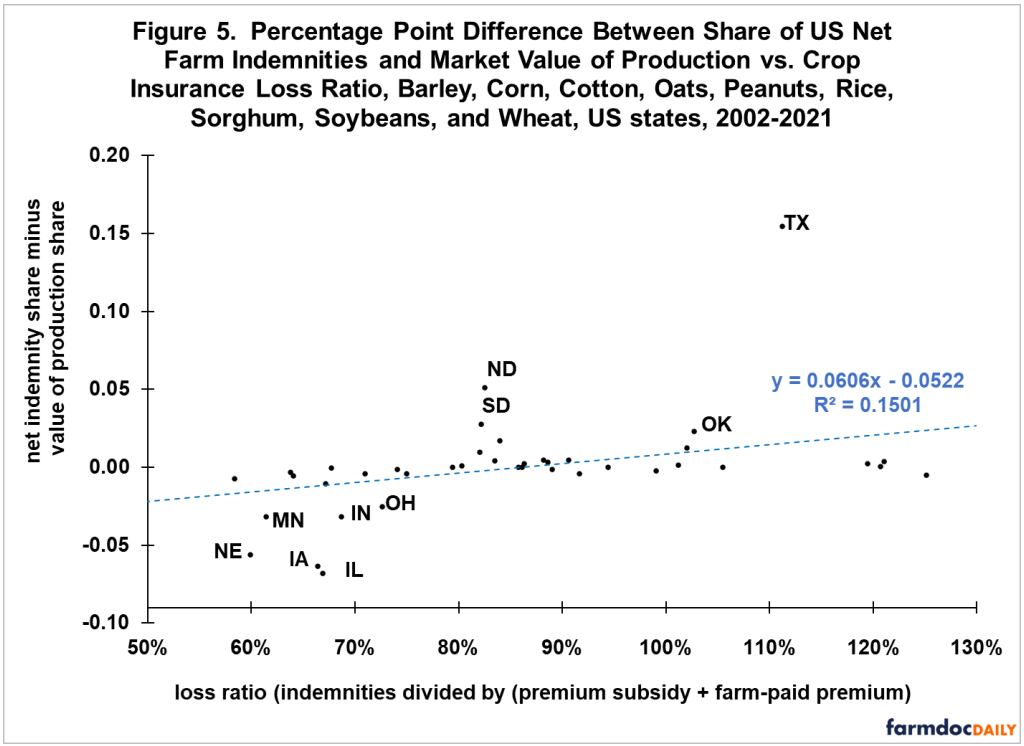

Figure 5. Percentage Point Difference Between Share of US Net Farm Indemnities and Market Value of Production vs. Crop Insurance Loss Ratio, Barley, Corn, Cotton, Oats, Peanuts, Rice, Sorghum, Soybeans, and Wheat, US states, 2002-2021

Discussion

Crop insurance is a risk management program. It is also a public income payment program since its premiums are subsidized.

Performance assessment of the US crop insurance program has focused on its loss ratio, a common measure of insurance performance. Its loss ratio is defined as (indemnity payments divided by (farm-paid premiums + premium subsidies). Using a state as the insured unit, this study found the average state loss ratio was similar to the target loss ratio of 0.88. Also, a state's loss ratio did not, in general, remain consistently high or low over the first and second half of the 2002-2021 study period. These findings do not suggest a performance issue at the aggregate state level.

Crop insurance performance as a public policy payment program was assessed by comparing a state's share of US net insurance indemnity payments (i.e. indemnities minus farm-paid premiums) with its share of US market value of production. Notable differences exist in these two shares. Moreover, states with high or low indemnities relative to value of production remained consistently high or low over both halves of the study period.

A state's loss ratio explained little of the difference between its shares of net indemnities and market value of production, prompting this policy question, "Is the loss ratio a sufficient measure of US crop insurance performance since crop insurance is also a public payment program?"

If the policy process decides the loss ratio is not a sufficient measure, among potential policy responses are:

1. Use historical net indemnities to help set premiums so shares of net indemnities and market value of production are similar over time.

2. Conduct research to identify factors other than loss ratio that explain the divergence between shares of net indemnities and market value of production, then use these factors to help set premiums.

References and Data Sources

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