

Crop Insurance and Conserving Agricultural Practices- What Research Tells Us

Keith H. Coble

*AAEA 2014 Crop Insurance and the Farm Bill Symposium,
Louisville, KY*



MISSISSIPPI STATE
UNIVERSITYTM

Department of Agricultural Economics

The Relationship of Crop Insurance & Conservation Practices

- Sandmo & Ishii show that an increase in risk will have a negative total effect on output
- Batra and Ullah derived the price risk implications for input demand. The risk averse competitive firm demands smaller quantities of inputs when output price is variable
- MacMinn and Holtman & Just and Pope addressed technological uncertainty.
 - They specify a production function $f(x,z)$ where x is a traditional input and z is a random uncontrolled input (rainfall, temperature, etc.). Input demand is ambiguous in sign. The sign is conditioned on the interaction between x and z . From this we can define risk increasing and risk decreasing inputs.

So what about crop insurance?

- If crop insurance is risk reducing:
 - Potentially expands output (production)
 - Expand acreage
 - Change crop mix
 - Substitute for risk reducing inputs (e.g. irrigation)
 - Enhance risk increasing inputs (e.g. fertilizer)
 - Question of magnitude in many cases

Literature cited thus far ignores subsidy

- *Subsidy = f[Crop value insured, Premium rate, Subsidy rate]*
crop value insured = f(E(price), E(yield), acres insured, coverage level)
- *Premium rate =*
f(underlying riskiness, coverage level, insurance product, unit structure)
- *Subsidy rate =*
f(coverage level, area or individual coverage, unit structure)

Another Vein of Literature-Moral Hazard

- Coble, Knight, Pope Williams
 - Insured farmer may shirk on inputs if not monitored
 - Deductible a means to avoid moral hazard
 - Found moral hazard conditional in-season weather and giving up on the crop
- Skees, Black and Barnett (AJAE 1997)
 - Suggested area based insurance to avoid the moral hazard problem because reducing inputs will not increase indemnity
 - Area yield and revenue insurance have become the skeleton for SCO & STAX

The Extensive Margin – Crop insurance effect on production in marginal areas

- Wu (AJAE 1999)
 - Providing corn insurance will shift land from hay and pasture to corn, which will increase chemical use at the extensive margin. This extensive-margin effect dominates the effect of crop insurance on the application rate, leading to an increase in total chemical use.
- Goodwin Vandever and Deal (AJAE 2004)
 - Focuses on corn and soybean production in the Corn Belt and wheat and barley production in the Upper Great Plains. Results confirm that increased participation in insurance programs provokes statistically significant acreage responses in some cases, though the response is very modest in every case.

The Extensive Margin

- O'Donoghue, Roberts and Key (JAE 2008)
 - Estimate how much United States farms changed enterprise diversification in response to a marked increase in crop insurance coverage brought about by the 1994 Federal Crop Insurance Reform Act, which substantially increased insurance subsidies. We find that the insurance subsidies caused a modest increase in enterprise specialization and production efficiency. Estimated efficiency gains are far less than the subsidies
- Miao, Feng & Hennessy (AAEA 2011)
 - In U.S. regions where the cropland growth is likely to have marked adverse environmental impacts. Simulation results show that when subsidy rate decreases by 5 percentage points, then about 0.60 percent of insured cropped land will be converted to non-cropped land. When crop price decreases by 5 percent, then about 1.01 percent of insured cropped land will be converted to non-cropped land.

Input use and crop insurance

- Horowitz and Lichtenberg (AJAE 1993)
 - Results suggest that insurance exerts considerable influence on corn farmers' chemical use decisions. Those purchasing insurance applied significantly more nitrogen per acre (19%), spent more on pesticides (21%), and treated more acreage with both herbicides and insecticides (7% and 63%) than did those not purchasing insurance. These results suggest that both fertilizer and pesticides may be risk-increasing inputs.
- Smith & Goodwin (AJAE 1996)
 - Recent research by Horowitz and Lichtenberg indicated that, contrary to conventional wisdom, farmers that purchased insurance tended to use relatively more chemical inputs than farmers who did not insure. In contrast, our results confirm the conventional view that moral hazard incentives lead insured farmers to use fewer chemical inputs.

Input use and crop insurance

- Babcock and Hennessey (AJAE 1996)
 - At all nitrogen fertilizer rates and reasonable levels of risk aversion, nitrogen fertilizer and insurance are substitutes, suggesting that those who purchase insurance are likely to decrease nitrogen fertilizer applications.
- Goodwin and Smith (JARE 2003)
 - Recent research has questioned the extent to which government policies, including conservation and risk management programs, have influenced environmental indicators. The impacts of income-supporting and risk management programs on soil erosion are considered... While the Conservation Reserve Program has reduced erosion an average of 1.02 tons per acre from 1982 to 1992, approximately half of this reduction has been offset by increased erosion resulting from government programs other than federally subsidized crop insurance.

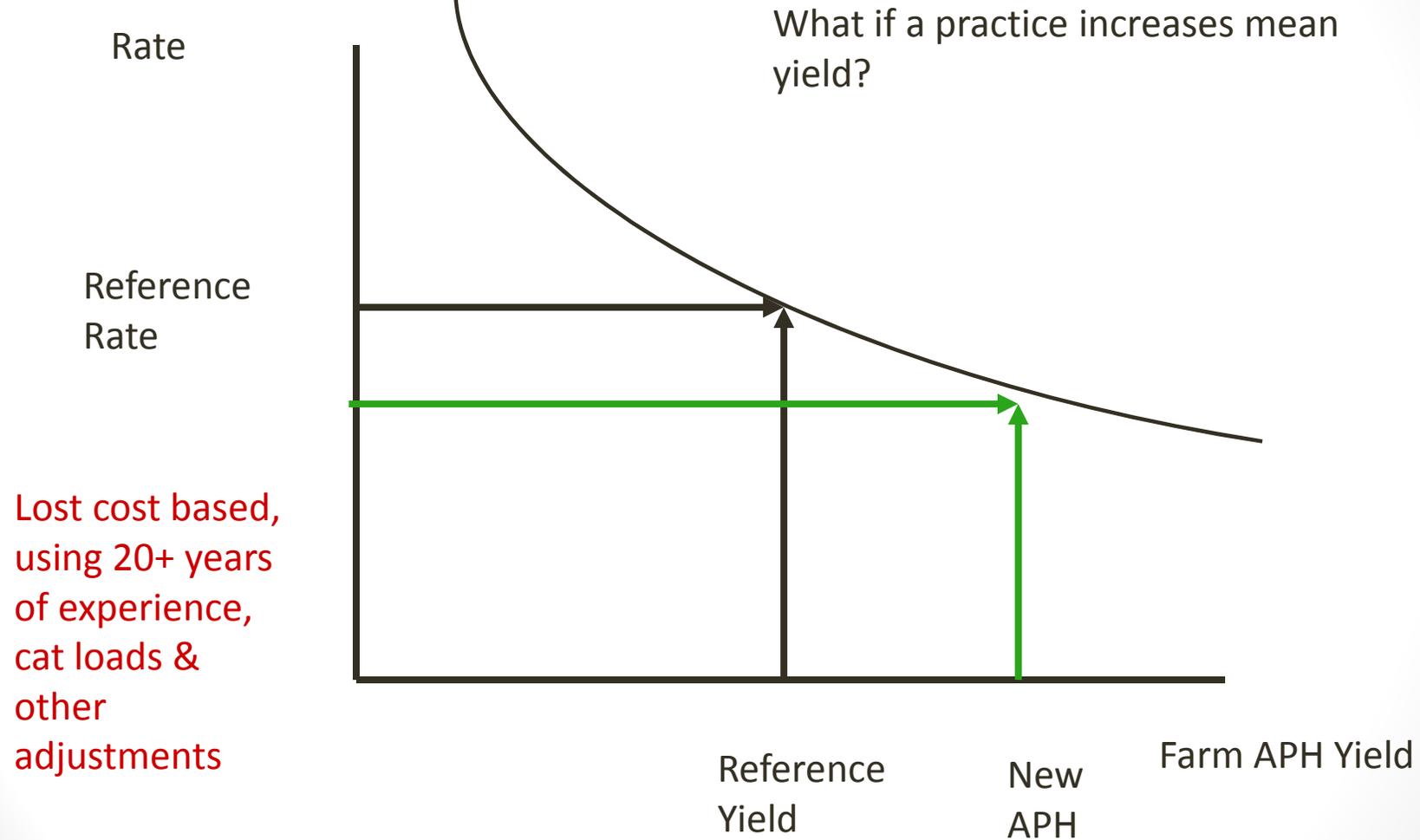
Input use and crop insurance

- Mishra, Nimmons, El-Osta (Journal of Environmental Management 2004)
 - Conclude that among winter wheat farmers, those who purchase revenue insurance tend to spend less on fertilizers but do not appreciably alter pesticide expenditures. When the environmental indicators included indicated a potential environmental fragility (i.e. high erosion, pesticide leaching or pesticide runoff potential), the input use equation suggested that fertilizer expenditures decreased... the marginal environmental benefit of revenue insurance is lessened because the reduction, where it matters most, accrues on land on which fertilizer use has already been curtailed to some degree.
- Roberts, Key, O'Donoghue, (AEPP 2006)
 - Uses federally subsidized crop insurance contracts from 1989 to 2002 to estimate the incidence of moral hazard for corn, soybeans, and wheat in Iowa, Texas, and North Dakota... Our results indicate some evidence of moral hazard in Texas, particularly for wheat and soybeans. Otherwise, we find little evidence of moral hazard affecting average yield or yield variability.

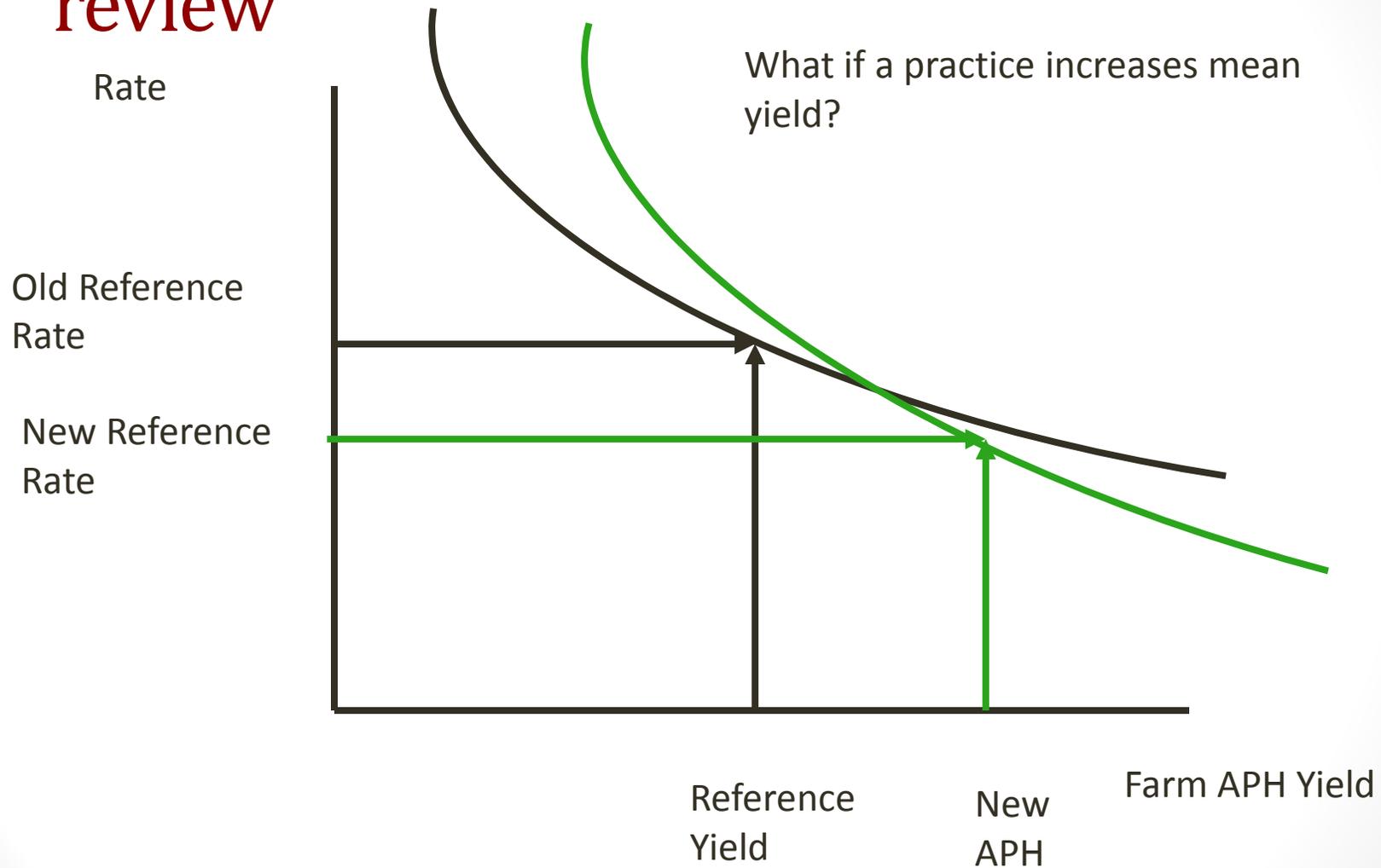
Input use and crop insurance

- Walters, Shumway, Chouinard, and Wandschneider (JARE 2012)
 - find some association between environmental effects and insurance contracts. On average, however, we find that environmental effects are generally small and as often beneficial as adverse. More importantly, we find that results are specific to local conditions and to particular environmental indicators and may be hidden in aggregate analysis.
- Schoengold, Ding, Headlee (AJAE forthcoming)
 - The paper examines the extent to which risk-reducing tillage practices and government programs are substitutes for each other. The empirical analysis shows that recent disaster and indemnity payments are associated with an increase in the use of no-till and a decrease in the use of other conservation till. Results also show that producers in counties with recent drought and flood events are more likely to use other conservation tillage.

A few thoughts from the Coble et al rate review



A few thoughts from the Coble et al rate review



Summary

- This research is important, but difficult and data intensive
- It is probably very production system specific
- Some of the effects are ambiguous
- We have a problem with short-term agronomic studies
 - Most focus on the mean effect
 - A 3-4 year study is of little value for risk measurement
- Some of the practice effects get captured in the mean effect
- Largely calls upon us to estimate high quality production functions
 - Big Ag Data may allow that analysis