Evidence from a Corn Belt Farmers' Survey:

A Multi-Layered Analysis of Understanding Farmers' Adaption Strategies to Climate Change

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Introduction

- Under the projected climate scenarios, farmers are likely to see dramatic yield reductions in the next following decades (Roberts and Wolfram, 2009).
- Corn Belt farmers are likely to adopt or increase the use of a series of agricultural practices or actions to mitigate the possible negative consequences in the future weather patterns.

Background

- How farmers choose the agricultural practice in the context of uncertainties of the future weather patterns is a complex process.
- Permanence of each practice :different practices impose different decisions given their time horizon.
- Farmers' tenure; the land tenure arrangements bring about another layer of complication.
- What sets of weather measures (extreme or averages) are best for understanding farmers choices.

Objectives

- Do farmers show different responses to the tile drainages versus cover crops under different land tenure arrangements?
- Is the owner of the land more likely to expand the tile drainage system because he or she can reap all the long-run benefits?
- Is there any difference when it comes to cover crop adoption since the cost and benefit are all realized in the short run?
- Do farmers respond more to the weather anomalies measured by the five-year-deviation from 30-years average than the deviation from the twenty-years average?
- Are farmers more likely to respond more to deviations from extreme measurements of the weather events than to deviations from the average measurements of the weather events?

Data and Methodology

Survey: "Farmer Perspectives on Agriculture and Weather Variability in the Corn Belt," collected in 2012.

- Determine if farmers are likely to implement different agricultural actions in response to the climate change
- Two practices of interest: tile drainage and cover crops.

Econometric Strategy

$$P_{i,a,t}(Increased\ adoption = 1) = f\left(demographic_i, soil\ quality_{i,t}, farm_{i,t}, weather_{i,t,}\right)$$

i : the farmer, a: agricultural practice, t: tenure type (owned vs. rented) and $P_{i,a,t}$:probability that agricultural practice a is adopted by farmer i with tenure t.

- Demographics: age, farming experience (Survey level collected data)
- Soil quality: county-level percent of cropland under different land capabilities classes(SSURGO).
- Farm characteristics : land tenure (NASS 2012).
- Weather characteristics: statistical measures for temperatures and precipitations measured as 2007-2012 anomalies from the respective climate normal, where the normals were defined over thirty, twenty, and ten years (PRISM).

Testing Strategy

Use **Chow-type to answer the following research questions:**

- *Owner vs. Renter:* Considering the same agricultural actions and controlling for the other explainable variables, are owners more likely to increase/adopt the use than renters?
- *Long-term (tile drainage) vs. short-term (cover crop) investment*: Considering the same type of land tenure actions and controlling for the other explainable variables are farmers more likely to undertake agricultural actions with long-term benefits?

Use **the likelihood dominance test** (Pollak and Wales, 1991)

- Which set of statistical weather measurements are best to explain farmers' choice.

Results and Conclusions

- The concept of adaption to new conditions either climatic or economic is an important aspect of the agricultural decision-making process (Arbuckle et al., 2013).
- Adopting cover crops, reduced tillage, extending the drainage systems, adjusting crops management are only a few examples of adaptive actions (Arbuckle et al., 2013).
- These actions as long as they have private benefits (increased profits, reduced risk) can be easily implemented.
- However, each adaptive action has different economic and environmental consequences
- For example, the expansion tile drainage could boost the corn/soybean yields, but has the potential to move more nutrients from the field to the river systems and thus contribute to local or national water quality problems, such as the Gulf of Mexico hypoxic zone. On the other hand, cover crops can help alleviating the water quality nutrient related problems, but the yields effects might be negative at least in the short run.
- This research helps understanding which factors best motivate the farmers' likelihood to use different agricultural actions as strategies to adapt to the future weather patterns. For a policy maker interested in mitigating the negative consequence on water quality, our analysis might suggest different intervention directions pending on the possible differences found between the farmers who own or rent the land when deciding their adaption strategy.

References:

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