Impact of climate change on insecticide use

Peiley Lau

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- How will climate change, in particular increases in temperature and volatility in temperature fluctuation, affect insecticide application?
- A future extension: How will changes in insecticide application affect incidence of cancer? (probably not within the scope of 2YP)

- Insecticide application in the US has been trending downwards from 131 mi lb in 1968 to 29 mi lb in 2008 (USDA - ERS 2014).
- Min and max winter and spring temp trending upwards across continuous US from 1980 - present (NOAA).
- Warmer temp $\rightarrow$ extend the development time window for crop pests and can migrate further northward. Farmers spray more?

INSECT PHYSIOLOGY

- Insect rate of development is function of temperature, especially during critical windows during the year.
- Sequencing of temperature and rate of temperature change across days matter.

DATA

- USGS Pesticide National Synthesis Project
  - Estimated Annual Agricultural Pesticide Use
  - annual pesticide estimates for each chemical compound, 1992 - 2014, county-level
  - 3029 counties, 23 years, 492 unique chemical compounds
- LUGE Harvested Area and Yields of 175 crops dataset
  - county-level crop acreage data from 1960 - 2008
- Berkeley Earth Climate Data
  - gridded daily temperature data, 1992 - 2014
  - max, min and average temp at county centroid

IDENTIFICATION STRATEGY

- ► 2SLS
    1. 1st stage: Instrument for crop pest density with temperature
        - ► $\widehat{pest\_density_{c,y}} = \alpha_0 + \alpha \cdot temp\_sequence_{c,y} + Z \cdot X_{c,y} + \gamma_c + \delta_y + \epsilon_{c,y}$
    2. 2nd stage:
        - ► $pesticide\_application_{c,y} = \beta_0 + \beta \cdot \widehat{pest\_density_{c,y}} + Z \cdot X_{c,y} + \gamma_c + \delta_y + \varepsilon_{c,y}$

$X_{c,y} =$ covariates for that county-year

c = county

y = year

THOUGHTS ON KARL'S PRESENTATION

Alaska Permanent Fund and Automobiles: Data

- Announcement date of Permanent Fund?
- At what time scale are the data on wholesale auto auctions?

THOUGHTS ON KARL'S PRESENTATION

Alaska Permanent Fund and Automobiles: Identification
Strategy

- Propose to use DiD. Consider using synthetic control
  method instead?
- Run DiD on each year independently – how to take
  account of autocorrelation between permanent fund
  amounts and people's consumptions across years?
- What is the time window that you assume people are
  making decisions over?
- How to interpret treatment?