The Effects of Government Payments and Ethanol Plant Location on Farmland Values

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Motivation

• How do government policies impact farmland values?

• Are government payments capitalized into land values?
  • Who benefits from agricultural support policies?
    • Operator or landowner

• What is the impact of ethanol facilities on land prices?
  • Do farmers have incentives to lobby for ethanol policies/location of ethanol facility?
Motivation

- Capitalization of agricultural support payments is debated
  - Only 25 percent is capitalized (Kirwan 2009)
  - High rates of capitalization (Goodwin, Mishra, and Ortalo-Magné 2011)

- Ethanol policies impact land prices
  - Increases returns to corn production
    - Drives up price of land
  - Strengthens basis in the local market (McNew and Griffith 2005; Henderson and Gloy 2009)
Pricing models

- Supply and demand models
- Hedonic pricing models
- Co-integration
- Capitalization models
Pricing models

- Supply and demand models:
  - Used in 1960s (Herdt and Cochrane 1966; Tweeten and Martin 1966; and Reynolds and Timmons 1969)
  - Worked well in sample
  - Did not perform well out of sample
  - Land has fixed supply

- Hedonic pricing models:
  - Used more recently
  - Price based on land attributes
Pricing models

- Co-integration:
  - Movement of two time series together (Campbell and Shiller 1987)

- Capitalization models:
  - Dominate the literature
The capitalization model

- Value of land is the sum of discounted future returns plus an opportunity cost

\[ V_L = E_0 \left[ \sum_{t=1}^{\infty} \frac{Ret_t}{(1 + i)^t} \right] + Op_0 (Urban_t, Amenity_t) \]
Factors affecting land prices

- Returns:
  - Market returns
  - Rental payments
  - Government payments
    - Increase returns
    - Stabilize market returns
  - Different discount rates
Factors affecting land prices

- Ethanol facilities:
  - Increase demand for corn
  - Reduce transportation costs

- Urban influences and amenity score:
  - Opportunity cost of keeping land in agricultural use

- Inflation
Rental rates

- Potential problems with capitalization model:
  - Land is an infinitely lived asset
  - Land appreciates
  - Does not deal with uncertainty/policy changes adequately

- Rental rates:
  - Set for a short period of time
  - Can change rapidly with shifting market factors and policies
  - 45.3% of agricultural land is operated by someone other than the landowner (Goodwin et al. 2011)
  - Value of marginal product equals rental rate
Data

• Agricultural Resource Management Survey (ARMS)
• Conducted annually
• U.S. Department of Agriculture’s (USDA)
  • National Agricultural Statistical Service (NASS)
• 1998-2008
• 48 contiguous states
Data

- 80 million acres of corn planted every year in the in US Heartland region:
  - Impacted by agricultural support and ethanol policies
  - 132 operating corn ethanol facilities
  - Indiana, Iowa, Illinois fully included
  - Ohio, Kentucky, Missouri, Nebraska, South Dakota, Minnesota partly included
Data

- Land values:
  - Prior research:
    - Used bankers estimates (Henderson and Gloy 2009)
    - Sales data
  - Constructed from ARMS data
    - Value of land and building minus value of buildings divided by acres owned
  - $200 and $20,000 per acre (Goodwin et al. 2011)
Data

- Rental rates:
  - Constructed from ARMS data
    - Cash rent divided by acres rented for cash
  - $0 and $2,000 per acre (Goodwin et al. 2011)
Factors affecting land values

- Returns (per acre operated):
  - Market
    - Livestock and crops sales
  - Government payments
    - Coupled payments (linked to current production and/or current price)
      - Countercyclical payments (CCP)
      - Loan deficiency payments (LDP)
    - Decoupled payments
      - Production flexibility and fixed direct payments
    - Disaster payments
      - Market lost payments
  - Conservation reserve payments
  - Wetland reserve payments
  - EQUIP payments
  - Other government payments
Factors affecting land values

- Amenity score
  - Temperature, sunlight, surface water
- Urban pressure
  - Beale code 1 to 9
    - 1 most urban/highest population
    - 1-3 metropolitan
    - Even -- metro adjacent
    - Odd -- not metro adjacent
Factors affecting land values

- Ethanol facility location
  - Renewable Fuels Association and American Coalition for Ethanol
  - Specific addresses, including zip code
  - Production capacity
  - Date of operation
Matching ethanol facility and farm location

- Specific addresses of respondents not included in ARMS
- Zip code is report in years 1998-2008
  - 32,000+ observations
- Created an indicator variable:
  - If farm is located in a zip code with an ethanol facility, ETHANOLZIP is equal to 1 otherwise it equals 0
Matching ethanol facility and farm location

- An ethanol facility will have an effect that reaches beyond its zip code
- Created an indicator variable:
  - If farm is located in a county with an ethanol facility, ETHANOLFIP is equal to 1 otherwise it equals 0
- Match zip code to fip code: 5 digit codes -- first 2 digits represents the state and the last 3 representing the county
- Some zip codes span more than one county
- Matched to county containing most of the area in the zip code
- Some counties have multiple ethanol facilities:
  - NUMETHANOL number of ethanol facilities in county
Matching ethanol facility and farm location

- Zip code can span multiple counties and an ethanol facility will affect neighboring counties:
- Created an indicator variable:
  - If farm is located in a county containing a zip code with an ethanol facility, ETHANOLMULT is equal to 1 otherwise it equals 0
- Some counties have multiple ethanol facilities:
  - NUMETHANOLMULT number of ethanol facilities in county
### Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
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<tbody>
<tr>
<td>ACRES OPERATED</td>
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<td>379.39</td>
<td>1,212.64</td>
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<td>ACRES OWNED</td>
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<td>ACRES OF CORN</td>
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<td>GOV</td>
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</table>
Main findings: All years

- RETCROP: $0.04**
- GOV: $1.30*
- CCP: $11.59**
- LDP: -$4.60*
- DP: $5.65
- DISASTER: $2.55
- CRP: -$2.81
- WETLAND: $5.60
- EQUIP: $2.08
- OTHERGOV: $3.70
- Urban influence, amenity score and CPI highly significant
Main findings: All years

- Impact of ethanol facility on farmland values:

- Zip code-level analysis:
  - Positive but not significant
  - Range: $197-378

- County-level analysis:
  - Aggregate government payments
    - 1 plant: $266.72***
    - 2 plants: $1023.98**
  - Disaggregate government payments
    - 1 plant: $266.72***
    - 2 plants: $1023.98**
Main findings: All years

- Nearby county-level analysis:
  - Aggregate government payments
    - 1 plant: $207.07***
    - 2 plants: $1045.64***
    - 3 plants: $2167.34***
  - Disaggregate government payments
    - 1 plant: $224.53***
    - 2 plants: $2478.25**
    - 3 plants: $3379.68***
Main findings: Prior to 2002

- RETCROP: $0.04**
- GOV: $5.84***
- CCP: --
- LDP: $3.46
- DP: $9.12
- DISASTER: $3.35
- CRP: $4.80
- WETLAND: $2.85
- EQUIP: -$12.59
- OTHERGOV: $11.04
- Urban influence, amenity score and CPI highly significant
Main findings: Prior to 2002

- Impact of ethanol facility on farmland values:
  - Positive but not significant

- Zip code-level analysis:
  - Range: $811-1668

- County-level analysis:
  - 1 plant: $234

- Nearby county-level analysis:
  - 1 plant: range: $177-186
Main findings: After 2002

- RETCROP: $0.05-0.06***
- GOV: $0.53
- CCP: $8.09
- LDP: -$7.23
- DP: -$8.61
- DISASTER: $10.43
- CRP: -$9.97
- WETLAND: $24.64***
- EQUIP: $4.55
- OTHERGOV: $1.29
- Urban influence, amenity score and CPI highly significant
Main findings: After 2002

- Impact of ethanol facility on farmland values:
- Zip code-level analysis:
  - Positive but not significant
    - Range: $64-122
- County-level analysis:
  - Aggregate government payments
    - 1 plant: $255.50***
    - 2 plants: $1031.81**
  - Disaggregate government payments
    - 1 plant: $466.35**
    - 2 plants: $2374.84***
Main findings: After 2002

- Nearby county-level analysis:
  - Aggregate government payments
    - 1 plant: $204.53***
    - 2 plants: $1030.76***
    - 3 plants: $2250.06***
  - Disaggregate government payments
    - 1 plant: $258.71***
    - 2 plants: $2604.23**
    - 3 plants: $3410.51***
Results

- Positive effects of ethanol facilities on neighboring land values and rental rates
  - Impact decreases with the distances
  - More than one ethanol facility will increase the effects

- Government payments impact land values and rental rates
  - When government payments are disaggregated:
    - Sign of the effect depends on year and model

- Effects of government payments are not significant in later years, while effects of ethanol facilities are not significant in early years
Results

- Urban influence has a large positive impact on land values and rental rates
  - The higher the urban influence code score the lower the effect on land values

- Amenities have a positive impact on land values
Conclusions

- Government policies can impact land value
  - Evidence payments are capitalized into land value
  - Operators are not the only beneficiary of policy

- Ethanol plants have positive effects on land values
  - Increase market returns and lower transportation costs
  - Incentives to lobby for ethanol policies and ethanol plants
Future Research

- Use exact distances from farm to ethanol facilities
  - Calculate distance using zips
  - Selecting a subsample of ARMS respondents
  - Use ARMS 2008 Bio-energy questionnaire data
- Include size of ethanol facility
- Further disaggregate market returns
- Urban pressure measures
  - Population growth
- Compare to basis change
- Land quality
- Expectation of payments