

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

<u>Variable</u>	<u>No. Obs.</u>	<u>Mean</u>	<u>Std. Dev.</u>
ACRES OPERATED	31,454	379.39	1,212.64
ACRES OWNED	31,454	200.62	786.71
ACRES OF CORN	31,454	121.66	511.14
CORN YIELD	22,346	139.97	37.32
REAL ESTATE	31,454	\$457,094.83	\$1,734,816.41
LAND VALUE	31,454	\$125,222.10	\$832,155.21
PER ACRE LAND VALUE	31,454	\$2,826.52	\$2,645.54
RENT	17,680	\$123.34	\$5,900.37
GOV	31,454	\$25.51	\$35.95
CCP	28,968	\$1.53	\$7.62
LDP	15,542	\$5.93	\$11.83
DP	31,454	\$7.85	\$14.51
DISASTER	12,559	\$2.62	\$11.98
CRP	12,559	\$5.79	\$8.91
WETLAND	12,559	\$0.11	\$2.47
EQUIP	12,559	\$0.11	\$1.24
OTHERGOV	12,559	\$2.29	\$23.05
RETLIVE	31,454	\$188.34	\$178,712.25
RETCROP	31,454	\$254.50	\$10,551.05

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