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Macroeconomic Impacts of Water Use in Agriculture

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Overview

- Introduction & Background
- Methods
- Results
- Questions and Discussion

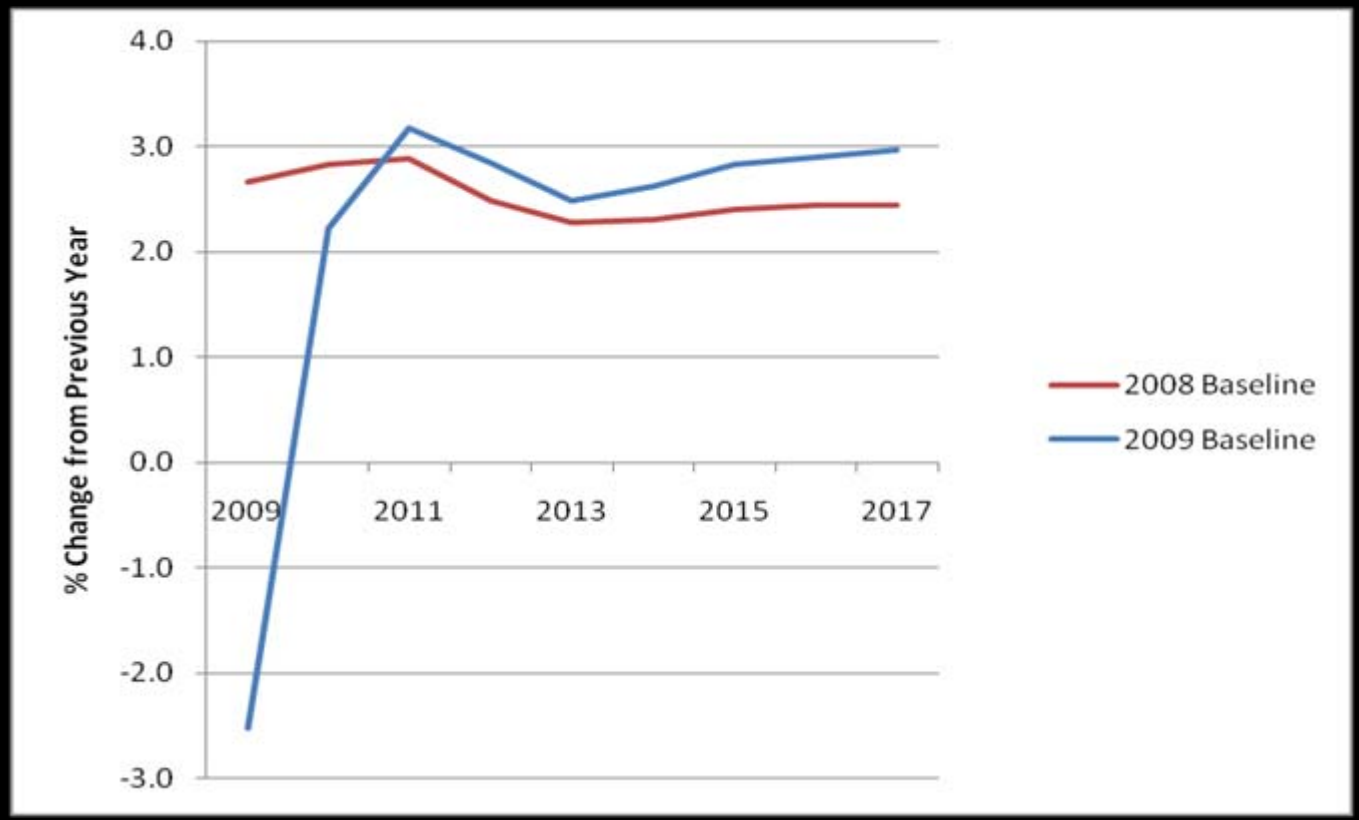
Introduction & Background

Macroeconomics and Agriculture

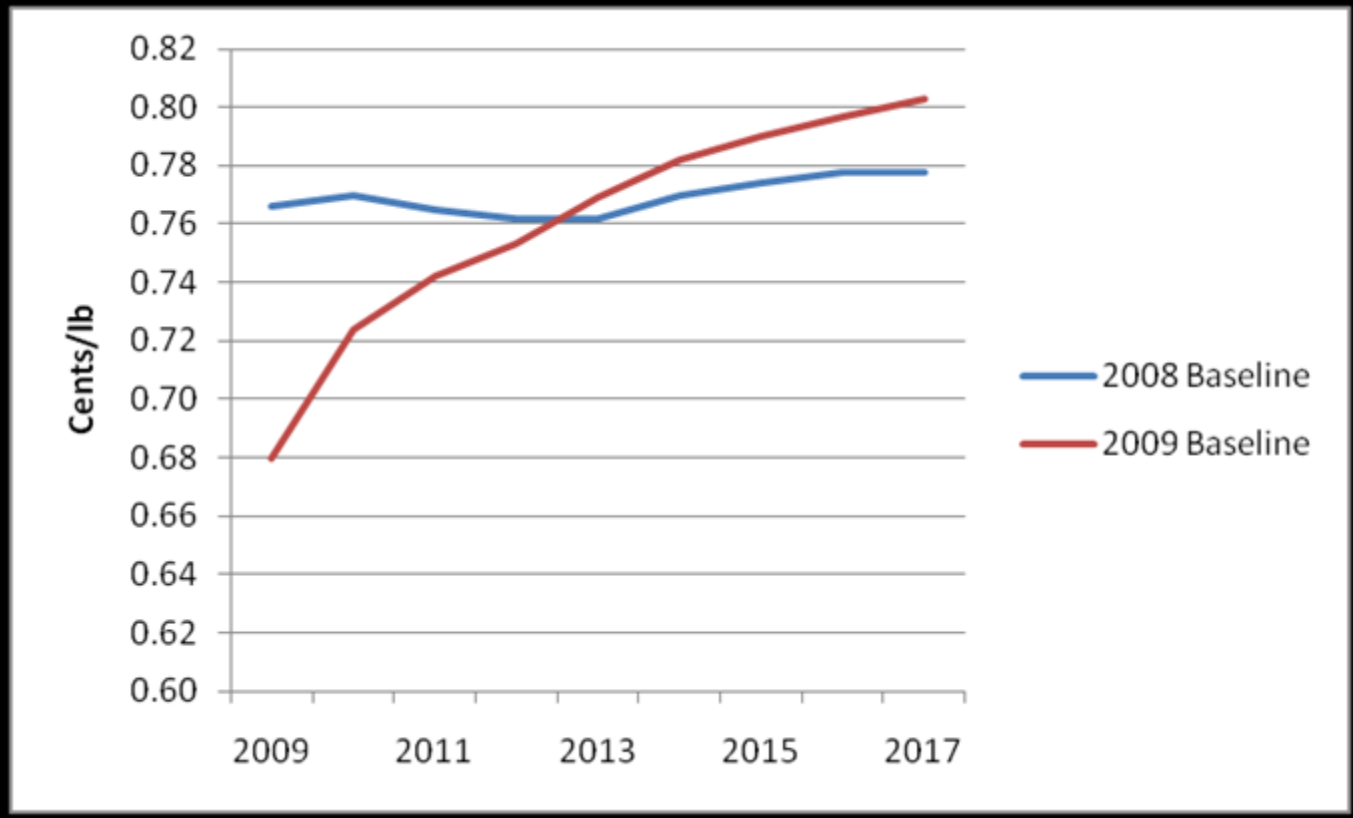
- Shifts in the macroeconomic measures can directly impact the agricultural sector primarily through commodity prices and input costs

- Recent/current recession presents a unique opportunity to study the interaction of macroeconomic variables and how they are tied to irrigation on the Southern High Plains of Texas (SHP)

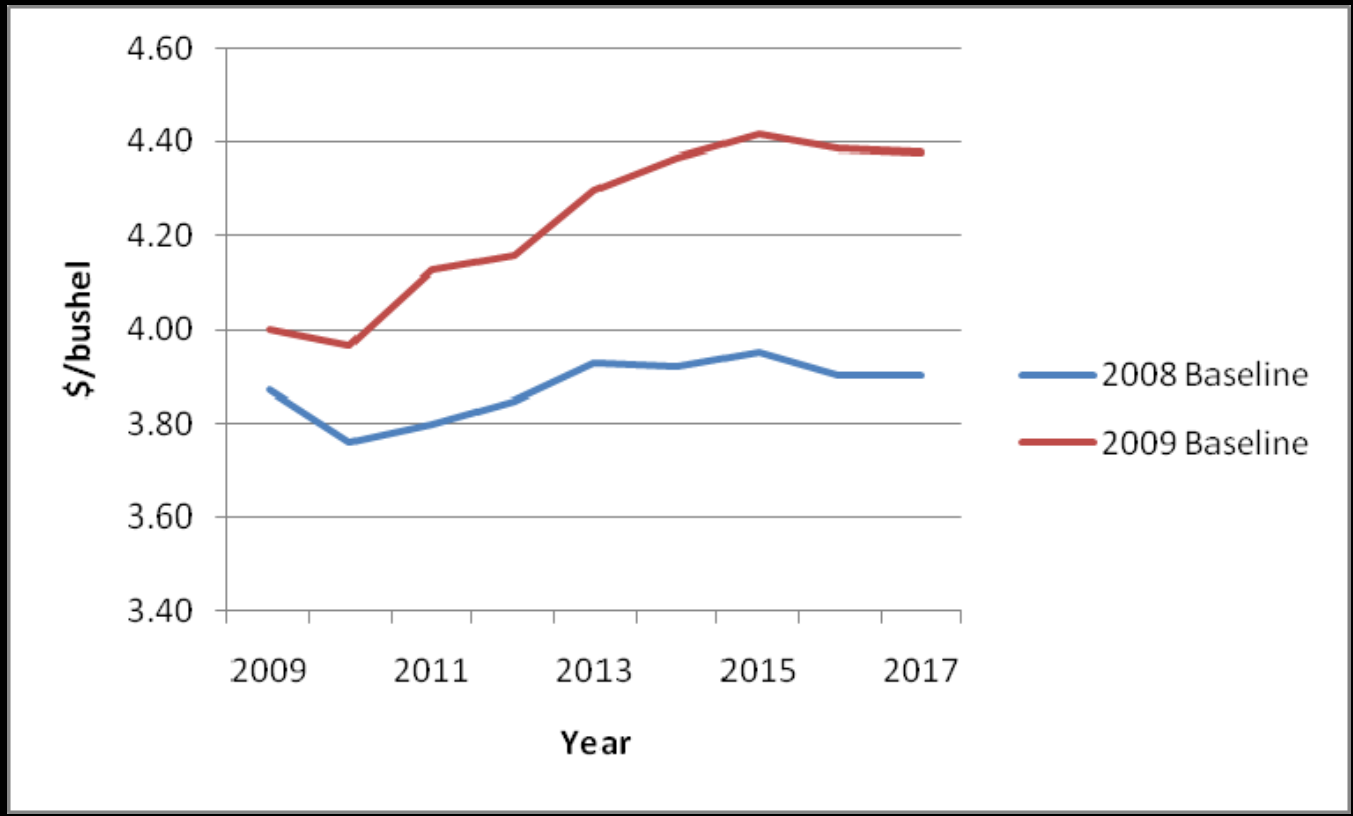
U.S. Real GDP Projections (FAPRI)



FAPRI Cotton Outlook (localized)



FAPRI Corn Outlook (localized)



2008 Recession

Shifts in interest rates, exchange rates, economic growth

Shifts in commodity prices, input cost, etc.

Changes farm level production decisions and input use

General Objective

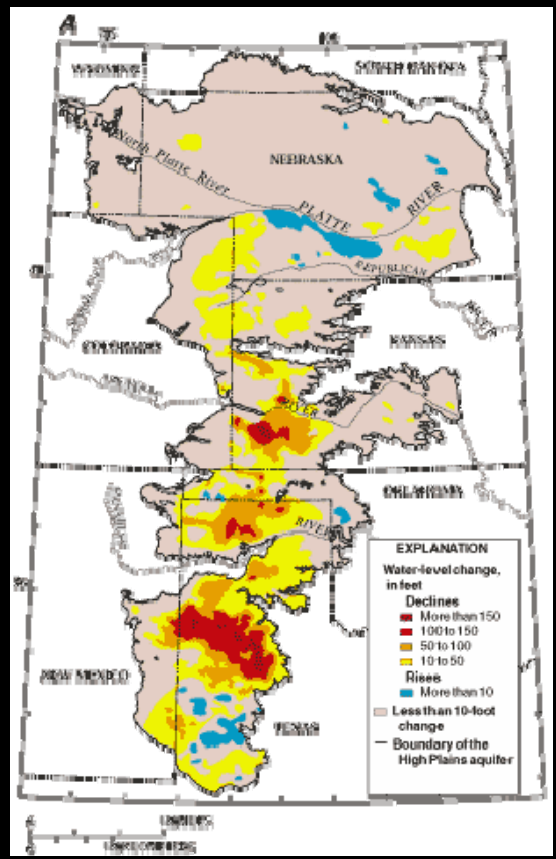
- The general objective was to determine how the macroeconomic forces observed in the 2008 recession affected the rates of withdrawals from the Ogallala Aquifer in the Southern High Plains of Texas

Specific Objectives

- Identify regional water issues
- Determine the farm level prices and costs caused by the recession
- Estimate impacts to water withdrawals for irrigation and compare to a baseline
  - Scenario 1 – both commodity price and production costs are allowed to change
  - Scenario 2 – only commodity prices change holding production costs constant at 2008 level

Regional Water Concerns

- Southern Ogallala Aquifer is declining
- 3.5 million acres irrigated in the Southern Ogallala (Texas)
- Is a crucial driver of regional economic activity

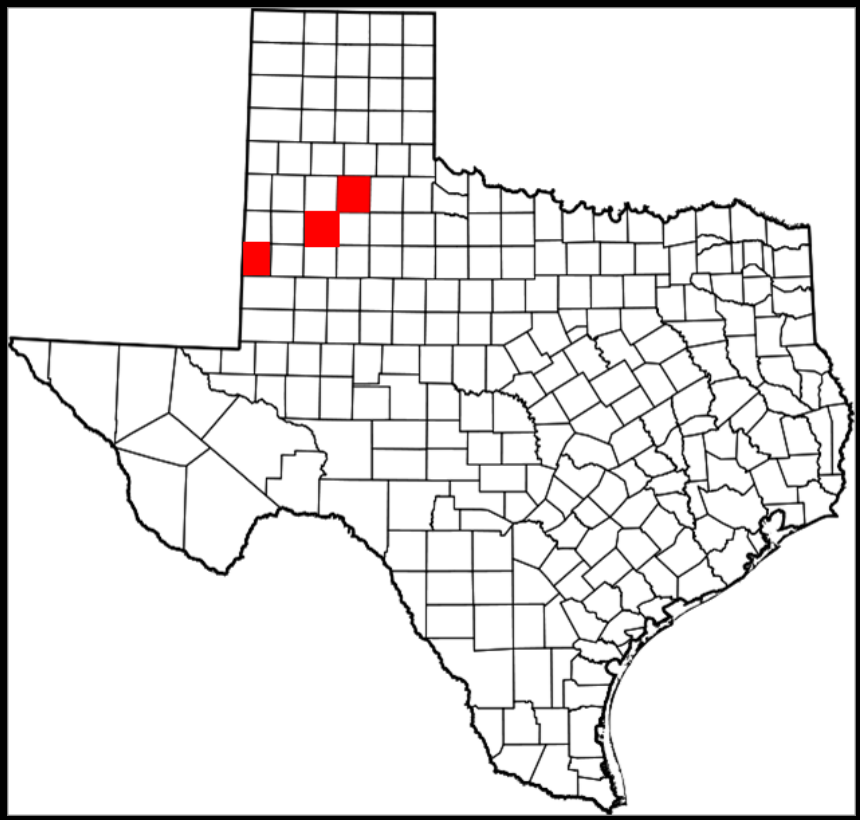


Methods

Approach

1. Identify three counties in the SHP which represent typical irrigated agricultural production
2. Use the 10-year Food and Agricultural Policy Research Institute (FAPRI) Outlooks for 2008 and 2009 as indicators of macroeconomic changes to commodity prices and input costs (before and after recession)
3. Use the Southern High Plains Ogallala Model with the 2008 and 2009 baselines to estimate impacts on water withdrawals over a 10 year time horizon

Counties Selected



- Floyd County
- Lubbock County
- Yoakum County
  - Represent varying soil types, irrigation capacity, and crop mix

County Data

Crop	County		
	Floyd	Lubbock	Yoakum
	----------Acres----------		
Irrigated Cotton	103,900	157,950	61,526
Irrigated Corn	7,925	-	-
Irrigated Sorghum	19,525	5,700	5,250
Irrigated Peanuts	-	-	21,750
Irrigated Wheat	11,650	4,225	24,450
Dry Cotton	56,275	97,300	68,900
Dry Sorghum	19,300	7,625	13,300
Dry Wheat	80,425	21,100	13,100

Hydrologic Characteristics

	County		
Characteristic	Floyd	Lubbock	Yoakum
Avg. recharge (inches/yr)	3.7007	3.3196	2.3621
Avg. specific yield (%)	0.154	0.155	0.153
Avg. saturated thickness (ft)	76	56	52
Avg. pump lift (ft)	226	130	94
Avg. well yield (gpm)	205	146	135

Methods

- Commodity prices – FAPRI - Localized
- Input Cost
  - Initial cost derived from Texas Agrilife Extension Budgets District 2, then grouped and shifted by % changes U.S. production indices provided by FAPRI
- EPIC - Provided water response functions

Southern High Plains Ogallala Model

- A non-linear dynamic economic optimization model by county
- Max NPV = $\sum NR_t \ (1 + r)^{t-1}$,
  - Where:
    - $NR_t = \sum_i \sum_k \Theta_{ikt} \{ P_i Y_{ikt} [WA_{ikt}, (WP_{ikt})] - C_{ik} (WP_{ikt}, X_t, ST_t)\}$
    - The Ogallala Model does not estimate revenues from crop insurance and farm programs

Results

Scenario 1

Both commodity prices and input costs allowed to change through time according to FAPRI outlooks

2008 Baseline (acre-feet/year)			
	Floyd	Lubbock	Yoakum
Cumulative	2,226,202	2,474,005	1,270,590
2009 Baseline (acre-feet/year)			
	Floyd	Lubbock	Yoakum
Cumulative	2,296,304	2,472,802	1,270,590
% Change	**3.15**	**-0.05**	**0.00**

Scenario 1 Summary

- Floyd county increased pumping by 3.15%
  - Caused by two main factors:
    - Floyd county has sufficient water available to react to price or cost changes
    - Lower pumping costs in 2009 outweighed the lower commodity prices (more yield compensates low output price)
- Lubbock and Yoakum could not react as they are already at maximum pumping capacity

Scenario 2

Only commodity prices allowed to change according to FAPRI outlooks, production costs held constant at 2008 values

2008 Baseline (acre-feet/year)			
	Floyd	Lubbock	Yoakum
Cumulative	2,226,202	2,474,005	1,270,590
2009 Baseline (acre-feet/year)			
	Floyd	Lubbock	Yoakum
Cumulative	2,215,668	2,471,715	1,270,590
% Change	**-0.47**	**-0.09**	**0.00**

Scenario 2 Summary

- Floyd and Lubbock county decreased pumping slightly
  - Decrease in commodity prices
- Yoakum County lacks the flexibility to react to the range of prices represented in this analysis
- The price affects appear to be less of a decision than the cost of irrigation

Conclusions

1. 2008 recession had a relatively small impact on water use in the SHP
2. Crop mix was unresponsive to price and costs changes
3. Water use is responsive only when pumping flexibility exists
4. Macroeconomic forces are not likely to impact water use substantially
5. This study suggest that water use is more sensitive to changes in fuel costs for pumping than commodity price shifts

Thank You

Questions and Discussion

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