

## **19. Economic Impacts of the Ogallala Aquifer Depletion in West-Central Kansas**

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*Bill Golden assists farmers, policy makers, and other stakeholders throughout Kansas in developing and implementing policies associated with the State's natural resources. He also works extensively with land-water-related issues such as valuing irrigation water rights. Current research and extension efforts are evaluating producer and community impacts associated with alternative water conservation policies and the impacts of climate change.*

### **Abstract/Summary**

*Between 1990 and 2005, Groundwater Management District #1 experienced a reduction in irrigated crop acres of approximately 44,500 acres or 16.6%. The purpose of this research was to estimate the economic impact associated with this reduction on the producer and regional economy. The preliminary results suggest that the reduction in irrigated acres occurred gradually enough to allow producers and communities to mitigate possible losses in revenues. Evidence suggests that rapid adoption of more efficient irrigation technology allowed irrigated crop producers to maintain profitability by shifting to a higher valued crop mix. Comparisons of farm revenue, farm labor, and total wages in the community suggest that relative to Groundwater Management District #4, Groundwater Management District #1 experienced limited negative economic impacts.*

## Preliminary Results:

### Economic Impacts of the Ogallala Aquifer Depletion in West-Central Kansas

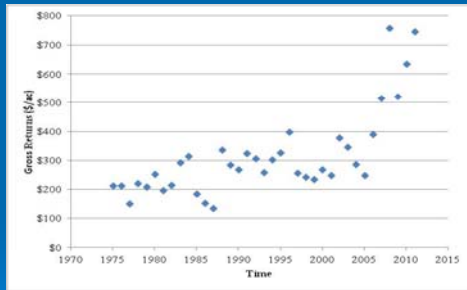
Bill Golden  
and  
Dan O'Brien

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## Preliminary Results

- This presentation starts my review process of stakeholders
  - Producers
  - Community leaders
  - State and local groundwater managers

## Background The Value of Groundwater

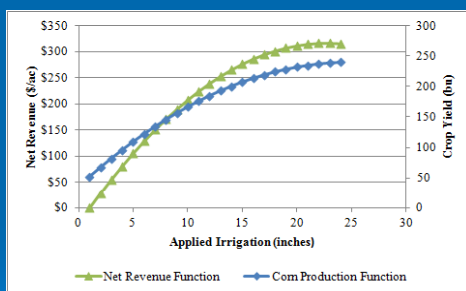


Gross returns to groundwater for corn: 0.4% for 1975-1999; 9.7% for 2000-2011; 3.5% for 1975 - 2011

## Background

- Groundwater resources in western Kansas are diminishing.
- Several voluntary groundwater conservation policies are being considered that either limit irrigated acreage or water-use per acre – in any case groundwater supplies are diminishing.
- Stakeholders want information on the possible negative economic impacts of reducing groundwater use.

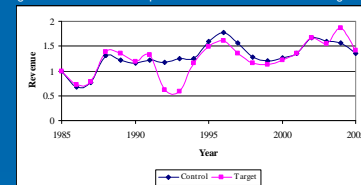
## What We Think We Know



Example from Southwest Kansas. Both curves exhibit diminishing marginal returns to applied groundwater. Curves vary by crop, location, precipitation, and time

## What We Have Observed: Wet Walnut Creek: Irrigated Crop Revenue

Figure 6. Time Series Comparison of the Indexed Values of Irrigated Crop Revenue



- Statistically significant short-run and a statistically insignificant long-run reduction in annual irrigated crop revenue.

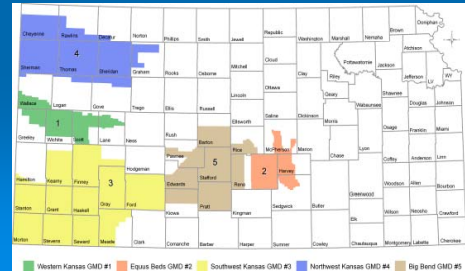
## Study Motivation

- Economists are very good at predicting the initial 'shocks' - '*Ceteris Paribus*'. But we know individual market participants develop strategies to mitigate adverse economic impacts – they try to make lemonade out of the lemons.
- Will we observe the same thing in western Kansas?
- Between 1990 and 2005, Groundwater Management District #1 experienced a reduction in irrigated crop acres of approximately 44,500 acres or 16.6%.
- What happened to the agriculture community, and the regional economy,
- A case study of the West Central Kansas may help fill the empirical 'gap'.

## Target and Control Group

- Mahalanobis distance metric (Insures the Target and Control areas are similar)
  - Defines similarity based on a vector of socio-economic characteristics (include population, population growth rate, employment in the agriculture sector, per capita personal income, average wage per job, unemployment rate, nominal taxable retail sales, total annual payroll, total property tax, annual precipitation, proportion of cropland in the conservation reserve program, and the proportion of cropland that is irrigated)

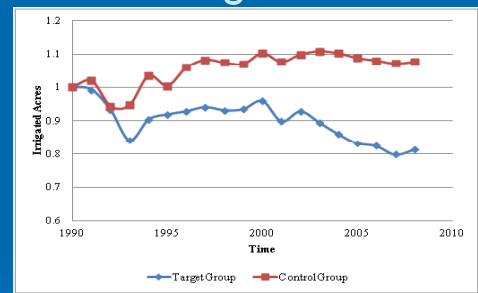
We want the Target and Control group to be statistically similar so the statistical model comparing the two can be simple.



## Research Methods

- Quasi-experimental control group analysis
  - Statistically compare the 'difference' in the time path for various economic indicators between the control and target groups
    - The Target group got the treatment and the control group did not get the treatment
  - Treatment: the loss in irrigated acres in West Central Kansas
  - Comparison: Trend in economic indicators in GMD#1 relative to GMD#4

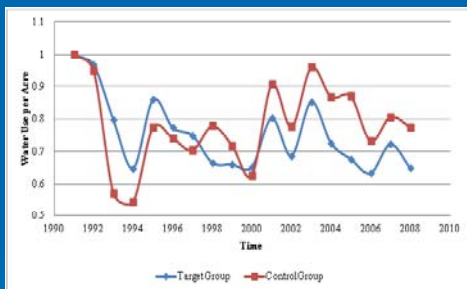
## Total Irrigated Acres



- Statistically significant reduction in annual irrigated acreage

Source: Water Right Information System

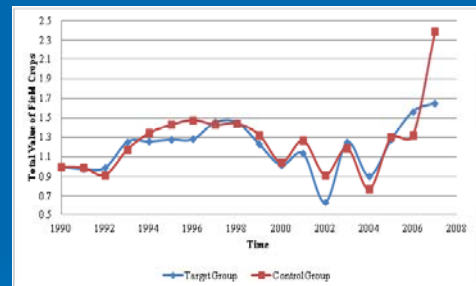
## Water Use per Acre



- Statistically significant reduction in water use per acre

Source: Water Right Information System

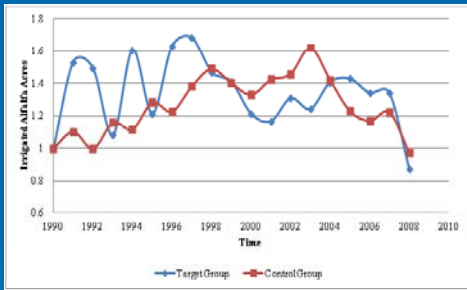
## Total Value of All Crops



- No statistically significant reduction in the annual total value of all crops.

Source: www.ipwr.ku.edu

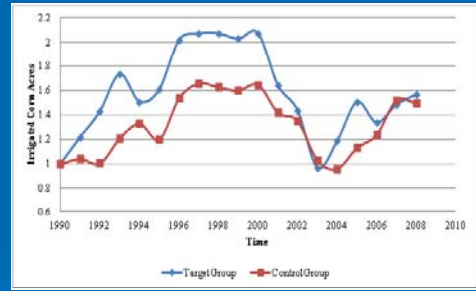
## Irrigated Alfalfa Acres



- No statistically significant change in irrigated alfalfa acreage

Source: Water Right Information System

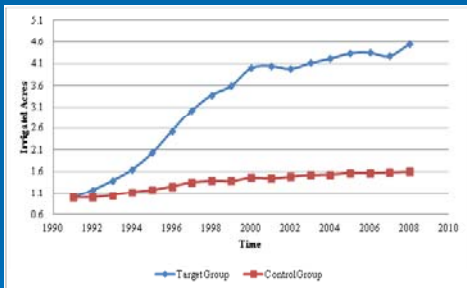
## Irrigated Corn Acres



- Statistically significant positive increase was observed in irrigated corn acreage.

Source: Water Right Information System

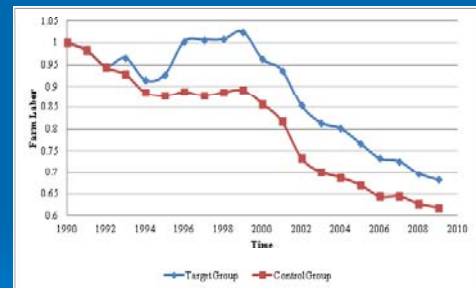
## Center Pivot Irrigated Acres



- Statistically significant positive increase was observed in center pivot irrigated acreage.

Source: Water Right Information System

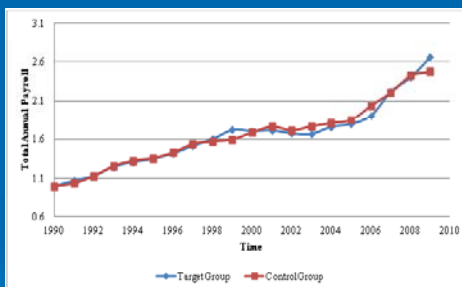
## Farm Labor



- There was no reduction in farm labor.

Source: www.ipwr.ku.edu

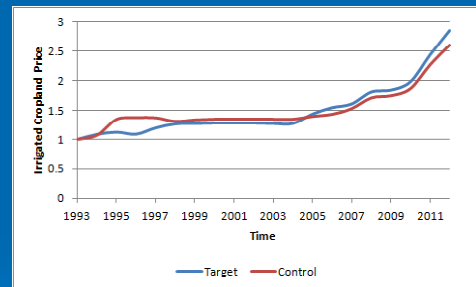
## Total Annual Payroll



- No statistically significant reduction in total annual payroll.

Source: www.ipwr.ku.edu

## Irrigated Cropland Price



- Irrigated cropland prices have inflated at similar rates.

Source: Farm Management Guide MF-1100, Kansas Land Prices and Cash Rental Rates by Dhuyvetter and Taylor

## Lessons Learned

- We may be over estimating direct economic impacts
- Irrigators operate in a dynamic setting and implement long-run strategies to mitigate negative economic impacts
- It is difficult to predict in advance what these long-run strategies will be
- We may not be as economically efficient in ground water use as we think.

## Questions



- Do you believe this?
- What does this tell us about managing groundwater use reductions?
- Does this mean we can reduce groundwater use today without negative impacts?
- What innovative strategies will producers use to manage groundwater water use reductions in the future?