# Impacts of the U.S. Ethanol Boom on Corn Transportation Markets

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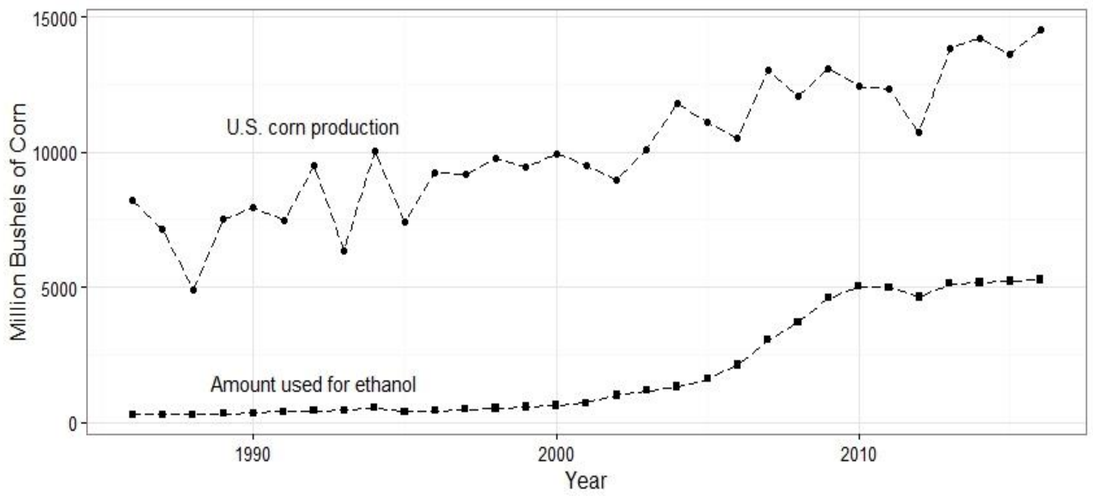
## RESEARCH QUESTIONS

How do changes in U.S. energy policy change corn basis? How do persistent changes in basis influence grain and oilseed freight markets?

## BACKGROUND

This project focuses on the effects of the 2005 Energy Policy Act and the 2007 Energy Independence and Security Act. The Energy Policy Act authorized the Renewable Fuel Standard (RFS) program which requires a minimum amount of ethanol to be used in motor fuel. In 2007 the Energy Independence and Security Act expanded program (RFS2) and nearly doubled the ethanol mandate in the original RFS. Per USDA Feed Grains Yearbook Tables, 13 percent of U.S. corn consumption went to fuel production in the 2002-2003 marketing year and 44 percent of domestic corn consumption went to fuel in the 2015-2016 marketing year. U.S. Department of Energy data shows this trend in the graph below.




Energy policy has far-reaching economic effects. The literature has documented effects of the ethanol boom on cropping patterns (Wallander, Claassen, and Nickerson 2011) and commodity storage markets (Carter, Rausser, and Smith 2013). However, this topic is also of interest to transportation industry stakeholders. Agricultural commodities are relatively low revenue and railroad firms rely on high volumes to cover the fixed costs of operating in many regions.

Corn is typically shipped short distances via truck and long distances via rail and barge. Production of ethanol in corn production regions, such as Iowa, might increase the use of truck transportation of corn. This project investigates how the U.S. ethanol boom has changed intermodal and intramodal relationships in corn transportation markets. I have obtained detailed rail receipts and am combining this with elevator-level cash bids to learn more about how the ethanol boom has influenced geographic pricing patterns and competition in grain freight markets.

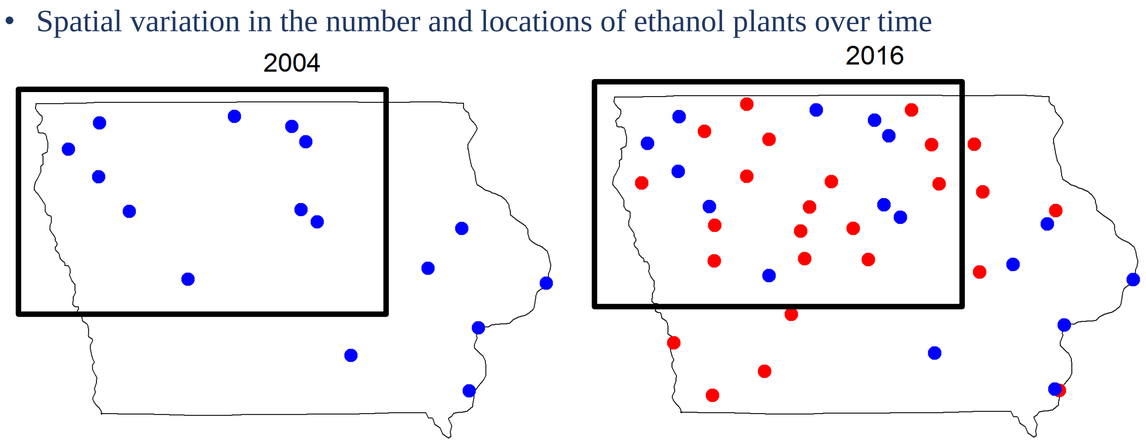
## CONTRIBUTION

A common topic in the literature about rail market regulation are papers showing that the 1980 Staggers Act, which deregulated rail markets, has had heterogenous effects on rates for different commodities (Wilson 1994, Wilson 2001, Bitzan et al. 2003). Concerning analyses of market power in rail transport, Hughes (2011) finds evidence of price discrimination in rail transport of fuel ethanol. Busse and Keohane (2007) also find evidence of price discrimination in rail transport of low-sulfur coal. Both articles have identification strategies that use spatial variation in elasticities of commodity demand derived from environmental policy.

The previous literature has focused on regulation targeting the rail industry or on market power, this research evaluates the indirect effects of energy policy on agricultural freight markets. Furthermore, this is the first research to consider how the ethanol boom has influenced dry bulk freight demand.

## WHY NORTHWEST IOWA?

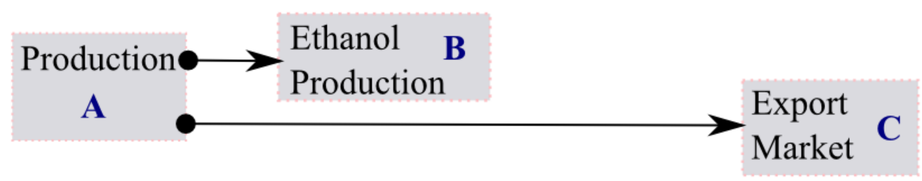
- Two crops dominate farm acreage
- Many rail carriers serve the region
- Relatively far from a major waterway
- Spatial variation in the number and locations of ethanol plants over time




## DATA AND STRATEGY

| Data | Source |
|---|---|
| Corn and soybean acreage | NASS |
| Diesel prices<br>Rail and barge cost indices | USDA Grain Transportation Report |
| Ethanol plant locations | Renewable Fuels Association |
| Shipment-level data<br>(all modes)<br>(rail only) | 2012 Commodity Flow Survey<br>Confidential Waybill Sample |
| Local commodities prices | GeoGrain |

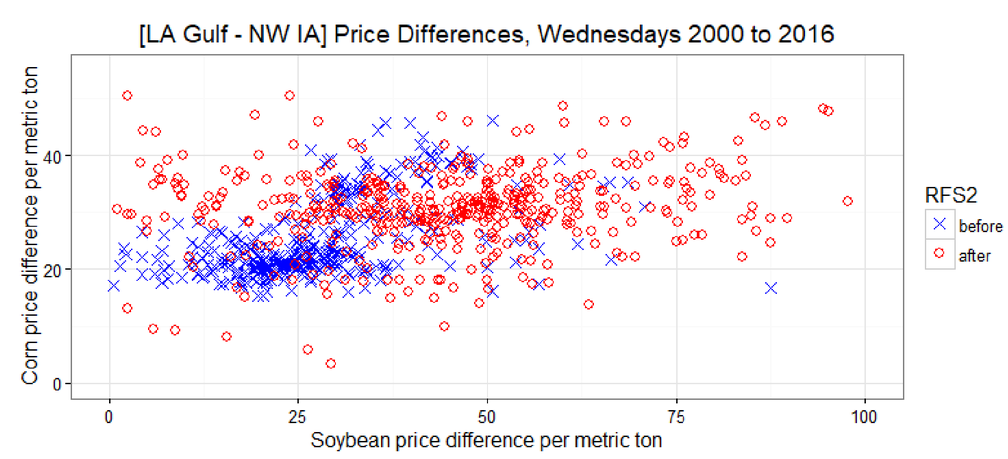
Commodity Flow Survey Microdata show truck shipments of grain and oilseed in Iowa are typically 100 miles or less. Ethanol production takes place near corn production regions meaning that a large proportion of corn produced in Northwest Iowa travels to ethanol plants instead of longer distances for processing or export. Transportation supply and demand is derived from excess supply in production regions and excess demand in consumption regions. The ethanol boom should have increased demand in regions close to production but would not change export or other processing demand.




$$Basis_A - Basis_B = [(futures\ price) - (spot\ price)_A] - [(futures\ price) - (spot\ price)_B]$$
$$Basis_A - Basis_B = (spot\ price)_B - (spot\ price)_A$$
$$Basis_A - Basis_c = (spot\ price)_C - (spot\ price)_A$$

A persistent change in these relative prices should be evident in cash bid data. Specifically, the price difference of nearby locations should have increased relative to the price difference of distant destinations.

$$\underbrace{\left|\frac{Basis_A - Basis_B}{Basis_A - Basis_c}\right|}_{pre\ boom} < \underbrace{\left|\frac{Basis_A - Basis_B}{Basis_A - Basis_c}\right|}_{post\ boom}$$




Above are preliminary results using AMS bids in the Louisiana Gulf and Northwest Iowa. Before RFS2 was implemented, corn and soybean geographic basis was more tightly related than after implementation. Log-log model regression results confirm that a percentage change in geographic basis of corn due to a percent change in soybean basis is lower than before RFS2. Because transportation demand comes from price differences in locations, the secondary implication is that the cross price elasticity of corn and soybean transportation demand has changed after RFS2 was implemented. Notably, this was not the case for locations in Oklahoma, which has no ethanol production.

The next step for this project is to begin precise geospatial analysis of the cross price elasticities using elevator-level bids, rail receipts, ethanol plant locations, and district hog production. Corn is a key ingredient in hog feed and according to NASS data, Iowa hog inventories have steadily increased more than 25 percent between 2005 and 2015.

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