The Impact of the Renewable Fuels Standard on Corn Acreage

Nicholas Pates and Nathan P. Hendricks[1]

November 2018

Overview

An expansion of the Renewable Fuels Standard increased the price of corn relatively more than the prices of other crops giving a greater incentive for farmers to plant corn. We estimate how farmers changed cropping patterns in response to changes in prices and use the model to simulate the change in corn acres due to the expansion in the RFS. We find that the policy increased corn acres by 6.9 million acres annually on existing cropland with the largest increases in the Dakotas, Northwest Minnesota, and Mississippi Delta regions. Our estimates only represent the impact on existing cropland and do not account for any expansion in cropland area due to higher prices.

Methods

First, we estimate the impact of corn prices and other crop prices on the probability of planting corn on a given field. Our regression models account for the common practice of rotating crops (e.g., alternating between corn and soybeans) and follow closely the framework of Hendricks, Smith, and Sumner (2014) and Hendricks et al. (2014). We estimate separate models in different Major Land Resource Areas (MLRAs) and soil texture groups to account for the fact that corn acreage may be more responsive to price in some regions. A complete description of the modeling and data sources can be found in Pates (2018).

Second, we use the estimated model to simulate the impact of a change in prices. We calculate the probability of planting corn in each field given actual crop prices between 2009 and 2016 and calculate the total corn acreage across all fields. Based on estimates by Smith (2018), we assume that the price of corn would have been 30% lower without the expansion in the RFS and the prices of soybeans and wheat would have been 20% lower. We then calculate the new predicted corn acreage using these counterfactual prices without the RFS expansion. The change in acreage is due to the impact of the RFS on crop prices.

The analysis utilizes field-level data on cropping patterns across the major field crop production areas of the United States. Data on the crops planted are from the Cropland Data Layer that utilizes remote sensing to classify the crop type. Field boundaries are from the Common Land Unit (CLU) boundaries produced by the Farm Service Agency. If CLUs were not available, then we use field boundaries from Yan and Roy (2016). Crop prices are from over 1,000 local markets at the time of planting and adjusted for the expected change in price by harvest using the futures market. Our regressions also control for a productivity index of the soil and climate, the

[1] Nicholas Pates is a PhD Candidate in Agricultural Economics at Kansas State University. Nathan Hendricks is an Associate Professor in Agricultural Economics at Kansas State University. This research was supported by a grant from the National Wildlife Federation.

slope of the field, the amount of precipitation during the planting season, irrigation, and a time trend. The area included in our analysis includes roughly 89.0% of corn production in the United States and roughly 80.7% of corn acreage. To estimate the impact of the expansion in the RFS on corn acres across the entire United States, we scale up the estimate of the expansion in our study area assuming that the acreage response is the same in areas not included in our analysis.

Results

We estimate that the expansion of the Renewable Fuels Standard in the 2007 U.S. Energy Independence and Security Act increased corn acreage by 6.9 million acres annually.[2] According to USDA, farmers planted an average of 91.5 million acres of corn annually between 2009 and 2016. Therefore, our estimate implies that farmers would have only planted 84.6 million acres of corn on average during this period had the expansion in the RFS not occurred. In other words, about 7.5% of the current corn acreage in the United States is attributed to the expansion in the RFS.

The increase in corn acres was largest in the Dakotas, Northwest Minnesota, and Mississippi Delta regions (figure 1).[3] In these areas the increase in corn acres due specifically to the RFS was nearly 6% of the total land area. Another way of expressing this is to note that in the northern regions and the Mississippi Delta, 30-50% of current corn acres can be attributed to the expansion in the RFS (figure 2).

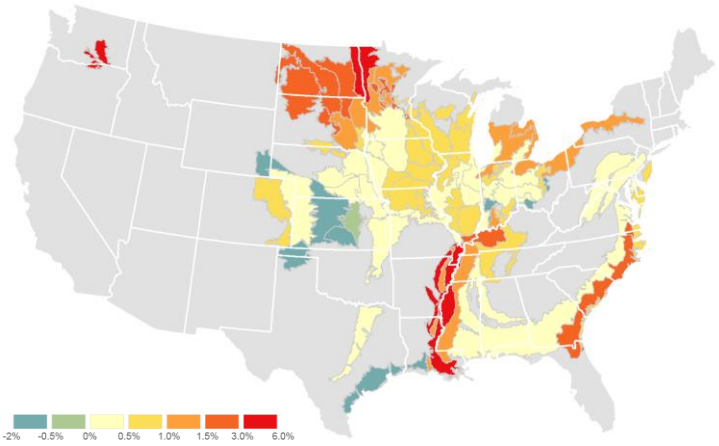

Figure 1. Percent of each MLRA region planted to corn due to expansion in RFS

[2] Even if we assume that there was no increase in corn acreage outside the area in our analysis, we estimate the RFS increased corn acreage by 5.5 million acres.

[3] We calculate the increase in corn acres in each MLRA and divide by the total area of the MLRA (cropland and noncropland area) in order to adjust for the fact that some MLRAs are larger than others.

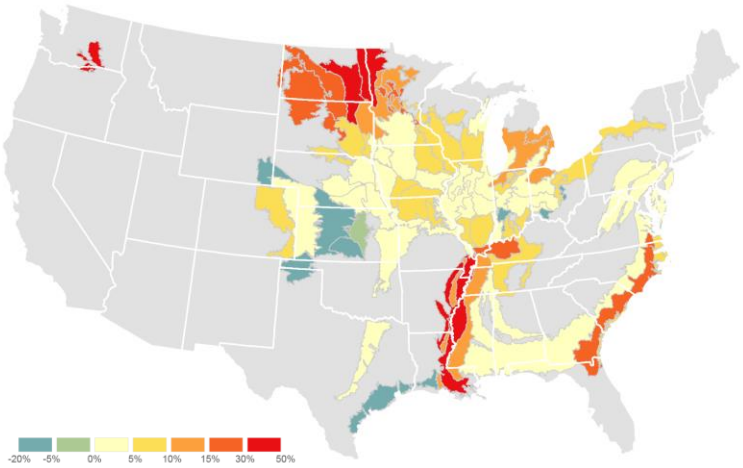

Figure 2. Percent of current corn acres that are attributable to expansion in RFS

Conclusion

The area planted to corn increased 12.6 million acres between the periods 1999-2006 and 2009-2016. While several factors played a role in this expansion, we can attribute 55% of the increase due to the 2007 expansion of the Renewable Fuels Standard.

References

Hendricks, Nathan P, Aaron Smith, and Daniel A. Sumner. 2014. "Crop Supply Dynamics and the Illusion of Partial Adjustment." *American Journal of Agricultural Economics* 96 (5): 1469–91.

Hendricks, Nathan P., Sumathy Sinnathamby, Kyle Douglas-Mankin, Aaron Smith, Daniel A. Sumner, and Dietrich H. Earnhart. 2014. "The Environmental Effects of Crop Price Increases: Nitrogen Losses in the U.S. Corn Belt." *Journal of Environmental Economics and Management* 68 (3): 507–26.

Pates, N.J. 2018. "Supply from many: Studies on heterogeneous US land use decisions at the extensive and intensive margins." PhD dissertation, Kansas State University.

Smith, A. 2018. "Effects of the Renewable Fuel Standard on Corn, Soybean and Wheat Prices." Working paper. University of California, Davis. Available at: https://are.ucdavis.edu/people/faculty/aaron-smith/papers/

Yan, L., and D. P. Roy. 2016. "Conterminous United States Crop Field Size Quantification from Multi-Temporal Landsat Data." *Remote Sensing of Environment* 172: 67–86.