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Did Rapid Growth of Ethanol Production in the US Affect Global Food Price Volatility?

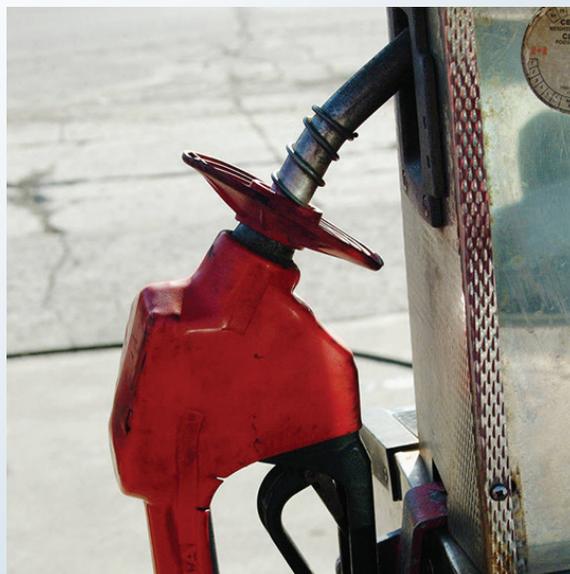
Michael J. Roberts and Anh Nam Tran

The National Renewable Fuel Standard Program (RFS), also known as the ethanol mandate, was initiated in 2005 and revised in 2007. Among other things, the RFS required 15 billion gallons of corn-based ethanol to be blended into the nation's gasoline supply by 2015. The intent was greater energy independence, lower fuel prices, and lower greenhouse gas emissions.

Largely as a result of the RFS, US ethanol production expanded rapidly, reaching 13.3 billion gallons in 2012, an increase from 3.9 billion gallons in 2005. The US is now the world's largest ethanol producer, accounting for 47 percent of world total ethanol production.

As ethanol production increased, internationally traded food prices also grew and became more volatile. By February 2011, the Food and Agriculture Organization (FAO) food price index, comprised of five major food groups: cereal, oils/fat, dairy, meat, and sugar, hit an all-time high of 238, more than double its level in 2005, and has remained above 200 ever since (Figure 1).

The confluence of these trends raises the question: Did the US ethanol mandate cause the global spike in food prices and volatility? Although it's clear that greater demand will increase price, many other factors simultaneously affected world food commodity markets. Persistent drought sharply reduced crop production in Australia from 2006–2010, Russia and Europe in 2010 and the United States in 2011 and 2012. Many also point to rapid economic growth and demand for commodities in emerging Asian economies. Given these coincident events, there is some debate about the role of ethanol in recent price spikes.



The mandate came under scrutiny because ethanol expansion markedly increased demand for corn. By 2012, US ethanol production used more than 40 percent of corn harvested, an awesome proportion given the US is the world's dominant producer and exporter. Roberts and Schlenker (2013) estimated that corn used in US ethanol production in 2009 amounted to 5 percent of the world total calories harvested from corn, soybeans, wheat, and rice in 2010 combined.

The price spikes matter because they hurt the well-being of consumers, particularly people in less-developed and food-importing countries, whose food expenditure can account for more than half of household income. In 2009, FAO estimated that the price spike in 2007–2008 drove the number of undernourished people in the world from 915 million to more than 1 billion, the highest in over 40 years (FAO, 2009). A similar number of people are believed to have been pushed into poverty and undernourishment as a result for the price spikes in 2011–2012. Rising food prices also may have triggered food riots and political unrest (Figure 1).

The potentially severe implications of rising food prices on the world's poor have sparked an extensive literature looking at the potential economic role played by the US ethanol mandate.¹ While results from these studies vary widely, they all agree that the ethanol mandate caused food prices to rise. Recently, Condon et al. (2013) pointed out that if previous literature normalized their analysis, the findings are fairly similar. Looking across studies, the authors found that each billion gallon expansion in ethanol production yields a 2–3 percent increase in corn prices.

Most research on the issue focuses on the overall long-run price change. Recent work by Roberts and Tran (2013) considers the short-run: whether the abrupt growth in

Figure 1. Time Dependence of FAO Food Price Index from January 2004 to May 2011



Notes: Light blue vertical lines correspond to beginning dates of food riots and protests associated with the major unrest in North Africa and the Middle East. The overall death toll, calculated by the authors from news sources, is reported in parentheses. Inset shows FAO Food Price Index from 1990 to 2011.

Source: M. Laj, K.Z. Bertrand, Y. Bar-Yam (2011).

ethanol production caused prices to temporarily spike or become more volatile.

It is important to consider the short run implications of the US ethanol mandate because poor consumers are sensitive to food prices and even a short period of elevated prices might have a sustained impact. It is also possible for the short-run price change to be greater than the long-run price change.

Roberts and Tran (2013) consider economic impacts of the US ethanol mandate by modeling storage decisions. When food demand increases relative to supply, such as stemming from the US ethanol mandate, the excess demand can be partly fulfilled by existing grain inventories. As a result, the impact of the US ethanol mandate on food prices

¹ For a detailed list of studies, please refer to Condon et al. (2013).

is small when grain storage is high and potentially much greater when inventories are low.

To simplify the analysis as well as to provide a broad-scale index for global food commodities, four key food crops—corn, rice, soybeans, and wheat—were aggregated by caloric content into a single index, which roughly follows FAO's food price index. This constructed annual price index increases 71 percent from 2005 to 2009.

To evaluate effects of the mandate Roberts and Tran used a competitive storage model. This kind of model is useful for examining how markets anticipate and adjust to shocks, like weather or an ethanol-induced shift in demand for staple commodities. This model is calibrated so that simulated outcomes closely match historical data. The study found:

1. The US ethanol mandate can account for 23 percent of the total food price increase between 2005 and 2009. This result roughly accords with several previous studies including, among others, Hausman et al. (2012), Roberts and Schlenker (2013), and Rosegrant (2008).
2. Prices rise as soon as speculators can digest the full implications of the policy change on future demand. This happens because higher future prices cause greater storage, which withdraws grains from the market, thereby causing current prices to rise. The price change in the short run can be higher than that of the long run if initial inventories are low and market is slow in realizing the full implications of the policy change.
3. Price volatility might decrease in the short run. This happens because people store more grains in anticipation of higher future food prices. Greater inventories, in turn, can help to buffer prices from ancillary shocks affecting supply, demand and prices.

Together, these results suggest that while the effects of the ethanol mandate were considerable, other factors, such as bad weather and above-trend growth in food commodity demand, likely account for most of the world price increase and volatility changes since 2005. Still, by directing roughly 40 percent of the US corn crop into

ethanol, the US ethanol mandate will continue to contribute to global food price increases, and increase the odds of more food crises. ■

FOR FURTHER READING

Condon, N., H. Klemick, and A. Wolverton. 2013. Impacts of Ethanol Policy on Corn Prices: A Review and Meta-Analysis of Recent Evidence. US EPA National Center for Environmental Economics Working Paper Series. Working Paper #13-05.

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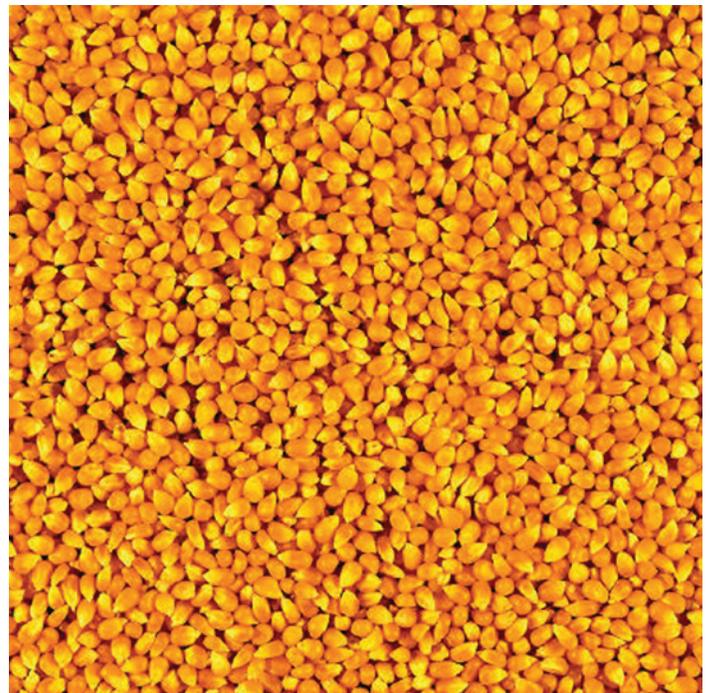
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Rosegrant, M.W. 2008. Biofuels and Grain Prices: Impacts and Policy Responses. Testimony for the US senate committee on homeland security and governmental affairs.



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