



Global Impacts of the Biofuel Emergence on Food Markets

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Introduction

- Interest in food-feed-energy tradeoffs implied by the "global emergence" of biofuels. Are these tradeoffs significant? Where (geography and food-chain location) do they take place?
- Concerned mostly with ethanol in the US, Brazil, China, EU, and India
- Biodiesel expansion probably not viable
- US and Brazil the largest ethanol producers and consumers with potential world market impact

Introduction

- Use FAPRI models for global analysis of 2 shocks:
 - An exogenous increase in US ethanol demand
 - An exogenous increase in world demand for ethanol (Brazil, China, EU, India)
- Compute effects in deviation from 2007 US and World FAPRI baseline (2007/08 to 2016/17)
- Compute impact multipliers on key variables (dln variable/dln shock) reported as average over time
- Focus on food tradeoffs via multiple channels

US Ethanol Shock

- Scenario 1: increase in ethanol use by roughly 3% in the US (exogenous horizontal shift of demand by 10%)
- Direct impact on US ethanol production and use of feedstock and US ethanol trade
- Trickle-down of price effects (ethanol, corn to other grains, to other crops, to feed prices to livestock and poultry, to meat prices to retail prices)

US Ethanol Shock: US Feedstock

- Market responses: Trade has the highest multipliers, then stocks, then acreage
- Large impact on feedstock markets (corn, some other grains -sorghum)
- Substitution possibilities in feed demand for corn. Sorghum, DDGs, barley, oats, and wheat. Total feed demand falls moderately
- Food demand for coarse grains changes little

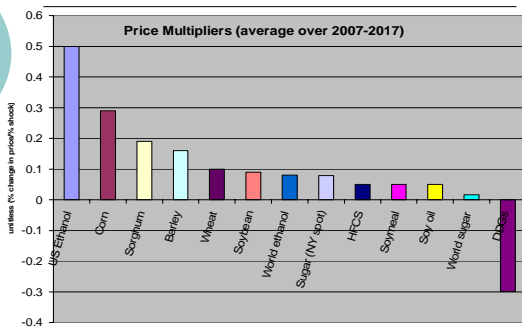
US Ethanol Shock: US Corn

- Derived demand from ethanol increases (1.04 to 1.1)
- Feed use falls (-0.19 to -0.22)
- Seed use increases (0.18)
- Food corn use falls slightly: HFCS (-0.06), food (-0.02)
- Total corn use increases (0.29)

US Ethanol Shock: US Corn

- Exports decrease (-0.6)
- Stocks fall (-0.45) and acreage increases (0.12), potentially by more if larger shock as some inventory are necessary
- Same qualitative (but smaller) impacts on US sorghum and barley

US Ethanol Shock: Prices



US Ethanol Shock: Prices

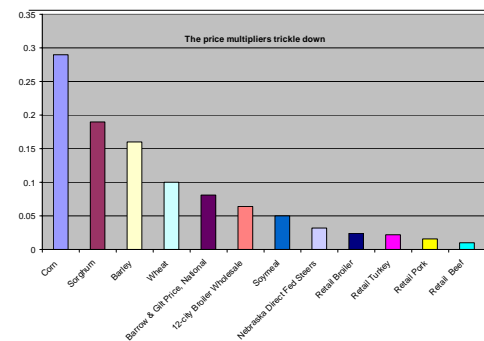
Impact multipliers for commodity prices

US Ethanol: 0.5 World ethanol: 0.08
 DDGs: -0.3 Corn: 0.29
 Sorghum: 0.19 Barley: 0.16
 HFCS: 0.05
 Sugar (NY spot): 0.079 World sugar: 0.016
 Wheat: 0.1
 Soybean 0.09 Soy oil: 0.05 Soymeal: 0.05

US Ethanol Shock: US Livestock

- Increase in feed grain prices, lower DDG price and very small increase in meal price
- Small reduction in aggregate meat production
- Substitution in consumption induces net gains to some sectors. US beef production increases slightly
- Wholesale meat prices increase moderately
- Retail prices increase by less (see chart)

US Ethanol Shock: From Feed to Meat Retail Prices



US Ethanol Shock: US Meat Prices

Price Multipliers

Nebraska Direct Fed Steers	0.032
Barrow & Gilt Price, National	0.081
12-city Broiler Wholesale	0.064
Retail Beef	0.010
Retail Pork	0.016
Retail Broiler	0.024
Retail Turkey	0.022

US Ethanol Shock: US Dairy Prices

Dairy Price Multipliers

All Milk	0.027
Butter Wholesale	0.075
Cheese Wholesale	0.020
Nonfat Dry Milk Wholesale	0.008

US Ethanol Shock: US Oilseeds & Oils

- Reduction in soybean production (-0.09)
- Reduction in seed demand (-0.14)
- Small reduction in crush demand (-0.07)
- Small effects on soy oil food intake (-0.03)
- Expansion of corn oil use (0.32)
- No change in US oil food consumption
- Reduction in biodiesel production (-0.15)

US Ethanol Shock: World Impact

- Increase in US ethanol imports (0.6) from small base
- Negligible impact on world ethanol markets except in net trade
- Increase in US feed grain prices transmits to other countries but less than fully
- World corn production increases (0.08)
- Impact through feed grain prices and trade of most countries, moderate impact on grain production

US Ethanol Shock: World Impact

- Feed use falls moderately (-0.1 for world corn feed demand)
- Small negative food grain consumption effects except in Middle East, corn in Egypt (-0.135) and Israel (-0.12), and barley in Saudi Arabia (-0.43)
- Increases in meat prices (max 0.08 and often much less). Total meat consumption per capita in any country falls slightly (-0.01 or higher)
- Small increase in dairy prices, (0.01) for butter and cheese, (0.025) on NFD. Dairy consumption falls by little

World Ethanol Shock

- Scenario 2: increase in ethanol use by roughly 3% in Brazil, China, The EU, and India (horizontal shift of demand by 5%)
- Similar approach: compute impact multipliers for 2007/08 to 2016/17 of the shock. Denominator is the relative increase in aggregate ethanol use for Brazil, China, EU, and India (larger than one for EU and India, smaller than one for Brazil, about one for China)

World Ethanol Shock: Ethanol

- Average impact on ethanol prices:
 - World ethanol (3.11)
 - US ethanol (Omaha) (0.01)
- Ethanol trade impacted as it is thin: US imports (-2.27), Brazil exports (1.31), and EU imports (8.92)
- Brazil production increases (0.94)
- Very small increases in US production and feed stock use (0.04). Small decrease in US use (-0.02)

World Ethanol Shock: Feedstock

- Average impact on world feedstock prices:
 - sugar (0.13)
 - corn (0.013)
 - other feed grains (0.009)
- Some impact on grain stocks and trade flows; negligible impact on grain production in most countries.
- Feedstock use increases in China (0.75), EU (0.24), India (molasses) and sugarcane in Brazil (0.94)

World Ethanol Shock: Food

- Impact on sugar is the only significant change in food markets
- Brazil sugar production (-0.11) and exports (-0.168) fall. Other competitive exporters expand their exports and production (0.01 to 0.04)
- Sugar consumption per capita falls (-0.02 or less in absolute value)
- Sugar cane production increases worldwide (0.148), but world sugar output falls (-0.012)

Conclusions

- Effects of ethanol expansion on US food prices are moderate, mostly through feed prices trickling down to livestock to meat prices to retail prices
- Geographical impact of higher grains prices limited to consumers in some Middle East countries
- Impacts on trade flows are large because trade flows are residual and much smaller than production or use

Conclusions

- Claims on higher consumer food prices in popular press are exaggerated
- However, livestock producers are affected as feed prices are significantly affected
- Energy prices and increasing retail margins are competing explanations for the rising food prices

Conclusions

- Near-separability between US market and international markets for US ethanol expansion. Feedback effects to the world through feed prices and trade adjustments
- Similar separable result for world ethanol shock with its negligible impact on US agriculture. The shock impacts sugar markets outside US
- Larger shocks could lead to different effects and establish stronger global links when stocks hit bottom, if shocks are perceived as permanent, and without ethanol tariff