Unobligated RINs for Renewable Fuel Exports

Impact on Ethanol Volumes

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Charles River Associates

Providing unobligated RINS for ethanol exports would be expected to <u>increase</u> overall demand for US-produced ethanol

- The proposed regulatory change that we examined:

  Remove the automatic obligations (RVOs) for biofuel exporters and grant RINs for exported volumes of undenatured ethanol designated as fuel

- Expected impacts on ethanol demand:
  - **Domestic consumption remains steady**
    - The RFS mandate is no longer the primary driver of ethanol volumes blended in E10
    - Ethanol is the most economic option for octane enhancement, and ~10% is the base blend amount required for regular gasoline's mandated octane level
    - Mandated volumes beyond the blend wall have been met by biodiesel, not ethanol
  - **Export volumes increase**
    - Providing RIN value improves the price position of US-produced ethanol in global markets
    - CRA has estimated the scale of the opportunity as up to 1.2 billion gallons per year (greater than baseline export levels)
  - Overall – Continued domestic use of ethanol for octane enhancing and increased exports would result in a net increase in ethanol demand under the proposed regulatory change

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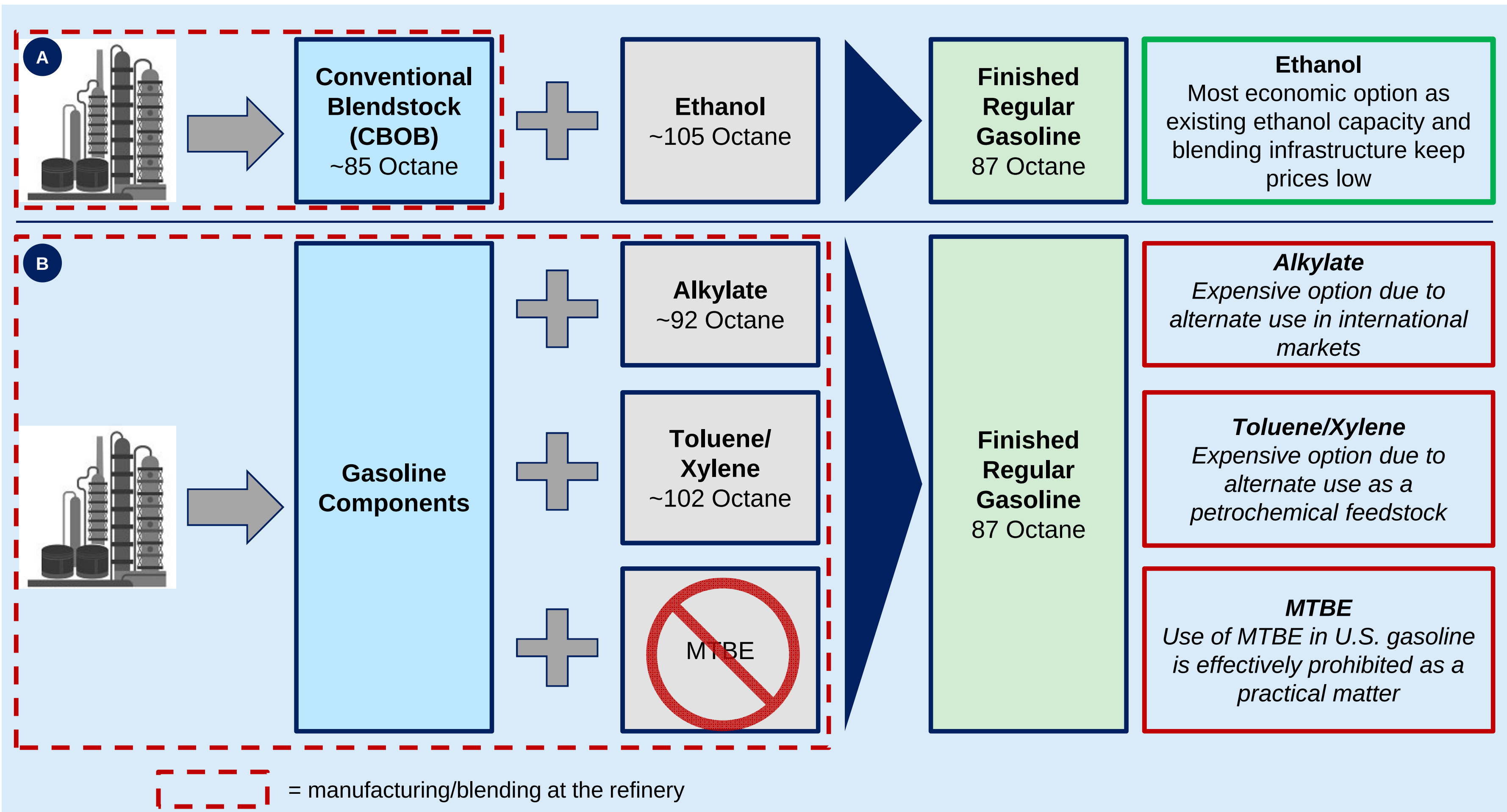
Ethanol competes with petroleum-derived octane enhancers, such as aromatics

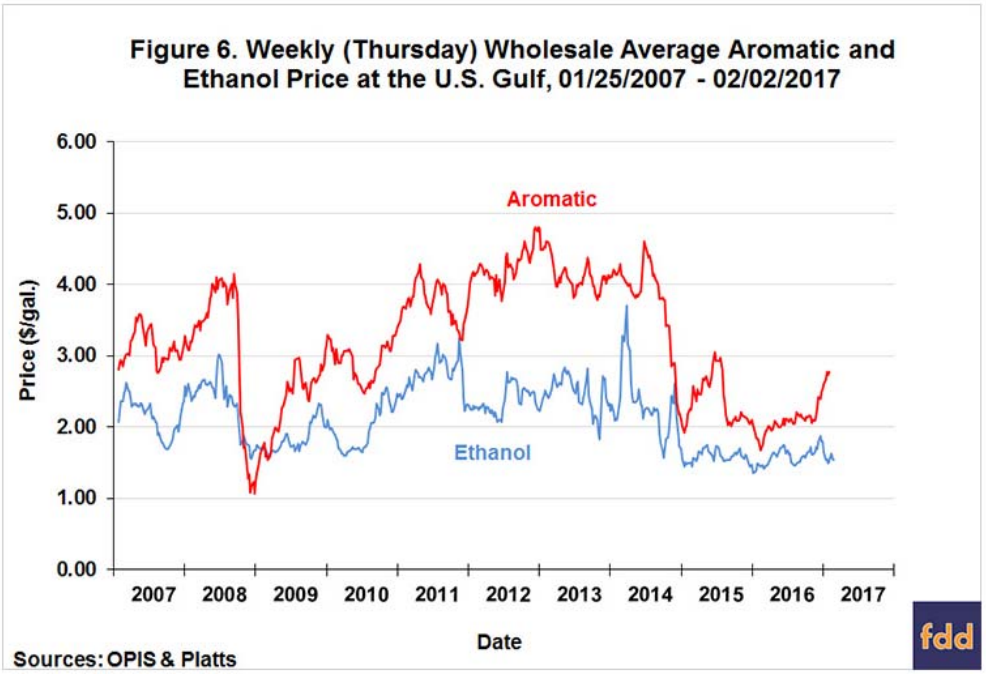
- Refiners and blenders have two options for meeting octane requirements:



Domestic Consumption Volumes

Now that ethanol production infrastructure is in place, ethanol is the economic option for meeting octane requirements

- Studies have shown that ethanol volumes have displaced aromatics in domestic gasoline blending[1]
- The following chart (from a University of Illinois study) shows the price of ethanol versus the price of other octane enhancers (benzene, toluene, and xylene)



- This dynamic would be expected to persist under the proposed regulatory change

[1] http://farmdocdaily.illinois.edu/2017/03/on-the-value-of-ethanol-in-the-gasoline-blend.html

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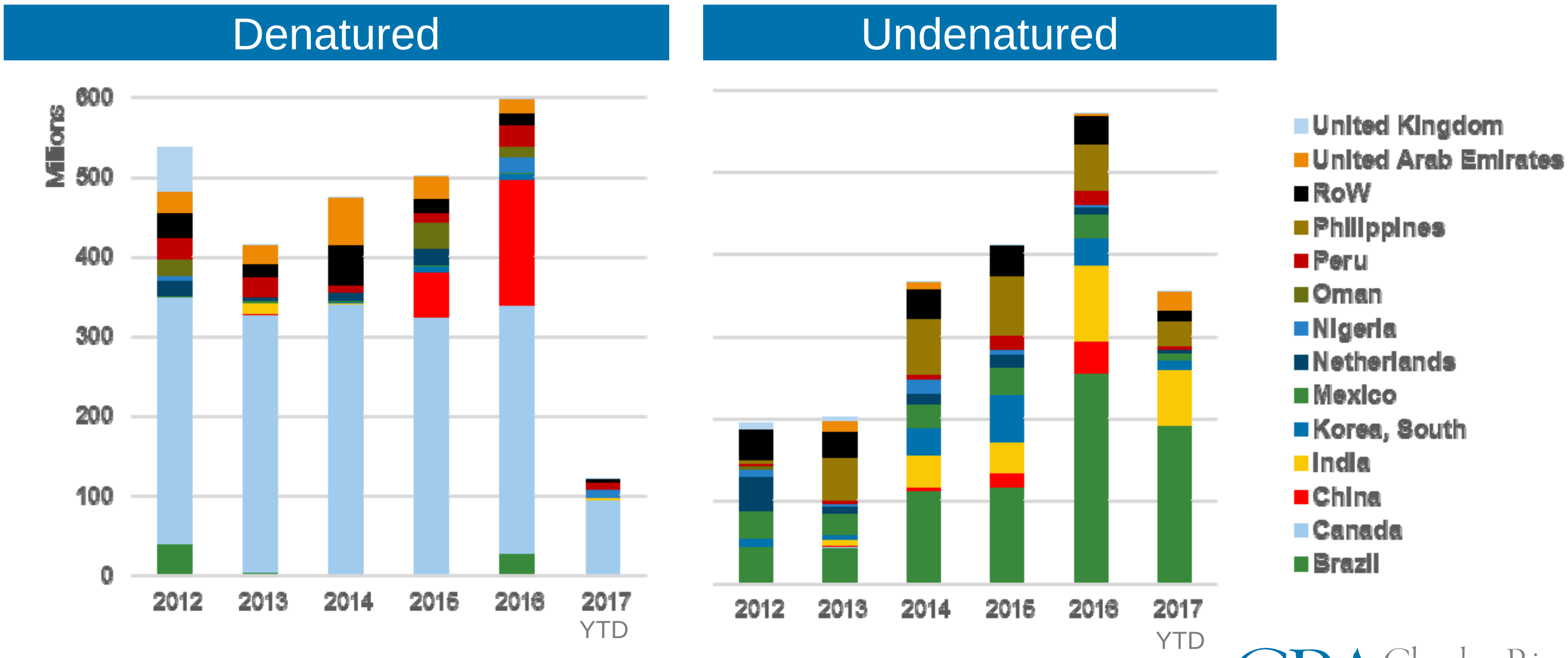
Historical ethanol exports have varied significantly year-to-year and between denatured/undenatured ethanol

- The U.S. exported ethanol to 34 different markets in 2016 alone
- There are several countries that were previously major importers that have been lost as export markets
- Largest single year gains were Brazil, China and India in 2016, and largest loss is China in 2017

U.S. Ethanol Exports, 2012-2017 (million gallons)



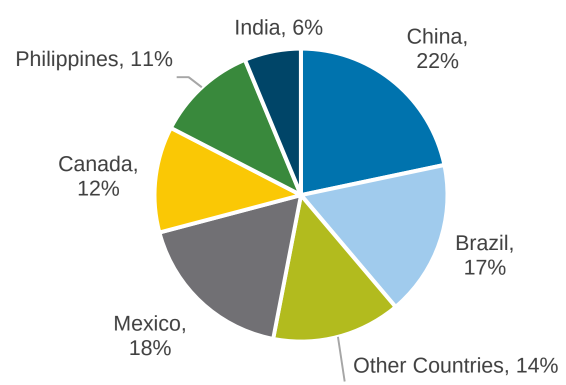
The scale of the new opportunity is dependent on macroeconomics and policies, but is likely significant

- RIN value provides competitive value for US exporters, helping them:
  - Overcome protective tariffs of importing countries
  - Make increased mandates in other countries more economically palatable
  - Directly compete on price with foreign producers

- We conducted a scenario analysis to examine the scale of the export volume opportunity

Key Assumptions	
Current tariffs, proposed tariffs, and current macroeconomic trajectories will hold. Non-corn feedstock prices move slightly against U.S. corn ethanol.	No major changes by foreign governments to severely limit biofuels consumption that cannot be overcome by price factors
RIN value of $0.25/gallon of exported fuel ethanol	No constraints to US ethanol production/export expansion

Key Findings	The following represents country-level shares of the incremental exports:
By 2020, the RIN value for exporters could increase exports by **1.2 billion gallons** over a scenario with no RIN value for the exports	
The majority of this volume represents expanded opportunity. It also includes: • Regaining ethanol volumes that have already been lost (such as the losses experienced in 2017) • Protecting volumes that would likely be lost between now and 2020 if RINs are not granted for ethanol exports	



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