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An Economic Analysis of Transportation Fuel Policies in Brazil

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Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, DC, August 4-6, 2013.

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An Economic Analysis of Transportation Fuel Policies in Brazil

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Biofuel Policy Intervention

Brazil:

- 18%-25% anhydrous ethanol blending mandate
- Tax rates applied to gasoline are significantly higher than those to ethanol
- Refinery price of gasoline is regulated

U.S.:

Renewable Fuel Standard:

- 136 billion lt of biofuel blending mandate by 2022
- 79.5 billion lt must be "advanced" biofuels with at least 50% GHG emission reduction*
- 60.5 billion lt must be "cellulosic biofuels"
- Tax credit for cellulosic biofuel

Others:

- EU 10% blending mandate by 2020
- Canada 5% blending mandate
- China 10% blending mandate by 2020**

*Sugarcane ethanol is eligible for both the "advanced" and conventional renewable fuel categories in the U.S. **In the five most densely populated provinces

Research Questions

We address the following issues:

i) What will be the implications of these fuel policies for the fuel mix in Brazil?
ii) How would the ethanol international trade be affected?
iii) What will be the effect of these fuel policies on the welfare of food and fuel consumers?
iv) To what extent can fuel policies change local and global GHG emissions?
v) What would be the implied losses/gains for the governments?

We undertake this analysis using two policy instruments:
1) the Brazilian blending rate and
2) modify gasoline and ethanol tax rates in Brazil

And under two possible scenarios:
1) an average situation of sugarcane production and sugar exports (copper planes) and
2) a shock to reduce sugarcane productivity and to increase sugar exports (blue planes)

Contribution

Analyze in an integrated and detailed numerical framework the impacts of changing Brazilian fuel policies (i.e. blending and tax rates) on the domestic consumers' driving behavior, amount of fuel consumption and fuel choice, international ethanol trade and other variables

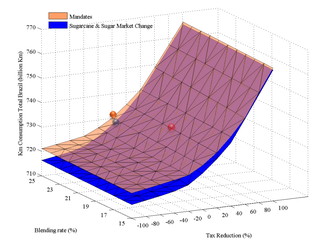
The Model

A spatial, multi-market, price-endogenous partial equilibrium model, regionally disaggregated for the agricultural and transportation fuel sectors in Brazil and the U.S. and also including trade with Argentina, China and ROW :

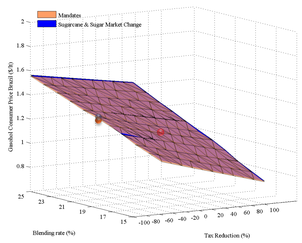
Main features of the model: i) Explicit demand functions for km driven by conventional, flex-fuel, and ethanol-dedicated vehicles. ii) Spatial disaggregation: 137 mesoregions in Brazil, 295 Crop Reporting Districts in the U.S. and 15 Provinces in Argentina; iii) 16 major crops; iv) 3 pasture categories in Brazil: planted in good condition, planted degraded, and native; v) Different beef-cattle systems and ranching activities; vi) Agro-Ecological Zones for Sugarcane; vii) Energy crops and crop residues as alternative cellulosic feedstock in the U.S. viii) Explicit internal fuel and livestock transportations costs

Implications for Fuel Market in Brazil (2022)

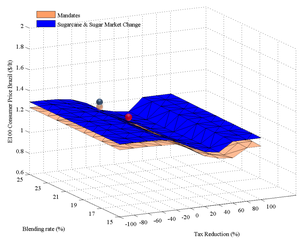
Total VKT



Gasohol Price

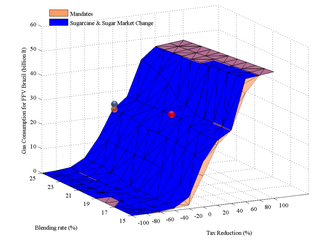


E100 Price

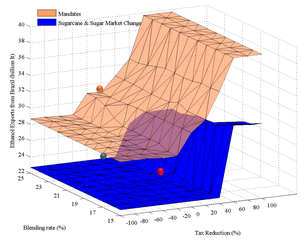


Blending rate 25%, no change in sugarcane market Blending rate 25%, change in sugarcane market Blending rate 20% gasoline & tax reduction of 20%, change in sugarcane market

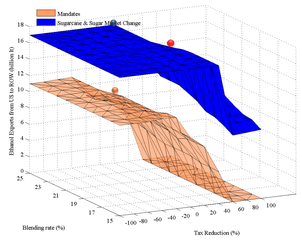
Gasoline Consumption by FFVs



Ethanol Exports from Brazil



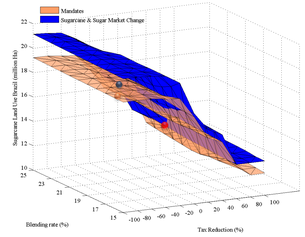
Ethanol Exports from U.S.



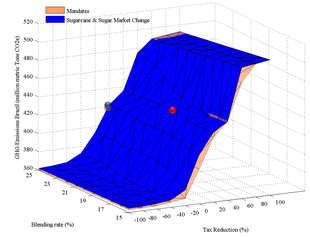
- Total VKT decreases when both the blending rate is reduced and gasoline tax is increased
- When the Brazil sugarcane industry is shocked, fuel prices will be higher and VKT would shift downward significantly (average of 3 billion km, 0.35%)
- The distance driven by FFVs, which will have the largest share (85%) in the light-duty vehicle fleet in 2022, wouldn't change with the blending mandate rate
- Brazil would keep the dominant position in the international ethanol market, while the U.S. would have a lower but also significant share, which declines when the taxes are reduced

Land, Environmental and Welfare Results in Brazil (2022)

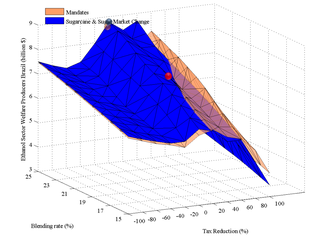
Sugarcane Area



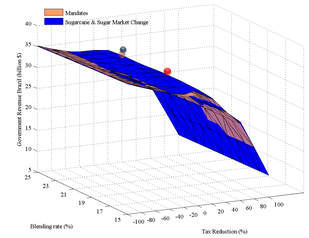
Direct Lifecycle GHG emissions



Ethanol Producers' Economic Surplus



Government Revenues



- The reduction in gasoline tax rates lessen the sugarcane area to some extent
- GHG emissions increase due to the increased share of gasoline in the gasohol mix
- Ethanol producers would receive the highest gains when the gasoline tax rate is increased and the ethanol sector is shocked

Conclusions

- The average VKT reduction due to a tax increase and an ethanol shock would be equivalent to one and half day of no driving by all light-duty vehicle fleet
- Decreasing ethanol blending rate harms light-duty vehicle's users, but their losses could be higher under a negative ethanol supply shock
- Reducing gasoline tax rates makes the drivers better off regardless of the blending rate
- When the tax and blending rates are reduced under an ethanol supply shock, governments benefit from increased revenues

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