



The Political-Economy of Biofuel and Cheap Oil Policies in Brazil

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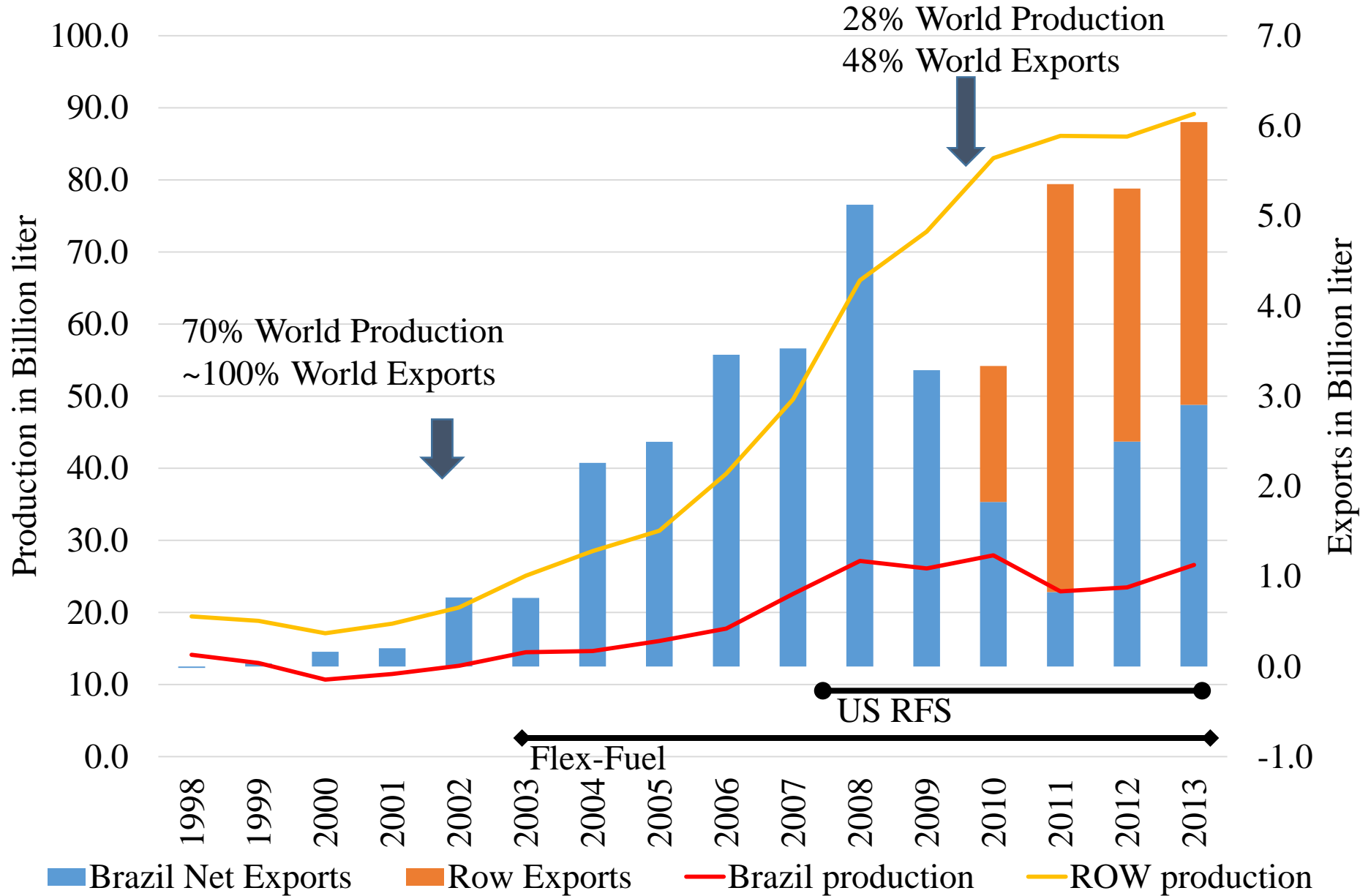
David Zilberman, University of California, Berkeley

Presentation at

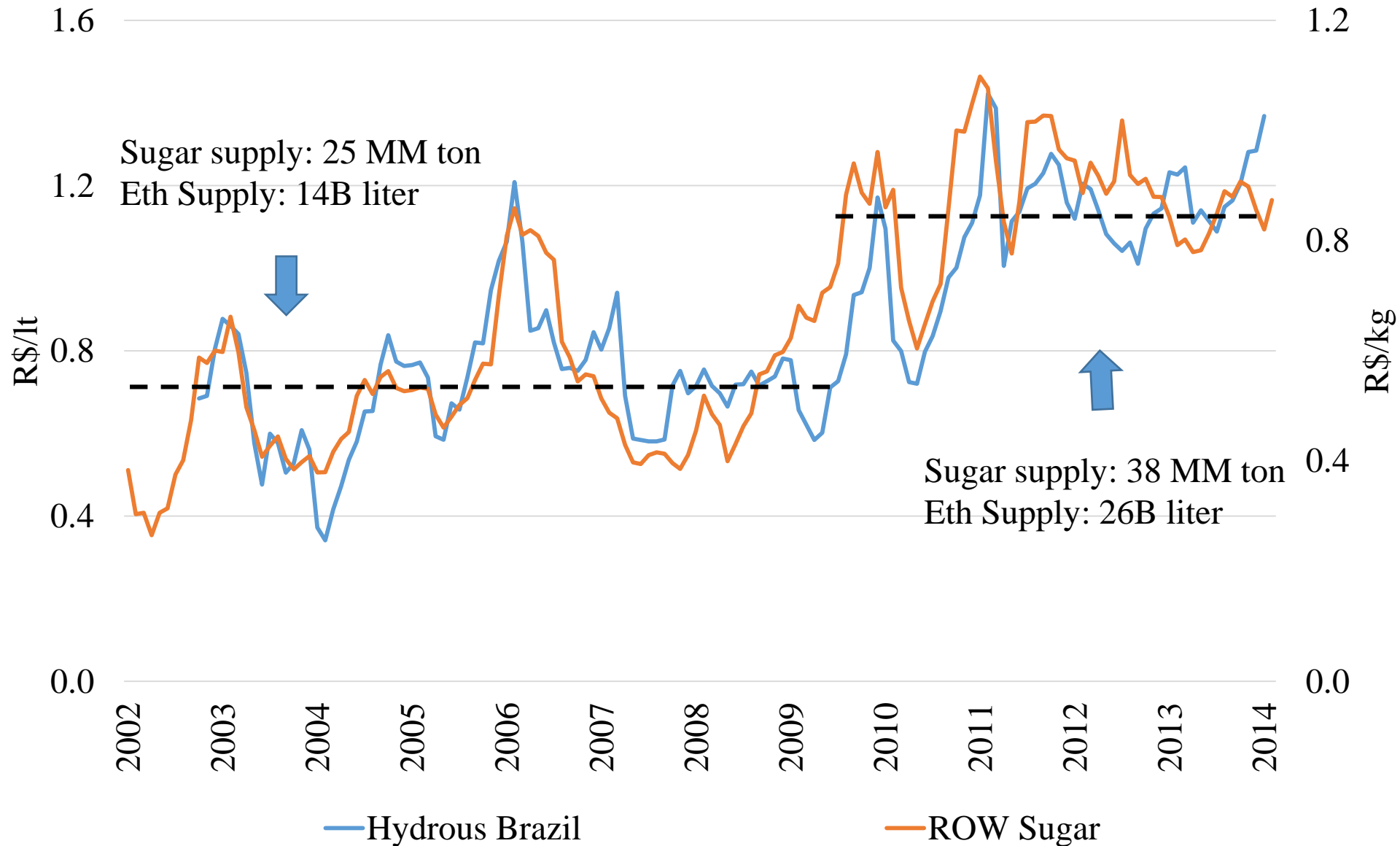
Berkeley Bioeconomy Conference

Berkeley, March 26-27, 2013

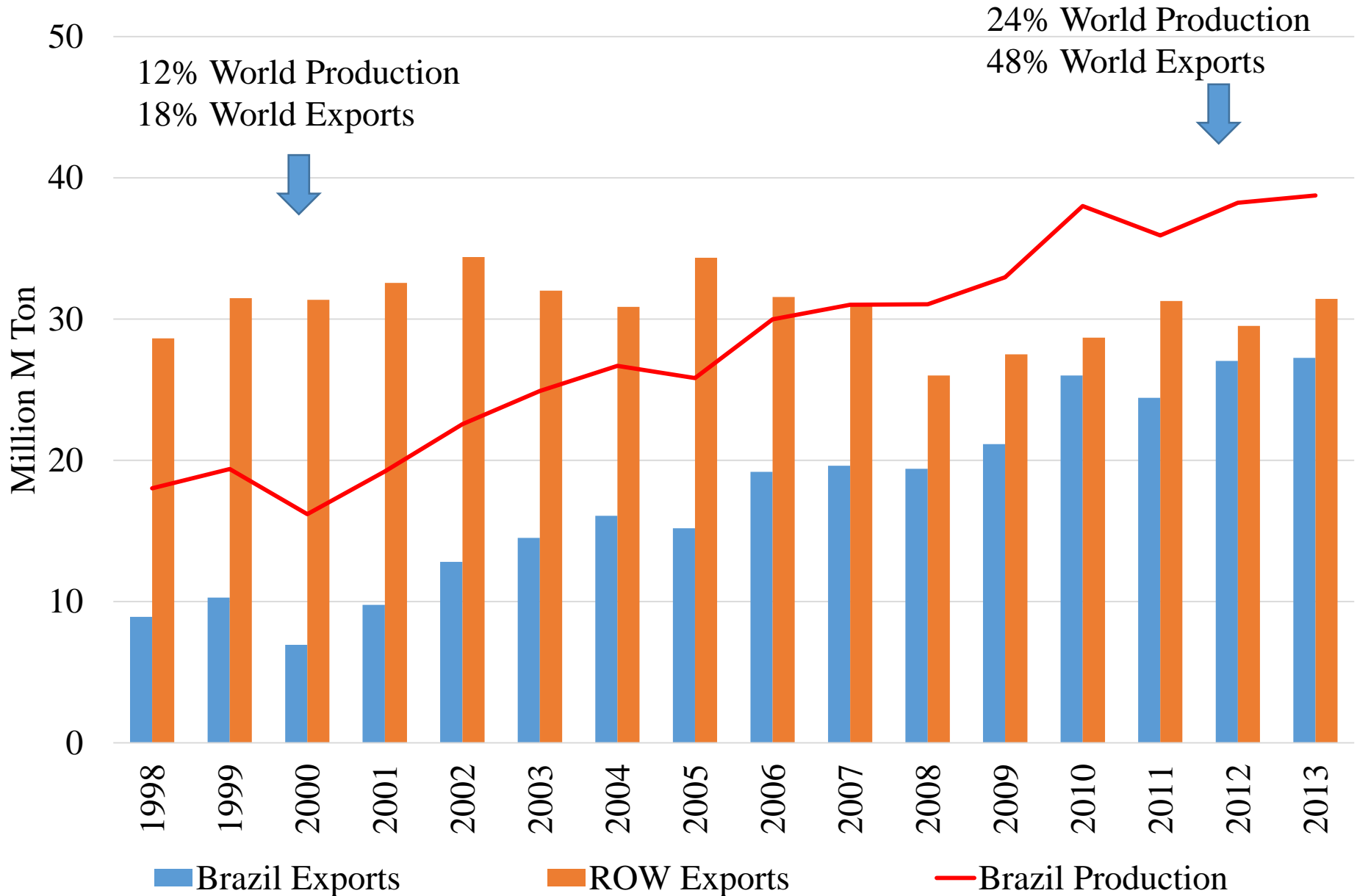
Ethanol Market



Sugar & Ethanol Prices $\rho > 0.83$

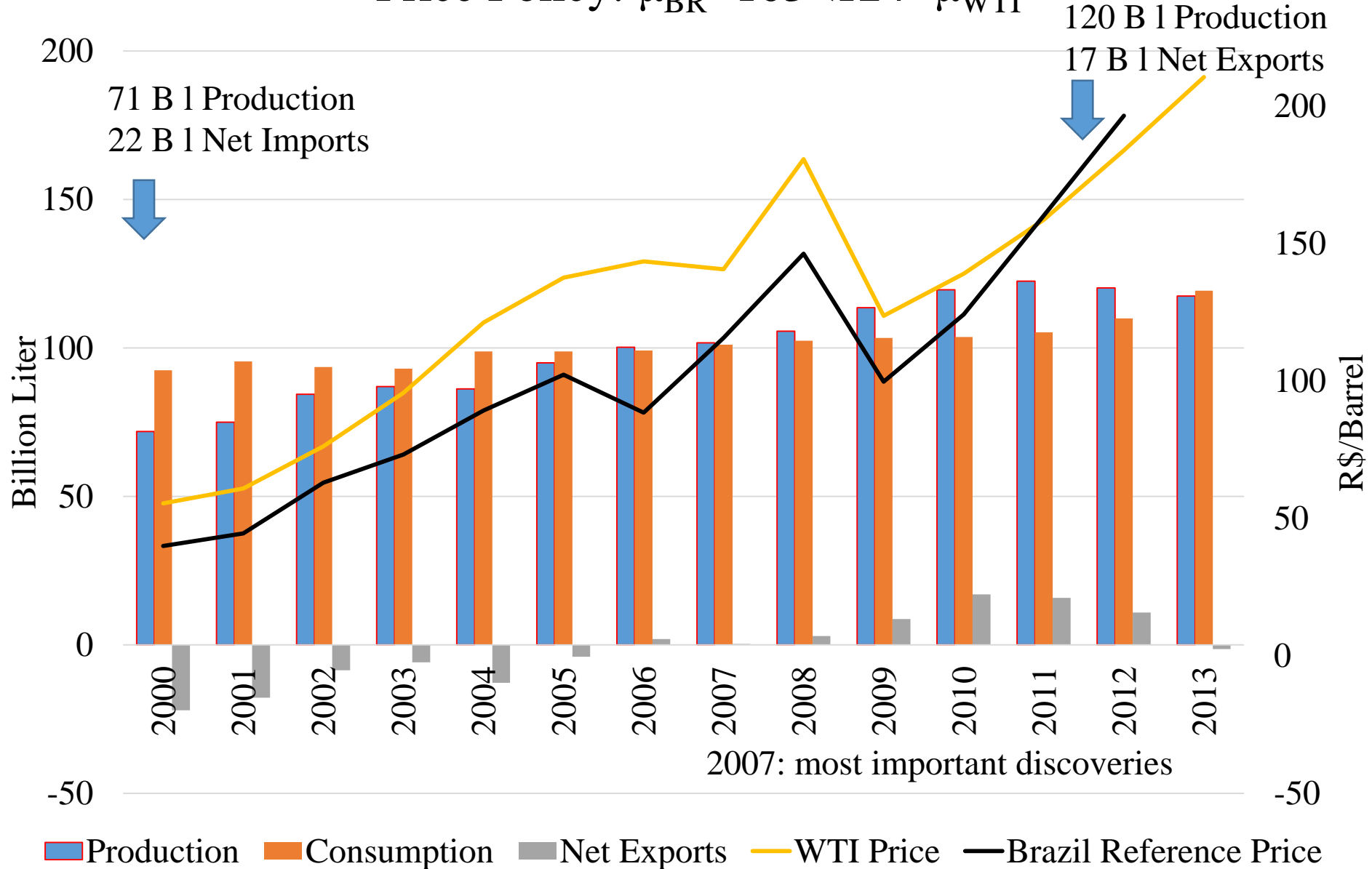


Sugar World Market Power



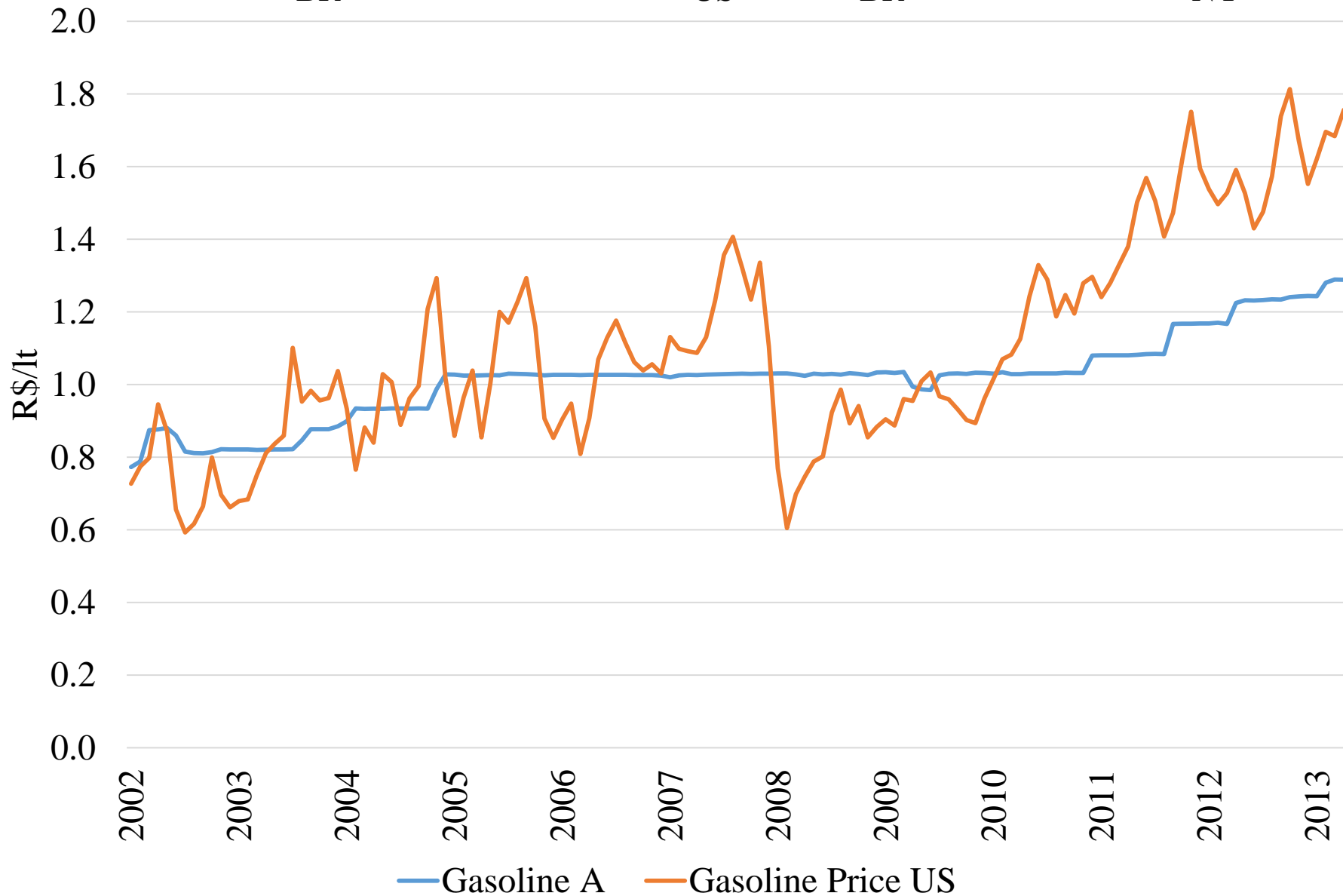
Brazil: Oil Self-Sufficiency

Price Policy: $\mu_{BR}=103 < 124 = \mu_{WTI}$



Wholesale Gasoline Prices

Policy: $\sigma_{BR} = 0.14 < 0.32 = \sigma_{US}$ and $\mu_{BR} = 0.99 < 1.06 = \mu_{NY}$

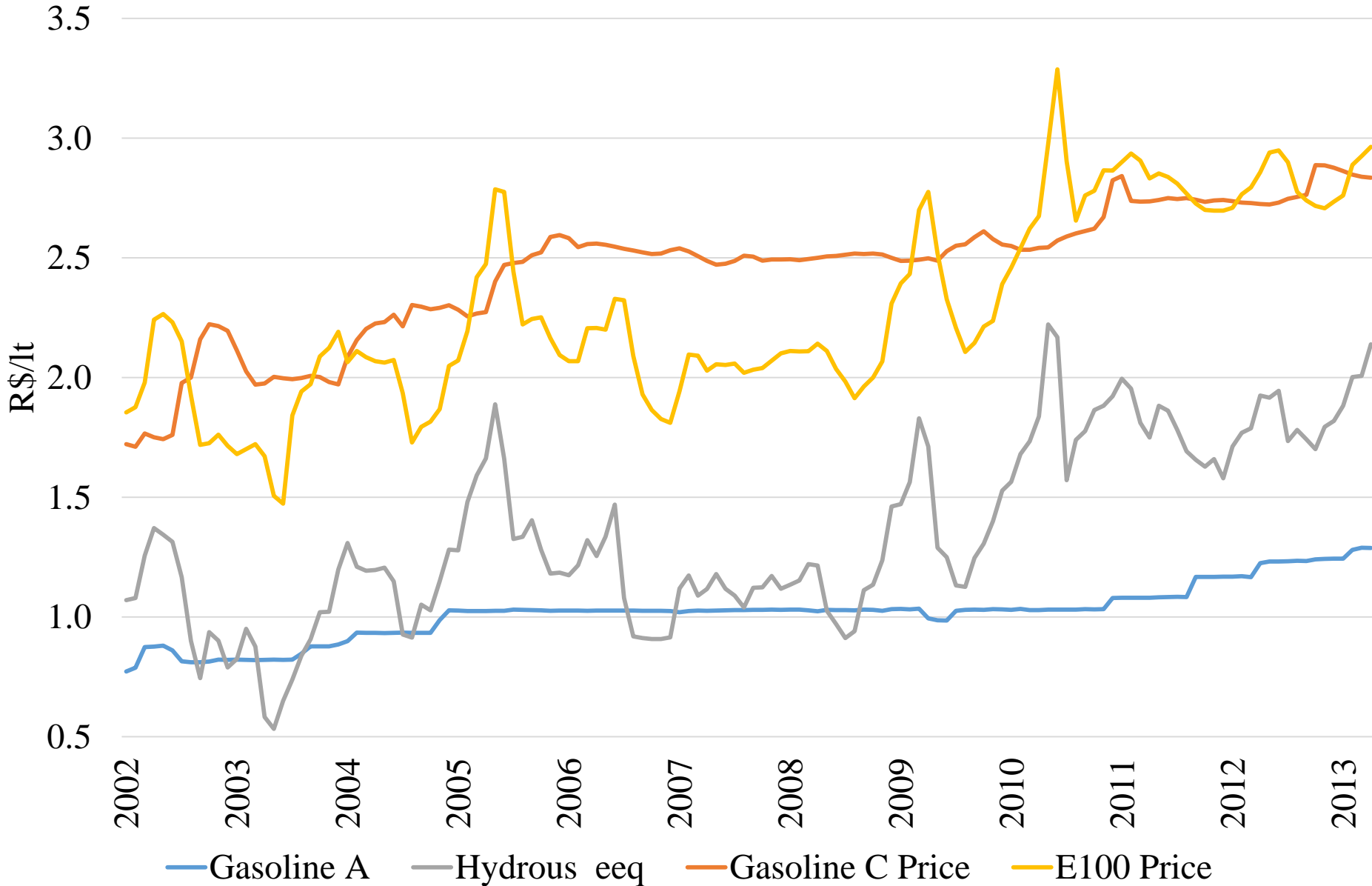


Fuel scheme in Brazil 2011 (eeq)

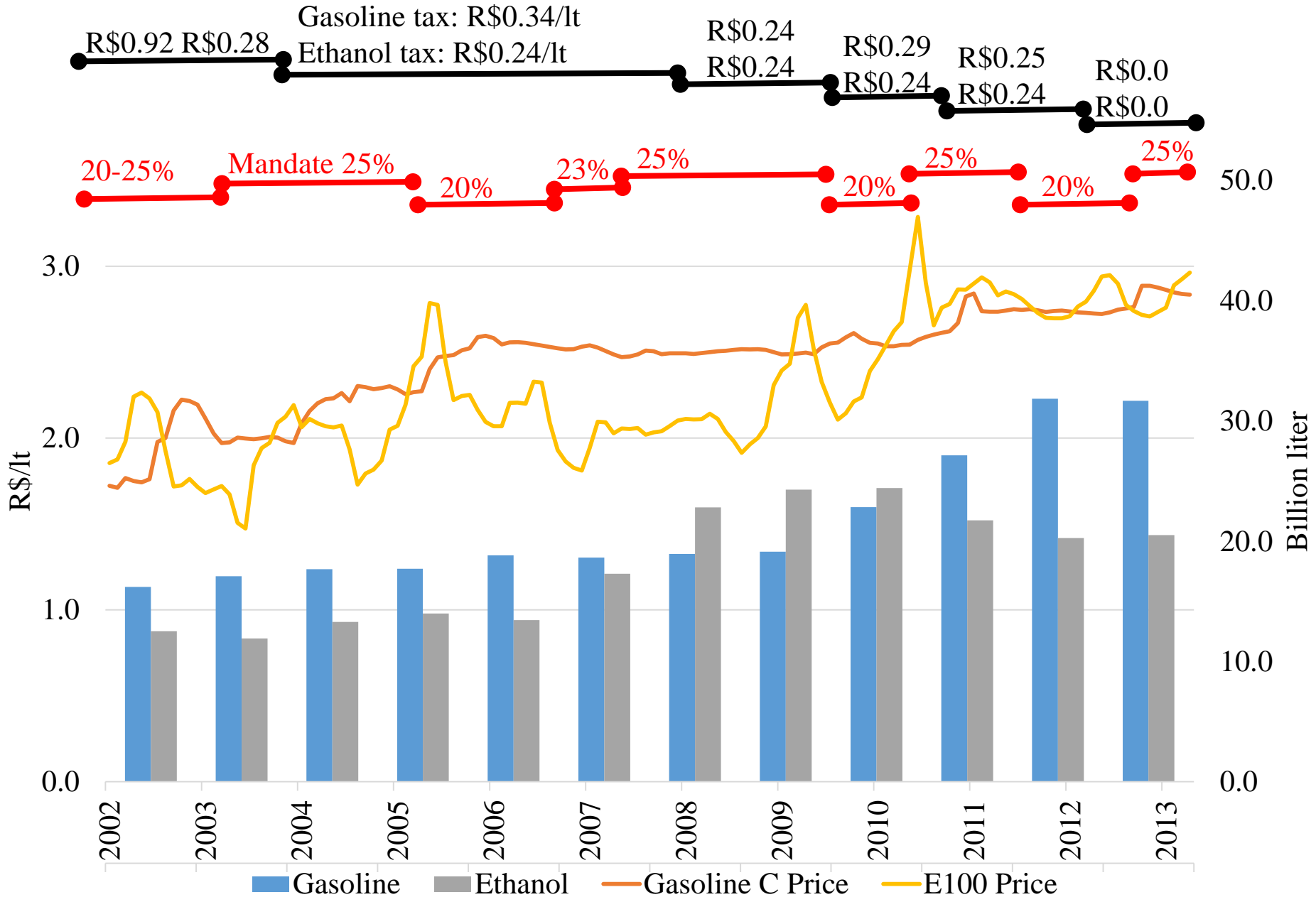
	Gasoline		Anhydrous		Hydrous	
Wholesale	1.33	[36.3%]	2.34	[66.8%]	2.08	[58.1%]
Federal Taxes	0.50	[13.6%]	0.20	[5.6%]	0.39	[10.9%]
State Taxes	0.95	[26.0%]	0.34	[9.8%]	0.46	[12.9%]
Freight and Mark. Margins	0.89	[24.2%]	0.62	[17.8%]	0.65	[18.1%]
Final Price	3.67		3.50		3.59	
Retail Price			3.63		3.59	

Gasoline & Ethanol Prices

$\mu_{\text{Gas A}}=0.99 > 1.35=\mu_{\text{Hydrous}}$ vs. $\mu_{\text{Gas C}}=2.4 > 2.23=\mu_{\text{E100}}$



Gasoline & Ethanol Markets: Policy



Summary Policy Intervention

- Reference oil price lower than world price
- Domestic wholesale price of gasoline fixed below world price (7c/liter)
 - These could result in \$3.6B lower revenue for Petrobras (2005-2011)
- Blend mandate: share of anhydrous 18-25%
- High tax on gasoline: 40% and
- Low tax on ethanol: 24%
- Although this gap has been reduced during the last years
- Significant dependence on fuel tax revenue, mainly for the states:
 - 4-5% of total tax revenue in Brazil from fuel market
 - 2-3% from gasoline; 1% from ethanol and rest from diesel

Motivation

- In the case of Brazil its biofuel policies reflect its unique institutional structure in the oil sector which is dominated by the state-owned producer, Petrobras.
- As a major exporter of sugar, a major producer of biofuel and a growing exporter of oil, fuel policies in Brazil have global implications.

Research Goals

- Analyze and quantify the impact of alternative fuel policies (first best and second best) in Brazil on consumption of fuels
- Analyze the political-economic motivations for the fuel market policy interventions by the Brazilian government
 - Gains and losses to consumers, producers, government in the fuel and sugar markets
 - GHG emissions

Hypothesized Motivations for Fuel Policy Interventions

- To increase competitiveness of ethanol and benefit the sugarcane sector – social development goals
- Improve the terms of trade by raising the price of sugar (export commodity)
- To increase exports of oil
- Raise tax revenue for other cross-subsidies for consumers
- Partially mitigate adverse implications of fuel policies on consumers by subsidizing the wholesale price of oil
- Implicitly induce a reduction in GHG intensity by inducing a switch to a less carbon intensive fuel

Methods

- Partial equilibrium open economy model of fuel and sugarcane sectors in Brazil, maximizing total social welfare
 - Downward sloping domestic demand curves for sugar, fuel and other petroleum products
 - Fuel needs can be met by gasoline and/or ethanol
 - Price taker in the world oil market
 - Downward sloping world demand for sugar
 - Upward sloping supply curves for sugarcane and oil
 - Per-unit costs of fuels and sugar
 - Technical and policy parameters
- Numerical simulation (including sensitivity)

First Best Policies

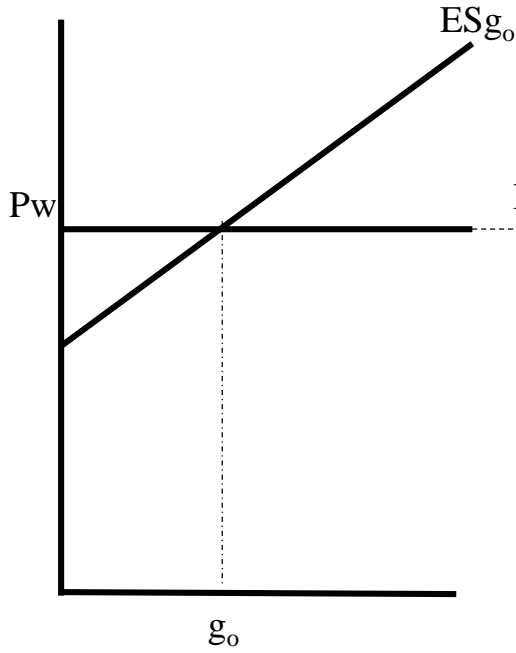
- Social planner maximizes consumer and producer benefits in the Oil sector and Sugarcane related sectors and internalizes GHG externality
- First best policies: Carbon Tax and an Export Tax on Sugar

Domestic price of oil = world price of oil =
MC of oil production + Carbon related tax

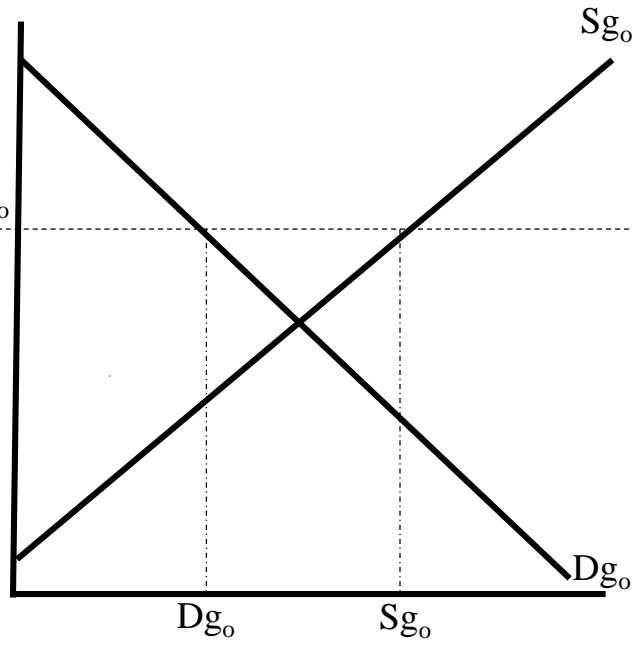
Consume ethanol such that
MC of ethanol + Carbon related tax =
the energy equivalent price of gasoline

Optimal level of sugar production will be such that
MC of sugar + opportunity cost of not producing biofuel
(affected by the world price of oil) + Carbon related tax =
Price + export tax

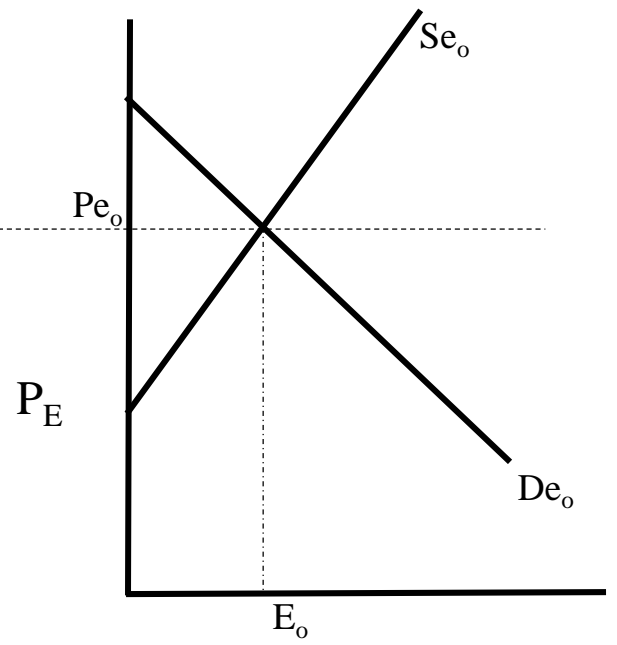
World Gasoline



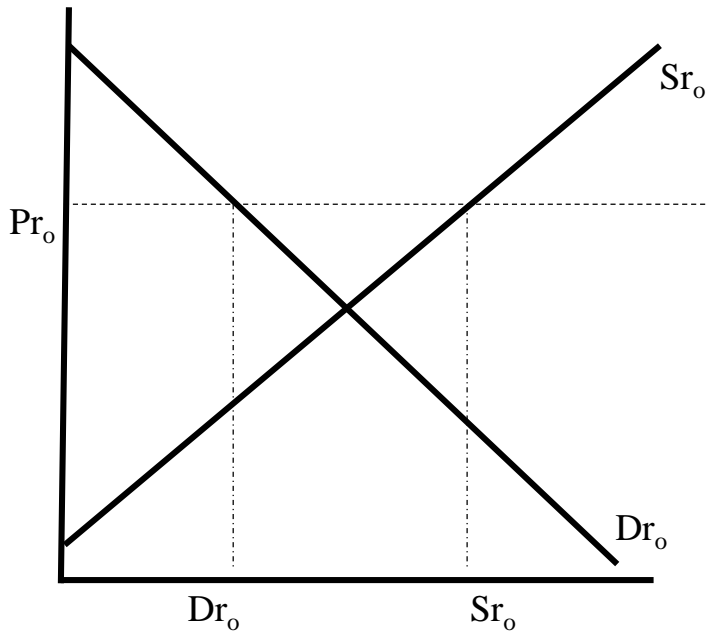
Domestic Gasoline



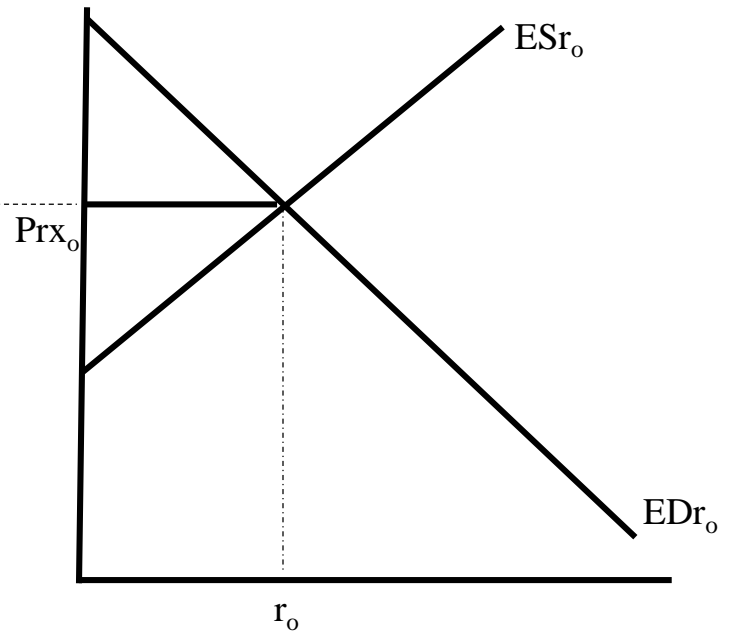
Ethanol



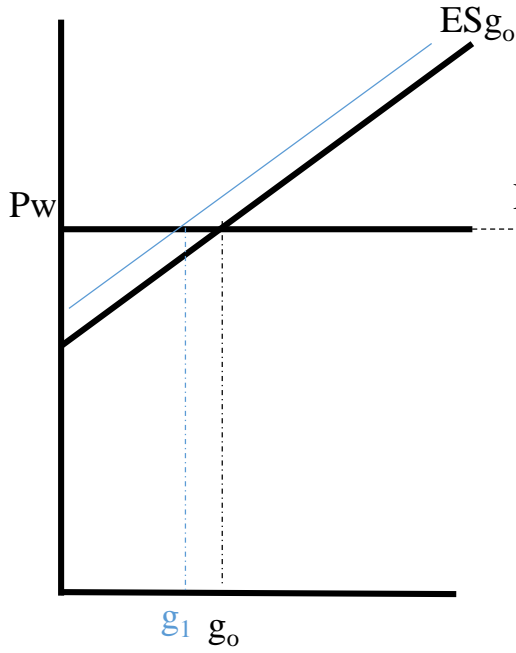
Domestic Sugar



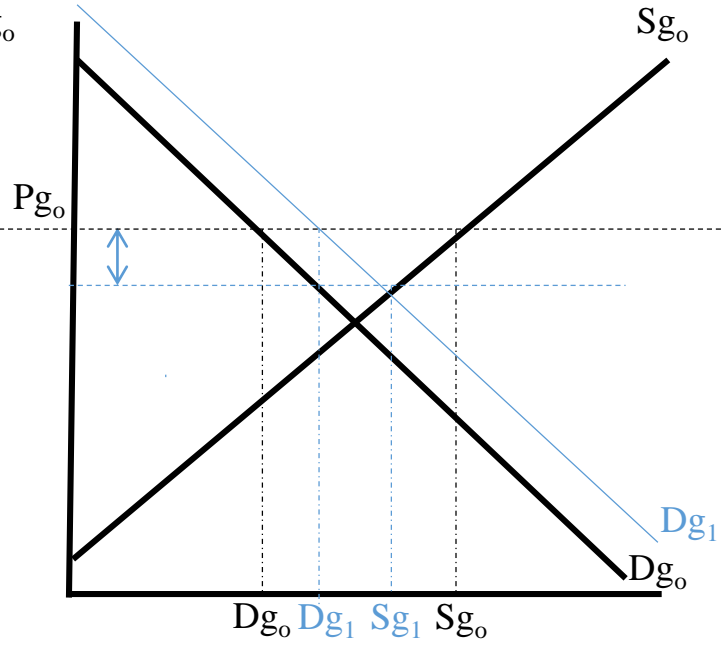
World Sugar



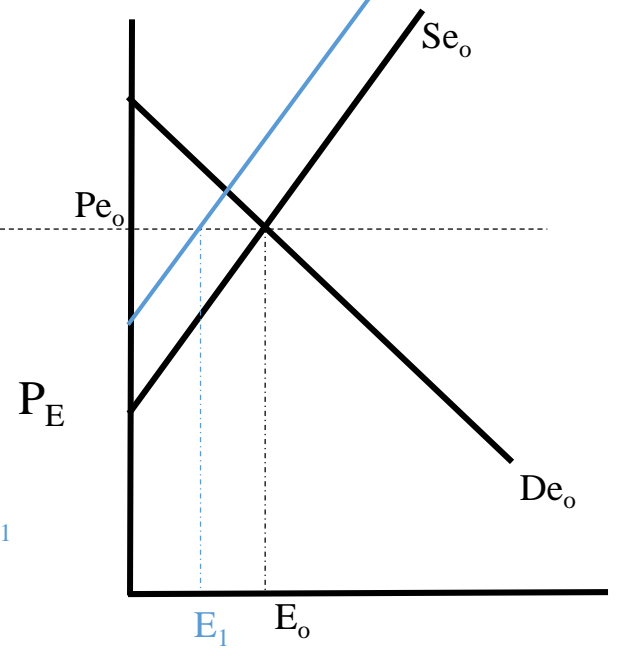
World Gasoline



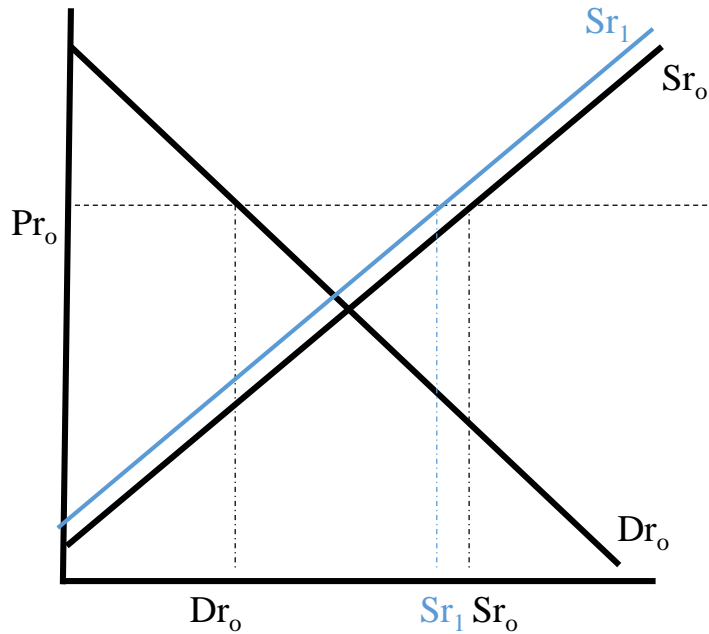
Domestic Gasoline



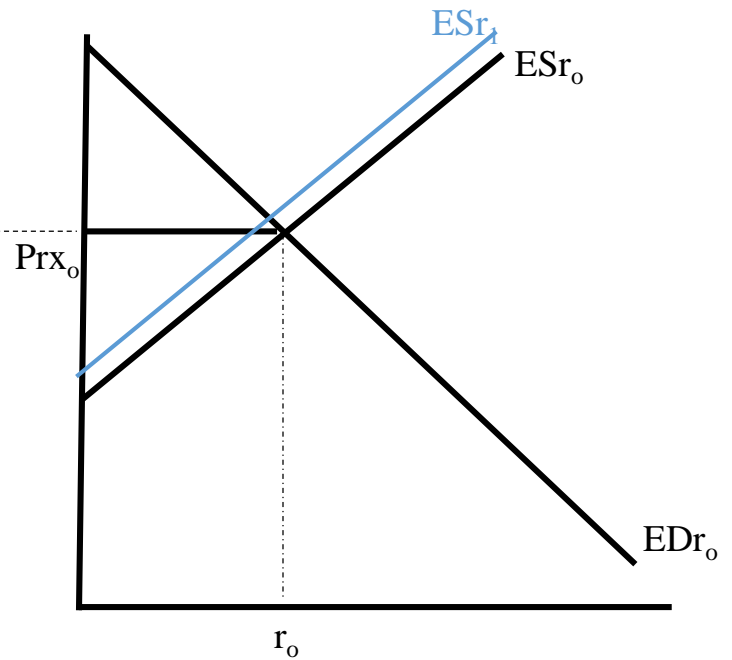
Ethanol

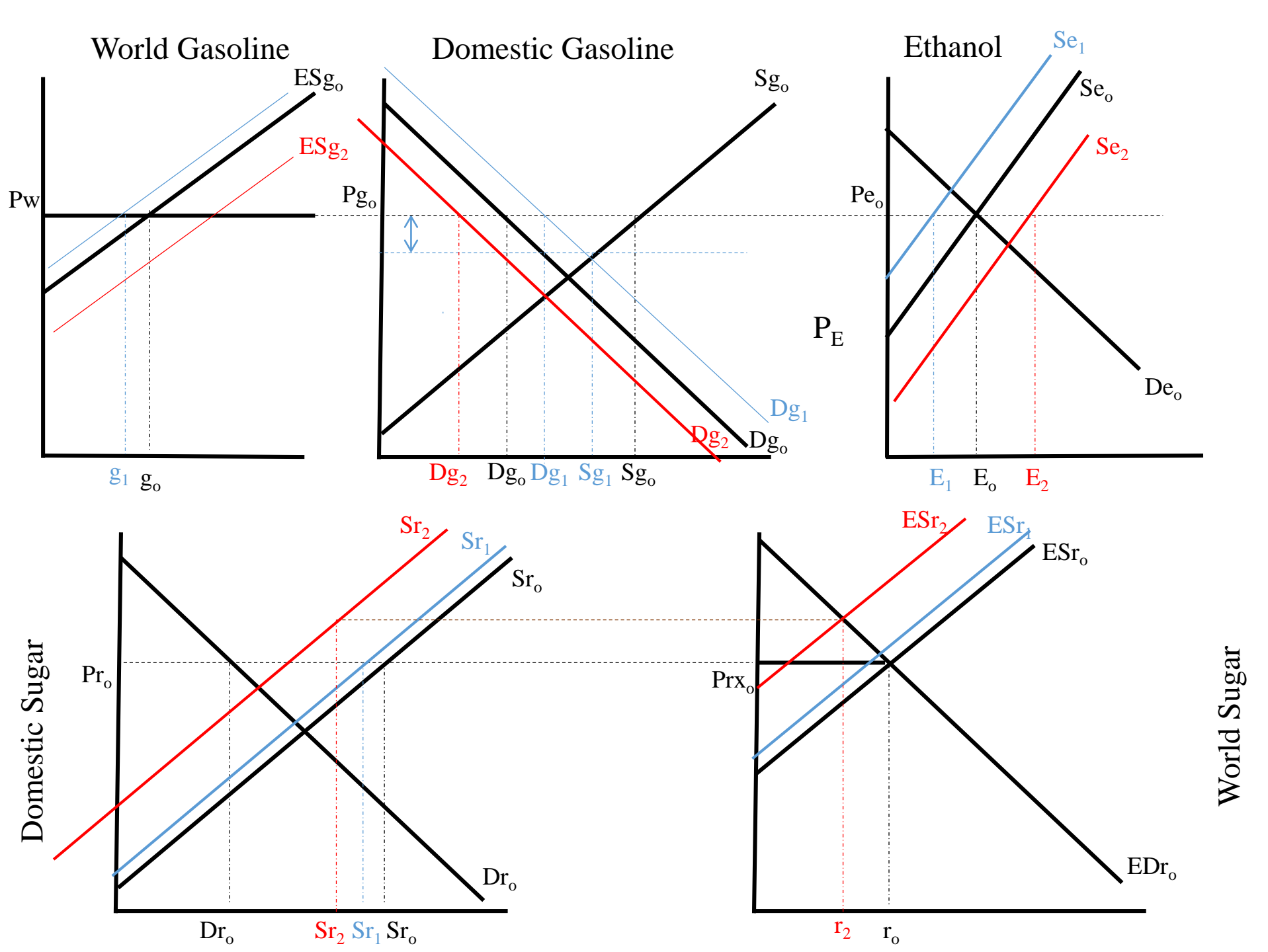


Domestic Sugar



World Sugar





Outcomes With a Carbon Tax and an Export Tax on Sugar

- Higher world price of sugar, reduction sugar exports and sugar supply, less sugarcane, but more ethanol supply.
- Higher ethanol production, lower domestic demand for gasoline and more exports of oil
- Larger value of exports of sugar and oil
- Reduced emissions
- Tax revenues for government
- Higher social welfare after accounting for environmental damages

Second Best Policies

- Blend mandate
 - Imposes an implicit tax on gasoline and an implicit subsidy on ethanol
 - Increases demand for ethanol
- Supplemented with an explicit tax on gasoline and an explicit tax credit on biofuels
 - Lowers domestic price of ethanol and makes it more competitive, increases export of oil
- Cost of these policies borne entirely by consumers
- Reduction in wholesale price paid to Petrobras: transfers some costs to it/government

Numerical Simulation

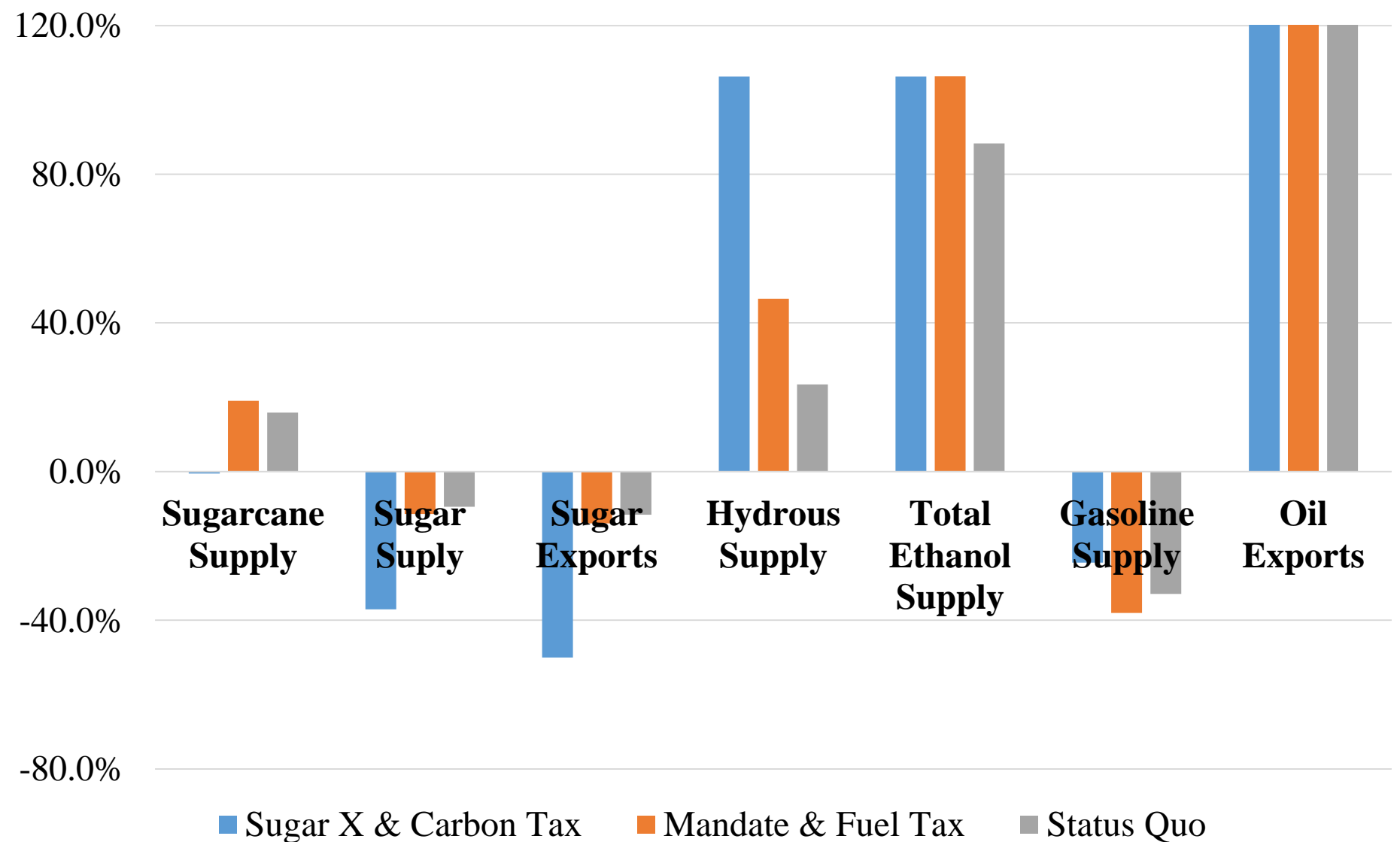
- Model is calibrated for 2010/11 using estimates of price elasticities for various demand and supply functions from the literature
- Supply quantities and prices: oil and sugarcane
- Demand: oil and sugar exports; gasoline, other oil products, anhydrous and hydrous ethanol and sugar
- Policy parameters: fuel tax/tax credits, mandate, carbon tax
- Finally, sensitivity analysis on price elasticities (15,625 simulations from a uniform distribution)

Policy Scenarios

- No Policy
- Carbon tax and Export Tax on Sugar
- Blend Mandate + Fuel Tax/Tax Credit
- Status Quo: Blend Mandate + Fuel Tax/Tax Credit
+ Cap on domestic oil

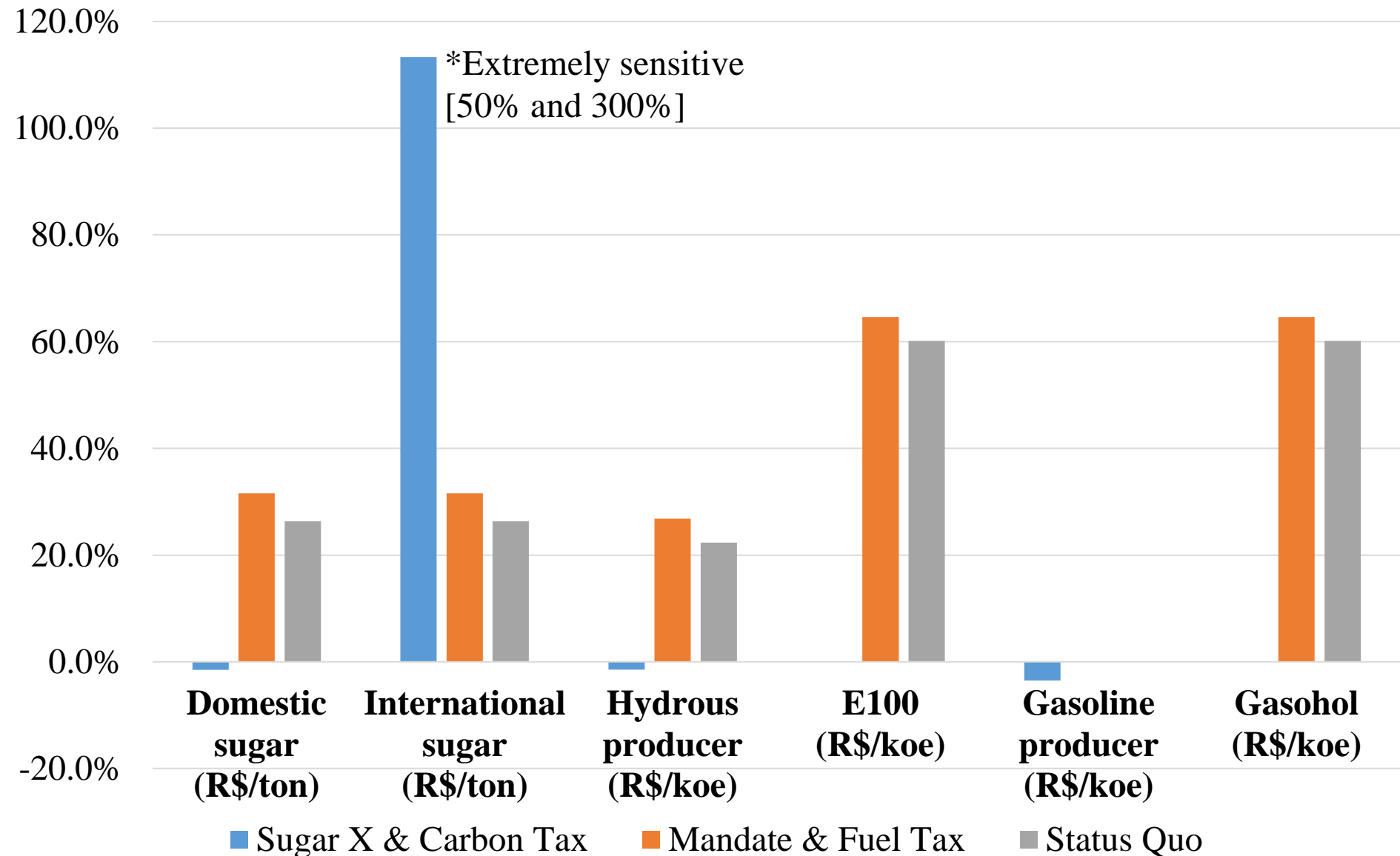
Effect of Alternative Policies on Production and Exports

(% Deviation respect to No-Policy)



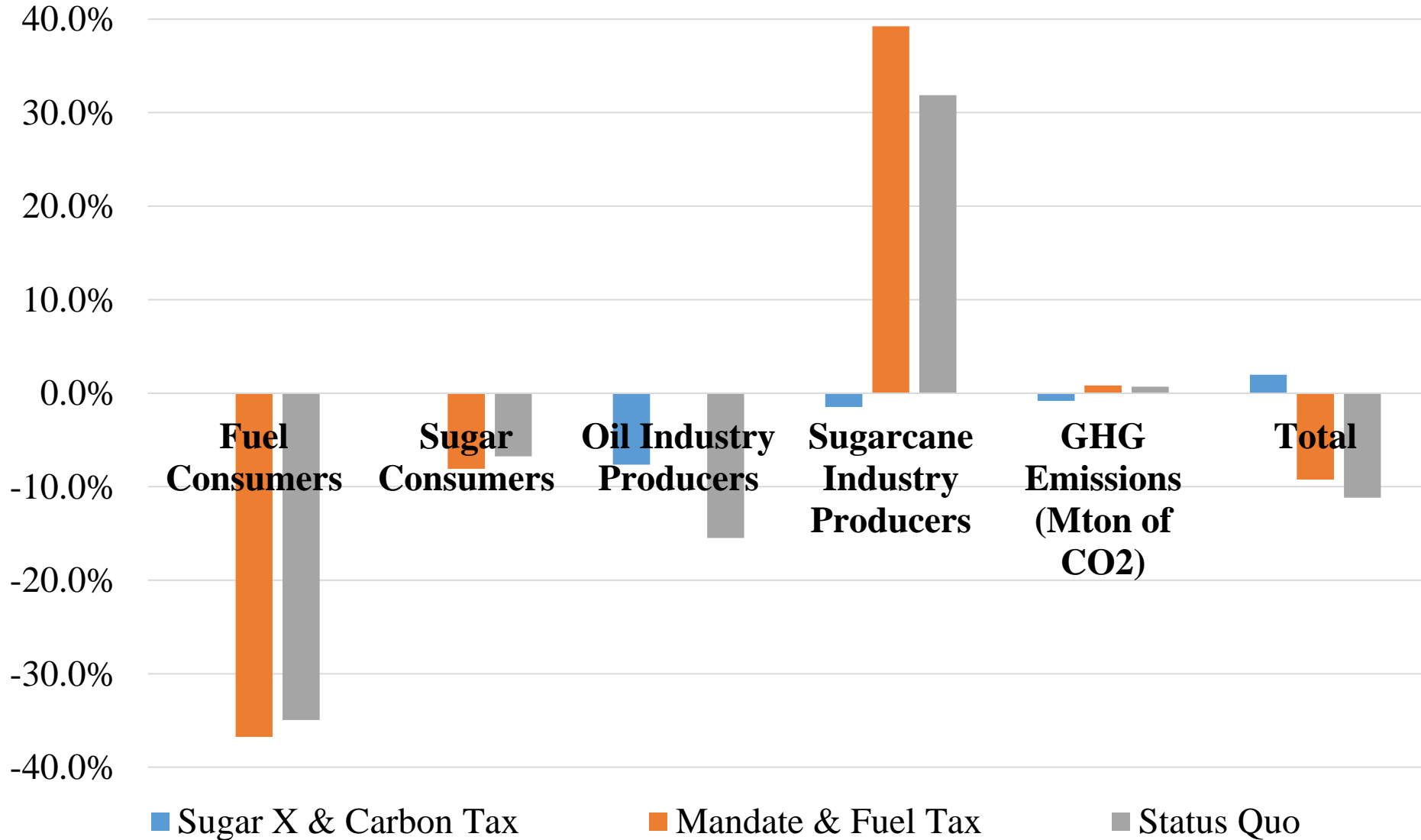
Effect of Alternative Policies on Market Prices

(% Deviation respect to No-Policy)



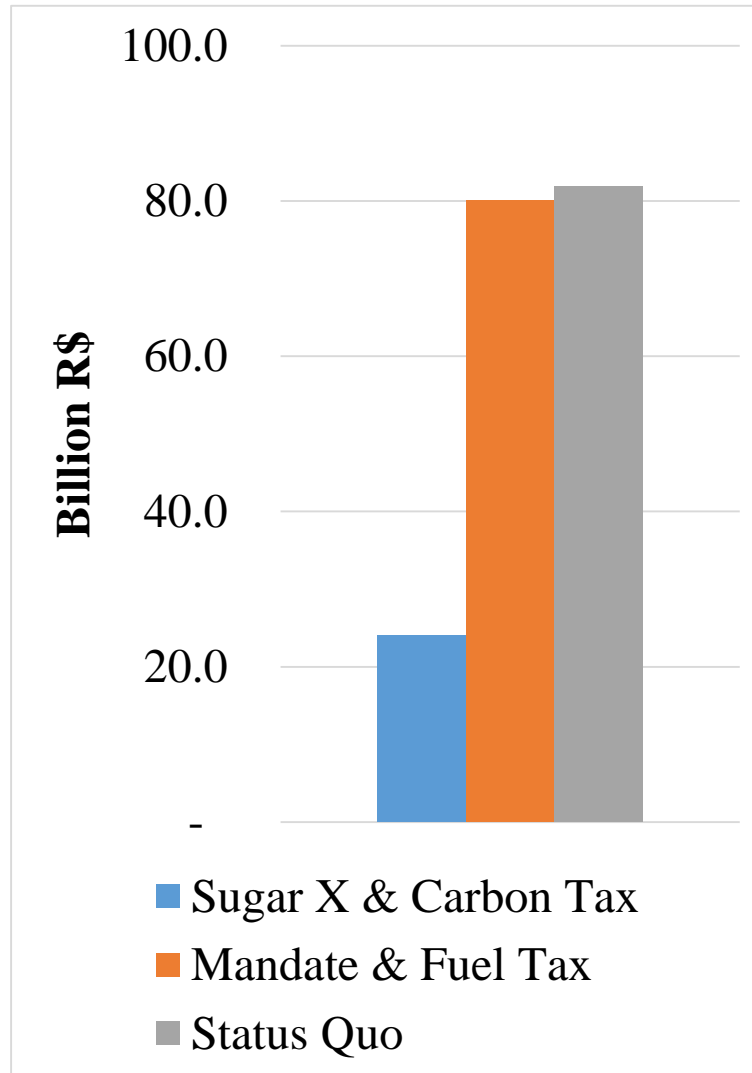
Economic Gains and Losses and GHG effects

(% Deviation respect to No-Policy)



Government Revenue effects

(Absolute Deviation respect to No-Policy)



Conclusions

- Current mix of fuel policies is sub-optimal
 - from an aggregate social welfare perspective
 - Significant negative impact on fuel and sugar consumers, that are only partially mitigated by the gas subsidy
 - Increase GHG emissions
- First best policy would have large negative impact on sugar producers but compensated by ethanol producers gains
- Existing policies likely to be more politically acceptable than first best
 - Provide higher benefits to sugarcane producers, mitigates negative impacts on sugar/ethanol producers
 - Raise tax revenue and export revenue

THANK YOU!!!

Questions?



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