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# Uncertainty about Indirect Effects of US Ethanol on Brazilian Land Use

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# What are the indirect effects of US biofuels?

- Indirect effects
    - Feedstock use
    - Market effects
    - Land use
  - Studies
    - Partial equilibrium
    - General equilibrium
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# Models

## US model

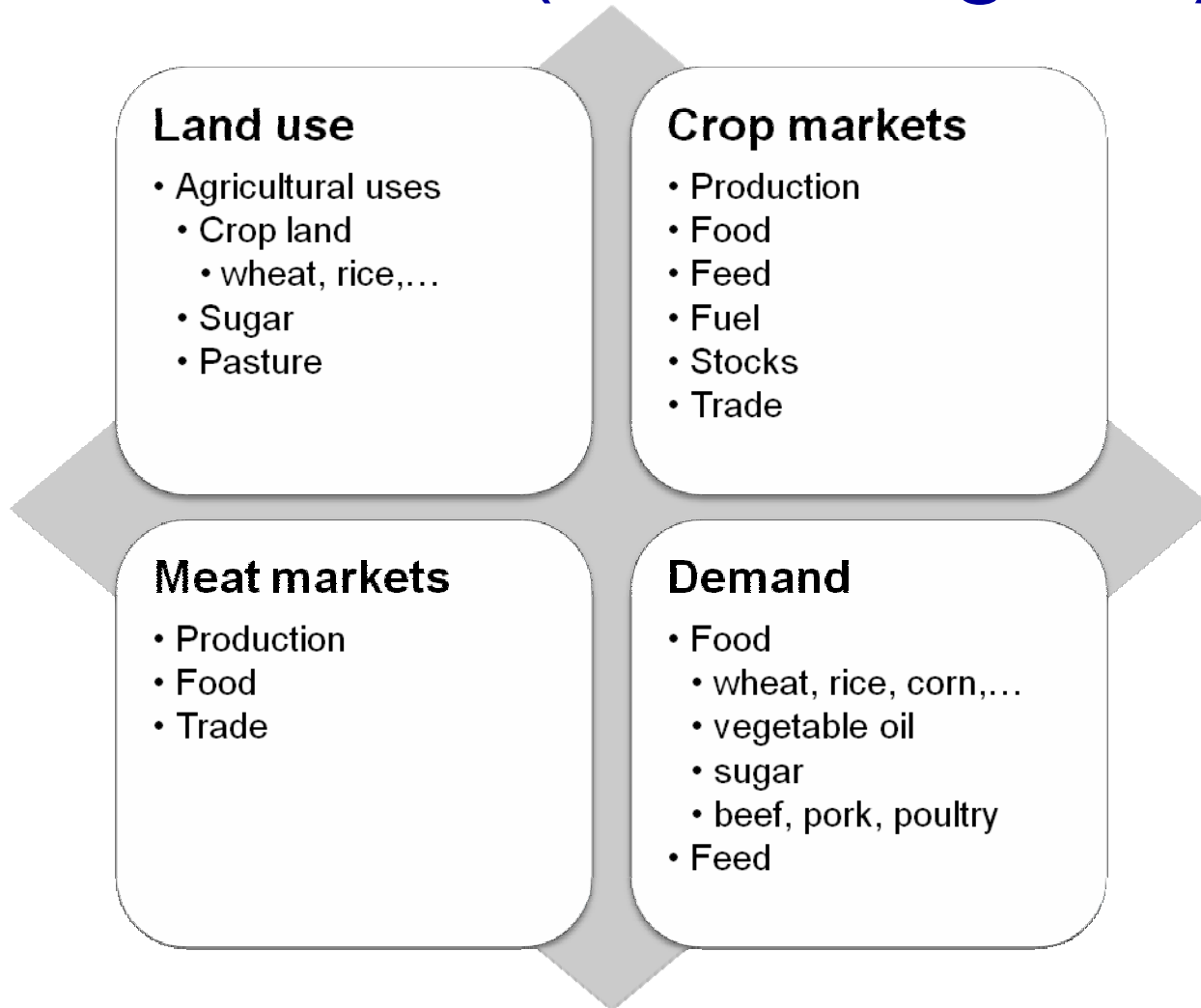
- **FAPRI-MU US agricultural and biofuel markets**
  - national crop and milk supplies
  - no reduced form for trade

## World model

- **Standardized representation**
  - Brazil, Argentina, China, India, Indonesia, EU, and Mexico; and rest of world trade
  - wheat, rice, corn, other coarse grains, sugar, soybean, rapeseed, sunflower, palm oil, vegetable oil, oilseed meal, beef, pork, and poultry; and ethanol

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# Standard agricultural market representation (excluding US)



# Partial equilibrium, world markets

## Commodities

wheat  
rice  
corn  
other coarse grains  
vegetable oil  
oilseed meal  
sugar  
beef  
pork  
poultry  
*ethanol*

## Countries, regions

US  
Brazil  
Argentina  
China  
India  
Indonesia  
European Union  
Mexico  
*rest of world*

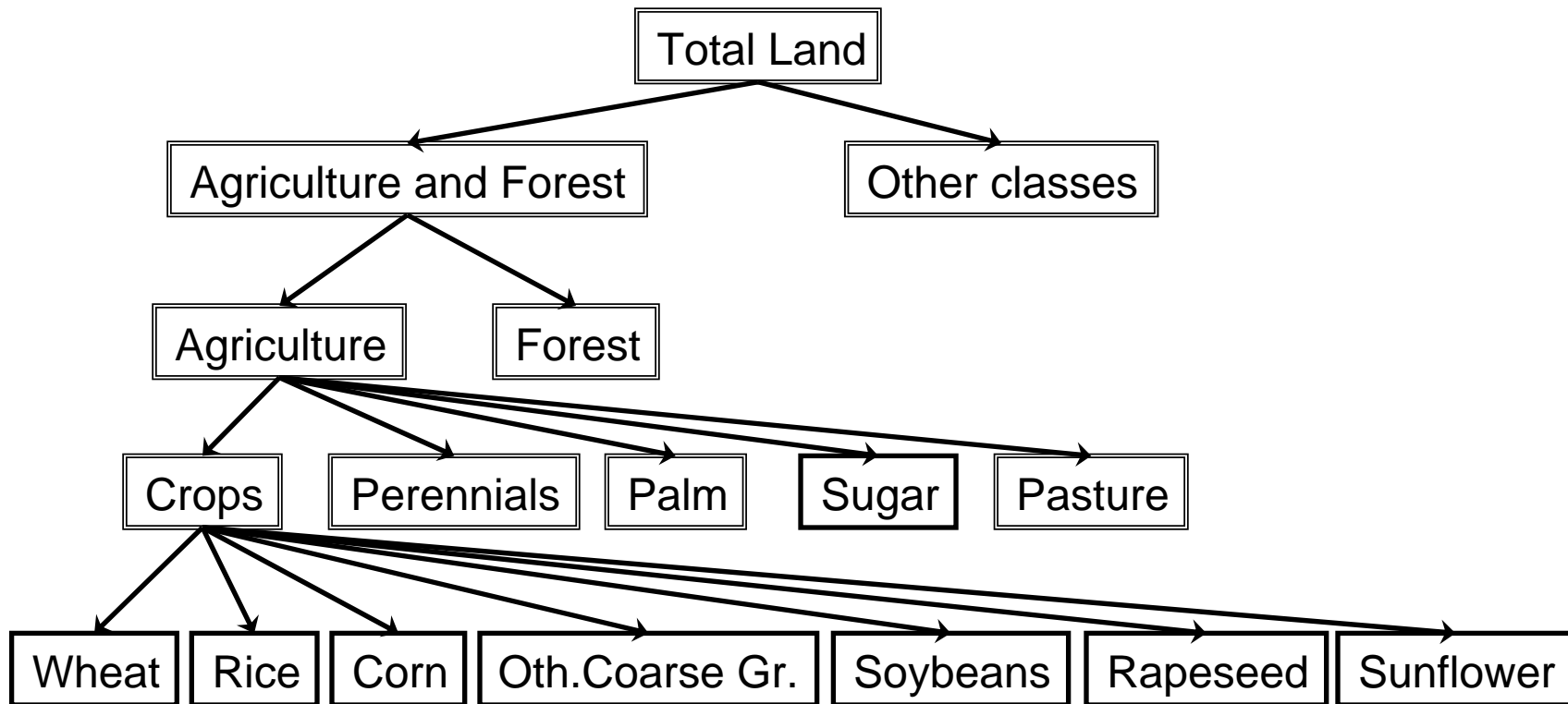


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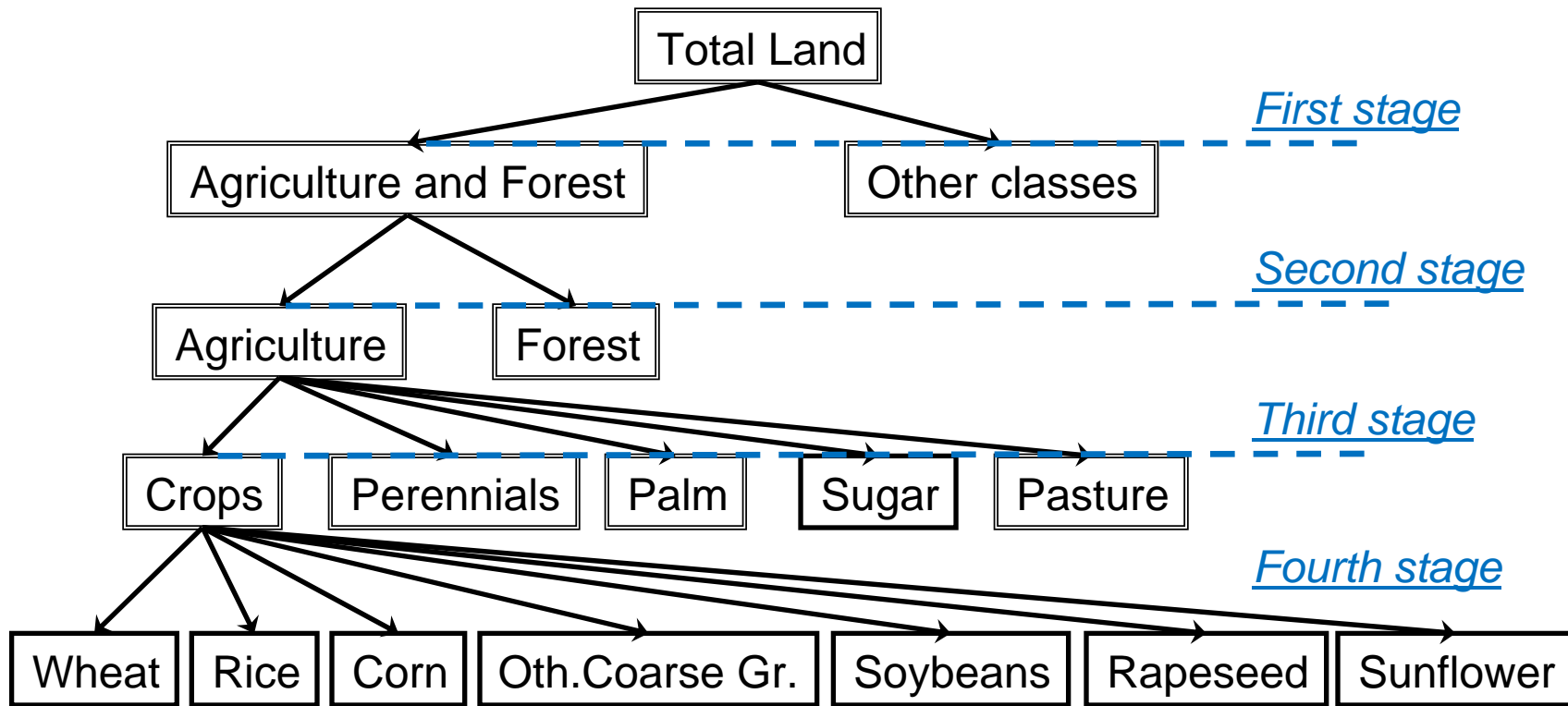
# US ethanol model

- Ethanol demand
    - Additive
    - E10
    - E85
  - Supply capacity building and use
  - Policy
    - Tax credits and tariffs
    - EISA mandates
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# Standard land allocation (not US)



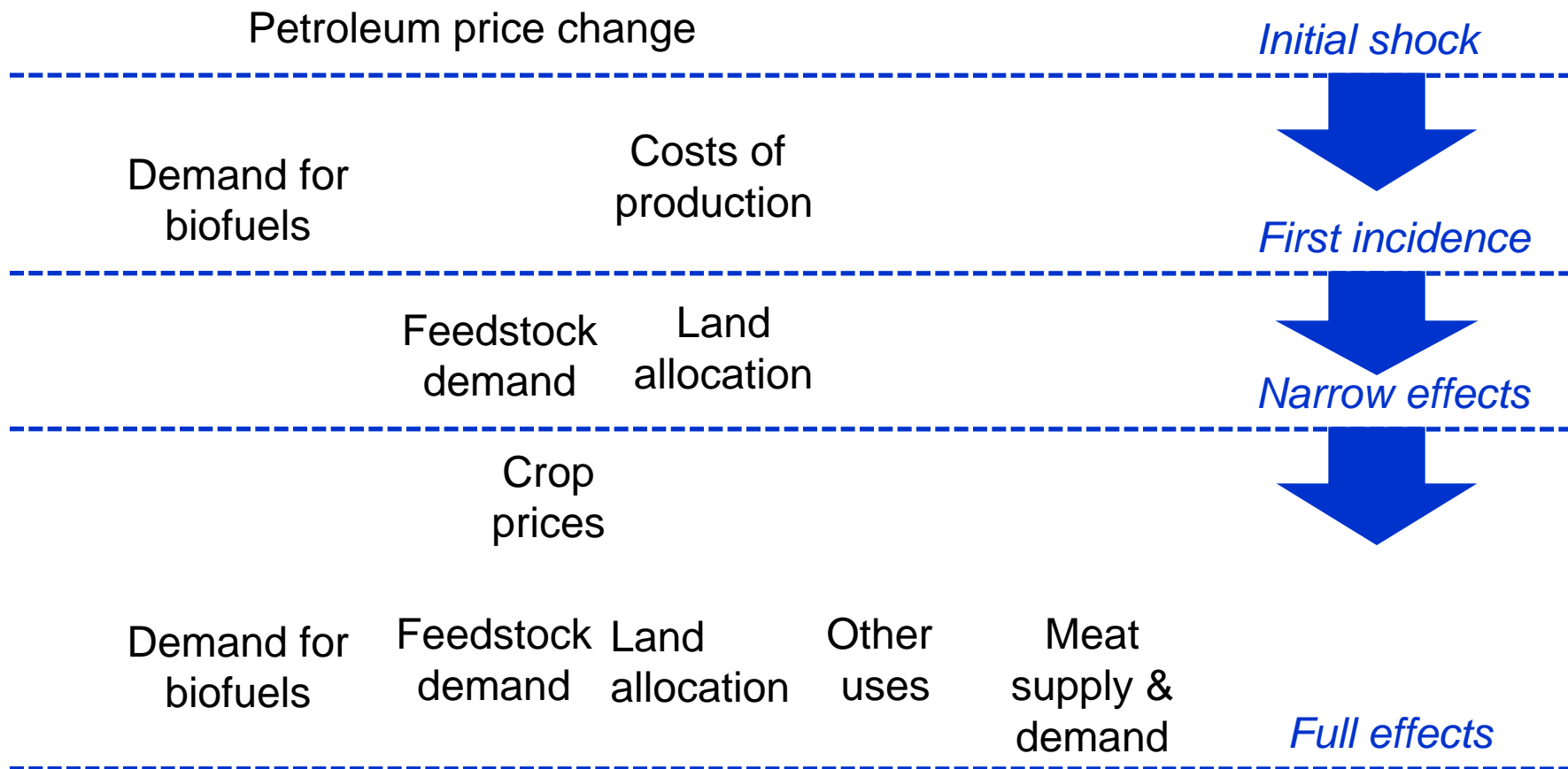
# Land allocation elasticities



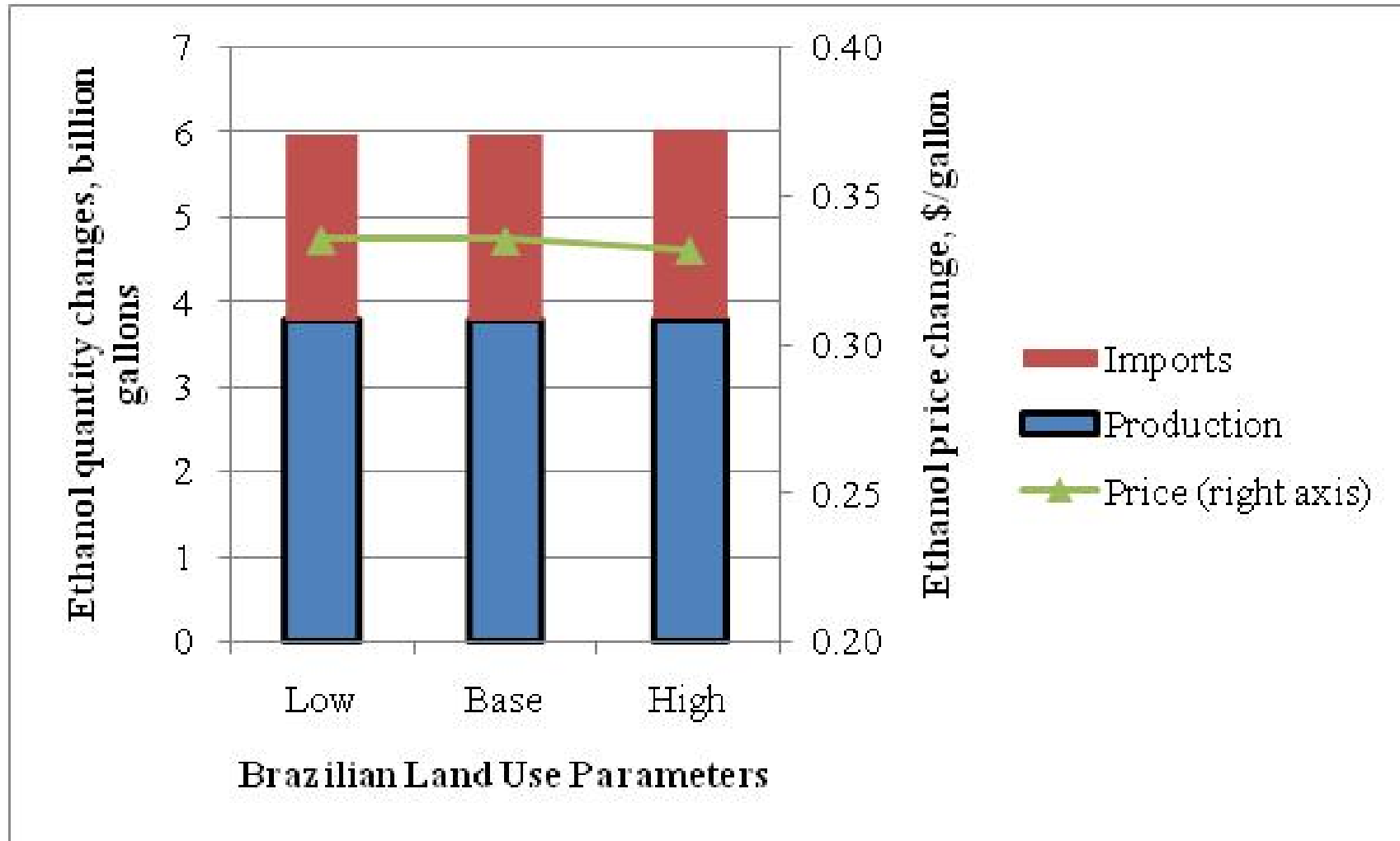
	Low	Base	High
First stage	0	0.05	0.10
Second stage	0	0.10	1.00
Third stage	0.075	0.15	1.00



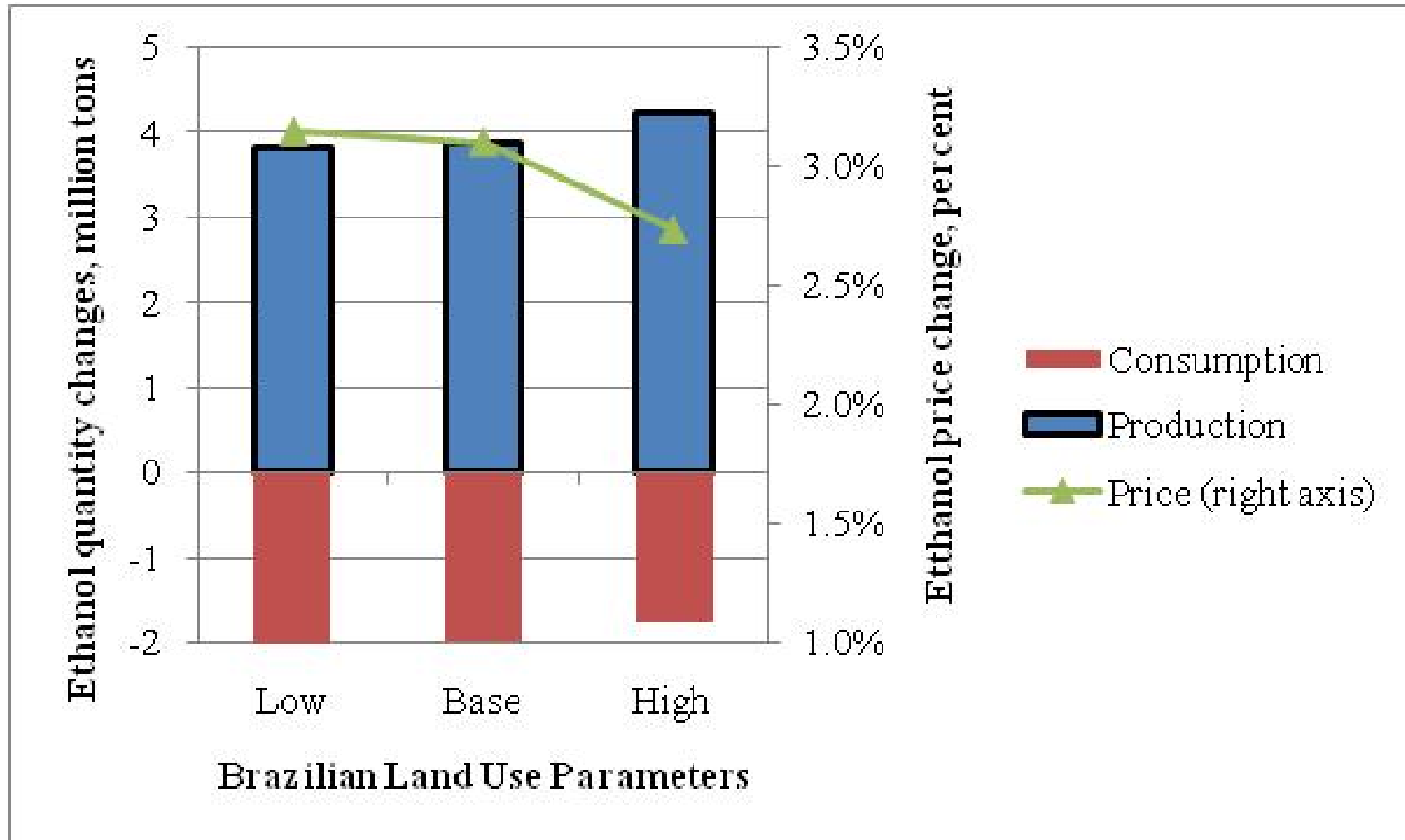
# Petroleum price change effects from US perspective only



# Petroleum from \$125 to \$160: Effects on US ethanol market



# Petroleum from \$125 to \$160: Effects on Brazil ethanol market



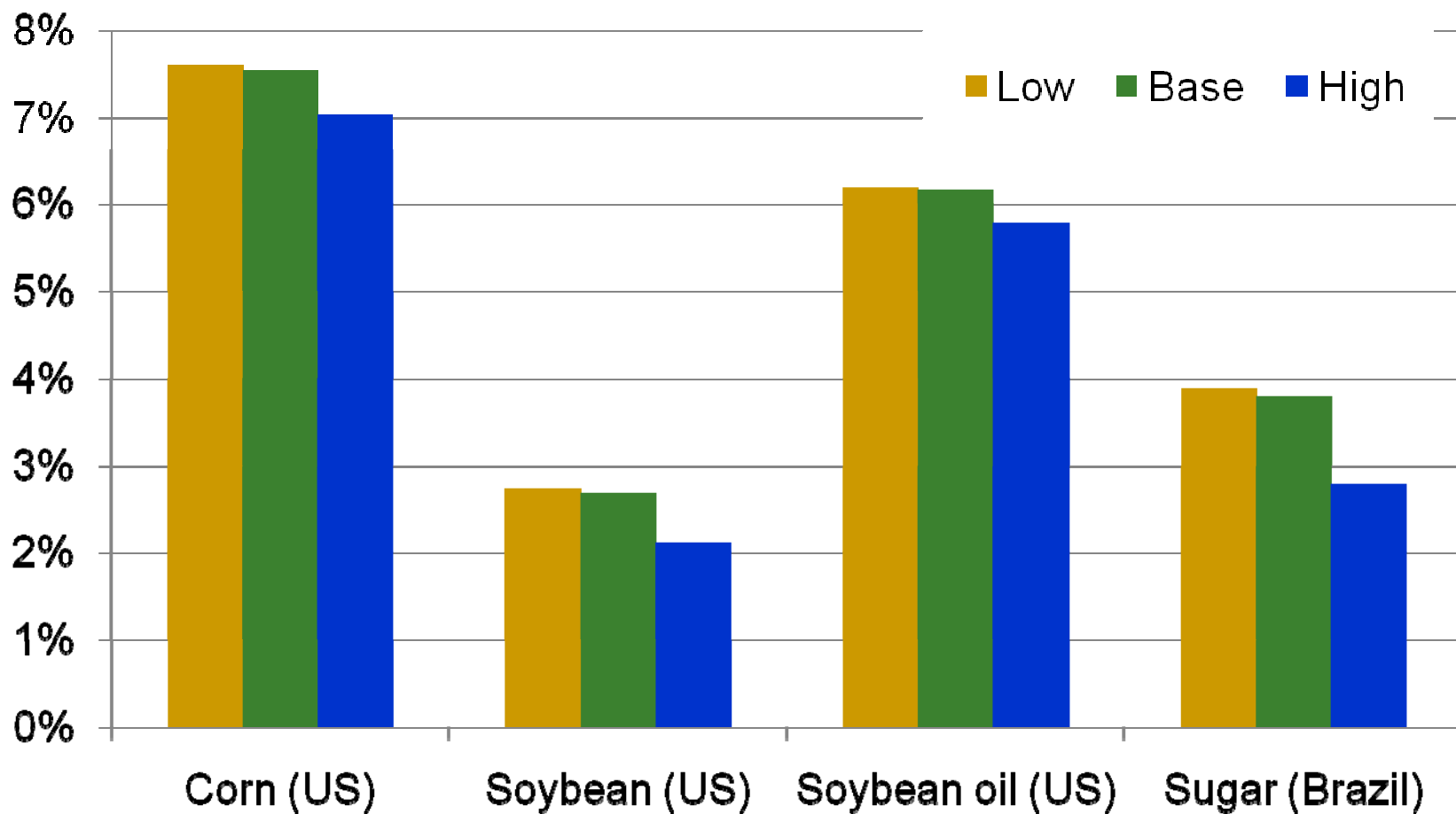
# Petroleum from \$125 to \$160: Effects on Brazil land use

	Low		Base		High	
Other land classes	0.0	0.00%	-29.9	-0.03%	-54.9	-0.05%
Forest	0.0	0.00%	-77.1	-0.02%	-819.2	-0.18%
Agriculture	0.0	0.00%	106.9	0.04%	874.1	0.30%
Pasture	-87.6	-0.04%	-104.4	-0.05%	-846.2	-0.43%
Perennial Crops	-9.2	-0.12%	-15.5	-0.21%	-87.1	-1.16%
Sugar	10.5	0.18%	22.5	0.39%	122.5	2.12%
Annual Crops	86.2	0.11%	204.1	0.27%	1683.6	2.20%
Wheat	-10.7	-0.60%	-7.7	-0.43%	29.4	1.64%
Corn	121.8	0.83%	146.2	0.99%	447.9	3.04%
Soybeans	-34.9	-0.16%	-2.4	-0.01%	400.7	1.84%
Rice	-13.6	-0.46%	-8.7	-0.29%	52.7	1.76%

# Petroleum from \$125 to \$90: Effects on Brazil land use

	Low		Base		High	
Other land classes	0.0	0.00%	32.8	0.03%	61.2	0.06%
Forest	0.0	0.00%	85.1	0.02%	916.9	0.20%
Agriculture	0.0	0.00%	-117.9	-0.04%	-978.1	-0.34%
Pasture	85.3	0.04%	92.4	0.05%	759.8	0.39%
Perennial Crops	10.2	0.14%	17.2	0.23%	99.5	1.32%
Sugar	-3.2	-0.06%	-8.5	-0.15%	-49.2	-0.85%
Annual Crops	-92.3	-0.12%	-218.9	-0.29%	-1787.7	-2.33%
Wheat	8.0	0.44%	4.8	0.27%	-34.5	-1.92%
Corn	-236.0	-1.61%	-261.0	-1.78%	-567.2	-3.86%
Soybeans	95.9	0.44%	61.4	0.28%	-365.1	-1.67%
Rice	8.5	0.29%	3.3	0.11%	-61.5	-2.05%

# Petroleum from \$125 to \$160: Effects on market prices



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# What to conclude about indirect effects on land use?

Land allocation responsiveness critically important, but so are other assumptions.

- Ethanol market effects?
- Commodity market interactions?

Complicated interaction of ethanol market, commodity market, and land use effects.

- Larger price effects consistent with inelastic markets → small land use effects or small consumption effects.
  - Smaller price effects consistent with elastic markets → larger land use or consumption effects.
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# For more information

- For more on the FAPRI-MU US stochastic baseline and biofuel policy analysis work, go to
    - <http://www.fapri.missouri.edu/>.
  - For FAPRI US and world baseline and analysis, go to
    - <http://www.fapri.missouri.edu/> or <http://www.fapri.iastate.edu>.
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