U.S. Climate Policy and Agricultural Trade

MARSHALL WISE, HAEWON MCJEON, AND LEON CLARKE

Joint GCAM Community Modeling Meeting and GTSP Technical Workshop
Joint Global Change Research Institute
College Park, Maryland, USA

September 19, 2012
Background: Everything is Connected

- Biomass is potentially an important contributor to U.S. climate mitigation efforts.
- Biomass competes with other uses of land.
  - It competes with other crops (with a caveat regarding efforts to only grow bioenergy on marginal lands)
  - Expansion of crop land may result in land use change emissions.
- Agricultural products are heavily and readily traded.

- How might U.S. climate policy influence trade in biomass?
- How might U.S. climate policy influence trade in other agricultural goods?
- How might efforts to reduce biomass imports or protect forests influence trade in other agricultural products?

- We have intuition about the answers to these questions. How does this intuition hold up?
This analysis is based on EMF 24

<table>
<thead>
<tr>
<th>Technology Dimension</th>
<th>High (Default)</th>
<th>Single Technology Sensitivities</th>
<th>Combined Sensitivities</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Use Technology</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>CCS</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Nuclear energy</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Wind &amp; Solar</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Bioenergy</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cap &amp; Trade 50%</td>
<td>US06F</td>
<td>US05F</td>
<td>US08F</td>
<td>US07F</td>
<td>US10F</td>
<td>US09F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap &amp; Trade 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap &amp; Trade 20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap &amp; Trade 30%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap &amp; Trade 40%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap &amp; Trade 60%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap &amp; Trade 70%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cap &amp; Trade 80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND**
- **Required Common Scenarios**
- **Required Policy Scenarios**
- **Required Technology Scenarios**
- **Optional Scenarios**
Scenarios: Building on EMF 24

- **Baseline:**
  - LowTech - all low tech (US23F)
  - BioRE - advanced bioenergy and renewables (US01G)
  - NucCCS - advanced nuclear and CCS (US21F)
  - Adv - all advanced supply tech (US15F)
  - AdvEE - all advanced supply tech and high end-use efficiency (US13F)

- **Emission constraints:** (indexed to 2005)
  - Unconstrained (baseline)
  - USA 50% abatement by 2050
  - USA 80% abatement by 2050

- The rest of the world takes on a “muddling through” policy in which the more developed countries reduce emissions by 50% by 2050, and less ambitious actions take place in some other countries, and no reductions in some fossil exporting countries.
  - This holds even under no climate action scenarios in the U.S.

- **Other Constraints**
  - Trade: free trade of biomass, no constraints
  - Restrict: trade restriction on biomass
  - Restrict-Protect: USA 90% forest protection, bio trade restriction
  - Restrict-Global Protect: Global 90% forest protection, bio trade restriction
Without climate policy, the U.S. exports biomass in 2050.
The U.S. imports biomass when nuclear and CCS are not available.
At 80% reduction, the U.S. imports biomass in all technology scenarios.

This depends to a large degree on what is happening elsewhere in the world.
Without climate policy, the U.S. remains a corn exporter.
Corn exports decrease with 50% mitigation.
The U.S. remains a corn exporter in the 80% reduction scenario.
The effect on land use is consistent with intuition. Increasing stringency leads to more land dedicated to biomass and less land dedicated to other crops or unmanaged lands.
80% Abatement with Advanced Technology Scenario Focus
Explore the Case of 80% Emissions Reductions and all Advanced Technology

This scenario is not the most extreme of the 80% scenarios in terms of biomass imports.
Scenarios

▸ Baseline:
  - LowTech - all low tech (US23F)
  - BioRE - advanced bioenergy and renewables (US01G)
  - NucCCS - advanced nuclear and CCS (US21F)
  - Adv - all advanced supply tech (US15F)
  - AdvEE - all advanced supply tech and high end-use efficiency (US13F)

▸ Emission constraints: (indexed to 2005)
  - Unconstrained (baseline)
  - USA 50% abatement by 2050
  - USA 80% abatement by 2050

▸ Other Constraints
  - Trade: free trade of biomass, no constraints
  - Restrict: the U.S. does not import biomass
  - Restrict-Protect: USA 90% forest protection, bio trade restriction
  - Restrict-Global Protect: Global 90% forest protection, bio trade restriction
Biomass import: USA 2050

Protecting forests alters biomass trade consistent with intuition.

Restricting imports increases domestic production.

- Import
- Export
- Municipal waste
- Residue biomass
- Purpose grown
Agricultural Commodity Prices: USA 2050

Restricting trade leads to a difference between U.S. and global biomass prices.

Protecting forests increases the prices of all crops.

RestricCng	
  trade	 leads to a
difference between U.S. and
global biomass prices.

Bounding box:
- bounding_box: (110, 415, 708, 605)
- bounding_box: (490, 376, 888, 566)
- bounding_box: (128, 372, 426, 562)

Price Change from 2005

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>RoW</th>
<th>USA</th>
<th>RoW</th>
<th>USA</th>
<th>RoW</th>
<th>USA</th>
<th>RoW</th>
<th>USA</th>
<th>RoW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OilCrop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- trade- not protect
- trade- USA protect
- trade- Global protect
- restrict- not protect
- restrict- USA protect
- restrict- Global protect
Without restrictions on trade, the U.S. is a corn importer.

Restricting trade turns the U.S. into a corn importer.

Protecting forests increases U.S. corn imports.
Protection increases U.S. forest at the expense of other uses of land.

Trade restrictions increase U.S. biomass production at the expense of other uses.
Crop Production USA 2050

Mt

2005 | not protect | USA protect | Global protect | not protect | USA protect | Global protect

- Wheat
- SugarCrop
- Root_Tuber
- Rice
- PalmFruit
- OtherGrain
- OilCrop
- MiscCrop
- FodderHerb
- FodderGrass
- FiberCrop
- Corn

Mt

Delta

USA Forest Protection Effect
RoW Forest Protection Effect
Trade Restriction Effect
USA Forest Protection Effect
RoW Forest Protection Effect

Crop Production USA 2050
Summary: our results largely confirm Intuition, but the devil is in the details

- How might U.S. climate policy influence trade in biomass?
  - U.S. climate policy will increase the demand for biomass in the U.S.
  - All other things being equal, this should increase biomass imports or decrease biomass exports.
  - The precise magnitude depends on a range of factors, including international climate policies.

- How might U.S. climate policy influence trade in other agricultural goods.
  - In general, there will be an effect on other agricultural commodities because U.S. land for biomass will increase, which will reduce exports or lead to imports.

- How might efforts to reduce biomass imports or protect forests influence trade in other agricultural products.
  - When we limit trade on biomass, there is an increase in domestic biomass production which will decrease exports and increase imports.
  - The influence of forest protection really depends on where and how it is applied.

- What about growing biomass only on marginal lands?
The End