Using Recent Land Use Changes to Validate Land Use Change Models

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Unique Opportunity to Estimate Ag Supply Response

• Largest sustained increased in agricultural production in the last 60 years

• Next chart:

  % change in current price compared to lagged five year average price
Change in Harvested Land: 2011-13 from 2004-06.
World change = 97 m. ha. (7.8%)
What’s Happened to US Cropland Since 2006?

• Three measures:
  – Harvested land
    • double counts doubled cropped acreage, does not count fallow land, does not count planted but harvested acres
  – Planted land
    • double counts double cropped acres, does not count fallow land
  – US Cropland
    • adds fallow land, subtracts doubled cropped acres
US Cropland Changes since 2004

- Harvested
- Planted
- Cropland

Graph showing million hectares of cropland for harvested, planted, and total cropland from 2004 to 2014.
Percent Change in Cropland

Harvested

Planted

Cropland

Implies an elasticity of land use between 0.01 and 0.04.
Million Hectares

Total Planted Land in India
Total Planted and Multiple Crop Area in India

- **Planted**
- **Double Cropped**
Cropland Area in India since 2004

million ha

Brazil Harvested Land Since 2004

Million Hectares

Brazilian Intensive and Extensive Land Use Change since 2004

[Graph showing the change in million hectares of extensive and intensive land use from 2005 to 2013. The graph indicates a steady increase in extensive land use and a mixed trend for intensive land use.]
Change in Indonesia Harvested Area by Crop as Reported by FAO: 2004-2006 vs 2011-2013

- Cassava
- Coffee
- All other crops
- Coconuts
- Corn
- Rubber
- Cocoa beans
- Rice
- Palm oil fruit

Million Hectares

-0.5 0 0.5 1 1.5 2 2.5 3
Change in Arable Land Plus Permanent Crops: 2004-2006 to 2011-2013

Global Net Change=33.5 m. ha
Observations

• Other than in African countries, extensive land use has totaled a net of 10 million ha

• Countries with extensive land use increases include
  – Argentina: (lost wheat land needed for double cropped soybeans)
  – Indonesia and Malaysia (palm oil plantations)
  – Other SE Asia (Vietnam, Thailand)
  – Other S. America (Uruguay and Paraguay soybeans)
  – Brazil (soybeans outstripping double cropped corn)

• All these countries have agricultural frontiers
Observations

• Countries that expanded at the extensive margin have land available to expand.

• Countries with low agricultural productivity and rapidly expanding populations (and income?) expand at the extensive margin.

• Countries with fully developed agricultural sectors expand at the intensive margin.

• Countries with messed up ag policies (Argentina) expand at the extensive margins.
Implications

• Total factor productivity a much better measure of productivity than yield changes
• Past models of land use changes have over-estimated land use changes relative to what they would have done had they included land use intensification
• Observed land use changes place limits on the impact of higher prices on land use change
  – Countries that contracted would have contracted more
  – Countries that expanded would have expanded less or not at all
  – Countries that had not changes would have contracted
• Importance of government land use policy cannot be over-estimated