Draft Work Plan for Elasticity Values Workgroup

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Task 1.

- Translate GTAP constant elasticity of land transformation into own and cross price supply elasticities and calculate implied elasticities for important AEZ's (U.S. and Brazil at a minimum).

- Why?
  - Need to interpret GTAP elasticities into elasticities that people can interpret for comparison purposes

CET Supply Function

$$Q_{land} = \alpha \left[\sum_{i=p,f,c} \beta_i Q_i^{\rho} \right]^{1/\rho}$$

Elasticity of land transformation

$$\sigma = \frac{1}{1-\rho} < 0$$

Convert to Price Elasticity

Cross price elasticities of land use

$\varepsilon_{forest,crop} \equiv$ % change in forest land due to a 1% change in crop returns

$\varepsilon_{pasture,crop} \equiv$ % change in pasture land due to a 1% change in crop returns

$\varepsilon_{pasture,forest} \equiv$ % change in pasture land due to a 1% change in pasture returns

$$\varepsilon_{forest,crop} = \theta_{crop}\sigma \qquad \varepsilon_{pasture,crop} = \theta_{crop}\sigma \qquad \varepsilon_{pasture,forest} = \theta_{forest}\sigma$$

$\theta_i =$ share of revenue from land use i

Convert to Price Elasticity

Own price elasticities of land use

$\varepsilon_{crop,crop} \equiv$ % change in crop land due to a 1% change in crop returns

$\varepsilon_{pasture,pasture} \equiv$ % change in pasture land due to a 1% change in pasture returns

$\varepsilon_{forest,forest} \equiv$ % change in pasture land due to a 1% change in forest returns

$$\varepsilon_{crop,crop} = -(\varepsilon_{crop,pasture} + \varepsilon_{crop,forest}) = -\sigma(1-\theta_{crop})$$

$$\varepsilon_{pasture,pasture} = -\sigma(1-\theta_{pasture})$$

$$\varepsilon_{forest,forest} = -\sigma(1-\theta_{forest})$$

First Task

- GTAP database as revenue shares for each AEZ
- Revenue shares and constant elasticity of transformation define all own and cross price elasticities for all AEZ's
- Need to calculate them to allow a comparison
- For example in the U.S. with CET = -0.2:

$\varepsilon_{crop,crop} = 0.05$ $\quad \varepsilon_{pasture,pasture} = 0.18$ $\quad \varepsilon_{forest,forest} = 0.18$

$\varepsilon_{pasture,crop} = -0.15$ $\quad \varepsilon_{forest,crop} = -0.15$ $\quad \varepsilon_{forest,pasture} = -0.0195$

Second Task

- Determine “reasonable” estimates of own and cross price elasticities
  - Look at published sources (eg, Lubowski et al)
  - Use introspection for different types of AEZ’s (what makes sense)
  - Obtain a range of acceptable values by

Third Task

- Compare range of acceptable values to actual values used in GTAP
- How well do they match up for different time dimensions?
  - If they do not match up, figure out if a better calibration can be done
  - If a better calibration cannot be done (too few parameters) can GTAP be reparameterized?

Fourth Task

- Develop procedures and estimate the ratio of the productivity of new land to old land (CARB's elasticity of crop yields with respect to area expansion)
  - Do Brazil and the U.S. (at a minimum)

Fifth Task

- Develop a procedure to allow for increased pasture intensification as pasture returns increase
- Determine if there is data to use to estimate the extent to which intensification actually occurs
  - Brazil and Argentina

Sixth Task

- Rerun GTAP for all biofuels with the same (updated) set of elasticities for all biofuels pathways