An Improved World Fertilizer Markets Model

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Overview

• Fertilizer model upgrades
  – Supply Side
  – Fertilizer Prices
  – Demand Side

• Scenario Analysis
So far, the WorldNPK model assumes a horizontal supply
   - Implies no change in fertilizer prices as demand changes

Introduce an world upward sloping supply curve
Upgrades – Fertilizer Supply

• Supply curve
  – Short run: capacity constrained (less elastic)
  – Long run: capacity building (more elastic)

• Challenging: some fertilizer products are feedstocks of other (& self) industries. Must be taken into account
Upgrades – Fertilizer Supply

• Two main implications
• Fertilizer prices will adjust to demand changes
  – Nutrient price projections at the country level
  – Improved assessment of the cost of production in each crop yield equation
• Interaction with the FAPRI model
  – Each iteration of the FAPRI model will require a “pass” through the WorldNPK model
  – Changes in fertilizer prices update each run of the FAPRI model
Upgrades – Fertilizer Supply

• Data requirements:
• Production of fertilizer (IFA data)
  – By N, P & K products
  – By country
• Production capacity of fertilizer (IFA data)
  – Surveys on existing capacities
  – Surveys on projected capacity building
  – By nutrient & by major producing countries
  – 5 years observed, 5 projected (2006 – 2015)
• Fertilizer prices
Upgrades – Fertilizer Supply

IFA data on Production Capacity

– Nitrogen products
  • Ammonia 2006 – 2015
  • Urea 2006 – 2015
  • Urea Ammonium Nitrate 2006 – 2015
  • Ammonium Nitrate 2004 – 2013

– Phosphorous products
  • Processed Phosphates 2007 – 2015
  • Single Superphosphate 2004 – 2012

– Potassium products
  • Potash 2007 – 2014
Upgrades – Fertilizer Prices

• Model requires nutrient-specific prices per country at the farm level
  – So far, price transmission equation based on world fertilizer price (U.S. farm-level prices)

• Proposal: improve data on fertilizer prices
  – Data collection on domestic prices
    • China, India, U.S., Brazil, EU-27 (73% of World’s use)
    • Top 23 countries (92% of World’s use)
    • No other country alone consumes more than 2.3% of World’s use
  – If price not available, use the price transmission equation
Upgrades – Fertilizer Demand

Production elasticities revisited

- Yield response to N, P, & K application rates

\[ y_{ij} = F_j(N_{ij}, P_{ij}, K_{ij}, S_{ij}; \theta) \]

- \( S_{ij} \): Suitability of country \( i \) to produce crop \( j \)
- Suitability index (% achievable of potential yields)
- AEZ - Global Agro-Ecological Zones (FAO & IIASA data)
- Available by crop & by country

- Change crop’s production function \( (F_j) \) to CES
  (with low elasticity of substitution) to better describe nutrient’s relationship
Scenario Analysis

• As suggested by BIC