An Improved World Fertilizer Markets Model Project Update

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Overview

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

Production elasticities revisited

– Yield of crop $j$ in country $i$, a function of:
  • $N_{ij}, P_{ij}, K_{ij}$: Fertilizer application rate
  • $S_i$: country-$i$ soil/terrain/climatic constraints to agricultural production. Based on Global Agro-Ecological Zones (FAO & IIASA data)
  • $GC_i$: Agricultural Gross Capital (FAO data)
  • Interaction terms

– Allows us to have some countries more responsive to N, P, & K rates than others.
Upgrades – Fertilizer Demand

– Model estimation:
  • Cross-section of countries for each crop
  • All required data already collected
  • Elasticity estimates for all countries and all crops
  • Straightforward implementation in FAPRI model
Upgrades – Fertilizer Demand

Corn Production Function (selected countries)

- United States of America
- Pakistan
- Australia
- India

Nitrogen Rate (kg/ha)

Corn Yields (metric tons/ha)
Upgrades – Fertilizer Prices

• Model requires nutrient-specific prices per country at the farm level
• Collected domestic prices for China, India, U.S., Brazil, EU-27 (73% of World’s use)
• Price transmission equation for rest
Upgrades – Fertilizer Prices

Source: USDA-ERS
Upgrades – Fertilizer Prices

Brazil: UREA farm-level price

Source: Conab-Brazil
Upgrades – Fertilizer Prices

India: Fertilizer farm-level prices

Source: Fertilizer Association of India
Upgrades – Fertilizer Prices

• U.S.
• India:
  – farm-level prices subsidized by Government
  – Cannot update with international fertilizer prices
  – Further research (other sources give different prices)
• Brazil:
  – Model is at regional level
  – Regional differences in fertilizer prices
• China and EU-27
Upgrades – Fertilizer Supply

• So far, the WorldNPK model assumes a horizontal supply
  – Implies no change in fertilizer prices as demand changes
• Introduce an world upward slopping supply curve
Upgrades – Fertilizer Supply

Source: IFDC
Upgrades – Fertilizer Supply

• Option -> time series (Interested in fertilizer market cleared at the World level)

• World production of fertilizer (IFA data)
  – By N, P & K products

• World production capacity of fertilizer (IFA)
  – Surveys on existing capacities
  – By nutrient

• Natural gas prices or other relevant input
Upgrades – Fertilizer Supply

• Importance of including industry capacity
• Industry has been operating at high levels of capacity utilization
• One of their main arguments for fertilizer prices spikes
Upgrades – Fertilizer Supply

• Importance of including capacity

Source: IFA, IFDC
Upgrades – Fertilizer Supply

Urea: Nominal Price Index vs. Production (1973-2011)
Upgrades – Fertilizer Supply

Urea: Nominal Price Index vs. Capacity Utilization
Upgrades – Fertilizer Supply

• World UREA supply and demand system
• Two-stage least square and IV estimation
• Model 1:
  • Supply: Urea prices on
    – Quantity produced (and Quantity squared)
    – Natural Gas price
  • Preliminary long-run price elasticity of supply = 0.45
• Model 2:
  • Supply: Urea prices on
    – Capacity Utilization (and Capacity Utilization squared)
    – Natural Gas price
  • Preliminary long-run price elasticity of supply = 1.09
Bonus Track

- FIS fertilizer prices forward curves
- As per July 25th 2011
Upgrades – Other Slides
Upgrades – Fertilizer Supply

• Data requirements:
• Production of fertilizer (IFA panel data)
  – 2006 – 2009
  – By N, P & K products
  – By country
• Production capacity of fertilizer (IFA data)
  – Surveys on existing capacities
  – By nutrient & by major producing countries
  – 5 years observed (2006 – 2011)
• Fertilizer prices
  – Problem: prices highly correlated. Not much information added with cross-section of countries