An Improved World Fertilizer Markets Model Project Update

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Overview

• Fertilizer model upgrades
  – Demand Side
  – Fertilizer Prices
  – Supply Side
The World Fertilizer Model

Fully interacts with the FAPRI model

Projects fertilizer demand
- By nutrient (N, P, K)
- By country
- By crop
- By year

Projects fertilizer application rates
- Same coverage

Projects world equilibrium fertilizer prices
- By nutrient
- By year
- Through adding a supply function
- Funded by BIC
Production elasticities revisited

- Some countries more responsive to N, P, K application rates than others.

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

- U.S.
- Pakistan
- India
- Russia
- World

Corn Yield (MT/ha) vs. Nitrogen (kg/ha)
Upgrades – Fertilizer Demand

Graph showing the relationship between P+K (kg/ha) and corn yield (MT/ha) for different countries:
- U.S.
- Pakistan
- India
- Russia
- World
Upgrades – Fertilizer Demand

![Graph showing the relationship between nitrogen (kg/ha) and wheat yield (MT/ha) for different countries including Australia, U.S., Pakistan, Brazil, India, Russia, and World.](image-url)
Upgrades – Fertilizer Demand

![Graph showing the relationship between Potash (kg/ha) and Wheat Yield (MT/ha) for different countries: U.S., Pakistan, Brazil, India, Russia, and World.](image-url)
Upgrades – Fertilizer Demand

![Graph showing rice yield vs. nitrogen demand for different countries and the world. The x-axis represents nitrogen (kg/ha) ranging from 30 to 250, and the y-axis represents rice yield (MT/ha) ranging from 0 to 6. The graph compares China, India, Bangladesh, Indonesia, Thailand, Vietnam, and the world. The lines show an upward trend as nitrogen increases.]
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)
  - U.S., Brazil
  - India
  - China
  - EU-27
- Other countries, price transmission equation
Phosphate Prices - India

Source: Fertilizer Association of India
Fertilizer Prices - China

China Fertilizer Price Index

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<th>Coefficient</th>
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Source: China National Bureau of Statistics
Upgrades – Fertilizer Supply

- Introduce upward sloping world supply curve
- Equilibrium fertilizer price (Demand=Supply)
  - World price
  - By nutrient (N, P, K)

![Graph showing world demand and supply curves with equilibrium price and quantity.](image-url)
Upgrades – Fertilizer Supply

Source: IFDC
Upgrades – Fertilizer Supply

• World UREA supply and demand system
• Two-stage least square and IV estimation
• Model:
  – Long-run Supply: Urea prices function of
    – Capacity Utilization
    – Natural Gas price
    – Instruments: prices of corn and other commodities
    – Long-run price elasticity of supply = 1.23
  – Short-run Supply: Based on price spikes
    – As approaches to industry’s capacity
    – Short-run price elasticity of supply = 8.03
Upgrades – Fertilizer Supply

• Implementation in fertilizer model
  – Nitrogen example

• Objective:
  – Solve for world equilibrium price of N

• Equilibrium price arguments in year t
  • Natural gas price
  • Nitrogen quantity demanded
  • Industry capacity
  – All projected within model
Projection of fertilizer demand

- Projected within the model
  - Fertilizer Rates x Harvested Areas
  - By nutrient
  - By country
  - Aggregation across countries: world demand
Upgrades – Fertilizer Supply

• Importance of including capacity

Source: IFA, IFDC
Upgrades – Fertilizer Supply

• Projection of industry capacity
  – Subsequent 5 years - data on surveys
  – After that --> projection
    • At the world level
    • By nutrient

• Probability of building capacity; function of
  – Expected net return
  – Expected interest rate
  – Trend
  – Logistic regression
Bonus Track

- Fertilizer Forward Curves
- As per April 16\textsuperscript{th} 2012

Source: FIS and LCH.CLEARNET
THANK YOU!

QUESTIONS/COMMENTS?