



Global Trade Analysis Project

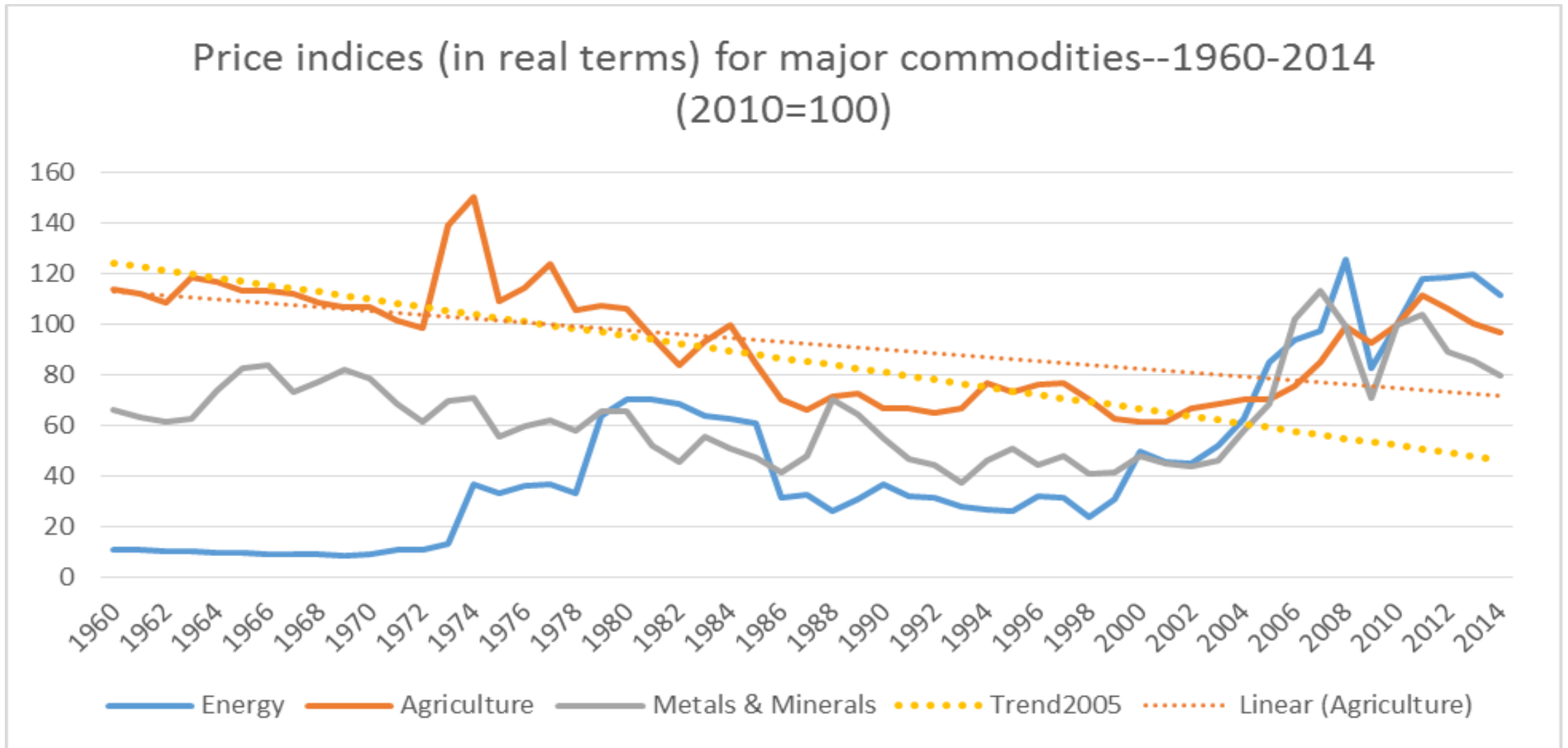


Global Economic Models: Up- and Down-stream Linkages

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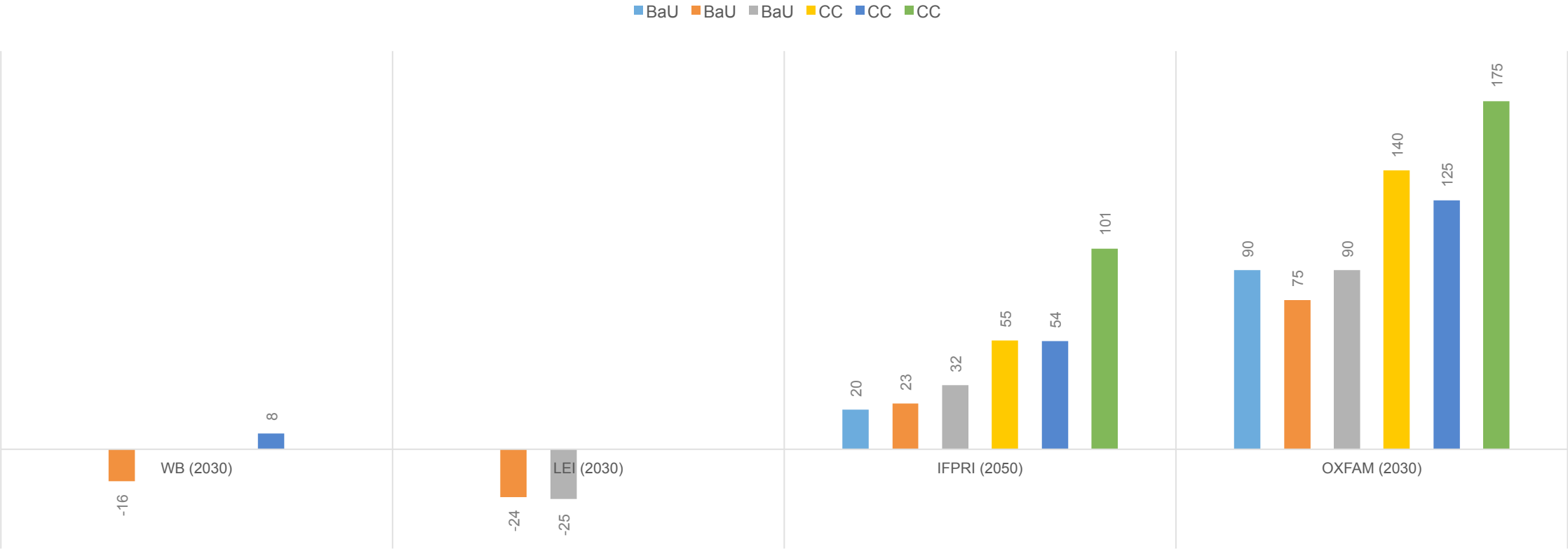
Past prologue to the future?



Source: World Bank Pink Sheet (accessed 8-Sep-2015)

Can we reconcile these differences?

WORLD PRICE PROJECTIONS AROUND 2010



Notes: WB (GEP 2009, all agriculture), LEI (Prins et al 2011) wheat represents temperate cereals, IFPRI (Nelson et al. 2010), Oxfam (Willenbockel 2011).

Key questions

- **How will production and demand evolve over time?**
 - How will this impact relative prices?
 - How will this impact trade/food self-sufficiency?
- **What will be the evolution of the rural economy?**
 - Historically strong pattern of rapid rural to urban migration?
 - How will this effect food security?
- **How will climate change affect agricultural production?**
 - Impacts on prices, trade and food security
 - What does this imply for adaptation—autonomous and investment?

Partial equilibrium (PE)	General Equilibrium (GE)
1) Statistical—reduced form or 2) Optimization to minimize costs across production systems	Deeply structural—explicit modeling of production (labor, capital, land, material inputs, energy, water)
Multi-market equilibrium model (supply=demand)	Based on micro-economic theory (producers minimize costs, consumers maximize welfare)
Generally focused on a set of sub-sectors (e.g. agriculture). Non-ag prices are exogenous (e.g. fert.)	Economy-wide—factor markets, non-agricultural markets. Closure matters (e.g. BoP constraint).
Homogeneous goods trade model	Goods differentiated by region of origin (Armington)
Typically country-based with FAO as source of base data. Many are now hybrid models with sub-national production units (FPUs, grid cells).	Aggregate regions—20-30. GTAP is main source of data (140 possible regions).
Can have significant commodity detail (limited by FAO data)	Largely limited to GTAP's definitions (8 crops, 4 livestock and 8 processed foods)
More direct evaluation of nutritional outcomes	

Challenges

- **Dynamics**
 - Drivers—exogenous
 - Technology—exogenous, sensitive to prices, R&D, pace of change, are there limits?
 - Preferences—diets, energy, etc.
 - Policy reactions, e.g. Russia, India
 - New technologies—GMO, renewables, bio-energy, CCS, etc.
- **Volatility, decision making under uncertainty**

Climate

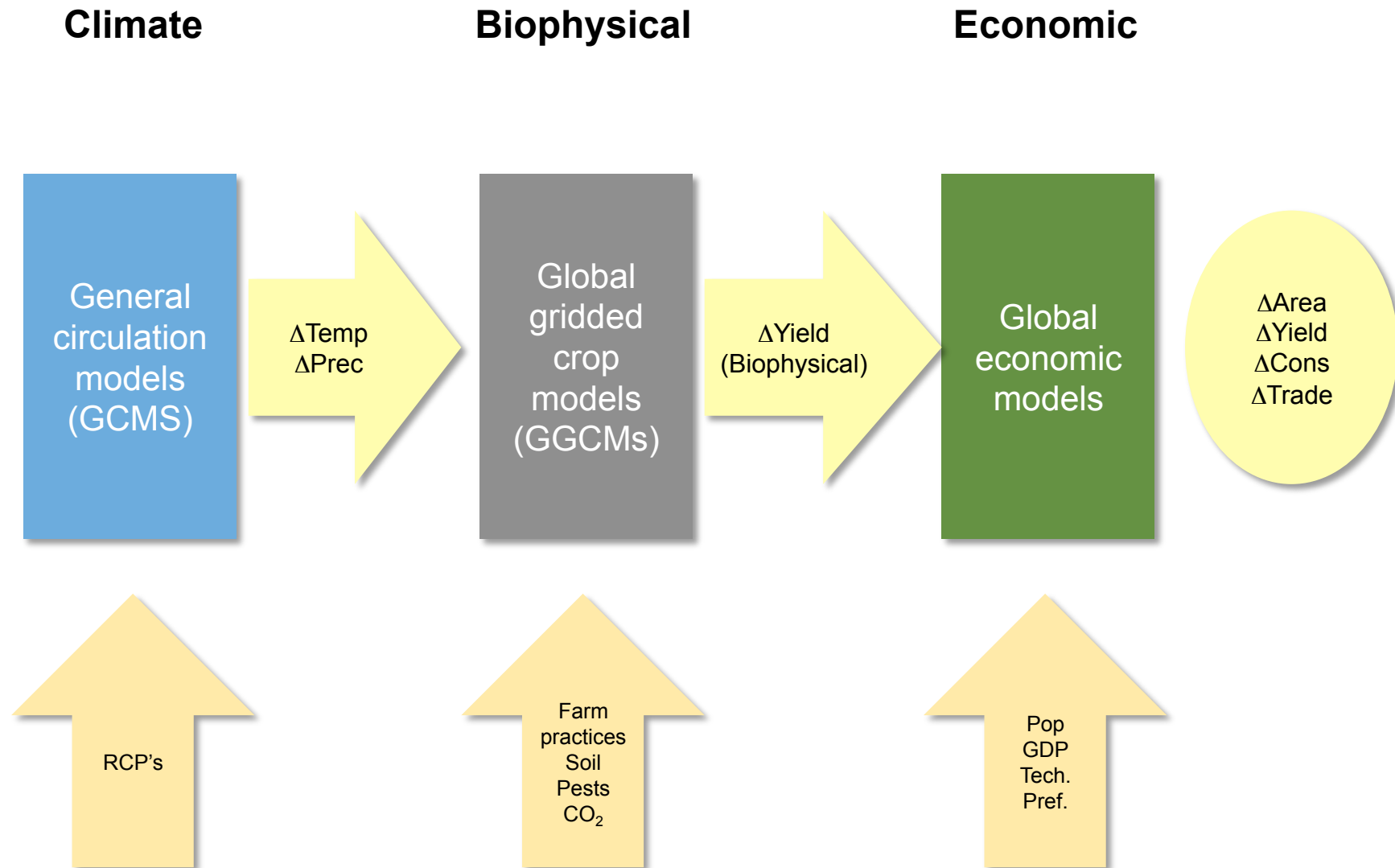
- **Impact**

- Typically exogenous (upstream)
- Some models have climate reaction curves (DICE, PAGE, Envisage)
 - Yields, water, sea-level rise, health/mortality, labor productivity, energy demand, tourism

- **Adaptation**

- Autonomous—crop switching, input substitution, factor supply (land, labor, capital, water), potentially efficiency price driven (e.g. water)
- Not process models—intra-seasonal effects not captured

The climate modeling chain: from biophysical to socioeconomic



Upstream

- **Agricultural impacts**
 - Emulator (GCM x GGCM)
 - Database (GCM x GGCM)
 - Livestock/forestry/grasslands

Downstream

- **Production, demand, trade, prices**
 - By region and by commodity
 - Some models can also report input prices (land, labor, fertilizers, energy)
- **Land use**
 - Some models can also produce emission levels
- **Challenges**
 - No harmonization on countries/regions, and sectors
 - Definitions (e.g. what is the 'world' price?)
 - Indices vs. quantities
 - Downscaling