POLYSYS Overview

Chad Hellwinckel
University of Tennessee
Knoxville

POLYSYS

- Partial equilibrium model of the agricultural sector of US
  - 8 major crops covering 88% of US cropland
  - 4 livestock commodities – beef, pork, chicken, turkeys
- A simulation model (not a projection model)
  - We use USDA annual baseline projections as the baseline on POLYSYS
  - We ‘shock’ this baseline and allow a new equilibrium to be found
- Solves annually for up to 50 years in future

POLYSYS

- 2 main parts to model
  - Supply side:
    - Each county has a linear programming model that solves for competing land uses
    - Profitability determined by - previous year crop prices and crop costs of production
  - Demand side:
    - National supply of commodities is parceled to demand sectors via elasticities
      - Demand sectors include; food, feed, industrial, export demands
    - Prices and demands are determined through simultaneous solving of demand side equations
      - i.e. If supply is constrained, prices will increase, if supply is plentiful, prices will increase

POLYSYS

- Annual Output includes
  - Crop and livestock prices, production, exports, food, feed, and industrial use, government payments, net farm income
  - landuse at county level
- ‘Shock’ variables include
  - Yields, government payments, incentives, costs of production, prices, demand levels

Also in POLYSYS

- Biomass feedstocks
  - Switchgrass, miscanthus, poplars, and willows, are included in model and can compete for landuse with other crops
  - Crop residues
  - Forest biomass
- Carbon accounting
  - Emissions from management practices are included
    - Direct on-farm emissions (CO2 and N20)
    - Indirect emissions from production of inputs
  - Soil carbon changes

Also

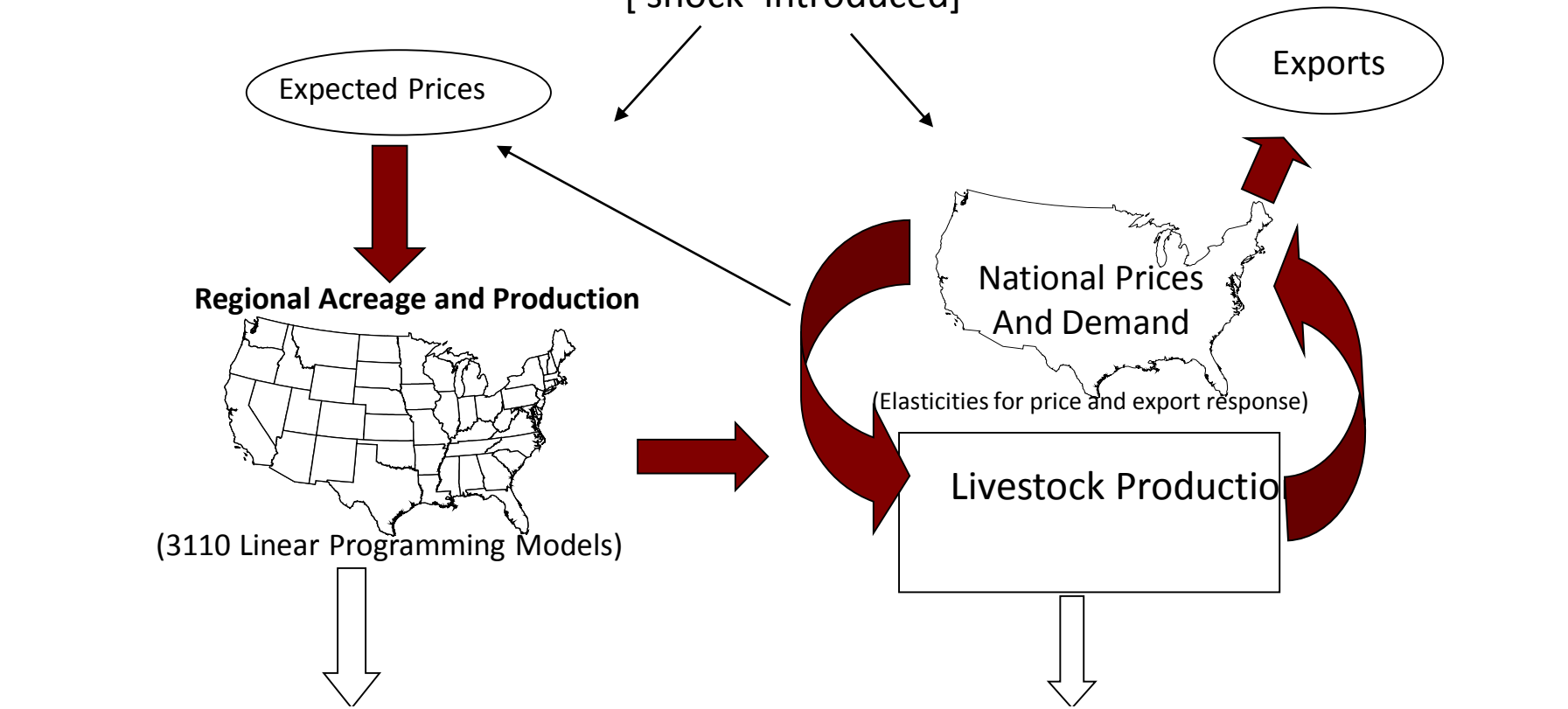
- POLYSYS can be run stochastically
  - In a given scenario, the model is run 100 times
    - Each run is shocked by selecting a set of crop yield deviations from the mean
    - Deviations are from historical data on annual crop yields
  - Stochastic runs give a distribution around the mean for all output variables

Flow of model

Start with USDA Baseline

USDA Basline Corn	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Planted acres (Mil)	80.90	81.60	80.50	81.00	82.00	84.00	84.50	85.00	85.00	85.00	84.50	84.50
Harvested acres	73.60	74.30	73.20	73.70	74.70	76.70	77.20	77.70	77.70	77.70	77.20	77.20
Yield/harvested acre	160.40	148.40	147.70	149.50	151.30	153.10	154.90	156.70	158.50	160.30	162.10	163.90
Exports	1,814	2,000	2,100	2,025	2,075	2,100	2,125	2,175	2,225	2,275	2,325	2,375
Farm price	2.06	1.80	2.00	2.20	2.45	2.55	2.60	2.60	2.60	2.55	2.60	2.60
Net returns (per ac)	197.05	135.40	124.44	125.37	164.79	182.16	192.15	194.51	197.01	191.54	202.15	204.73

['shock' introduced]



POLYSYS Regional Output

Annual acreage, production, government payments, income

POLYSYS National Output

Annual Prices, production, government payments, exports, income.

Flow of model (in one year)