Is Yield Endogenous to Price?
An Empirical Evaluation of Inter- and Intra-Seasonal Corn Yield Response

Barry K. Goodwin*, Michele Marra*, Nicholas Piggott* and Steffen Mueller**
*North Carolina State University **University of Illinois at Chicago

Yield-price elasticity, the extent to which yield changes occur in response to price, is one of the key variables influencing the results of computed equilibrium models and optimized agricultural models which are used to predict land use change from biofuels production. For example, a yield-price elasticity of 0.25 would indicate that a 10% increase in price would result in a 2.5% increase in yield. Computed equilibrium models used to assess land use change from biofuels production are quite sensitive to the variation of this parameter. For example, recent sensitivity analyses performed with Purdue's Global Trade Analysis Project (GTAP) model show a 34% increase in land demand when the yield-price elasticity ratio was reduced to 0.1 from 0.25 (Source: Taheripour to CARB 11/14/11).

The present study assesses two dimensions of yield-price elasticity: first, the extent to which realized yields (i.e. at harvest) tend to be influenced by planting-time quotes of post-harvest futures contracts (by considering the daily close of the post-harvest contracts during the pre-planting month of February), and second, the potential for intra-seasonal responsiveness of yields to significant price swings (by considering the ratio of the daily close prices for the post-harvest futures contracts during the months of April and February, respectively). A total of six different models were considered consisting of standard Ordinary Least Squares (OLS) models as well as Generalized Additive Models (GAM) with different treatments of price assumptions.

Specification	Inter-Seasonal Elasticity	Intra-Seasonal Elasticity
Model 1: OLS With Real Prices	0.2499	0.0085
Model 2: OLS With Price Ratio	0.2732	0.0087
Model 3: GAM With Price Ratio	0.1906	0.0074
Model 4: Illinois (GAM With Price Ratio)	0.4253	0.0108
Model 5: Indiana (GAM With Price Ratio)	0.1512	0.0098
Model 6: Iowa (GAM With Price Ratio)	0.2830	0.0061

Management Decision	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Herbicide/fungicide purchasing decision					↔	↔						
Nitrogen application (including nitrification inhibitors)							↔	↔				
Sidedressing; herbicide/fungicide application									↔	↔		
Replanting Decision											↔	↔
Lock in fertilizer for next year, lock in hybrid											↔	↔
Seed selection for next year; take soil samples	↔	↔										
Putting on anhydrous, tillage, fertilizer application			↔	↔								
Equipment Upgrades	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Grain marketing decisions	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Longer Term, Multi-Year Decisions												
New Combines	Every 2-3 years											
New Tractor	Every 5-10 Years											
New Irrigation System Purchase	Several Years											

The aggregate models suggest an inter-seasonal yield-price elasticity of about 0.15 to 0.43. The 0.25 estimate currently used in the GTAP modeling framework is at the lower bound of this range. Of great interest is the effect of intra-season price movements on yield (the impact between February and April in a new crop year). The results suggest that a small but statistically significant response of yield occurs when prices strengthen or fall early in the growing season.

These results are consistent with focus group discussions that suggest the potential for intra-seasonal adjustments that would increase realized yields. More specifically, the focus group with several Iowa corn growers revealed that farm management practices such as seeding rates, farm equipment upgrades, field inputs (including side-dressing and the application of nitrification inhibitors) may be influenced by early price swings. In contrast, other management adjustments including hybrid selection, investment in irrigation and purchase of combines and tractors occur on a multi-year time frame.

A more detailed report on this research is made available through http://ageconsearch.umn.edu.

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