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A Global Analysis of Crop Supply Response to Domestic Prices

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Introduction

- Several recent studies have estimated global supply response for major crops using international futures price as the measure of price (e.g., Roberts and Schlenker 2013; Hendricks, Janzen, and Smith 2015; Haile, Kalkuhl, and von Braun 2016)
- However, the international futures price may be a poor indicator of the price that farmers in a specific country expect to receive (Haile, Kalkuhl, and von Braun 2016)
- Many countries seek to stabilize domestic prices by changing trade distortions as international prices change
- This implies that estimates of the supply elasticity with the international price are likely to underestimate the true supply response

Research Objectives

- Determine if using international futures versus domestic prices underestimates supply response.
- Implement a new IV approach to resolve the endogeneity of domestic prices.

Econometric Model

We propose a new two-stage least squares (2SLS) framework to estimate the impact of domestic prices on production. Our second stage regression is

$$(1) y_{it} = \alpha_i + \beta P_{it} + f(t) + \epsilon_{it}$$

where y_{it} is growing area in country i in year t , α_i is a country fixed effect, P_{it} is the price, and $f(t)$ is a flexible time trend. We estimate regressions for aggregate area of corn, rice, soybeans, and wheat and also estimate regressions for each crop as separate regressions. Our first stage regression is

$$(2) P_{it} = \pi_i + \theta \varphi_{-i,t-1} + f(t) + \eta_{it}$$

where $\varphi_{-i,t-1}$ is the yield shock (deviation of yield from trend) for all other countries in the previous year. The validity of this instrument rests on the argument of Roberts and Schlenker (2013) that production shocks in previous periods affect the price in the current period through storage. We include the yield shock in all countries other than i as the instrument because it affects global price but is unlikely to affect growing area of country i .

Data

- Country level data on growing area of major crops (wheat, rice, maize and soybeans) are obtained from the FAO (Food and Agriculture Organization)
- Data on domestic prices are from the World Bank dataset "Estimates of Distortions to Agricultural Incentives, 1955-2011" (Anderson and Nelgen 2013)
- Data on futures prices are obtained from Quandl
- For aggregate area elasticity estimation, growing area weighted fisher index is used as price

Results

Aggregate Area Elasticity	
	Area Elasticity
Futures Price OLS	0.136*** (0.016)
Futures Price 2SLS	0.176*** (0.038)
Farm gate Price OLS	0.082*** (0.016)
Farm gate Price 2SLS	0.194*** (0.051)
Observations	956

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Own Price Supply Elasticity				
	Wheat	Maize	Soybeans	Rice
Futures Price OLS	0.098*** (0.024)	0.114*** (0.013)	0.127*** (0.033)	0.041*** (0.009)
Futures Price 2SLS	0.154*** (0.053)	0.132** (0.052)	0.112 (0.137)	-0.593 (4.226)
Farm gate Price OLS	0.071*** (0.019)	0.086*** (0.017)	0.134*** (0.033)	-0.073*** (0.02)
Farm gate Price 2SLS	0.161*** (0.054)	0.120** (0.054)	0.231* (0.134)	0.116 (0.144)
Observations	1314	1174	747	990

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results and Discussion

- Growing are response to farm gate prices is larger than to international prices
- Regression-based test of exogeneity
 - Does not reject the null hypothesis that futures price is exogenous (p=0.33). OLS estimates are consistent
 - Rejects the null hypothesis that domestic price is exogenous (p=0.02) OLS estimates are not consistent
- Endogeneity induced by anticipated production shocks is more pronounced for domestic price response than for international futures price
- The lagged yield shock in other countries has a larger impact on the supply elasticity for domestic farm gate prices rather than futures prices

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