Agricultural Marketing and Price Analysis
Lecture 8
Price linkages

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Introduction

- Horizontal price integration measures extent of price changes for a commodity spilling over on price changes for another commodity
- reason for this could be common demand shocks or common production shocks
- Cross-price substitution may smooths the the impacts of price changes by spreading them across multiple markets
- Horizontal price integration is exoected to be strong for storable commodities, e.g. corn, wheat, rice, etc.

Example

Release of an Australian crop report that reveals an unexpected decrease in forecasted wheat production is likely to cause the price of European corn to immediately increase. this increase occurs because traders will anticipate a higher wheat price, and will also anticipate that the higher wheat price will induce European farmers to shift acreage out of corn and into wheat. Traders will therefore expect a higher price of corn in the future due to the anticipated increase in demand and decrease in supply. An increase in the expected future corn price implies that more corn will be stored by European traders. The higher level of storage will reduce the current supply of corn , and this reduction will have an immediate and positive impact on the European price of corn. Substitution effects, combined with the capacity of firms to adjust inventories when relative prices change, implies that news about a future supply shock in the australian wheat market will have an immediate impact on the European price of corn.

Some measures of integration

- Correlation
- Co-integration (time series analysis)
- Copulas

Correlation table

	Corn	Wheat	Hogs	Cattle
Corn	1			
Wheat	0.493	1		
Hogs	0.082	0.068	1	
Cattle	0.043	0.076	0.160	1

Reasons for integration (or lack of)

- limited storability results in lack of integration
- weak substitution results in lack of integration
- supply response lags

Food for fuel debate

- Rising demand for ethanol and biodiesel has raised the demand for corn and soybeans
- The increase in the price of corn and soybeans has induced farmers to substitute away from other crops and toward corn and soybeans on the supply side.
- the price increase has also induced feedlots to to substitute away from corn and soybeans and toward feedgrains on the demand side.
- The combination of reduced supply and higher demand for crops other than corn and soybeans has placed upward pressure on prices for both non-processed and processed food products.

The Model

- We will assume two goods: Corn and the Other composite crop (OCC).
- C is the quantity of corn produced by the farmer.
- C_L qunatity of corn used by the feedlot sector
- C_B quantity of corn used by the biofuels sector.
- The quantity of OCC produced by the farmer is X

Adding up conditions

$$C = C_L + C_B$$

$$X = X_L + X_H$$

Farm production

The following is the production technology for the farm in implicit form:

$$f(C, X) = K$$

How much C and X can be produced with K units of capital?
Diminishing marginal productivity of farm capital implies the PPF is concave to the origin.

Feedlot production

$$g(C_L, X_L) = Q$$

Q units of livestock.
diminishing returns of livestock production to increased feed.

Aggregate willingness to pay for Corn

$M_B(C_B)$ is the aggregate willingness to pay for corn in the biofuel processing sector.
Increasing marginal cost of converting corn to ethanol implies $MB'(C_B) > 0$ and $M''(C_B) < 0$ concavity implies that $P_B(C_B) \equiv M'_B(C_B)$ is downward sloping function.

Aggregate Willingness to pay for OCC

$M_H(X_H)$ is the aggregate willingness to pay for OCC by food processors. Concavity implies $P_H(X_H) = M'_H(X_H)$ is downward sloping.

Value of livestock

$M_L(Q)$ is society's valuation of Q units of livestock.
Livestock supply is assumed to be fixed and exogenous.

Social planner's problem

$$\max_{C_L, C_B, X_H, X_L} W(C_B, X_H) = M_B(C_B) + M_H(X_H) + M_L(Q) - F_K - F_L$$

subject to

$$f(C_L + C_B, X_L + X_H) = K$$

and

$$g(C_L, X_L) = Q$$

Lagrangian

$$L(C_L, C_B, X_H, X_L) = M_B(C_B) + M_H(X_H) + M_L(Q) - F_K - F_L +$$

$$\lambda_1[K - f(C_L + C_B, X_L + X_H)] + \lambda_2[Q - g(C_L, X_L)]$$

Recall,

$$P_B(C_B) = M_B^{'}(C_B)$$
$$P_H(X_H) = M_H^{'}(X_H)$$

First-order conditions

$$\frac{\partial L}{\partial C_L} = -\lambda_1 \frac{\partial f}{\partial C} - \lambda_2 \frac{\partial g}{\partial C_L} = 0$$

$$\frac{\partial L}{\partial C_B} = P_B(C_B) - \lambda_1 \frac{\partial f}{\partial C} = 0$$

$$\frac{\partial L}{\partial X_L} = -\lambda_1 \frac{\partial f}{\partial X} - \lambda_1 \frac{\partial g}{\partial X_L} = 0$$

$$\frac{\partial L}{\partial X_H} = P_H(X_H) - \lambda_1 \frac{\partial f}{\partial X_H} = 0$$

$$f(C_L + C_B, X_L + X_H) = K$$

$$g(C_L, X_L) = 0$$

Equilibrium conditions

$$\frac{P_B(C_B)}{P_H(C_H)} = \frac{\frac{\partial f()C,X)}{\partial C}}{\frac{\partial f(C,X)}{\partial X}}$$

$$\frac{P_B(C_B)}{P_H(X_H)} = \frac{\frac{\partial g(C_L,X_L)}{\partial C_L}}{\frac{\partial g(C_L,X_L)}{\partial X_L}}$$

Graphical solution: Social planner's problem