

Spatial and Vertical Price Transmission in Meat Markets

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Overview

- ▶ I hoped to accomplish three things in this paper:
 - ▶ Briefly review the literature on price transmission (especially with regard to meat markets)
 - ▶ Review the criticisms often raised about empirical tests of price transmission, responding to some and adding a few of my own
 - ▶ Provide a brief overview of an application that illustrates recent developments in nonlinear time-series analysis
- ▶ The goal is to stimulate discussion (i.e., feel free to be critical)
- ▶ I view the main question to be
 - ▶ *What can we learn from empirical price transmission studies?*

The Existing Literature

An extensive literature has addressed price transmission in both spatial and vertical dimensions

- ▶ Several surveys:
 - ▶ Vertical price transmission issues:
 - ▶ Meyer and von Cramon-Taubadel (2004)
 - ▶ Conforti (2004)
 - ▶ Weldegebriel (2004)
 - ▶ Wohlgenant (2001)
 - ▶ Spatial price transmission issues:
 - ▶ Fackler and Goodwin (2001)
 - ▶ Barrett (2001)

Vertical Price Transmission

- ▶ Why do we care about vertical price transmission?
 - ▶ Often considered to be relevant to structure, conduct, and performance issues (i.e., market power)
 - ▶ Seems especially important in meat and livestock markets (GIPSA issues, etc.)
 - ▶ Market behavior often characterized by:
 - ▶ Extent of adjustment
 - ▶ Permanent versus temporary responses
 - ▶ Time required for adjustment
 - ▶ Asymmetric adjustments

Asymmetric Adjustments

- ▶ Much of this literature has been directed toward *asymmetric* adjustments.
- ▶ Why such concern? (What does asymmetric adjustment mean?)
 - ▶ Conventional wisdom: “big processors pass on price decreases but not price increases.”
 - ▶ Pelzman (2000) “. . . consumers suspect prices they pay promptly reflect increases but tend to not reflect price decreases.”
 - ▶ Ward (1982), Blinder (1994) and Blinder et al. (1998) argue the opposite, that competition may make sellers hesitant to raise prices, but not to lower them.
 - ▶ Bailey and Brorsen (1989) note may reflect asymmetries in underlying costs of adjustment
 - ▶ Kinnucan and Forker (1987) note government intervention effects

Spatial Price Transmission

- ▶ Also a wide literature, directed toward:
 - ▶ International trade issues (exchange rate determination)
 - ▶ Defining the extent of a market for anti-trust considerations
 - ▶ Indicator of “efficiency” of market (beware the term—but usually questions of infrastructure in developing economies).

Common Criticisms

- ▶ Empirical tests of spatial market integration are fragile and not informative (Fackler and Goodwin, Barrett, etc.)
 - ▶ Problems for correlation and regression tests due to common factors
 - ▶ Ignorance of transactions costs (addressed in recent work)
 - ▶ We commonly estimate

$$P_t^1 = \alpha + P_t^2$$

- ▶ When we should be working with

$$P_t^1 \leq \alpha + P_t^2.$$

- ▶ Potential for nonstationary transactions costs

Common Criticisms

- ▶ It has been argued that, absent flow data, tests based on price data alone are not informative
- ▶ Some disagreement over the definition of “integration” (see Fackler and Goodwin (2001))
- ▶ Barrett (2001) argues that direct flow provides best definition
- ▶ I disagree in that I believe most market linkages do not involve a flow of commodity
 - ▶ Two sellers selling to a common buyer
 - ▶ Two banks on opposite sides of the street

My Personal Opinions

- ▶ No empirical test is likely to produce useful results absent a thorough understanding of the *economics* of the problem being considered
- ▶ One must thoroughly understand:
 - ▶ Market institutions
 - ▶ Unobservable factors (that remain important)
 - ▶ Infrastructure issues (e.g., marketing practices, structural change, government policy)
- ▶ Any empirical test has the potential to produce misleading inferences if models are poorly specified
- ▶ Criticisms are valid and reinforce my position that one must not ignore the economic issues
- ▶ Test results may suggest further analysis (e.g., consider time series properties of transaction cost proxies if tests reject integration)

My Personal Opinions

- ▶ Too often, price transmission is studied without the appropriate consideration of the *economic* phenomena under consideration
- ▶ Understanding the fundamental structure of the markets under consideration is essential to the proper interpretation of results
- ▶ Because the mechanisms involved are more complex, this is more of a concern for vertical price transmission studies
- ▶ Example—what does a finding of asymmetry tell us about a market?
- ▶ Many explanations and without knowing more about the market, it tells us responses are asymmetric but nothing else.

A Review of Empirical Techniques

- ▶ Early analysis used regression and correlation-based tests
- ▶ More recent attention to time-series properties of the data
- ▶ Current research focusing on nonlinear time-series models
 - ▶ Regime switching models
 - ▶ Threshold and STAR type models
 - ▶ Other nonlinear models

An Empirical Examination of U.S. Meat Prices

- ▶ To illustrate recent developments in the literature and to shed some light on some the aforementioned issues, I considered an analysis of vertical price transmission for monthly beef, pork, and chicken prices
- ▶ January 1985-December 2003 for beef and pork and through December 2002 for chicken
- ▶ Three approaches:
 - ▶ Standard VEC models (similar to standard VAR)
 - ▶ Threshold VEC models (used by Goodwin and Holt (1999) and Goodwin and Harper (2000))
 - ▶ A fully nonlinear EC type of model (recently introduced by Baghli (2005))
- ▶ The aforementioned criticisms of empirics without attention to structural details and institutions apply here—interpret what you see carefully.

A Vector Error Correction Model

- ▶ Consider a standard cointegration equilibrium relationship

$$y_{1t} - \beta_1 y_{2t} - \beta_2 y_{3t} - \dots - \beta_k y_{kt} = \nu_t, \quad \text{where} \quad \nu_t = \rho \nu_{t-1} + \epsilon_t.$$

- ▶ If $\rho \neq 1$, a standard VAR representation of the variables in y_{it} can be written as:

$$\Delta y_t = \sum_{i=1}^p \gamma_i \Delta y_{t-i} + \theta \nu_{t-1} + \epsilon_t$$

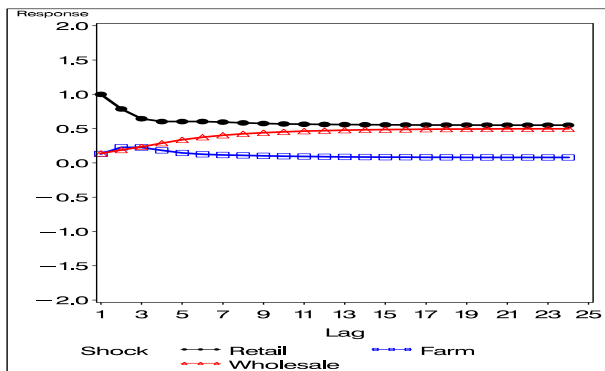
- ▶ Or

$$\Delta y_t = \sum_{i=1}^p \gamma_i \Delta y_{t-i} + \theta \gamma (y_{t-1}) + \epsilon_t$$

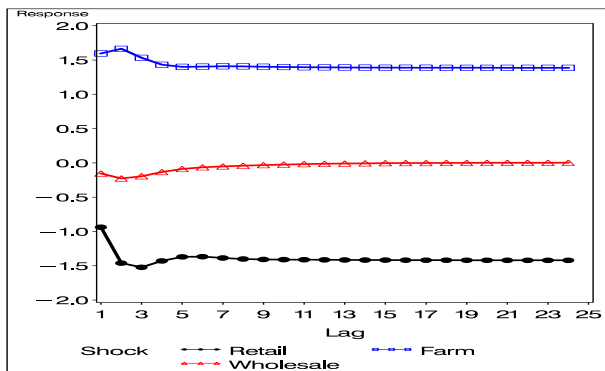
Overview of Results for Standard Models

- ▶ Most evidence suggests prices nonstationary (not all evidence though—suspicions of structural changes)
- ▶ Cointegrating regressions give odd result that farm price parameter is negative (also found in other studies)
- ▶ Cointegration tests confirm long-run stable equilibrium among prices
- ▶ Confirms standard findings that farm level prices are affected by retail shocks but not vice versa

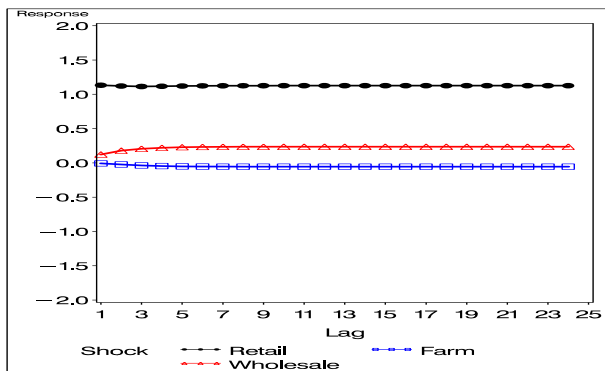
Beef Retail Price Impulse Responses



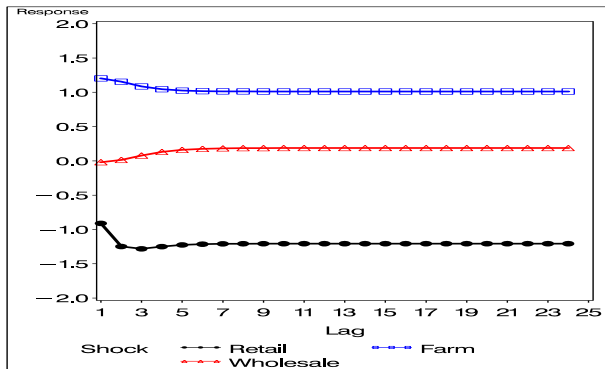
Beef Farm Price Impulse Responses



Pork Retail Price Impulse Responses



Pork Farm Price Impulse Responses



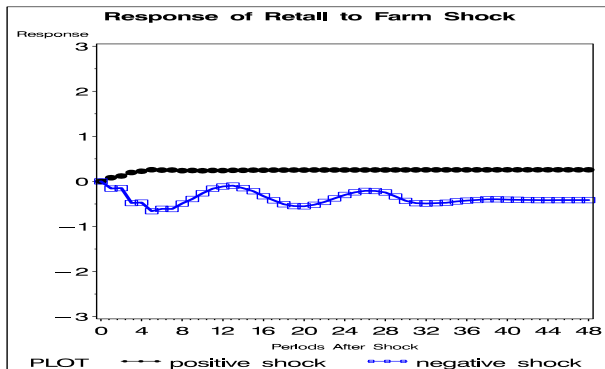
A Threshold Vector Error Correction Model

- ▶ We now modify the VEC (following Balke and Fomby) to allow nonlinear adjustment
- ▶ We allow the adjustment to depend on the size and sign of the deviation from equilibrium (i.e., the error correction term ν_{t-1}).

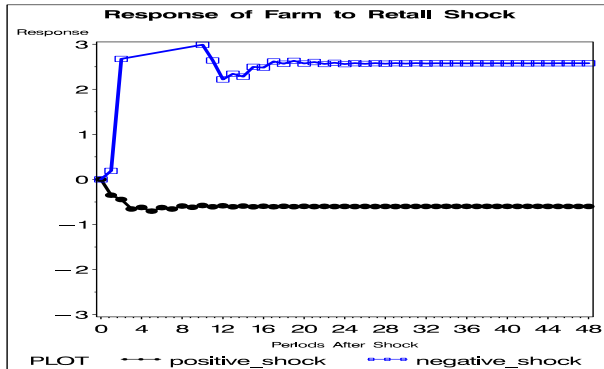
$$\Delta y_t = \begin{cases} \sum_{i=1}^p \gamma_i^{(1)} \Delta y_{t-i} + \theta^{(1)} \nu_{t-1} + \epsilon_t^{(1)} & \text{if } \nu_{t-1} < c_1 \\ \sum_{i=1}^q \gamma_i^{(2)} \Delta y_{t-i} + \theta^{(2)} \nu_{t-1} + \epsilon_t^{(2)} & \text{if } c_1 \leq \nu_{t-1} \leq c_2, \\ \sum_{i=1}^p \gamma_i^{(3)} \Delta y_{t-i} + \theta^{(3)} \nu_{t-1} + \epsilon_t^{(3)} & \text{if } \nu_{t-1} > c_2 \end{cases}$$

- ▶ We allow for two thresholds (to permit asymmetric adjustments) and choose the optimal thresholds by a minimizing the joint likelihood function (using a grid search over positive and negative thresholds).

Threshold VEC Beef Retail to Farm Responses



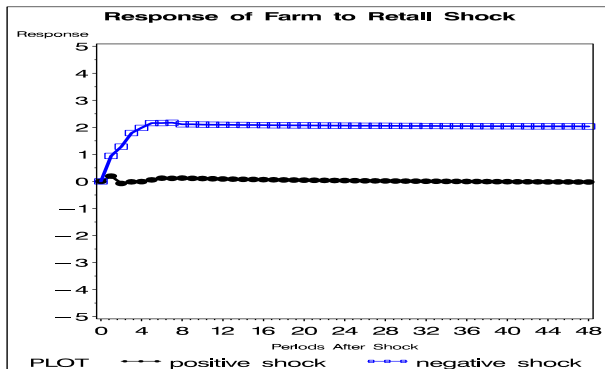
Threshold VEC Beef Farm to Retail Responses



Threshold VEC Pork Retail to Farm Responses



Threshold VEC Pork Farm to Retail Responses



A Fully Nonlinear Error Correction Model

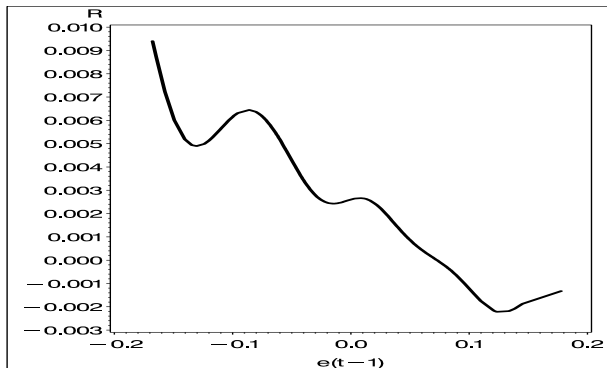
- ▶ A recent paper by Baghli discusses fully nonlinear error correction adjustments
- ▶ He uses polynomial expansions, splines, and nonparametric regression
- ▶ We considered a nonlinear error-correction process characterized by

$$E(\Delta P_t^i | \nu_{t-1} = \nu_t, \Delta P_t^j = 0) = F(z_{t-1}).$$

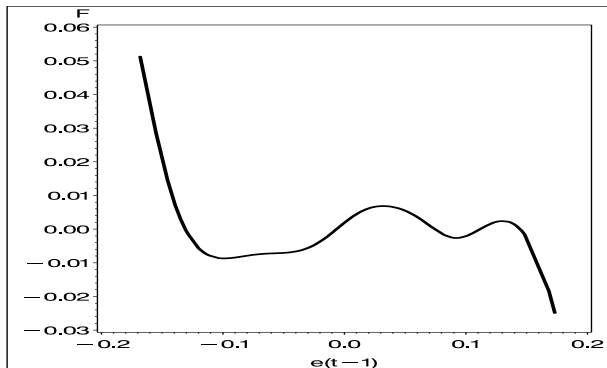
- ▶ $F(\cdot)$ is represented by a Nadaraya-Watson kernel regression:

$$F(z_{t-1}) = \frac{(hT)^{-1} \sum_{t=2}^T \Delta P_t K\left(\frac{z-z_{t-1}}{h}\right)}{(hT)^{-1} \sum_{t=2}^T K\left(\frac{z-z_{t-1}}{h}\right)},$$

Beef Retail Price Nonlinear Error Correction Model



Chicken Farm Price Nonlinear Error Correction Model



Concluding Remarks

- ▶ We provide an overview of the current state of research addressing vertical and spatial price transmission in meat markets
- ▶ An important point—these empirical analyses may not be very meaningful without attention to the economic setting (i.e., structure and institutions) pertinent to the problem at hand
- ▶ Price-based tests of spatial and vertical price transmission are vulnerable to many valid criticisms (especially in the case of vertical transmission studies)
- ▶ Most of the issues highlighted in these criticisms can be avoided in thoughtful research
- ▶ In general, farm prices respond to shocks further up the marketing chain but not vice versa—we next need institutional research to tell us why