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Collusion and Price Behavior in the U.S. Beef Packing Industry

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Collusion and Price Behavior in the U.S. Beef Packing Industry

U.S. Beef Packing Industry:

Structure and Fed Cattle Marketing Arrangements

A highly concentrated industry

- CR4 in fed cattle slaughtering and beef sales is approximately 85%
- The four largest firms are
- Tyson Foods, JBS USA, Cargill, and National Beef Packing Company

Fed cattle are sold/purchased using spot market and fed cattle marketing arrangements

- The latter include formula contracts and forward contracts
- The share of fed cattle sold in the spot market has been decreasing
- The share of fed cattle sold using forward and formula contracts has been increasing

Alleged Beef Packer Input and Output Price-Fixing Cartel

In 2019, fed cattle producers and beef buyers filed class action antitrust lawsuits

Alleged that the four largest beef packers engaged in an unlawful conspiracy

- To decrease fed cattle prices and
- To increase wholesale and retail prices of beef as early as January 2015 and
- Violated Section 1 of the Sherman Act (1890)

The beef packers implemented anticompetitive and coordinated supply restraints affecting

- Quantities of fed cattle purchased and slaughtered and
- Beef quantities produced and sold

Research Objective and Empirical Methods

To analyze price behavior in the U.S. beef supply chain

- In the period of alleged input and output price-fixing cartel (CP: 2015-2019) and
- A prior, more competitive period (Pre-CP: 2010-2014)

The focus is on evaluating

- Changes in the level and volatility of
- The farm, wholesale, and retail values of beef between the two periods

Empirical methods

- Descriptive statistical analysis (Averages and Coefficients of Variation)
- Econometric analysis: ARCH models

Hypotheses

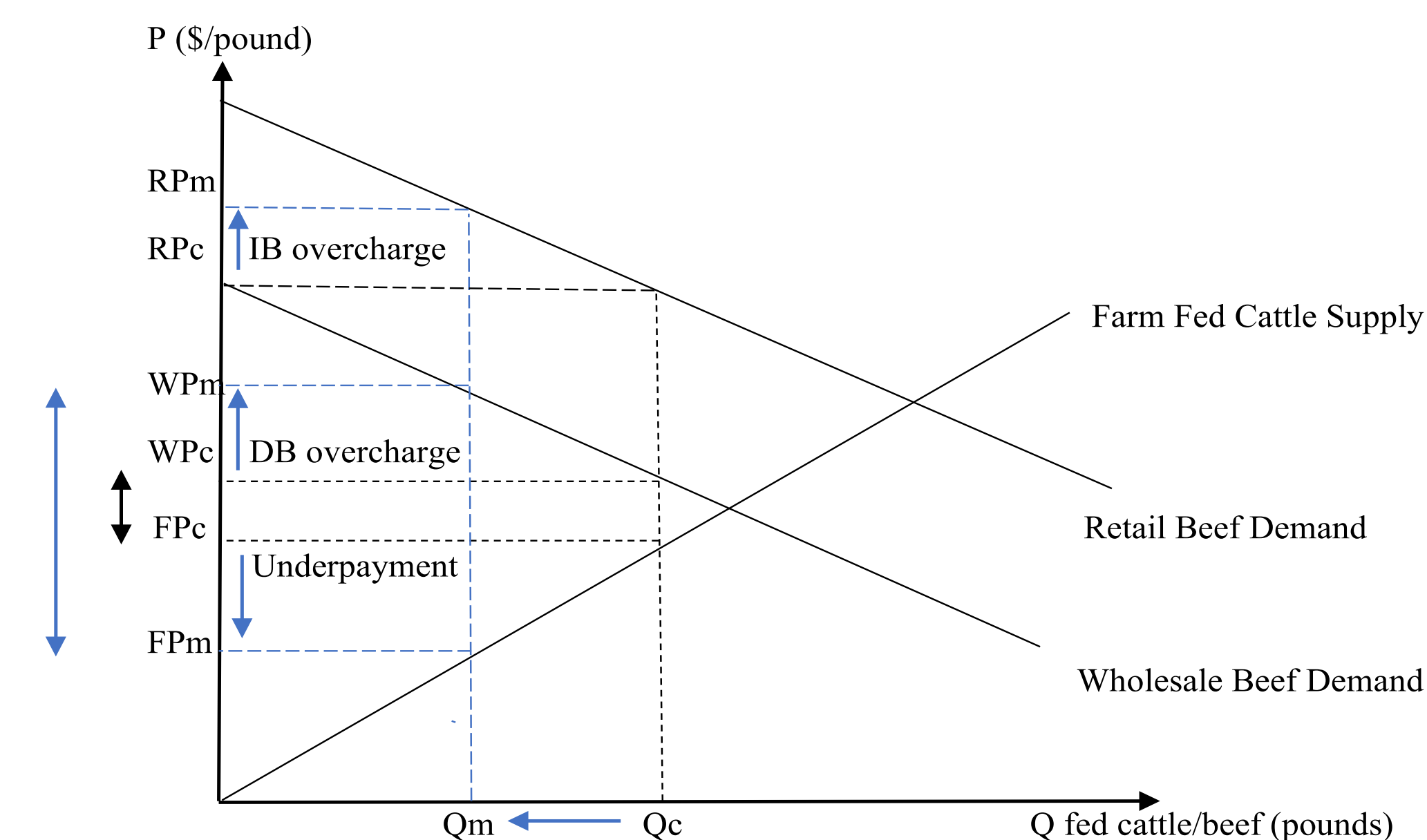
The input and output price-fixing cartel (beef packers' coordinated supply restraints)

- Increases beef packers' buyer market power in the market for fed cattle
 - The fed cattle price is expected to be lower in CP, relative to Pre-CP
- Increases beef packers' seller market power in the market for beef
 - The wholesale and retail beef prices are expected to be higher in CP, relative to Pre-CP
 - The fed cattle and beef prices are expected to be less volatile in CP, relative to Pre-CP

Data and Data Source

- The farm, wholesale, and retail values of beef are used as proxies for prices
 - At the farm, wholesale, and retail levels of the beef supply chain
- USDA Economic Research Service
- Historical Monthly Price Spread Data for Beef, Pork, Broilers
- <https://www.ers.usda.gov/data-products/meat-price-spreads/>

FIGURE 1: The Beef Packing Industry: The Market Power Effects on Beef Quantity, Prices, and Margins



Note: Q is fed cattle/beef production. FP, WP, and RP are farm, wholesale, and retail prices, respectively. (WP-FP) is farm-to-wholesale margin. (RP-WP) is wholesale-to-retail margin. Subscripts "c" and "m" indicate a competitive industry scenario and a market power scenario, respectively.

FIGURE 2: U.S. Monthly Farm, Wholesale, and Retail Values of Beef, 2000-2019.

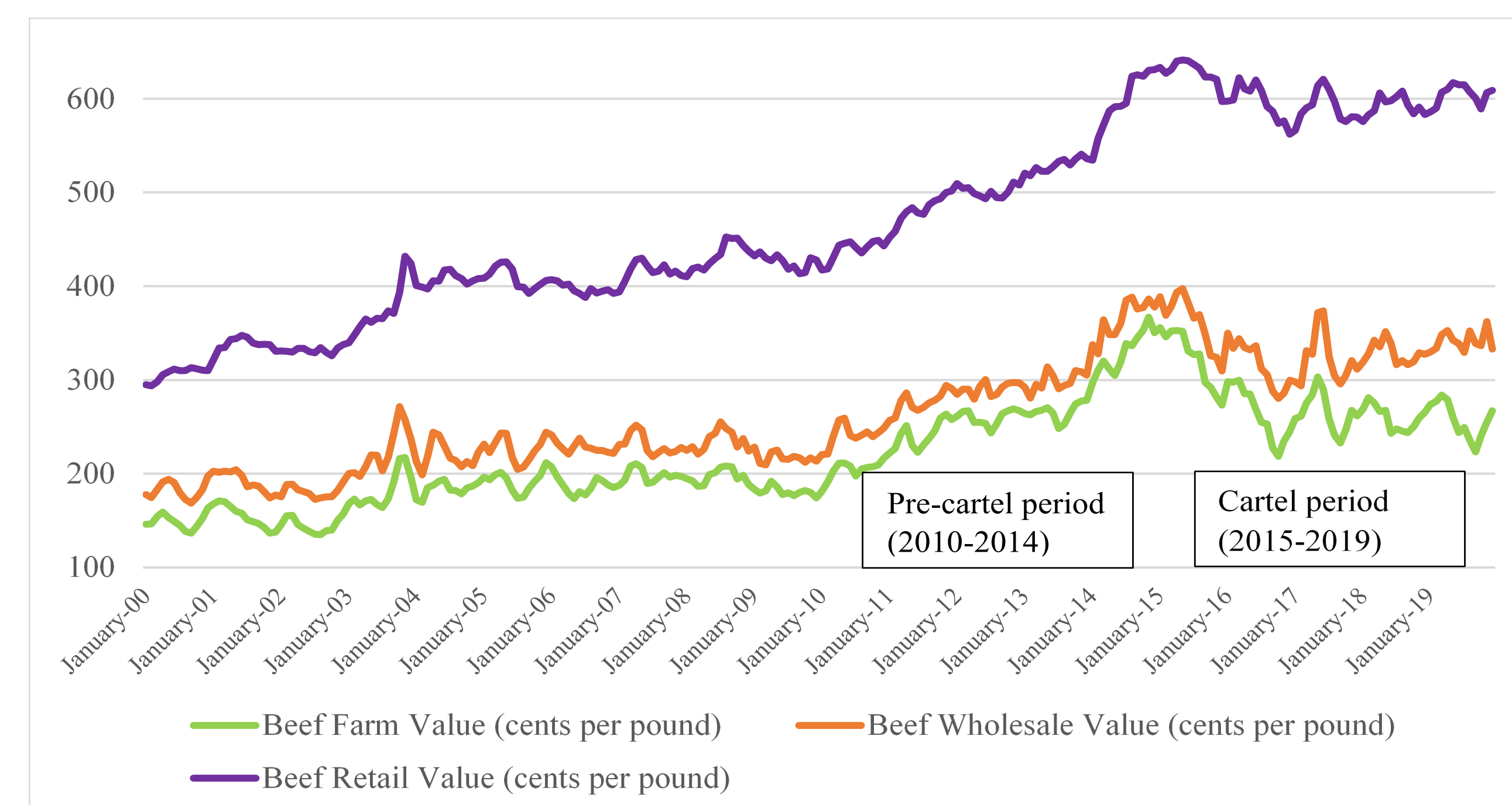


TABLE 1: U.S. Beef Production and Farm, Wholesale, and Retail Values (2010-2019):

Descriptive Statistics

Variable	Pre-cartel period (2010-2014)		Cartel period (2015-2019)		Change in cartel period, relative to pre-cartel period	
	Average	CV	Average	CV	Average (%)	CV (%)
Production (million pounds)	25,750.74	0.03	25,892.20	0.05	141.5 (0.5)	0.02 (67.3)
Farm value (cents per pound)	260.06	0.17	273.99	0.12	13.9 (5.4)	-0.04 (-25.6)
Wholesale value (cents per pound)	294.12	0.14	334.21	0.08	40.1 (13.6)	-0.06 (-44.1)
Retail value (cents per pound)	509.38	0.11	602.56	0.03	93.2 (18.3)	-0.08 (-70.2)

The yearly averages are calculated for beef production. The monthly averages are calculated for beef values. CV is the Coefficient of Variation (=Standard Deviation/Average).

Autoregressive Conditional Heteroscedasticity Model: ARCH (1)

Conditional Mean Equation

$$P_t = \beta_0 + \beta_1 * P_{t-1} + \gamma_1 * C_t + \gamma_2 * CP_{t-1} + \theta * M_t + u_t$$

Conditional Variance Equation

$$u_t^2 = \alpha_0 + \alpha_1 * u_{t-1}^2 + \delta_1 * C_t + v_t$$

P_t is monthly farm/wholesale/retail value of beef

u_t^2 is the conditional farm/wholesale/retail value variance

C_t is a binary variable for CP (2015-2019); M_t is a set of monthly binary variables

γ_1 and δ_1 are the estimated coefficients capturing changes in the average farm/wholesale/retail value and its variance, respectively, in CP, relative to Pre-CP

Results

Descriptive statistical analysis

The monthly average farm, wholesale, and retail beef values are higher and less volatile in CP, relative to Pre-CP

Econometric analysis

Beef farm value is higher and less volatile in CP, relative to Pre-CP

- The farm value increase is statistically significant from zero
- The farm value variance decrease is not statistically significant from zero

Beef wholesale value is higher and more volatile in CP, relative to Pre-CP

- The wholesale value increase is statistically significant from zero
- The wholesale value variance increase is not statistically significant from zero

Beef retail value is higher and more volatile in CP, relative to Pre-CP

- The retail value increase is statistically significant from zero
- The retail value variance increase is not statistically significant from zero

TABLE 2: U.S. Beef Farm, Wholesale, and Retail Value Behavior (2010-2019):

ARCH Model Estimation Results

Independent variable	Farm Beef Value ARCH (1)	Wholesale Beef Value ARCH (2)	Retail Beef Value ARCH (1)
	Estimated Coefficient (T-ratio)		
Conditional mean equation			
P_{t-1}	0.98* (42.01)	0.98* (33.61)	1.03* (85.77)
C_t	20.94* (1.56)	36.35* (1.87)	88.82* (2.66)
CP_{t-1}	-0.10* (-1.81)	-0.11* (-1.86)	-0.16* (-2.85)
Constant	13.32* (2.11)	12.82* (1.51)	-12.01* (-1.84)
Conditional variance equation			
u_{t-1}^2	0.18* (1.31)	0.24* (1.76)	-0.09* (-5.44)
u_{t-2}^2	-	0.46* (2.52)	-
C_t	-35.69 (-0.20)	14.08 (0.55)	16.60 (1.19)
CP_{t-1}	0.30 (0.46)	-	-
Constant	50.23* (4.39)	51.84* (2.91)	52.27* (5.44)
R2	0.94	0.91	0.99

The estimation results are obtained using ML estimation procedure

*The estimated coefficient is statistically significant from 0 at 10% alpha-level (two-tailed T-test)

#The estimated coefficient is statistically significant from 0 at 10% alpha-level (one-tailed T-test)

T-statistic cut-off values are |1.64| for a two-tailed T-test and |1.28| for a one-tailed T-test

Sample size is 120 monthly observations

Limitations

Beef values used in the empirical analysis are proxies for beef prices

- Using actual cattle and beef prices would provide a more accurate set of results

The method chosen to evaluate the price variance affects the pattern of results

- The variance patterns revealed by changes in CV fully support the stated price variance hypothesis
- The variance patterns revealed by ARCH results are mixed