Price Discovery in the Egg Industry

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Formula pricing of eggs is typically based on quotations issued by Urner Barry Publications, and egg producers worry that the quotes are systematically lower than equilibrium levels. Egg Clearinghouse, Inc. (ECI) provides a public forum for cash trading, intended to facilitate price discovery. Evidence from 1994–95 does not suggest that Urner Barry understates producer level prices on average. Granger causality tests indicate a feedback relationship between the Urner Barry quotes and ECI prices, with ECI leading during price upswings. Lead times appear to have fallen since the late 1970s and early 1980s, confirming earlier predictions regarding market efficiency.

Most eggs (90–95%) are produced under contract or within integrated operations (ECI 1995), and shell egg transactions from the producer level through the retail level are typically priced by formula using the Thursday wholesale-level price quotations published in *Urner Barry's Price-Current.* The difficulty of discovering equilibrium price levels in such an environment prompted the formation of Egg Clearinghouse, Inc. (ECI) in 1971. ECI provides a public forum for cash trading in graded loose, nest run, breaking stock, and egg product categories. Daily trading on ECI is intended to provide a means of discovering what eggs of a known quality are worth, thus encouraging sensitivity and accuracy in the Urner Barry quotes.

Bessler and Schrader (1980) performed a Granger causality analysis comparing 1977–78 twice-weekly Urner Barry quotes and quotes developed from ECI trading activity. The ECI-based quotes were found to be a leading indicator of the Urner Barry quotes, supporting their hypothesis that ECI was a residual market where the marginal price-making transactions occurred, and implying that market efficiency could be improved if ECI trading activity expanded and was given a larger role in forming the Urner Barry quotes.

The egg industry experienced a turbulent period of consolidation and bankruptcies during the late 1970s and early 1980s, causing reductions in ECI's membership and trading volume. Strategic public trading on ECI, intended to influence the Urner Barry quotes, threatened to disrupt ECI's intended function as a price discovery mechanism (ECI 1995). A second Granger causality analysis by Schrader, Bessler, and Preston (1985) concluded that during the period 1979–82 the direction of causality had reversed: Urner Barry was a leading indicator of ECI.

Many of the factors affecting price discovery have changed since the two initial studies were performed. ECI's management and operations were substantially revised in 1984. In 1988 Urner Barry Publications agreed to expand the role of producer-level cash trading (of which ECI's volume now accounts for about 35%) in formulating its market price quotations. ECI's yearly trading volume has expanded dramatically, more than quadrupling since 1988 (ECI 1995). Computer access to daily egg market activity via Urner Barry's Comtel satellite service is just one example of enhancements in the availability of information.

One issue remains unchanged. Today, the egg industry is as concerned about the sensitivity and accuracy of the Urner Barry quotes as it was two decades ago. ECI's home page on the World Wide Web contains an estimate that a one cent per dozen change in the market price of eggs over the course of one week results in a one million dollar change in industry revenues (ECI 1995). Producers in particular worry that transaction prices derived from the Urner Barry quotes may understate equilibrium levels. The industry's strong interest in this issue and the opportunity to verify Bessler and Schrader's predictions motivated a reexamination of the relationships between ECI prices and Urner Barry quotes.

For purposes of comparing the results of this study with those of Bessler and Schrader, a very

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similar analysis was performed. Differences include use of daily observations instead of twice-weekly observations, comparison of prices at identical levels, examination of upswing and downswing series separately, correction for unit-root nonstationarity, tests for cointegration, and sole reliance on ECI trading activity rather than Egg Market Evaluation Committee quotations (which were based on ECI but supplemented with other information sources). Whereas Bessler and Schrader found ECI to be a leading indicator of Urner Barry, this study indicates a feedback relationship in general, with ECI leading on the upswing. The results are interpreted with reference to industry structure and strategic behavior.

Data

Daily Urner Barry price quotes for class 1 white gradeable nest run eggs were obtained from *Urner Barry's Price-Current* for the period January 4, 1994, through November 30, 1995. Daily average ECI trading prices for class 1 white gradeable nest run eggs were provided by ECI. Both the Urner Barry quotes and the ECI trading prices include delivery; neither includes processing, cartoning, and further transportation costs. Urner Barry reports quotes for four regions in its Eastern edition: Northeast, Midwest, Southeast, and South Central. ECI trades in six regions: the four covered in *Urner Barry's Price-Current* (which constitute the great majority of trades) plus the Southwest and Northwest.

A trade occurs through ECI when a potential buyer posts a bid (which includes delivery) equal to a potential seller's offer (which is f.o.b.) plus freight. Ideally, one would also like to exploit the information contained in the unfilled bids and offers. The data set contained low bid and high offer information, but only for days in which at least one trade occurred. In light of the incomplete data on bid and offer activity, analysis was restricted to completed ECI trades.

If ECI reported no trading activity on a given day, the missing observation was replaced by the previous day's value to hold the ECI price steady pending new information. Another important data issue involved consolidating the four regional Urner Barry quotes into a single daily observation comparable to the daily average ECI price. While daily information was available on which regions ECI had traded in, the data did not specify which regions were origins and which were destinations. For example, a daily observation might reveal only that three trades occurred involving the Northeast and the Midwest regions.

Simply averaging across the four Urner Barry regions was not deemed satisfactory because ECI rarely traded in all regions on a given day; regional movements in ECI trading might be similarly reported by Urner Barry but diluted by averaging. Furthermore, a disproportionately large share of ECI trades (40%) was delivered to the Midwest region during ECI's 1994–95 fiscal year, and a disproportionately small share of ECI trades (6%) was delivered to the Southeast region (ECI 1995). This study needed a single Urner Barry series that matched the regions ECI traded in on a day-by-day basis as closely as possible, and in ambiguous cases recognized the different probabilities of delivery to each region.

The decision was made to compare the daily ECI price with a weighted average of the Urner Barry quotes. If ECI did not trade in a given region on a given day, the weight on that region's Urner Barry quote was set equal to zero. If ECI trading did involve a given region, that region's Urner Barry quote was weighted by a ratio based on the regional distribution of ECI deliveries during the 1994–95 fiscal year. The weighted regional Urner Barry quotes were then summed across regions to arrive at a single daily value. This approach mitigated to some extent the potential bias resulting from lack of precise regional information. The outcome was two series of 486 observations each, summary statistics of which are shown in table 1.

Methods

Granger causality refers to a predictive (not necessarily causal) time series relationship between two variables X and Y contained in a given uni-

Table 1. Summary Statistics of ECI Prices and Urner Barry Price Quotes for Class 1 White Gradeable Nest Run Eggs, 1/4/94–11/30/95

	Mean	Std. Dev.	Min	Max
ECI	48.92	7.95	34.00	78.00
UB average*	49.20	7.78	35.00	76.50
UB-Northeast	49.07	7.42	35.00	75.00
UB-Midwest	48.25	7.67	35.00	75.00
UB-Southeast	49.74	7.60	35.00	77.00
UB-South Central	50.61	8.41	35.00	79.00

*Represents a weighted average of regional Urner Barry quotes, with weights determined by 1994–95 ECI trade destination frequencies. If ECI did not trade in a region on a given day, that region's weight is set equal to zero.

verse. If current values of Y can be better predicted with knowledge of past values of X than without such knowledge, then X is said to cause Y. In other words, movements in X at time t will correspond to movements in Y at time $t + i$, for some positive i.

Nonstationarity and serial correlation, if present, need to be addressed prior to testing for causality. In this analysis the most likely form of nonstationarity was expected to be unit-root nonstationarity, which was identified using the Dickey-Fuller test (Dickey and Fuller 1981), and corrected for by first-differencing the original time series. Correction for serial correlation involved identifying an ARIMA process associated with each time series, estimating the parameters of the process, and retaining the innovations (residuals) for analysis. After filtering, each series of innovations was itself white noise, but Granger causality relationships between variables were preserved by definition (Pierce 1977).

Granger causality can be tested for by cross-correlating the innovations of series X with lagged innovations of Y (Pierce and Haugh 1977). Nonzero estimated cross-correlations at positive lags constitute evidence that X leads Y; conversely, nonzero cross-correlations at negative lags imply that Y leads X. Nonzero cross-correlations at both positive and negative lags imply a feedback relationship, a nonzero cross-correlation only at lag zero implies instantaneous causality, and a lack of nonzero cross-correlations at any lags suggests series independence.

The U-statistic can be used to test whether estimated cross-correlations from lag +1 to lag $+m$ are jointly sufficiently different from zero to reject a null hypothesis of series independence (Pierce 1977):

$$U_m = n \sum_{k=1}^{m} r_k^2,$$

where n denotes the number of observations and r_k denotes the estimated cross-correlation at lag k. The U-statistic is chi-square distributed with m degrees of freedom under the null hypothesis of series independence, but it is biased once series independence is rejected (Sims 1977). In other words, when testing for Granger causality using estimated cross-correlations and the U-statistic, evidence of one-way causality does not preclude the possibility of two-way causality (i.e., feedback).

The ambiguity associated with the U-statistic motivates a second test for Granger causality described by Sims (1972). Current innovations of series X are regressed using OLS on past and future innovations of series Y. Joint significance of the estimated coefficients of future innovations of Y supports the claim that X leads Y. A second regression of current innovations of Y on past and future innovations of X can be used to test whether Y leads X.

The Bessler and Schrader study was performed under the assumption of stationarity, while this application tests for nonstationarity and uses differencing as a remedy. However, differencing may imply a loss of long-run information if the series are cointegrated and the difference operator is not also recognized in the error process (Johansen and Juselius 1990). Cointegration can be tested for and addressed by repeating Sims's regression procedure in an error correction model framework.

Provided that both series exhibit unit-root nonstationarity, a straightforward test for cointegration involves regressing one series on the other and then applying the Dickey-Fuller test to the residuals (Kennedy 1992). Stationarity of the residuals from the cointegrating regression implies that the two series are cointegrated, suggesting that an error correction mechanism is appropriate.

Let Δ denote a first difference, and suppose one wanted to construct an error correction model for the regression of ΔY on lags of ΔX from $t - 5$ through $t + 5$. The following model in undifferenced terms provides a starting point:

$$Y_t = \beta_0 + \beta_1 X_{t-6} + \ldots + \beta_{12} X_{t+5} + \beta_{13} Y_{t-1} + \epsilon_t.$$

By a series of algebraic manipulations the model can be equivalently expressed in first differences with an explicitly specified error correction term (Malley 1990):

$$\Delta Y_t = \beta_0 + \left(\sum_{i=2}^{12} \beta_i \right) \Delta X_{t-5} + \ldots + \beta_{12} \Delta X_{t+5} + (\beta_{13} - 1) \left[Y_{t-1} - \frac{\sum_{i=1}^{12} \beta_i}{1 - \beta_{13}} X_{t-6} \right] + \varepsilon.$$

Given the large sample size in this application, residuals from a regression of Y_{t-1} on X_{t-6} can serve as an instrument for the term in square brackets (Kennedy 1992). Sims's regression approach to testing for Granger causality can then be applied to the full model including the error correction term.

Results

Dickey-Fuller tests were performed on the Urner Barry and ECI price series. The null hypothesis of nonstationarity was not rejected in both cases at a .01 level, and not rejected at a .05 level in the case of the ECI series. First differences of both series were therefore used in subsequent analysis. In estimating ARIMA processes, a subsetting approach was used to account for observed cycles of approximately ten business days in each series. Based on goodness-of-fit, significance of individual parameter estimates, and parsimony, the ECI series was identified as a (0,1,3) ARIMA process with MA terms at lags 1, 10, and 11, and the Urner Barry series was identified as a (0,1,7) ARIMA process with MA terms at lags 1–5, 10, and 11. One-step-ahead forecasts were computed and compared with actual values, and two series of innovations were obtained. The resulting Q-statistics indicated that the innovations were white noise at a .10 level after filtering.

ECI innovations were then cross-correlated with lagged Urner Barry innovations. Significant cross-correlations at positive lags would offer evidence that ECI was a leading indicator of Urner Barry, and significant cross-correlations at negative lags would suggest that Urner Barry led ECI. Using the asymptotic standard deviation of $1/(485)^{1/2}$, the results indicated positive and significant cross-correlations at a .05 level at lags −4, −2, −1, 0, +1, and +2 (see table 2). U-statistics indicated that cross-correlations were jointly significant at a .01 level for negative lags −2 through −8 and positive lags +1 through +10. The statistical significance at both positive and negative lags suggested a two-way feedback relationship between the Urner Barry quotes and ECI prices.

As expected, the feedback relationship was confirmed by the results of the regression procedure (see table 3). ECI innovations were regressed using OLS against five past values of Urner Barry innovations, the current value, and five future values. The regression was then repeated without including the future Urner Barry innovations. A second pair of regressions was performed using Urner Barry innovations as the dependent variable and ECI innovations as the independent variables. The standard R^2 formula was used to test for joint significance of the five future values in each pair of regressions. Future Urner Barry values in the ECI regression were jointly significant at a .01 level (F = 4.79), as were the future ECI values in the Urner Barry regression (F = 3.77), again implying that the Urner Barry quotes and ECI prices both responded to and influenced each other.

Table 2. Granger Causality Tests via Cross-Correlations of Urner Barry Innovations with Lagged ECI Innovations

	All Data		Upswings Only		Downswings Only	
Lag	Cross-corr.	U-stat.	Cross-corr.	U-stat	Cross-corr.	U-stat.
−10	0.01	21.05*	−0.01	14.17	−0.03	17.46
−9	0.00	21.04*	−0.07	14.12	−0.06	16.93*
−8	0.02	21.03**	−0.01	11.64	−0.02	15.02
−7	0.04	20.90**	0.02	11.58	−0.02	14.83*
−6	−0.00	19.96**	−0.04	11.44	−0.01	14.70**
−5	−0.00	19.95**	0.01	10.83	−0.09#	14.60**
−4	0.11#	19.94**	0.10#	10.76*	−0.01	10.77*
−3	0.07	13.77**	−0.02	5.84	0.08	10.70*
−2	0.11#	11.70**	0.09	5.58	0.09#	7.96**
−1	0.11#	5.39*	0.06	1.81	0.09#	3.83
0	0.27##	n/a	0.31##	n/a	0.17##	n/a
+1	0.14##	8.87**	0.17##	13.92**	−0.03	0.32
+2	0.12##	15.95**	0.04	14.84**	0.14##	10.18**
+3	0.08	18.80**	0.08	17.95**	0.01	10.28*
+4	0.05	20.00**	0.02	18.10**	0.06	12.31*
+5	0.02	20.16**	0.00	18.10**	0.08	15.50*
+6	−0.07	22.73**	0.01	18.18**	−0.06	17.51*
+7	0.08	25.50**	0.10#	23.24**	0.00	17.52*
+8	−0.03	25.89**	0.00	23.24**	−0.03	17.87*
+9	−0.04	26.69**	−0.06	25.16**	−0.02	18.05*
+10	−0.00	26.70**	−0.01	25.27**	0.02	18.17

#Denotes statistical significance at .05 level.
##Denotes statistical significance at .01 level.
*Denotes U-statistic > chi-square (485,.05).
**Denotes U-statistic > chi-square (485,.01).

Table 3. Regression Results Suggesting Feedback in General, with ECI Leading on Upswings

	Dependent Variable: ΔECI Independent Variables: Lags of ΔUB			Dependent Variable: ΔUB Independent Variables: Lags of ΔECI		
Lag	All Data[a]	Upswing Only[b]	Downswing Only[c]	All Data[d]	Upswing Only[e]	Downswing Only[f]
INT	−0.00	1.00**	0.01	−0.00	−0.36**	−0.01
−5	−0.01	0.02	−0.25*	0.01	−0.02	0.04
−4	0.24**	0.21*	−0.04	0.02	−0.01	0.03
−3	0.15	−0.04	0.18	0.03	0.02	0.01
−2	0.19*	0.15	0.25*	0.06**	0.02	0.06**
−1	0.21*	0.13	0.20	0.07**	0.10**	−0.00
0	0.54**	0.58**	0.40**	0.12**	0.17**	0.07**
+1	0.30**	0.31**	−0.08	0.04*	0.04	0.04*
+2	0.25**	0.09	0.27*	0.05**	0.03	0.04*
+3	0.15	0.17*	−0.01	0.03	−0.03	0.04*
+4	0.11	0.04	0.14	0.05*	0.04	−0.00
+5	0.04	−0.01	0.19	−0.00	−0.00	−0.03
F[g]	4.79**	3.96**	2.57*	3.77**	1.76	3.07**

[a]Standard errors of .12 for intercept, .09 for independent variables.
[b]Standard errors of .08 for intercept, .08 for independent variables.
[c]Standard errors of .09 for intercept, .10 for independent variables.
[d]Standard errors of .06 for intercept, .02 for independent variables.
[e]Standard errors of .08 for intercept, .02 for independent variables.
[f]Standard errors of .04 for intercept, .02 for independent variables.
[g]Empirical F-statistic under H_0: (+1) = (+2) = (+3) = (+4) = (+5) = 0.
*Denotes statistical significance at .05 level.
**Denotes statistical significance at .01 level.

Concern about possible bias introduced during the construction of the weighted average Urner Barry series prompted comparisons of the ECI series to each regional Urner Barry series as limiting cases. A feedback relationship was observed in each of the four cases, thus providing greater confidence that the results were robust to linear combinations of the regional Urner Barry quotes.

Such a feedback relationship would exist if ECI typically led in some situations, and Urner Barry typically led in other situations. To examine this possibility, each series was separated into an upswing series and a downswing series. For each series, if the first difference at a given date was positive, it was retained for the upswing series and zero was assigned to the downswing series. Conversely, a negative value was retained (as a positive value) for the downswing series and zero was assigned to the upswing series. This approach is equivalent to using the methodology suggested by Heien (1980) and Gichuhi (1982) for studying irreversible supply relationships (which results in a nonstationary series), and then first-differencing the result to achieve unit-root stationarity.

The cross-correlation and regression procedures were then repeated on the upswing and downswing series. Q-statistics at selected lags indicated that the ECI upswing series was white noise at a .10 level, and thus it was not filtered. The ECI downswing series was identified as a (2,0,2) ARIMA process, the Urner Barry upswing series was identified as a (1,0,2) process with MA terms at lags 1 and 13, and the Urner Barry downswing series was identified as (0,0,4) process with MA terms at lags 1, 10, 11, and 16. After filtering, Q-statistics indicated that the resulting series of innovations were white noise at a .10 level.

Cross-correlations of the ECI and Urner Barry upswing series of innovations resulted in significant U-statistics at a .01 level through lag + 10, but U-statistics were not significant at a .01 level at any of the negative lags (see table 2). Thus, the results suggested that ECI led Urner Barry on the upswing. A feedback relationship was observed in the two series of downswing innovations. U-statistics were significant at a .01 level for negative lags −2, −5, and −6, and for positive lag +2.

The results of the regression procedure were again consistent with the findings of the cross-correlation procedure: ECI led on the upswing and feedback was found on the downswing (see table 3). In the case of upswings, future Urner Barry values in the ECI regression were jointly significant at a .01 level, but future ECI values in the Urner Barry regression were not jointly significant at a .05 level. Thus, the results suggested that ECI typically led on upswings; estimated parameters and t-ratios imply a lead of about three days. In the case of downswings, future Urner Barry values in the ECI regression were jointly significant at a .05 level, and future ECI values in the Urner Barry regression were jointly significant at a .01 level. As in the case of upswings, the duration of leads appeared to be approximately three days.

As expected, the Urner Barry and ECI price series displayed strong evidence of cointegration. Neither series alone was stationary, but Dickey-Fuller tests on the residuals from regressions of one series on the other rejected nonstationarity at a .01 level. Sims's regression procedure was repeated using error correction models, with the error correction terms defined by residuals from regressions of the dependent variable lagged once on a six-period lag of the independent variable.

The results of the error correction models, shown in table 4, are consistent with those of the ARIMA models in suggesting a feedback relationship between ECI prices and the Urner Barry quotes. In both sets of regressions, future values of the independent variable are jointly significant at a .01 level. The error correction terms are highly significant in both cases, consistent with the strong evidence of cointegration.

Table 4. Error Correction Model Results Confirming Feedback

	Dep. var. ΔECI_t		Dep. var. ΔUB_t
INTERCEPT	−0.15	INTERCEPT	−0.04
	(0.12)[a]		(0.06)
ΔUB_{t-5}	0.50**	ΔECI_{t-5}	0.21**
	(0.09)		(0.03)
ΔUB_{t-4}	0.66**	ΔECI_{t-4}	0.22**
	(0.09)		(0.03)
ΔUB_{t-3}	0.52**	ΔECI_{t-3}	0.23**
	(0.09)		(0.03)
ΔUB_{t-2}	0.54**	ΔECI_{t-2}	0.23**
	(0.09)		(0.02)
ΔUB_{t-1}	0.44**	ΔECI_{t-1}	0.22**
	(0.09)		(0.02)
ΔUB_t	0.64**	ΔECI_t	0.20**
	(0.08)		(0.02)
ΔUB_{t+1}	0.32**	ΔECI_{t+1}	0.11**
	(0.08)		(0.02)
ΔUB_{t+2}	0.21*	ΔECI_{t+2}	0.09**
	(0.08)		(0.02)
ΔUB_{t+3}	0.08	ΔECI_{t+3}	0.05*
	(0.08)		(0.02)
ΔUB_{t+4}	0.03	ΔECI_{t+4}	0.04*
	(0.08)		(0.02)
ΔUB_{t+5}	0.00	ΔECI_{t+5}	−0.01
	(0.08)		(0.02)
ERRCORRECT	−0.53**	ERRCORRECT	−0.17**
	(0.04)		(0.03)
F[b]	5.60**	F	9.12**

[a]Standard errors in parentheses.
[b]Empirical F-statistic under H_0: (+1) = (+2) = (+3) = (+4) = (+5) = 0.
*Denotes statistical significance at .05 level.
**Denotes statistical significance at .01 level.

Implications for the Egg Industry

One concern of egg producers is that the Urner Barry quotes, on which transaction prices are based, might be persistently lower than the "true" market price. The near equivalence of the ECI average price and the four regional average Urner Barry quotes does not support this concern, although it should be noted that egg transactions are typically based on the Urner Barry wholesale level quote instead of the producer level quotes examined in this study. The wholesale level quote recognizes processing, cartoning, and further transportation costs, and is approximately twenty-five cents per dozen higher than the gradeable nest run quote in a stable market. The current practice of offering discounts off the wholesale quote as a marketing tool supports the argument that the Urner Barry quotes are not persistently low at the wholesale level, either.

This study and previous studies suggest the importance of ECI's trading volume in encouraging efficient price discovery. Using 1977–78 data Bessler and Schrader (1980) found ECI to be a leading indicator of Urner Barry, concluded that ECI was performing its intended function, and predicted enhanced market efficiency as ECI trading grew. Instead, market developments during the late 1970s and early 1980s caused a decline in ECI's trading volume (ECI 1995). Using 1979–82 data, Schrader, Bessler, and Preston (1985) found that ECI no longer led Urner Barry, and expressed concern about ECI's future as an aid to price discovery.

The 1994–95 data displayed evidence of a feedback relationship between ECI prices and Urner Barry quotes. The feedback relationship may be largely due to the dramatic expansion of ECI trading volume and the 1988 decision to place greater weight on ECI trading activity in forming the Urner Barry quote. The results of this study could be interpreted as evidence of a maturing price discovery mechanism in the egg industry, with both Urner Barry and ECI now playing active (and interactive) roles.

Improvements in the sensitivity and accuracy of the Urner Barry quote may lead to improvements in the accuracy of ECI prices, and vice versa. For example, if the "true" market price rises and Urner Barry underreports the new, higher price, excess demand will remain, and the ECI price may overshoot the equilibrium price. Conversely, if Urner Barry overreports the new price, causing excess supply in the market, ECI prices may be driven below the equilibrium price. In this scenario, discussed briefly in Bessler and Schrader (1980), inaccuracies in the Urner Barry quote lead to more volatile ECI prices. To the extent that Urner Barry uses ECI trading information in formulating its price quotes, a self-correcting mechanism exists, but excess volatility in ECI prices is expected to obstruct the price discovery process. The implication is that neither Urner Barry nor ECI alone can guarantee efficient price discovery within the current pricing framework.

When the finding that ECI typically led on the upswing was presented to a group consisting mainly of egg producers, the most common reaction was "We've suspected this for some time." The results seemed to confirm producers' concerns that Urner Barry was too late bringing the market up, thus depriving producers of revenue. ECI's design as a residual market where the marginal price-making transactions can occur seems to favor the validity of ECI's lead. Both Urner Barry and ECI appeared to lead on downswings, however.

One could question the timing of response to downswings in ECI trading. A regression of whitened ECI prices on ECI trading volume indicated a significant positive relationship at the .05 level. Cross-correlations of trading volume and lagged ECI price innovations were positive and individually significant at lags −5 through +14, with the highest cross-correlation occurring at lag +5. Apparently, ECI trading thinned out during downswings, with trading volume typically peaking about five days before prices began to fall.

In private conversations, industry participants stressed the role of strategic behavior during downswings. Trading on ECI is public and observable by Urner Barry reporters; thus producers have some incentive to use private brokers rather than ECI during downswings. Schrader, Bessler, and Preston (1985) noted that this reluctance to trade publicly at low prices was a factor in the 1984 decision to disband the Egg Market Evaluation Committee.

Concentration in the egg industry is high enough, especially in certain regions, that the activity of a few firms can affect producer level prices. Firms that both buy and sell eggs may have an incentive to encourage Urner Barry's perception of a weak market at certain times. The extent to which markets can be "manufactured" in the egg industry is not known to the author, but incentives and opportunities appear to exist. Factors counteracting producers' ability to raise prices include chronic overproduction (as perceived by producers), the bargaining power of large retail buyers, and the diversion of breaking stock into table egg markets when prices are high.

In summary, Bessler and Schrader predicted that increasing the role of public cash trading in forming the Urner Barry quote would lead to more efficient price discovery, as would higher trading volume through ECI. Both events have occurred since the original article was published, and the predictions are confirmed in the form of shorter lead times. During the 1977–78 period ECI typically led Urner Barry by as many as one and a half weeks (Bessler and Shrader 1980), and during the 1979–82 period Urner Barry's lead over ECI was at least as long (Schrader, Bessler, and Preston 1985). In contrast, the 1994–95 data suggest leads of approximately three days. The trend toward shorter lead times may continue as ECI's growth persists; an all-time monthly trading record was posted in February 1996 (*Clearinghouse Trade News* 1996). However, various factors continue to complicate ECI's role as a price discovery mechanism. For example, the influence of market power and strategic activity on price movements is likely to be important to egg producers and market reporters, but is not well-documented.

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