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John B. Rowsell and Wayne D. Purcell

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SPECULATIVE ACTIVITY AND PRICE VOLATILITY IN THE LIVE CATTLE FUTURES MARKET

John B. Rowsell and Wayne D. Purcell*

The most widely discussed and researched economic justification for trade in futures is the providing of a risk transfer mechanism. The second function, contributing to the price discovery is arguably even more important. It is the case that price discovery process must be effective and efficient if risk transfer or hedging opportunities are to be effective. The price that is being "discovered" for the distant futures is the forward pricing or hedging opportunity facing the potential hedger.

Hedgers enter the futures markets to transfer exposure to price risk. Speculators accept that risk exposure and are motivated by a profit objective. Both types of traders are an integral part of the price discovery process.

A justification for futures trading and futures markets can be interpreted from Hayek's suggestion that "the unavoidable imperfection of man's knowledge implies the need for a system that allows information to be continually communicated and acquired" (p. 530). Individual market participants possess unique information, but no individual possesses information in it's totality. Individuals communicate information in the futures markets' efforts to discovery a price that balances the forces of supply and demand. The supply and demand forces determine a general level of prices. Via the process Taussig refers to as the "combats of bulls and bears", a specific price is discovered.

This study seeks to contribute to the information available to policy makers, regulators and futures exchanges concerning the role of speculators in the live cattle futures market. The paper proceeds by reviewing theoretical and empirical literature on the role of speculators. A framework for measuring relative speculative activity in futures markets is reviewed. An empirical examination of the influence of speculative activity on daily price volatility is presented.

Review of Literature

In separate studies, Working (1954) and Powers documented that for futures markets to succeed, hedging use must be present. A fundamental need to hedge or to manage exposure to price risk

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*Economist, Research Division, Chicago Mercantile Exchange, Professor and Director, Research Institute on Livestock Pricing, Department of Agricultural Economics, Virginia Tech, respectively.

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must exist. Without price uncertainty or price volatility, little need to transfer price risk would exist and little incentive to speculate.

Critics contend that for prices to reflect real supply and demand conditions long and short hedging should be in balanced proportions. In this view, the speculator can only be a facilitator of hedging, a provider of liquidity.

Grossman and Stiglitz argue that for all information to be fully reflected in price, it is both a sufficient and necessary condition that information be costless. If information has positive costs, and futures markets adhere to the efficient market hypothesis, the price in the futures market would reflect all information. In turn no incentive to collect information would exist. This implies the condition of efficient markets when information is not costless leads to a breakdown in the market function.

Grossman defines market liquidity as a situation where enough traders are present to rule out collusive behavior. A futures market can be expected to be thin (lack liquidity) if information is costless, implying market participants will possess all information. Because information is universally possessed by market participants little price risk would exist.

Grossman and Stiglitz propose that futures markets provide an opportunity to capture a return to collecting and analyzing information. Information is not costless and price risk provides an incentive to acquire and trade on information exists. Since all information is not possessed by a single individual, it is consistent to expect information collection and processing to have an associated cost.

The higher the degree of completeness of the information that flows to the market, the more accurate is the price discovered and the more efficient is the market. Purcell and Hudson note that the market (cash or futures) that is most efficient at receiving and interpreting information is where the price discovery process takes place. The market with the highest degree of efficiency is the center of price discovery. The live cattle futures market has increasingly become the center of price discovery as documented by Hudson and Purcell; Brorsen, Oellermann, and Farris; and Koontz, Hudson and Garcia.

Working defined speculation as holding in anticipation of a profit either a net long or net short position in a futures market that is not part of the normal course of business or incidental to operating a producing, merchandising or processing business. Wilmouth provided a cogent differentiation between speculative activity on futures markets and gambling. A gambler is one who seeks a profit by creating a risk while a speculator is one who accepts a risk that is presently in existence. It is clear that access to information is critically important to the

speculator.

Three forms of speculation are of interest; scalping, day trading, and position trading. Scalping and day trading are difficult to distinguish. The primary factor differentiating them is the length of time a position is held during the day.

Scalpers trade price ticks, holding a position for a matter of moments anticipating the last price change will be followed by an opposite price move. Scalpers provide the liquidity needed to provide low transaction costs. Scalping activity produces conditions similar to the bid-ask spread of specialists in securities markets. The smaller the spread, the lower the transaction costs.

Day traders close out their positions by the end of the trading session. Day traders anticipate the direction of prices during the day. They accumulate positions on the expectation of price changes, liquidating positions when the expected price change takes place. Working (1977) described the activity of a day trader who kept within-day records of all trades. He observed that this trader was continually seeing reasons to expect price to change.

Scalping and day trading facilitate price discovery by allowing hedgers and position trade speculators to enter and exit the market. Scalpers and day traders provide liquidity. Petzel maintains that because neither scalpers nor day traders hold positions beyond a single trading session, they are precluded from having a sustained price influence.

Scalping and day trading produce volume, not open interest. Increased volume by scalpers in particular tends to narrow the bid-ask spread. Silber contends that higher volume reduces the market-maker's (scalper's) risk because increased volume allows them to adjust their positions quickly, thus making the market more competitive.

Working (1960) suggests that while the only appropriate measure of speculative activity is the number of open positions held by speculators, volume is still important. Positive price volatility-volume relations indicate a greater divergence in opinion held concerning price, resulting in more initiation and termination of positions. This phenomenon may overwhelm the number of open positions held by either hedgers and speculators, yet it allows the opportunity for more divergent assessments of information relevant to price determination to be made.

Price variability or price volatility has been linked to trading volume by numerous studies (Martell and Wolf, Cornell, Tauchen and Pitts, Peck 1981). Martell and Wolf hypothesize that a direct relationship between price volatility and trading volume exists because these two variables are a function of the same underlying phenomenon, that being information shocks. The more

often information changes, the more trading activity will occur.

Price volatility can imply increased uncertainty in the market. If speculators earn a return to evaluating information, reliable economic information needs to be available. Price volatility could also be the result of a paucity of reliable information in the market. Peck (1981) found that periods of increased price variability were associated with declines of speculative activity.

Empirical Analysis of Speculative Activity

The Commodity Futures Trading Commission (CFTC) in the *Commitment of Traders Report* publishes for one day per month the number of open positions held by reporting speculators and hedgers for a specific commodity. Theses monthly data have formed the base for the majority of studies examining hedging and speculative behavior. Working (1960) developed the *Speculative T-Index*. The index measures the amount of speculation relative to the amount of hedging in a market. The index was developed based upon an examination of speculative and hedge ratios for a number of different markets. Monthly large trader data from the CFTC (or predecessor organizations) was the information base. The variables used in developing these ratios and the index are as follows;

SL = Long Speculation,
SS = Short Speculation,
HL = Long Hedging,
HS = Short Hedging, and
T = Speculative Index.

Working (1960) observed from plots between the speculative and hedge ratio, where the hedge ratio is HL/HS if HS>=HL, and the speculative ratio is SL/HS if HS>=HL, a linear relationship existed;

$$\frac{SL}{HS} = (1+a) - (1-a)\frac{HL}{HS}$$

or

$$SL = (1+a)HS - (1-a)HL$$

which is equivalent to

$$SS = a(HS+HL)$$

where **a** is the speculative characteristic of the market, and

$$a=\frac{SS}{HS+HL}$$

the speculative index then is

$$T=1+\frac{SS}{HS+HL} \quad if(HS \geq HL),$$

or

$$T=1+\frac{SL}{HS+HL} \quad if(HL>HS).$$

Working (1960) noted that it is important not just to balance long and short hedging. These activities are not expected to occur simultaneously. It is important to provide more speculative services than is required to offset hedging needs to prevent heavy hedging activity on one side of the market from causing excessive price moves.

An alternative specification was suggested by Ward for measuring speculative activity in futures markets. Ward's index is as follows;

$$i=\frac{SL}{HS-HL} \quad if(HS \geq HL)$$

or

$$i=\frac{SS}{HL-HS} \quad if(HL>HS)$$

where the variables have the same definition as those in Working's index. This specification has been rejected because it is inherently unstable. If long and short hedging were balanced the index would be undefined.

Using Working's index, Peck (1980) created upper and lower bounds of speculative activity to examine the speculative nature of storable and nonstorable commodity markets. Peck assumed either all nonreporting positions were speculative positions or were all hedging positions. Nonstorable commodities were found to have higher speculative indexes than those for the storable commodities. Seevers postulated nonstorable commodities requiring more speculative activity because price is being discovered for a commodity under anticipated supply and demand conditions.

Peck (1981) found that speculative activity has a dampening affect on price variability for corn, wheat, and soybean markets.

Leuthold, using CFTC monthly large trader data and Working's speculative index, documents a similar relationship between speculative activity and price variability in live cattle, feed cattle, and live hog futures. Leuthold also created an upper a lower bound to the speculative index based on assumptions about nonreporting positions. The speculative indexes Leuthold calculated for livestock commodities were significantly higher than those that Peck (1980) had calculated for grains.

The CFTC requires the numbers of positions reporting traders ho at the end of each trading session be reported. The reporting limit was 100 contracts for live cattle during 1983-1987 period analyzed in this study. These positions are classified accordir to whether they are held by commercial traders (hedgers) or noncommercial traders (speculators). From these reports, a dail series of speculative and hedge position in the nearby live cattle futures contract was derived.

The classification of positions totals are (a) long reporting speculators, (b) short reporting speculators, (c) long reporting hedgers, and (d) short reporting hedgers. Little is known concerning the composition of trader in the nonreporting category. Total long and short positions held by nonreporting traders positions can easily be derived. The position data were augmented with a daily series of prices, volume and open interest.

Using volume and open interest data an additional variable is derive. Volume represents the total number of trades made during trading sessions. Open interest represents the total number of positions held at the end of a trading session. Subtracting the absolute difference between open interest on day one and day two from the volume of trade on day two, the activity of scalpers and day traders is quantified.

The data are for the nearby live cattle contract which is defined as the contract nearest to the delivery month but not in the delivery month. The delivery month is avoided because the CME enforced restrictions on the number of contracts an individual could hold during the delivery month.

The average percentages of long and short positions held for the period analyzed are reported in Table 1. Peck (1980) reported that, based on monthly CFTC reports for the period 1971 to 1977, reporting hedgers held 8 percent of long positions and 40.2 percent of short positions, on average, in the live cattle futures market. Leuthold analyzed the monthly CFTC reported data for live cattle between June 1969 and December 1980 and found that 9.8 percent of long positions and 35.1 percent of short positions, on average, were held by reporting hedgers.

Table 1. Positions Held by Trading Groups as Percentage of Long and Short Open Interest, February 1983 to September 1987.

POSITION	MEAN	STD. DEVIATION
	PERCENT	
Reporting Long Speculation	22	10
Reporting Long Hedge	21	8
Nonreporting Long	57	9
Reporting Short Speculation	13	5
Reporting Short Hedge	39	8
Nonreporting Short	48	9

Rowsell, Hudson and Leuthold examined monthly data reported by the CFTC for live cattle for the period 1970 through 1987. The authors reported that the proportion of long open interest held by hedgers rose from 9.6 percent on average in the period 1970 through 1980 to 19 percent on average for the period 1981 through 1987. During the two periods, the portion of short open interest held by reporting hedgers was 26 percent and 37.6 percent, respectively.

Peck and Leuthold specified identical models to examine the influence of speculative activity on price volatility. In these studies, price volatility was measured as the monthly average of the daily price range. The models specified were as follows:

$$PR = f(T, MR, \sigma, V/O)$$

where:

PR = Average daily trading range of price for a month;

T = Working's speculative index;

MR = Monthly range of price;

σ = The standard deviation of the average daily price range; and

V/O = The volume over open interest.

The monthly range of price and the standard deviation of the average daily price ranges are indicators of the flow and certainty of information to the market. The flow of information is of interest because as new information enters the market, price must change to reflect a new equilibrium price. A proxy for the certainty of the information is the stability of price changes. Volume divided by open interest was used as a proxy for scalping and day trading activity.

Using averages and monthly data limited the strength of the analyses. The short-run variability in the data may be smoothed by averages. Estimated models may appear to provide greater explanatory power than they in fact do. The proxy used for scalping and day trading activity was imprecise. Relationships

between speculative activity and intraday price volatility need to be examined over consistent temporal dimensions.

Making use of similar model specifications as employed by both Peck and Leuthold, the impact of speculative activity on intraday volatility of price was examined. The variables specified differ somewhat from those specified in previous research. The function estimated was as follows:

HLDIF = f(T, 5-Day μ, 5-Day σ, Day TR)

where:

HLDIF = Difference between daily high and low price, each session's trading range;

T = Working's speculative T index, measured using three alternative methods;

5-Day μ = Average of the previous 5-day trading range;

5-Day σ = The standard deviation of the previous 5-day trading range; and

Day TR = Volume of positions open and closed but not held beyond the one trading session.

Working's T-index was calculated for a lower bound and upper bound for speculative activity and a large-trader-only index. The lower bound was calculated by assuming all nonreporting positions are hedge positions while the upper bound was created by assuming all nonreporting positions are speculative positions. A large-trader version was calculated by ignoring the nonreporting position and calculating the index using the data on reporting positions only.

The average trading range for the previous five days and the standard deviation of the trading range provide proxies for the flow of information and certainty with respect to that information flow. Five days were arbitrarily selected. The time period does represent the previous week of trading sessions.

The daily trading range price is a classic proxy for price volatility. In a review of alternative specifications for price volatility, using limited information, Garman and Klass suggest alternative measures that have significantly higher relative efficiency than a measure based on the daily range of price.** One of the alternative measure of price volatility is as follows;

$$\sigma_1^2 = \frac{(H_1 - L_1)^2}{4 ln2} = \frac{(u-d)^2}{4 ln2}$$

where:

H_1 = the natural log of today's high price,

L_1 = the natural log of today's low price,

O_1 = the natural log of today's opening price,

** Relative efficiency measured by Garman and Klass is the variance of one measure of volatility to the variance of the alternative measure of volatility.

$u = H_t - O_t$, the normalized high,

$d = L_t - O_t$, the normalized low.

The alternative estimate of price volatility provides a more precise measure of the intraday volatility of price, but makes use of the same information as the daily price range.

Using both the standard measure of price volatility, the daily price range, and one of those suggested by Garman and Klass with the models defined above it was possible to empirically examine if speculative activity reduces price volatility.

The mean, standard deviation, and range of estimates for the T-index are presented in Table 2. **LT** is the lower bound, **UT** is the upper bound, and **RT** is the large trader only estimate of Working's T-index of speculative activity. The results are consistent with those reported by both Peck and Leuthold.

The lower bound is most stable as the standard deviation indicates. It is expected, however, that this measure underestimates the actual speculative activity. The upper bound is the least stable of the three measures, and it may overstate the level of speculative activity in the market. The large-trader-only measure of the speculative index is between the two estimates. This is not to imply it is a more accurate estimate. It reflects the available information on the composition of trade.

Table 2. Mean and Standard Deviation of Alternate Measures of Speculative Index

	LT	UT	RT
MEAN	1.071	2.066	1.225
STD. DEV.	.031	.284	.105
MINIMUM	1.003	1.495	1.009
MAXIMUM	1.177	3.028	1.714

The estimated models using the daily high-low range as the measure of price volatility for the three alternative methods of estimating the speculative index are presented in Table 3. The specified models were estimated in log-log form.

The results in Table 3 suggest that during periods of relatively higher levels of speculative activity, price volatility is reduced. This result is present regardless of the criteria used to allocate positions in the speculation index. This is consistent with the results Leuthold found for live cattle and feeder cattle and those Peck found for corn, wheat, and soybeans. Based on the results in Table 3, a one percent increase in relative speculative activity, as measured by the speculative index, is associated with price volatility decreases of .27

percent to .84 percent.

The information flow proxy results in Table 3 indicate when price volatility has been high during the last five days it will be high in the current trading session. If the standard deviation of price volatility has been high, implying price volatility has been inconsistent, then price volatility during the current trading session will be lower. This latter result is not consistent with what both Peck and Leuthold. The proxy used to measure stability is very different than that employed by Peck and Leuthold. Their measure of stability was actually the standard deviation of the dependent variable.

Table 3.Daily Price Range Regressed on Alternate Measures of Speculative Activity (Log-Log Form)

	LOWER BOUND	UPPER BOUND	LARGE TRADER
VARIABLES			
Constant	-5.9470 (-23.201)*	-5.8152 (-22.654)	-5.8250 (-23.011)
T-index	-.8417 (-2.322)	-.2719 (-3.623)	-.2996 (-2.461)
5-Day μ	.2032 (4.268)	.1921 (4.056)	.1973 (4.151)
5-Day σ	-.0514 (-2.231)	-.0600 (-2.618)	-.0502 (-2.261)
Day TR.	.6367 (22.527)	.6357 (22.764)	.6308 (22.556)
REGRESSION STATISTICS			
R^2	.45	.45	.45
F	198.0	198.0	198.0
DW	1.72	1.72	1.72
N	974	974	974

*Numbers in ( )'s are t-ratios.

In this analysis, there is a very strong positive relationship between the amount of day trading and the price volatility. This result confirms the findings of both Peck and Leuthold. These results suggest that as the amount of day trading and scalping activity increases, the price volatility increases. The question of whether scalping and day trading activities respond to or cause price volatility is thus raised by this analysis.

In a separate analysis of correlation coefficients day trading exhibited a strong positive relationship to the previous five day average of daily price ranges. Without specifying a direction to the causal flow, if price activity has been volatile, then more day trading is taking place. When the proxy for the consistency of price volatility, the standard deviation of the previous five day trading ranges, was examined with the volume of day trading, a weak positive relationship was found. These two resulting provide an inkling that day trading is dependent upon the volume

of information flows to the market rather than on the consistency of the information flows.

The use of daily price ranges was attractive because it was a simple method to estimate price volatility. Garman and Klass contend there are superior methods to estimate price volatility. The Garman and Klass alternative estimate of intraday price volatility was substituted for the daily price range. In this analysis the five-day mean and standard deviation of this alternative price volatility measure was substituted for the proxies of flow and stability of information.

The results of this analysis are presented in Table 4. The correlation coefficient between the alternative estimate of price volatility with the daily price range method is .94. The expectation, then, is that the explanatory variables would exhibit similar influences on alternative measure of price volatility as was found using the daily price range.

Table 4. Daily Price Volatility Regressed on Speculative Activity (Garman and Klass Price Volatility Estimate)

DEPENDENT	σ_i^2		
VARIABLE	LT	UT	RT
Constant	-.0005 (-11.08).	-.0005 (-16.55)	-.0005 (-11.04)
T-index	.0000 (.543)	-.0001 (-2.825)	.0000 (.481)
5-Day μ	.6237 (9.028)	.6161 (8.996)	.6229 (9.014)
5-Day σ	-.3196 (-3.851)	-.3226 (-3.994)	-.3160 (-3.877)
Day TR.	.0001 (11.697)	.0001 (12.034)	.0001 (11.785)
REGRESSION STATISTICS			
R^2	.27	.28	.27
F	91	93	91
DW	1.84	1.85	1.84
N	974	974	974

*Numbers in ( )'s are t-ratios.

The results in Table 4 indicate that for the variable of greatest interest, the speculative index, the results are not consistent. For the remaining variables, the basic relationships are consistent. The upper bound estimate of speculative activity did, however, exhibit a consistent relationship as an explanatory variable for the alternative measures of price volatility. The upper bound indicator of speculative activity tends to be an over estimation. For the lower bound and the reporting trader only T-index, the estimated relations were not statistically different from zero. In fact, the coefficients themselves were zero at the four decimal point level.

Conclusions

It was intimated in the introduction that this analysis sought to increase our understanding of the role and behavior of speculators in the live cattle futures markets. Through an analysis of levels of speculative and hedging activity there is little evidence that excessive speculation is present in this market. The analysis suggest hedgers are playing an increasingly dominate role in this market when compared to the results of studies completed during the 1970s.

Empirical results using the Garman and Klass price volatility measure suggest caution in concluding increases in speculative activity reduces price volatility. Given this caveat the overwhelming evidence in this analysis indicates that increases in speculative activity relative to hedging use is associated with increased price stability in the live cattle futures market.

It is not unequivocally clear that increased speculative activity in the form of position traders will decrease price volatility. It is clear that increased speculative activity does constrain the range of price activity. If all nonreporting traders are assumed to be speculators then the body of evidence does indicate that speculators reduce price volatility.

With little information available on nonreporting traders in the live cattle market, the assumption on how to allocate these position is critical in an analysis of speculator and hedging behavior. This is the case with the other meat complex futures markets because nonreporting traders tend to represent a larger portion of open interest than is the case with other agricultural markets.

Given the temporal structure used in this analysis, no conclusions can be drawn concerning the direction of causal flow between price volatility and day trading. Further research examining how price and traders activities are related within the trading session is needed.

An inkling that day trading activity is dependent on the flow of information to the market was found. Intraday volume may be related to a phenomena of increased and varied flow of information rather specific information shocks. Research on this issue would help answer if trading volume is a reaction to information shocks and/or whether price volatility is a result of a paucity of information in a market.

With a highly concentrated packing industry, the potential for market power to be exerted is present. The question becomes one of whether there are institutional structures and potential market participants that can counter-balance the market power of large packers (hedgers) on the buying side. An understanding of the role of speculators in the live cattle market is therefore all the more important.

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