# Commitment of Traders, Basis Behavior, and the Issue of Risk Premia in Futures Markets

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## INTRODUCTION

An often asked question regarding futures contracts relates to whether or not futures prices contain risk premia. The arguments may be traced back to Keynes (1930), who suggested that hedgers must compensate speculators for providing the insurance that hedgers seek. Empirical studies that address this issue have generally associated profitability of speculative traders with a flow of risk premia, and the evidence has thus far been mixed [for instance, see Park (1985), Fama and French (1987), Kolb (1992), and Bessembinder (1993)]. This article suggests that the lack of consensus regarding the issue of premia is due largely to the fast that much guesswork is involved in determining what are returns and what are premia.

This study proposes a direct approach to the analysis of whether or not hedgers and speculators exchange risk premia. The approach involves

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relating any premia in futures prices to the imbalances in hedging contracts. The evidence from five agricultural commodities over the 1/1983 through 3/1995 interval indicates that speculators do not impose risk premia. Rather than obtaining an up-front price for their role, speculators seem to provide liquidity for a more efficient price discovery process. The results also suggest that large speculators have been the most profitable group of traders in the 1980s and 1990s.

## Background and Problem

A widely accepted rationale for the existence of futures trading is that it facilitates hedging—the transfer of risk to traders willing to assume it. This transfer of risk may or may not require the services of speculators. However, in the more likely market scenario where short and long hedgers do not have offsetting contractual needs, some hedgers must deal with speculators to establish or close out futures positions. Although there is much debate over the role of speculation in cash market behavior, there is little question that the speculator provides the vital service of accepting the risk transfer in the event that there are hedging imbalances.

There remains, however, the question of whether or not speculators are compensated for this service. A popular hypothesis, that hedgers pay premia to speculators, has its roots in Keynes's (1930) theory of normal backwardation. The theory was developed around the assumption that hedgers are net short, so that futures prices will be below expected future cash prices (backwardation). Note that this hypothesis also implies that the futures price will be a biased estimate of the spot price at contract expiration [e.g., Telser (1958), Gray (1960), Rockwell (1967), and Miracle (1972)]. Several authors, including Houthakker (1957) and Cootner (1960) have reformulated the original backwardation theory to allow for hedging positions to be net long, so that a premium would be manifested by futures prices being above that of the expected future cash price (contango). If long and short hedging imbalances occur randomly, the existence of risk premia would not itself imply that futures prices are biased estimates of future cash prices.

Alternate theories postulate that the risk premia are effectively bid to zero, as the supply of speculative services are infinitely elastic at zero return [e.g., Telser (1958), Rockwell (1967), and Hartzmark (1984, 1987)]. Large numbers of speculators will enter the market any time there is a risk premium, so that the futures price must equal the expected future spot price, if the costs of storage are ignored.[1] Moreover, it is plausible

[1] Hartzmark (1987) suggests that these traders may be risk lovers, or may simply enjoy dealing in futures markets.

that many speculators enter the market without knowing the specific category of the trader that holds the opposite side of the contract. For instance, although the Commodity Futures Trading Commission (CFTC) regularly compiles, in the Commitment of Traders (COT) report, the breakdown of contracts by trader type, it is not clear whether these data provide to the trader anything other than a general idea of the makeup of the market.[2] In markets where hedging imbalances are not obvious, there should be little reason to expect that speculators impose a risk premia based on trader classification.

Several researchers have sought to establish the existence or absence of risk premia. To address this question, researchers have generally analyzed the difference between current futures price and the future spot or futures prices. For instance, the fact that buy-and-hold strategies produce positive returns is taken to imply the existence of risk premia. The superior performance of speculators in markets that are presumed to be efficient is attributed to risk premia flowing from hedgers to speculators; while, evidence that dollar returns to speculators are randomly generated implies an absence of premia. The findings are, thus far, mixed sometimes confirming, sometimes denying the existence of premia.

The approach that relies on trader profitability to make inferences on risk premia has two weaknesses. First, some studies have indicated that certain groups of futures traders may have forecasting ability, so that it may become infeasible to differentiate between profitability and risk premia. For instance, studies, including those by Chang (1985) and Leuthold, Garcia, and Lu (1994), concluded that large traders have superior forecasting ability.[3] Second, the profitability approach does not account for the actual degree of interaction between groups of traders. Addressing these two concerns may be critical in the determination of whether or not there is an exchange of premia between hedgers and speculators.

With these concerns in mind, a more direct test of backwardation is proposed. In the absence of premia, the difference between the current futures price and current spot price (the basis) of a storable commodity is determined by the cost of carrying the commodity, and any convenience

[2]However, there may be situations when speculators are more likely to have an indication of the hedging imbalances. First, extraordinary surges in the level of hedging imbalances will likely draw the attention of speculators. For instance, sudden surges in the needs of short hedgers in agriculturals may be caught early when there are harvest revisions, or later, in the trading pits. Second, several commodities follow certain obvious patterns of hedging imbalances. For instance, coffee has historically had an excess of short hedgers over long hedgers, with some exceptions in 1984, and oats has had an excess of short hedgers since 1987.

[3]Chang (1985) finds superior forecasting ability of large traders in the wheat contract for the 1951–1980 interval, and Leuthold, Garcia, and Lu (1994) demonstrate that elite traders earn significant net dollar returns in the frozen pork bellies market.

yield associated with storing it. Risk premium is defined as the level of the basis over and above that which is explained by these factors. The test for backwardation involves examining the relationship between this variable and the imbalance of contracts between long and short hedgers. In essence, this study investigates the existence of an instantaneous risk premia flowing from hedgers to speculators. Such an approach makes it possible to directly address the question of whether the premia flows from the hedger to the speculator as compensation for trader interaction.

The next section lays the foundations for the direct testing procedure employed in the study. Section 3 describes the data and methodology. Section 4 presents the empirical findings. Section 5 summarizes the findings and implications of the study.

## PRIOR TESTS OF BACKWARDATION IN FUTURES MARKETS

In the traditional theory of backwardation, three assumptions motivate the existence of risk premiums:

1. Speculators are risk averse.
2. Hedgers are net short (or speculators net long).
3. Speculators do not have forecasting ability.

The second assumption has been relaxed by several researchers, given the reality that hedgers are not consistently net short. The first and third assumptions have allowed for a simplification of the test for risk premia. Namely, if the empirical evidence supports that the speculator is consistently profitable, there must be premia that flow from the hedger to the speculator. The profitability of speculators would imply a reward for risk bearing rather than for trading on superior information.

The studies of Dusak (1973), Bodie and Rosansky (1980), Kolb (1992) and Bessembinder (1993) rely on the third assumption. Dusak (1973), Kolb (1992) and Bessembinder (1993) fail to find clear evidence of positive mean returns in various commodity futures, and suggest the absence of risk premia.[4] On the other hand, Bodie and Rosansky (1980) find that a buy-and-hold strategy in 22 of 23 futures commodities investigated would yield consistently positive returns.[5] The authors conclude

[4]The samples in the above studies form a fairly continuous time frame of analysis. Dusak studied the returns of wheat, corn and soybeans over the 1952–1967 interval. Bessembinder studied 22 futures markets from 1967 to 1989.
[5]Bodie and Rosansky base their investigation on three-month futures returns over the 1950–1976 interval with quarterly data. The degree of freedom in their tests is relatively small.

that the positive returns are a manifestation of Keynesian backwardation—that is, there exists a downward bias in futures prices. Thus, the studies that associate contract profitability with risk premium have produced mixed results.

Other studies question the notion that futures profitability alone signals the existence of risk premia. Houthakker (1957), Rockwell (1967), and Chang (1985), among others, point out that the reconciliation of the questions regarding the existence of risk premia requires a distinction between rewards for risk bearing and rewards for forecasting or market timing skills. These studies estimate and compare the returns to three trader groups: large speculators, large hedgers, and small traders. The authors base their conclusions regarding risk premia on the returns to the naive speculator who possesses no forecasting ability. For instance, Rockwell defines a naive speculator as one who is long when hedgers are net short, and short when hedgers are net long. Rockwell finds the return to this hypothetical trader to be zero, and the return to the large speculator to be positive. Rockwell interprets the results as suggesting the absence of premia. Chang updates the Rockwell study and indicates the presence of premia in the wheat, corn, and soybean contracts in the 1950s, 1960s, and 1970s.

Although it can be argued that the technique adopted by Rockwell and Chang to study futures premia provides improvements over the techniques that rely solely on profitability, there are some concerns over their approach as well. First, Rockwell and Chang relax the assumption that speculators do not have forecasting ability, only to impose the assumption of forecasting inability of small speculators. However, risk-premium studies that rely on profitability of large and small traders find inconsistent results. For instance, Hartzmark (1984, 1987, 1991) indicates that returns to traders may be generated randomly.[6] Second, the approach of Rockwell and Chang makes no allowance for the degree of interaction between hedgers and speculators. These studies only evaluate the profitability of trader groups, without indicating the nature of the allocation of monetary gains and losses. For instance, there is no allowance for the possibility that premia are allocated between long and short contracts, rather than between hedgers and speculators. At one extreme, it is possible, though unlikely, that hedgers may not need the services of speculators at all. In such an event, any risk premia would be allocated entirely

[6]In fact, Hartzmark (1984, 1987) finds that hedgers outperform large speculators over certain intervals.

between long and short positions, rather than on a speculator–hedger basis.[7]

With the above concerns in mind, the next section develops alternate testable hypotheses for risk premia. The hypotheses are not based solely on trader profitability or the notion that some traders have (or do not have) forecasting ability. Instead, the hypotheses are developed around the structural relationships in the cost-of-carry model. More specifically, the tests are designed to examine whether speculators *that interact* with hedgers receive a return for their role in the contract.

## Alternate Tests for Backwardation

Define $S_t$ as the prevailing spot price and $F_{tT}$ as the current futures for delivery at $T$. Let $r$ represent the risk-free rate of interest, and $u$ be the cost of storage as a proportion of $S_t$. It can be shown via arbitrage arguments that, in the absence of risk premium, the markets will be at partial equilibrium at

$$F_{tT} = S_t e^{(r+u)(T-t)} \tag{1}$$

If $F_{tT} > S_t e^{(r+u)(T-t)}$, arbitrageurs would raise $(S_t + U)$ ($U$ being the dollar present value of storage costs), purchase one unit at $S_t$, and short one futures contract at $F_{tT}$. This will result in a profit of $F_{tT} - S_t e^{(r+u)(T-t)}$. If $F_{tT} < S_t e^{(r+u)(T-t)}$, investors who own the asset will find it rewarding to sell the commodity, invest the proceeds at the risk-free rate, and buy futures contracts. The riskless profit will be given by $S_t e^{(r+u)(T-t)} - F_{tT}$.

However, the above equilibrium may not hold if factors other than spot prices, interest rates, and storage costs determine futures prices. For instance, if the primary holders of the commodity have a commercial motive (say, food processing), they may be reluctant to follow up on the strategy that keeps $F_{tT}$ from going below $S_t e^{(r+u)(T-t)}$. Let the benefits that may come from holding commodities (referred to as the *convenience yield*) be $y$. Further, in the event of hedging imbalances, when the contracts of short and long hedgers do not match, allow for the possibility that some hedgers compensate speculators who are willing to assume the opposite side of their contracts. Let these premia, negative or positive, be

[7]The study by Raynauld and Tessier (1984) illustrates the validity of the second concern. Using quarterly data from 1970 to 1981, the authors find positive as well as negative risk premia (defined as futures price minus the three-month-in-future spot price) in the wheat, oats, and corn markets. During that sample period, hedgers were nearly balanced for wheat and corn, with speculators having "literally been driven out of these markets." Therefore, the authors conclude that the premia could only be allocated between long and short hedgers.

given by $p$. The variables, $y$ and $p$, can be defined collectively by the partial equilibrium equation,

$$F_{tT}/S_t = e^{(r+u-y-p)(T-t)} \tag{2}$$

The variables, $y$ and $p$, measure the extent to which $F_{tT}$ is greater than or less than the right-hand side of eq. (1). Equation (2) simply states that the difference between futures and spot price will be determined by the time to maturity, cost of carry, convenience yield, and any premia created by a hedging imbalance. If $p$ is prevalent one would expect from the theory of backwardation that it is positive when hedgers are net short, and negative when hedgers are net long. In other words, hedgers being net short (net long) would be expected to cause a downward (upward) pressure on the difference between the futures and spot price. If the premium is determined by the degree to which long or short speculator services are required by hedgers, a hedging imbalance defined by long hedger contracts minus short hedger contracts, $HL_t - HS_t$, will be positively related to $F_{tT} - S_t$ after carrying costs and convenience yield are controlled for.[8] Such an approach would address both the concerns regarding prior studies on risk premia. Namely, the approach would distinguish between profitability and premia, and control for the degree of interaction between hedgers and speculators.

Another approach to test for premia allows for the risk premia to be determined on an ex post basis. Assuming futures investments have zero net present value, one can demonstrate that

$$F_{tT} = E(S_T)e^{(r-k)(T-t)} \tag{3}$$

where $E(S_T)$ is the expected price of the commodity at $T$, and $k$ is the required rate of return associated with the commodity. Equation (3) suggests that the difference between the prevailing futures price and the time, $T$, expected spot price is determined by the risk premium on the commodity. That is, if $k = r$, there is no risk premia, so $F_{tT} = E(S_T)$. On the other hand, if $k > r$, then $F_{tT} < E(S_T)$. Finally, if $k > r$, then $F_{tT} > E(S_T)$. If rational expectations are assumed, so that $E(S_T) = S_T$ plus a random error term, the test for the premia being exchanged between speculators and hedgers would involve the relationship between the hedging imbalance and $F_{tT} - S_T$, the ex post risk premia. The presence of premia

[8]It is assumed that, in the event that speculators charge a risk premium, hedgers will seek out hedgers first, so that if long hedger contracts equal short hedger contracts, there is no interaction between hedgers and speculators.

(flowing from hedgers to speculators) will be supported by a negative relationship between $F_{tT} - S_T$ and hedging imbalance, as defined earlier.

This approach addresses the shortcoming in prior research in that it involves the relationship between premia and the interaction between speculators and hedgers. However, it does not get around the problem of disaggregating profitability and premia. If some traders have forecasting ability, $F_{tT} - S_T$ may jointly represent carrying charges, risk premium, and the dollar return from superior market timing.

## SAMPLE AND METHODOLOGY

Five major agricultural commodities—wheat, soybeans, corn, coffee, and cotton, over the interval 1/1983 through 3/1995 are investigated. The futures contracts for the five commodities are some of the most active contracts in U.S. markets and, barring coffee, have been the subject of risk premia research in the past [e.g., Dusak (1973), Bessembinder (1993)]. The coffee contract also offers an opportunity to investigate the risk premia hypotheses with respect to a commodity that is wholly of foreign origin.

Daily open interest and closing prices for the wheat (Chicago Board of Trade [CBT]), soybeans (CBT), corn (CBT), coffee (Coffee, Sugar & Cocoa Exchange), and Cotton No. 2 (New York Cotton Exchange) futures contracts are supplied by the Futures Industry Institute Data Center (FII), Washington, DC. The cash market prices for the underlying commodities listed on the respective exchanges at the close of futures trading are also obtained from FII.[9] Each contract is followed until the trading day prior to the futures expiration month. The rationale for restricting the data in this manner is that open interest for the nearby contract drops dramatically, sometimes to zero, in the expiration month.[10]

The CFTC-compiled Commitment of Traders (COT) data for the interval, 1/1983–3/1995, is obtained from Pinnacle Data Corp, Webster, New York. The CFTC requires that the clearinghouse members make a periodic report to the Commission showing each trader's positions on their books when such positions exceed an established reporting level.[11]

[9]The trading hours for the wheat, soybeans, and corn futures contracts are 9:30 am–1:15 pm central time. The coffee contract trades between 9:30 am and 1:58 pm eastern time, and the Cotton contract trades between 9:30 am and 3:00 pm eastern time.

[10]The expiration cycles for wheat, corn, and coffee are March, May, July, September, and December; for soybeans the cycle is January, March, May, July, August, September, and November; and for cotton the cycle is March, May, July, October, and December.

[11]Prior to 1991, the CFTC compiled the COT report once a month. The COT report was compiled bimonthly from 1/1991 to 10/1992, and weekly from 10/6/1992 to the present.

Traders must be classified as commercial traders (large hedgers), noncommercial traders (large speculators) and small traders (noncategorized traders).[12] The COT data is sampled at month-end levels from 1/1983 to 3/1995 and at weekly levels (close of each Tuesday) from 10/6/1992 to 3/28/1995. Finally, weekly 90-day Treasury bill rates for the 1/1983–3/1995 interval are obtained from the Pinnacle Data Corp.

Hedging imbalance is defined as $HI_t = (HL_t - HS_t)/OI_t$, where $OI_t$ represents open interest at time t. The standardization of the difference between long and short hedging contracts is aimed at controlling for any trends in the level of trading activity.[13] Basis is defined as the average (monthly or weekly) of the daily difference in log of futures and spot prices. Henceforth, the basis is referred to as $\log(F_{tT}) - \log(S_t)$, where $F_{tT}$, is the price of the nearby futures contract at $t$, and $S_t$ is the spot price at $t$. The basis tends to be positive for each commodity. In fact, for commodities such as cotton, the basis is equal to the absolute basis for much of the sample. Also, seasonal trends in the basis are found for each commodity. A general rise is found in the basis during the fall months for all but the wheat contracts. The basis for wheat is found to rise, on average, from June through September.

Indications of the positive trends and seasonalities in the basis are brought out in Figure 1, which plots the daily mean levels of two measures of basis for corn by contract maturity. There is a distinct rise in the basis or the absolute of the basis in October. These trends generally support the notion of convenience yields: Other things being constant, one would expect the convenience yield to be lowest, and, therefore, the basis to be highest, during the harvest season, when the supply of the commodity is the greatest. This is indeed the case for all the commodities examined.

If the relationships in eq. (2) are generalized, the hypothesis of premia is tested in the framework of the regression:

[12]A commercial trader classification is given to the traders whose positions exceed the CFTC reporting levels and who are involved with the production and/or processing of the underlying commodity. A noncommercial trader classification is given to traders whose positions exceed the CFTC reporting levels but who do not use futures contracts for hedging purposes. The positions of Small do not exceed the CFTC reporting levels and no distinction is made about trader motives. Because initial margin requirements are lower for hedgers, there may be some incentive for noncommercial traders to report themselves as commercials. Throughout this article it is assumed that any misclassifications do not significantly bias the representation of hedgers and speculators in the COT report.

[13]Two additional assumptions must be made regarding the COT data in deriving the hedging imbalance measure. It is assumed that the commitment of trader data is representative of the trader distribution in the nearby contract, and it is assumed that noncategorized contracts are held by hedgers and speculators in the proportion of reporting hedgers and speculators.

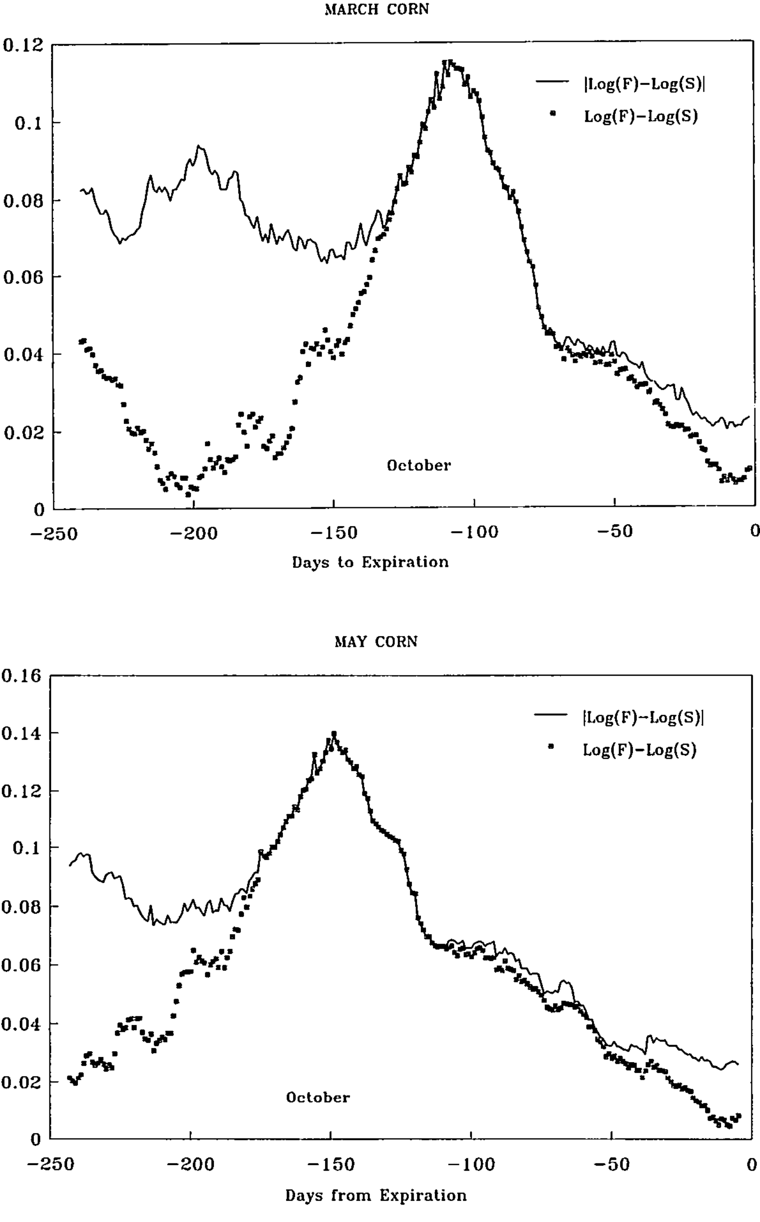
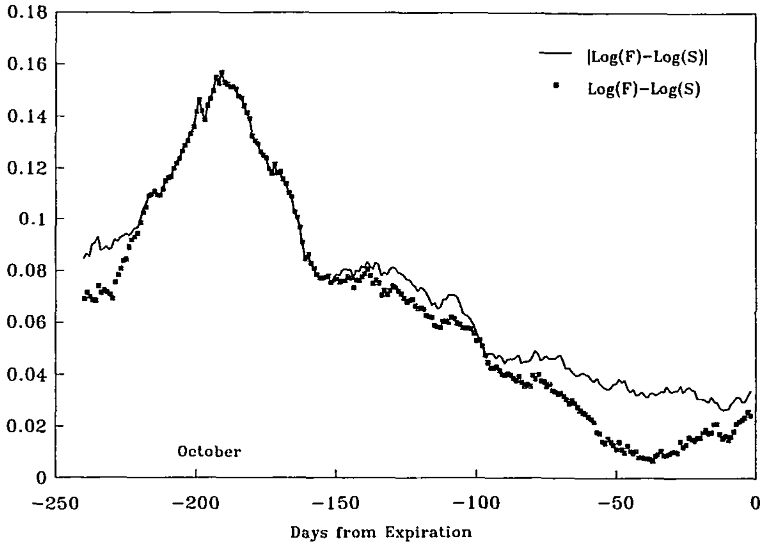



**FIGURE 1**
Basis seasonality in corn contracts (1/1983–3/1995).

JULY CORN




SEPTEMBER CORN

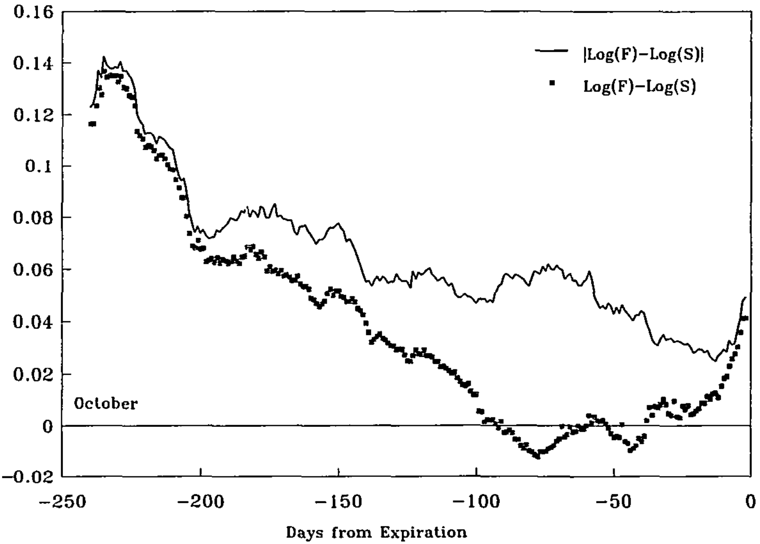



**FIGURE 1 (continued)**
Basis seasonality in corn contracts (1/1983–3/1995).

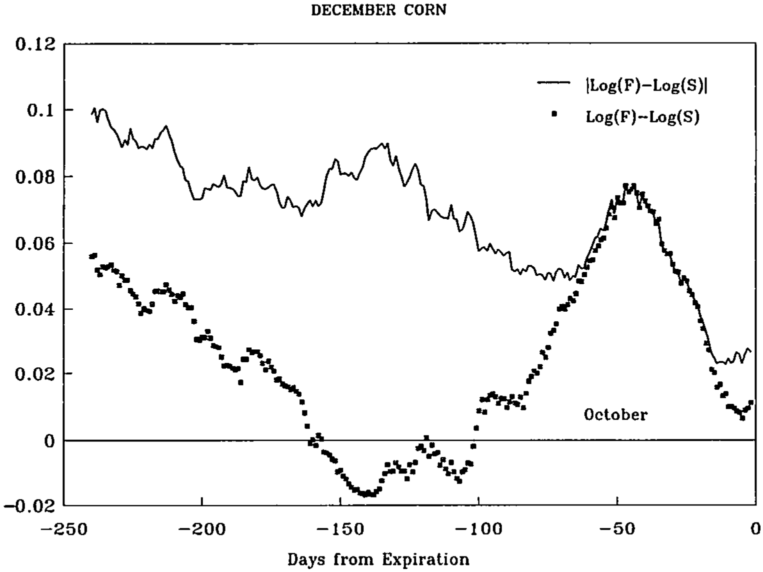



**FIGURE 1 (continued)**
Basis seasonality in corn contracts (1/1983–3/1995).

$$\log(F_{tT}) - \log(S_t) = \alpha + \beta_1 HI_t + \beta_2 HI_{t-1} + \beta_3 Tbill_t + \beta_4 TTM_t + \sum_{i=2}^{12} \delta_i \, Month_{it} + \varepsilon_t \qquad (4)$$

where $\alpha$ is the constant, the $\beta$s and $\delta$s are the coefficients to be estimated; $HI_t$ and $HI_{t-1}$ are the contemporaneous and lagged values of the hedging imbalance; Tbill is the change in the 90-day Treasury bill rate at $t$;[14] $TTM_t$ is the time (in days) remaining until maturity, or $T - t$; $D_2$–$D_{12}$ represent dummy variables for 11 months of the year (February–December), with the monthly basis levels evaluated against the basis in January, and $\varepsilon_t$ is the regression error term.

In the theory of backwardation, the premia flowing between speculators and hedgers arises because of imbalances in hedging contracts. If the premium is allowed to be determined by the degree to which long or short speculator services are required by hedgers, the HI variable is ex-

[14]The null hypothesis of nonstationarity of the T-bill rate is not rejected at the 10% level of confidence when the standard augmented Dickey–Fuller test for unit roots is employed. The first differenced T-bill rate and the other series in the regression are found to be stationary.

pected to proxy for any premia. The null that there is no premia flowing from hedgers to speculators will be rejected by a positive HI coefficient. The lagged HI variable is included because there may be considerable delay in the actual release of commitment of traders to the public.[15] The T-bill rate is included to control for part of the cost of carry alluded to in eq. (2). A positive coefficient is anticipated. The TTM is included to control for the time to maturity.[16] Finally, it is thought that the seasonal dummies will proxy for the monthly variations in convenience yield, and other variables that induce seasonality in the basis.[17] A continuous time series is obtained for the regression following a contract until the last day preceding the expiration month; thereafter a switch is made to the next nearest contract.[18]

# EMPIRICAL RESULTS

## Highlighting the Issue of Profitability versus Premia

The profitability of four trader groups is analyzed. The first three trader groups are large speculators, large hedgers, and small traders, all defined in the CFTC reports. The fourth trader group includes naive traders who follow a strategy that is contrary to that of the majority of hedgers. If hedgers are net short (long), the naive trader is long (short) one contract. Average dollar profits for each trader group are computed by multiplying the traders' positions at $t$ by the change in the settlement price between $t$ and $t + 1$ (within the same contract cycle). This approach is employed by the central clearinghouse to mark individual trader's accounts at the end of each trading session.[19]

[15]Prior to 1992, information regarding commitment of traders was generally released to the public 3–5 days after the initial month-ending compilation. Since 1992, data have been released every other Friday, and include values from the two previous Tuesdays.

[16]The positive relationship between time to maturity and basis is well documented [e.g., Castelino (1989)].

[17]The above regression model does not explicitly control for the cost of storage. In defense of the model, storage costs are known to be the least variable of the elements of carrying charges. Federally licensed grain elevators that have space available for storage attempt to keep storage costs competitively low. Further, changes in storage costs are determined mainly by the general inflationary trends and the proximity to the harvest season, thought to be captured by the interest-rate variable and seasonal dummies.

[18]Other variables may explain basis behavior. For instance, inflation levels and aggregate consumption levels are suggested in several equilibrium models [e.g., Raynauld and Tessier (1984)]. It is expected that interest rates and the hedging imbalance variable reflect such factors.

[19]To better estimate the trading positions over a period, trader positions are averaged with the use of month-end data. For instance, the average profits of speculators for a 1-month holding period are

Table I presents the estimated dollar returns for the four groups of traders over the 1/1983–3/1995 interval.[20] The results indicate that large speculators, on average, have profited in all five commodities, whereas hedgers have not. Small traders, an unknown mixture of speculators and hedgers, are found to be profit for the soybeans, corn, and cotton contracts. Finally, the naive trader broke even, on average.

Researchers in favor of the efficient market hypothesis might argue that these results are indicative of premia flowing from hedgers to speculators. Because speculators cannot have superior forecasting ability, their superior performance must come from a compensation for risk bearing. However, in the framework of other studies on backwardation, the results might support the absence of risk premia. Evidence that the naive trader, who has no forecasting ability, secures positive returns implies that there exist risk premia [e.g., Chang (1985)]. In fact, this study finds that the naive trader did not earn significant returns, but did not incur significant losses. Therefore, by employing the alternate benchmark, speculators earn no risk premium, and their entire profits arise from their ability to forecast and time the market. Thus, it is demonstrable that the results of the evaluation of risk premia employing the return-to-trader criterion is entirely contingent on a researcher's assumptions regarding the ability of various groups of speculators to earn positive returns.

## Tests for Premia

Tables II–IV present the results from a spectrum of tests that more directly test for risk premia. Table II reports the mean levels of the basis when hedgers are net long and net short. It is clear from these results that the traditional backwardation theory does not hold. Backwardation would require that, on average, (1) hedgers are net short, and (2) futures prices are lower than cash prices. The results do indicate that hedgers are net short on most occasions (as indicated by $N$) for the soybeans, corn, coffee, and cotton contracts. However, the average futures price is greater than the average cash price when this is the case. On the other hand, one can reject that $F_{tT} > S_t$ for wheat and coffee only when hedgers

given by

$$Profits_t = \frac{(F_{t+1} - F_t) * SL_{t,t+1} + (F_t - F_{t+1}) * SS_{t,t+1}}{SL_{t,t+1} + SS_{t,t+1}}$$

where $SL_{t,t+1}$ and $SS_{t,t+1}$ are the average number of contracts held by long and short speculators over the period, $t$ to $t + 1$.

[20]Only the statistics from the monthly series (1/1983–3/1995) are presented. The implications remain unchanged when a weekly series (10/1992–3/1995) is employed.

**TABLE I**

Trader Performance (1/1983–3/1995): Dollar Returns per Contract:[a,b]

| *Trader Category* | *Holding Period (months)* | *Contract* *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
|---|---|---|---|---|---|---|
| Large speculators | 1 | 3.174** | 2.608 | 2.159*** | 0.777 | 0.599*** |
| | | (2.169) | (1.159) | (2.667) | (1.168) | (2.828) |
| | 2 | 10.682*** | 7.978*** | 4.729*** | 2.149** | 1.519*** |
| | | (4.374) | (2.799) | (4.366) | (2.475) | (5.153) |
| | 3 | 14.707*** | 11.314*** | 5.738*** | 2.313** | 1.888*** |
| | | (4.381) | (3.354) | 4.677 | 2.057 | (5.242) |
| Large hedgers | 1 | −0.579*** | −1.361 | −0.709*** | −0.415 | −0.222* |
| | | (−2.682) | (−1.197) | (−3.283) | (−1.430) | (−1.805) |
| | 2 | −0.967*** | −3.792** | −1.348*** | −0.723* | −0.393** |
| | | (−3.114) | (−2.175) | (−4.546) | (−1.802) | (−1.969) |
| | 3 | −1.329*** | −4.877*** | −1.618*** | −0.796 | −0.500*** |
| | | (−3.207) | (−2.562) | (−4.815) | (−1.534) | (−2.299) |
| Small traders | 1 | 0.305 | 0.528 | 0.354** | 0.083 | 0.101 |
| | | (0.970) | (0.961) | (2.269) | (0.273) | (1.074) |
| | 2 | 0.373 | 1.562* | 0.652*** | 0.263 | 0.186 |
| | | (0.859) | (1.755) | (3.198) | (0.558) | (1.407) |
| | 3 | 0.582 | 1.893** | 0.745*** | 0.162 | 0.260* |
| | | (0.990) | (2.004) | (3.318) | (0.257) | (1.740) |
| Naive trader | 1 | 3.069 | −1.324 | −0.056 | −1.065 | 0.213 |
| | | (1.449) | (−0.352) | (−0.038) | (−0.887) | (0.428) |
| | 2 | 1.473 | −0.698 | −0.512 | 0.096 | −0.058 |
| | | (0.509) | (−0.138) | (−0.254) | (0.055) | (−0.091) |
| | 3 | 2.309 | −1.429 | 0.041 | −1.543 | −0.538 |
| | | (0.625) | (−0.239) | (0.017) | (−0.687) | (−0.683) |

[a]Statistics in parentheses are *t* statistics for null hypothesis: Monthly mean return = 0.
[b]Naive trader is a hypothetical trader that follows a strategy that is contrary to that of the majority of hedgers.
*Significance level of .10.
**Significance level of .05.
***Significance level of .01.

are net long. In fact, the basis is generally higher when hedgers are net short. Other factors held constant, these results are contrary to a flow of premia from hedgers to speculators.

Table III reports the correlation of hedging imbalance and the basis sampled at fixed intervals from maturity. Because hedging imbalances are defined as $(HL_t - HS_t)/OI_t$, the null hypothesis of a positive risk premium is rejected if there is no positive association between the two variables. In other words, when hedgers are net long, risk premium manifests itself via a higher basis, and vice versa. The correlations are consistently non-positive for all but the wheat contract, sampled at two months from expiration. In fact, the correlations are strongly negative for corn, coffee, and cotton contracts. Such findings point to the rejection of the null

**TABLE II**

Test for Backwardation Basis and Hedging Imbalances[a,b]

| | *Panel A: Sampled Monthly (1/1983–3/1995)* Basis $[\log(F_{tT}) - \log(S_t)]$ | | | | |
|---|---|---|---|---|---|
| | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
| When hedgers are net short | .0182** | .0184*** | .0486*** | .0966*** | .0660*** |
| | (2.571) | (15.530) | (10.396) | (9.582) | (10.396) |
| | $N = 65$ | $N = 122$ | $N = 77$ | $N = 138$ | $N = 77$ |
| When hedgers are net long | .0062 | .0166*** | .0355*** | .0031 | .0355*** |
| | (0.815) | (4.199) | (6.723) | (0.189) | (6.723) |
| | $N = 82$ | $N = 25$ | $N = 70$ | $N = 9$ | $N = 70$ |
| | *Panel A: Sampled Weekly (10/1992–3/1995)* Basis $[\log(F_{tT}) - \log(S_t)]$ | | | | |
| | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
| When hedgers are net short | .0367** | .0229*** | .0757*** | .1418*** | .0673*** |
| | (5.253) | (17.922) | (14.602) | (16.663) | (17.053) |
| | $N = 57$ | $N = 98$ | $N = 75$ | $N = 125$ | $N = 80$ |
| When hedgers are net long | .0061 | .0288*** | .0556*** | .0241** | .0429*** |
| | (0.075) | (11.657) | (13.418) | (2.443) | (8.742) |
| | $N = 73$ | $N = 32$ | $N = 55$ | $N = 5$ | $N = 50$ |

[a]Statistics in parentheses are *t* statistics for null hypothesis: Monthly mean return = 0.
[b]*N* is the number of observations.
*Significance level of .10.
**Significance level of .05.
***Significance level of .01.

hypothesis that speculators earn a risk premia for interacting with hedgers.

Table IV presents the least-squares regression results. This study finds some evidence of autocorrelated disturbances that employ the Ljung–Box–Pierce Q statistics for the contracts under investigation. Subsequently, the Newey and West (1987) variance estimator is employed for models with (first-order) autocorrelated disturbances.

The null hypothesis of a flow of premia from hedgers to speculators is rejected by the results in Table IV. Backwardation implies that, when hedgers are net short, some short hedgers must interact with long speculators, who elicit a premium by putting downward pressure on the $F_{tT}$. In other words, the presence of premium would be rejected if there is no positive and significant association between $(\mathrm{HL}_t - \mathrm{HS}_t)/\mathrm{OI}_t$ and $\log(F_{tT}) - \log(S_t)$, after controlling for the other determinants of the basis. In fact, the contemporaneous hedging imbalance coefficient is negative and significant for four of the five commodities analyzed. For the cotton con-

**TABLE III**

Test for Backwardation Basis [$\log(F_{tT}) - \log(S_t)$] and Hedging Imbalances Correlations

| | *Panel A: Monthly Levels (1/1983–3/1995)* | | | | |
|---|---|---|---|---|---|
| *Time to Expiration (in Months)* | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
| 3 | −0.213 | −0.076 | −0.202 | −0.469 | −0.521 |
| 2 | 0.096 | −0.260 | −0.396 | −0.314 | −0.445 |
| 1 | −0.248 | −0.166 | −0.366 | −0.144 | −0.467 |
| | *Panel A: Weekly Levels (10/06/1992–3/28/1995)* | | | | |
| *Time to Expiration (in Weeks)* | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
| 10 | 0.180 | −0.239 | −0.699 | −0.625 | −0.129 |
| 8 | 0.172 | −0.004 | −0.460 | −0.677 | −0.445 |
| 6 | −0.762 | −0.560 | −0.658 | −0.682 | −0.466 |
| 4 | −0.623 | −0.094 | −0.625 | −0.171 | −0.177 |
| 2 | −0.657 | −0.060 | −0.674 | −0.376 | −0.334 |

tract, the coefficient is insignificant. The lagged coefficients are significantly negative for corn and coffee. Thus, the results generally indicate a pattern that is contrary to the flow of premium between hedgers and speculators. Among the other notable findings, the time-to-maturity variable is positive and significant for all but the wheat contract, and there are strong seasonal tendencies in the basis. The seasonalities support the notion that the dummy variables capture the convenience yield alluded to in eq. (2).[21]

The separate treatment of the tests for profitability and risk premium in Tables I–IV allow the systematic evaluation of whether traders have forecasting ability, and/or whether they earn a risk premium. The results indicate that large speculators have the ability to earn positive returns, and that there is no flow of risk premium from hedgers to speculators. Theories that support the absence of premia are generally based on the argument that large numbers of speculators enter the market any time there is a reward for risk transfer, effectively bidding any premium to zero. Following this lead, the association between hedging imbalances and market liquidity is tested for.

[21]For all but the coffee contract, the coefficients are positive and significant for the months of September (wheat, soybeans, cotton), October (soybeans, corn), or November (cotton). These 3 months generally correspond to the months when these commodities are harvested. For instance, the harvest season is August–December for cotton, and September and October for soybeans. In other words, the basis seems to be highest when the commodity is the most plentiful.

**TABLE IV**

Basis [$\log(F_{tT}) - \log(S_t)$] and Hedging Imbalances: Regression Results (1/1983–3/1995)[a,b]

| | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
|---|---|---|---|---|---|
| | 0.004 | 0.002 | 0.004 | 0.047 | 0.054 |
| Constant | (0.337) | (0.662) | (0.154) | (0.715) | (1.179) |
| | −0.004** | −0.000*** | −0.002*** | −0.013*** | −0.000 |
| Hedging Imbalance$_t$ | (−2.261) | (−2.617) | (−2.826) | (−4.780) | (−0.089) |
| | −0.000 | −0.000 | −0.001* | −0.014*** | 0.000 |
| Hedging Imbalance$_{t-1}$ | (−0.795) | (−0.622) | (−1.962) | (−5.316) | (0.363) |
| | −0.003 | 0.005*** | 0.004 | −0.014 | 0.006 |
| Tbill$_t$ | (−0.080) | (5.074) | (0.872) | (−1.301) | (0.761) |
| | 0.006 | 0.008*** | 0.021*** | 0.034** | 0.040*** |
| Time to Maturity$_t$ | (0.533) | (5.553) | (2.969) | (2.226) | (3.566) |
| | 0.002 | 0.001 | 0.003 | −0.004 | 0.270 |
| February | (0.212) | (0.241) | (0.265) | (−0.112) | (1.410) |
| | −0.035 | 0.005 | −0.005 | −0.040 | −0.022 |
| March | (−1.422) | (1.124) | (−0.360) | (−0.856) | (−0.888) |
| | 0.024 | 0.002 | 0.009 | 0.017 | 0.040* |
| April | (1.032) | (0.354) | (0.740) | (0.431) | (1.924) |
| | 0.016 | −0.001 | −0.014 | −0.035 | −0.030 |
| May | (0.923) | (−0.149) | (−0.951) | (−0.746) | (−1.193) |
| | 0.036** | 0.007* | 0.017 | −0.017 | 0.010 |
| June | (2.569) | (1.784) | (1.440) | (−0.436) | (0.496) |
| | 0.038** | 0.001 | −0.031** | −0.050 | −0.134*** |
| July | (2.198) | (0.500) | (−2.097) | (−1.021) | (−4.253) |
| | 0.031* | −0.001 | 0.010 | 0.026 | −0.027 |
| August | (1.811) | (−0.720) | (0.815) | (0.642) | (−1.083) |
| | 0.085*** | 0.012** | 0.025 | −0.732 | 0.050** |
| September | (2.880) | (2.393) | (1.295) | (−1.214) | (2.424) |
| | 0.032 | 0.018*** | 0.041*** | 0.024 | −0.009 |
| October | (1.637) | (3.305) | (2.722) | (0.530) | (−0.355) |
| | −0.010 | 0.003 | 0.013 | −0.002 | 0.045** |
| November | (−0.554) | (0.535) | (1.083) | (−0.042) | (2.286) |
| | 0.006 | 0.006* | −0.004 | −0.054 | −0.027 |
| December | (0.321) | (1.948) | (−0.233) | (−0.905) | (−0.849) |
| Adjusted $R^2$ | 0.243 | 0.239 | 0.251 | 0.270 | 0.084 |
| *Diagnostics*[c] | | | | | |
| LM | 1.212 | 2.219 | 1.755 | 2.535 | 1.418 |
| BPG | 20.933 | 17.237 | 15.831 | 15.809 | 5.489 |

[a]Statistics in parentheses are $t$ statistics; the $t$ statistics employ the Newey and West (1987) variance estimator for models with first-order autocorrelated disturbances.

[b]Monthly dummies for basis are evaluated against January levels.

[c]LM represents the Jarque–Bera LM test statistic for normality. The statistic is distributed chi-square with 2 degrees of freedom and tests the null of normal residuals. BPG represents the Breusch–Pagan–Godfrey test for heteroskedasticity. The statistic is distributed chi-square with 15 degrees of freedom and tests the null of homoskedasticity.

*Significance level of .10.

**Significance level of .05.

***Significance level of .01.

Panel A of Table V presents correlations of absolute hedging imbalance, $|HL_t - HS_t|/OI_t$, with various measures of the level of speculation. SPEC represents the number of speculative contracts (long and short), HEDGE represents the number of hedging contracts, and Ratio represents the ratio of speculators to hedgers. URatio and LRatio represent the upper and lower levels of Ratio. URatio (LRatio) is derived under the assumption that all small traders are speculators (hedgers). Finally, SDX, USDX, and LSDX are the index of excessive speculation and the upper and lower limit of this index, respectively. SDX is given by $1 + SL_t/(HL_t + HS_t)$ if $HL_t \geq HS_t$, and $1 + SS_t/(HL_t + HS_t)$ if $HL_t < HS_t$, where $SL_t$ and $SS_t$ represent the number of long and short speculative contracts, respectively. USDX (LSDX) is derived similarly under the assumption that all small traders are speculators (hedgers).[22] The SDX, USDX, and LSDX indices indicate the level of speculation *over and above* that necessary to fill hedging imbalances.

The correlation coefficients indicate that hedging imbalances increase with the number of hedgers (the SPEC and HEDGE coefficients are positive). However, the ratio of speculators to hedgers also rises with hedging imbalances, indicating that some of the speculative activity may be in response to hedging needs. This hypothesis is supported by the negative relationship between hedging imbalances and the measures of excess speculation. That is, as hedging imbalances increase, there is a tendency of speculators to move away from the contracts that do not address the hedging needs. Finally, Panel B of Table V presents the correlations of the speculation measures with the absolute basis, $|\log(F_{tT}) - \log(S_t)|$. The results generally indicate a negative correlation between speculative activity and the difference between $F_t$ and $S_t$. Thus, the results in Table V support the argument that hedging imbalances lead to greater speculative activity, which is associated with a smaller basis.

## Ex Post Premia and Hedging Imbalance

The above results suggest that speculators do not impose a premium on hedgers. On the contrary, the presence of speculators seems to enhance market efficiency, and may actually lower the cost to hedgers. To examine whether the speculators that interact with hedgers profit despite the absence of premia, a second set of regressions that deploys the ex post premium as the dependent variable is undertaken. As suggested toward

[22] The SDX index is developed in Working (1960) and elaborated upon in Peck (1980). The upper and lower limits are derived in Ward and Behr (1983).

**TABLE V**

Explaining the Absence of Backwardation: The Hedging Imbalance–Speculation–Basis Association (1/1983–3/1995)[a,b]

*Panel A: Correlations of Absolute Hedging Imbalances ($|HI_t - HS_t|/OI_t$) and Speculation*

| | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
|---|---|---|---|---|---|
| $SPEC_t$ | .291 | .777 | .517 | .781 | .550 |
| $HEDGE_t$ | .155 | .717 | .424 | .771 | .363 |
| $Ratio_t$ | .217 | .532 | .429 | .346 | .514 |
| $URatio_t$ | .285 | .244 | .285 | .012 | .006 |
| $LRatio_t$ | .207 | .602 | .421 | .444 | .526 |
| $SDX_t$ | −.337 | −.529 | −.244 | −.227 | −.387 |
| $USDX_t$ | −.320 | −.658 | −.175 | −.505 | −.526 |
| $LSDX_t$ | −.330 | −.491 | −.240 | −.193 | −.351 |

*Panel B: Correlation of Speculation and Absolute Basis ($|\log(F_{tT}) - \log(S_t)|$*

| | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
|---|---|---|---|---|---|
| $SPEC_t$ | −.153 | −.145 | −.288 | .030 | −.494 |
| $HEDGE_t$ | −.064 | −.113 | −.125 | .688 | −.446 |
| $Ratio_t$ | −.164 | −.090 | −.022 | −.432 | −.351 |
| $URatio_t$ | −.230 | .063 | −.165 | −.648 | −.052 |
| $LRatio_t$ | −.129 | −.131 | −.017 | −.342 | −.423 |

$SPEC_t$ = total number of speculative contracts at $t$:
$HEDGE_t$ = total number of hedging contracts at $t$:
$Ratio_t = SPEC_t/HEDGE_t$:
$URatio_t$ = ($SPEC_t$ + nonreporting contracts$_t$)/$HEDGE_t$:
$LRatio_t$ = $SPEC_t$/($HEDGE_t$ + nonreporting contracts$_t$):
$SDX_t = 1 + SL_t/(HL_t + HS_t)$ if $HL_t \geq HS_t$; $1 + SS_t/(HL_t + HS_t)$ if $HL_t < HS_t$, where SS, SL, HS, and HL are number of short speculators, long speculators, short hedgers, and long hedgers:
$USDX_t$ = 1 + ($SL_t$ + nonreporting long contracts)/($HL_t + HS_t$) if $HL \geq HS_t$; 1 + ($SS_t$ + nonreporting short contracts)/($HL_t$ + $HS_t$) if $HI_t < HS_t$:
$LSDX_t$ = 1 + ($SL_t$)/($HL_t$ + $HS_t$ + nonreporting contracts) if ($HL_t$ + nonreporting long contracts) ≥ ($HS_t$ + nonreporting short contracts): 1 + ($SS_t$/($HL_t$ + $HS_t$ + nonreporting contracts) if ($HL_t$ + nonreporting long contracts) < ($HS_t$ + nonreporting short contracts).

the end of Section 2, this variable possibly contains a profit as well as a premium component.

To arrive at $\log(F_{T-i,T}) - \log(S_T)$ for each commodity, $F_{tT}$ is sampled 2 months away from each expiration, yielding 61 observations for wheat, corn, coffee, and cotton, and 86 observations for soybeans.[23] Following the relationship in eq. (3), the data are fit to the regression:

[23]Results from other sampling intervals (namely, 1 and 3 months) provide similar results. The inequality in the number of observations arises from the difference in expiration cycles: Soybeans have seven expiration cycles, and the other commodities have five.

$$\log(F_{T-2,T}) - \log(S_T) = \alpha + \beta_1 HI_{T-2} + \beta_2 Tbill_{T-2} + \sum_{i=2}^{n} \delta_i EC_{it} + \varepsilon_t \quad (5)$$

where the $\delta_i$s represent the coefficients of the dummy variables corresponding to $n - 1$ of the $n$ expiration cycles (EC) of each commodity. A positive HI coefficient would indicate that speculators that interact with hedgers are profitable and/or obtain a premium for their interaction.

The results from the regression are presented in Table VI. The hedging imbalance coefficients are insignificant for all contracts. These results suggest an absence of net profits (profits after premia) for those speculators that interact with hedgers. The results are also consistent with the evidence on the performance of naive traders (Table I). The traders following a strategy contrary to the majority of hedgers were not profitable, on average. The results in Table VI also support the notion that there is an absence of premia flowing from hedgers to speculators. Although speculators are found to be profitable (Table I), there is no indication that hedging imbalances cause a rise in trader profitability, measured by the difference in current futures price and the spot price at maturity.

## A Robustness Test

The above regression analysis on the existence of risk premia presumes that the hedging imbalance variable is exogenous to the system. However, a case may be made for the exogeneity of this variable. For instance, it is plausible that hedging imbalance is also dependent on the time of year: One would expect short positions to increase in the months prior to the harvest season, and decline following the harvest. Moreover, hedging imbalances may be determined by the price level of the commodity and/or the difference in futures and spot prices. If the basis and hedging imbalance are jointly determined, the OLS regressions will have produced estimates that may suffer from simultaneity bias.

In light of the above concern, the relationships implied in the cost-of-carry equation (2) are estimated via a two-stage least-squares (2SLS) procedure. The 2SLS model employed allows for two possible endogenous variables, basis and hedging imbalance, and 15 exogenous variables: lagged basis and hedging imbalances, Tbill, TTM, log of the commodity (spot) price, and 11 monthly dummy variables.

The results from the 2SLS model are reported in Table VII. The results are similar to the OLS results presented in Table IV. The $HI_t$

**Table VI**

Ex post Premia [$\log(F_{T-2})$-$\log(S_T)$] and Hedging Imbalances: Regression Results[a,b]

| | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
|---|---|---|---|---|---|
| Constant | 0.0.21<br>(0.482) | 0.020<br>(0.470) | 0.002<br>(0.051) | 0.071<br>(1.452) | −0.023<br>(−0.561) |
| Hedging Imbalance$_t$ | 0.171<br>(1.101) | 0.033<br>(0.513) | −0.004<br>(−0.056) | 0.007<br>(0.034) | 0.043<br>(0.712) |
| Tbill$_t$ | 0.000<br>(0.008) | 0.001<br>(0.125) | −0.000<br>(−0.061) | 0.001<br>(0.138) | 0.005<br>(0.981) |
| March | — | −0.022<br>(−0.590) | — | — | — |
| May | 0.021<br>(0.549) | −0.026<br>(−0.661) | 0.012<br>(0.355) | 0.026<br>(0.407) | −0.011<br>(−0.274) |
| July | 0.007<br>(0.171) | 0.043<br>(1.077) | 0.093***<br>(2.855) | 0.108*<br>(1.706) | 0.066*<br>(1.660) |
| August | — | 0.022<br>(0.563) | — | — | — |
| September | −0.031<br>(−0.797) | 0.013<br>(0.338) | 0.072**<br>(2.189) | −0.013<br>(−0.208) | — |
| October | — | — | — | — | 0.035<br>(0.880) |
| November | — | −0.009<br>(−0.223) | — | — | — |
| December | −0.062<br>(−1.573) | — | 0.032<br>(0.975) | −0.030<br>(−0.174) | 0.020<br>(0.512) |
| Adjusted $R^2$ | 0.082 | 0.036 | 0.087 | 0.043 | 0.011 |
| *Diagnostics*[c] | | | | | |
| LM | 0.463 | 2.433 | 4.621 | 4.101 | 1.242 |
| BPG | 5.631 | 3.966 | 6.608 | 8.196 | 4.621 |

[a]Statistics in parentheses are *t* statistics.

[b]Contract dummies are evaluated against March expiration for wheat, corn, coffee, and cotton, and against January expiration for soybeans.

[c]The statistic is distributed chi-square with 24 degrees of freedom and tests the null of no autocorrelation. LM represents the Jarque–Bera LM test statistic for normality. The statistic is distributed chi-square with 2 degrees of freedom and tests the null of normal residuals. BPG represents the Breusch–Pagan–Godfrey test for heteroskedasticity. The statistic is distributed chi-square with 6 degrees of freedom and tests the null of homoskedasticity.

*Significance level of .10.

**Significance level of .05.

***Significance level of .01.

coefficient is nonpositive for the five contracts, and is significantly negative for the wheat, soybeans, corn, and coffee contracts. Further, the significance of the Tbill, time to maturity and seasonal dummy variables is largely unchanged from Table IV. Therefore, the 2SLS results suggest that the above-documented relationship between basis and hedging imbalances are not the result of a model misspecification that could arise from a simultaneous relationship between the two variables.[24]

[24]An alternate 2SLS model that controls for annual differences in production levels (rather than

**Table VII**

Two-Stage Least-Square Results (1/1983–3/1995)[a,b]

| | *Wheat* | *Soybeans* | *Corn* | *Coffee* | *Cotton* |
|---|---|---|---|---|---|
| Constant | 0.005 | 0.000 | 0.004 | 0.057 | 0.064 |
| | (0.159) | (0.434) | (0.150) | (0.061) | (1.444) |
| $HI_t$ | −0.004* | −0.001*** | −0.005*** | −0.013*** | −0.001 |
| | (−1.799) | (−3.061) | (−4.225) | (−5.804) | (−0.378) |
| $Tbill_t$ | −0.004 | 0.005*** | 0.003 | −0.009 | 0.005 |
| | (−0.556) | (3.389) | (0.943) | (−0.470) | (0.875) |
| Time to maturity$_t$ | 0.006 | 0.010** | 0.024** | 0.032*** | 0.008* |
| | (0.743) | (2.032) | (2.161) | (2.750) | (1.732) |
| February | 0.002 | 0.000 | 0.004 | −0.000 | 0.217 |
| | (0.494) | (0.116) | (0.449) | (−0.197) | (1.231) |
| March | −0.039 | 0.005 | −0.007 | 0.011 | −0.222 |
| | (−1.369) | (0.951) | (−0.395) | (0.116) | (−0.938) |
| April | 0.237 | 0.001 | 0.002 | 0.032 | 0.016 |
| | (1.021) | (0.250) | (0.090) | (0.341) | (0.614) |
| May | 0.036 | −0.000 | −0.158 | −0.033 | −0.031 |
| | (1.593) | (−0.088) | (−0.935) | (−0.345) | (−1.297) |
| June | 0.043** | 0.007 | 0.017 | 0.003 | −0.016 |
| | (1.968) | (1.430) | (1.040) | (0.029) | (−0.675) |
| July | 0.047** | −0.001 | −0.035** | −0.125 | −0.103** |
| | (2.146) | (−0.220) | (−2.057) | (−0.134) | (−2.397) |
| August | 0.030 | −0.003 | 0.016 | −0.025 | −0.028 |
| | (1.330) | (−0.562) | (0.970) | (−0.271) | (−1.130) |
| September | 0.844** | 0.010** | 0.015 | −0.259 | 0.003* |
| | (2.227) | (1.980) | (0.520) | (−1.494) | (1.688) |
| October | 0.031 | 0.016*** | 0.029*** | 0.042 | −0.006 |
| | (1.378) | (3.139) | (2.728) | (1.210) | (−0.263) |
| November | −0.135 | 0.002 | 0.018 | −0.161 | 0.015 |
| | (−0.602) | (0.362) | (0.995) | (−1.620) | (0.615) |
| December | 0.006 | 0.007 | −0.010 | −0.255 | 0.004 |
| | (0.154) | (1.293) | (−0.360) | (−1.465) | (0.100) |
| $r^2$ | 0.276 | 0.318 | 0.270 | 0.158 | 0.147 |

[a]The model has two potential endogenous variables, $\log(F_{tt})$-$\log(S_t)$ and $HI_t$ (the hedging imbalance); there are 16 exogenous variables: $\log(F_{t-1}) - \log(S_{t-1})$, $HI_{t-1}$, Tbill, Time to maturity$_t$, $\log(S_t)$, and monthly dummy variables. $r^2$ is the squared correlation coefficient between the observed and predicted dependent variable.

*Significance level of .10.

**Significance level of .05.

***Significance level of .01.

## CONCLUSION

Do speculators impose risk premia (i.e., are they compensated) for their role in the hedging balance; or, does the presence of the speculator simply

commodity prices) is also estimated for all but the coffee contract [yearly production levels for the four contracts are obtained from the 1995 National Agricultural Statistics Services (NASS) records on United States crop production]. A production dummy is constructed that takes on the value of 1 (−1) if the commodity output level during the year represents one of four highest (lowest) levels of increase the liquidity of the market so that price distortions are eliminated and the basis compressed? This study empirically address these questions via a direct approach and keeps the issues of trader profitability and risk premia separate. The approach involves the isolation of the relationship between hedging imbalances and the difference between futures and spot prices.

The empirical results indicate that although large speculators are profitable in commodity futures markets, they do not impose an instantaneous risk premia on hedgers. In fact, the presence of speculators enhances market efficiency and may actually lower the cost to hedgers. The defense of the possibility of a negative risk premia would probably be much like the explanation of negative storage costs, indicated in Working (1949). If the expected returns on certain contracts are large enough, traders may actually assume substantial costs to enter into these contractual arrangements. The negative association between hedging imbalances and risk premia indicate that this may be true.

It may also be the case that speculators enter the market without knowing the specific category of the trader that holds the opposite side of the contract. Although the public is informed of the commitment of traders at regular intervals, it is not clear whether such information provides anything other than a general idea of the makeup of the market. In markets where hedging imbalances are not obvious, speculators may simply cover the balance without imposing a premia based on trader classification. Rather than obtaining a price for their role, speculators could thus serve to assist in the price discovery function of futures markets.

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production during the sample period, and zero otherwise. The nature of the results in Table VII remain unchanged when this model is employed.

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