The Performance of Chicago Board of Trade Corn, Soybean, and Wheat Futures Contracts after Recent Changes in Speculative Limits

by

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Abstract

Three attributes of futures contract behavior important for market performance—liquidity, volatility, and convergence—are investigated before and after the 2005 increase in speculative position limits for corn, soybean, and wheat contracts at the Chicago Board of Trade. The analysis of liquidity and market depth reveals a sharp increase in open interest for corn, soybeans and wheat beginning in late 2005. The increase in position limits likely accommodated the increase in speculative interest in corn, soybean and wheat futures, but some of the increase would have occurred without the increase as new market participants received hedge exemptions. The analysis of price volatility revealed no large change in measures of volatility after the change in speculative limits. For corn and soybeans, the picture that unfolds relative to convergence patterns is one of weakness, but not failure. For wheat, the picture that unfolds relative to convergence patterns is not only one of weakness, but failure to accomplish one of the fundamental tasks of a futures market. The persistence and growing magnitude of the delivery location basis in wheat suggests a problem with the contract specifications.

Key Words: corn, futures contract, performance, soybeans, speculation, wheat

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Questions about the performance of the Chicago Board of Trade (CBOT) corn, soybean, and wheat contracts have arisen on several occasions. Concerns about hedging effectiveness, liquidity in cash and futures markets, and convergence of cash and futures prices have resulted in a number of contract performance studies that led to rule changes by the CBOT (e.g., Peck and Williams, 1991, pp. 2-3). In 2005, the CBOT and the Commodities Futures Trading Commission (CFTC) approved revisions to Regulation 425.01 to increase the CBOT's "Single Month" and "All Months" speculative position limits for its corn and mini-size corn, wheat and mini-size wheat, soybean and mini-size soybean, soybean oil, soybean meal, and oat contracts. Those changes occurred in two phases, with the first phase effective on June 10, 2005 and the final phase effective December 10, 2005 (Table 1). Spot month limits for these contracts were not changed. Since the change, market participants have expressed concern that this added speculative activity has caused futures prices to be artificially inflated and volatile, contributing to weak and erratic basis levels from late 2005 through the first half of 2006 and to a lack of convergence of cash and futures prices during delivery in the first half of 2006 (e.g., Roberts, 2006). Weak basis and lack of convergence are antithetical to the core risk transfer function of futures markets, and consequently, adversely influence their usefulness to market participants.

We investigate three attributes of futures contract behavior—liquidity, volatility, and convergence—that are of importance for market performance (Hieronymus, 1971; Peck and Williams, 1991). Descriptive and statistical comparisons of these attributes for corn, soybeans, and wheat contracts before and after the 2005 change in speculative position limits are made to ascertain changes in behavior. The period before the 2005 speculative position limit changes starts with the first contracts impacted by the CBOT's 2001 change in storage charges for corn and soybeans.

The analysis and presentation have several components. First, to analyze liquidity and market depth, the volume and structure of open interest before and after the recent change in speculative position limits is examined. Data from the CFTC's Commitment of Traders Report are used for the analysis. Second, to analyze volatility, daily nearby futures settlement prices before and after the recent changes in speculative position limits are examined. Measures of volatility are constructed across all contracts by commodity and across contracts of the same maturity for each commodity to account for seasonality. Third, to analyze convergence, publicly available cash price data collected and reported by the USDA's Agricultural Marketing Service are used to compare the pattern of convergence by commodity and market before and after the change in position limits. Finally, we present conclusions and suggest measures to improve market performance.

Liquidity/Market Depth

Liquidity of futures markets generally refers to the magnitude of outstanding, or unfilled, contracts. A liquid market is one that has enough contracts outstanding to allow large transactions without a substantial change in price. Hieronymus (1971, p. 297) provides a succinct statement in this regard, "A liquid, speculatively active futures market is a useful and effective tool that can be and is used extensively by people who have risk problems." A common measure of liquidity and market depth is open interest. The magnitude of open interest should be sufficient to effectively provide the risk-carrying capacity needed in a given market.

The procedure used here is to compare the magnitude and the structure of open interest before and after the change in speculative position limits. The source of data is the weekly CFTC Commitments of Traders (COT) Reports.[1] The structure of open interest refers to the percentage held by traders in the commercial, non-commercial, and non-reporting categories.

Total open interest for all contracts, total open interest by reporting category, and percent of open interest by reporting categories are shown for corn, soybeans, and wheat in figures 1, 2, and 3.

The dashed vertical line identifies the date of the Phase I increases in position limits (June 10, 2005) which were effective beginning with the July 2005 contracts. For corn, total open interest was generally flat from September 2001 through about January 2004, spiked with the high prices that existed during the spring of 2004, and remained at the higher level through late 2005. Beginning in January 2006, open interest trended sharply higher, but appeared to reach a plateau in the summer of 2006. Open interest peaked at about 1.4 million contracts, more than three times the pre-2004 level. The magnitude of open interest among reporting commercial and non-commercial traders followed roughly the same pattern, although the percentage of open interest held by commercials (non-commercials) declined (increased) from the summer of 2005 through the summer of 2006. The portion of open interest held by non-reporting traders declined during that period.

For soybeans, total open interest trended higher from the spring of 2002 through the spring of 2006, with seasonal declines occurring in the fall of 2004 and 2005. Some decline was also noted in the summer of 2006. An increase in open interest occurred for both categories of reporting traders, with the percentage of open interest held by non-commercials increasing from the summer of 2005. Open interest peaked in the spring of 2006 at about 390,000 contracts, up from 150,000 to 200,000 contracts in the early period.

The most dramatic increase in open interest occurred in wheat, moving from about 100,000 contracts in the earlier period to a peak near 550,000 in the spring of 2006. The structure of the open interest followed a similar pattern to that of corn and soybeans, with reporting non-commercial traders accounting for a larger percentage of open interest from the spring of 2005 forward.

The increase of open interest in corn, soybeans, and wheat since the summer of 2005 and particularly since January 2006 likely reflects the widely-publicized increase in commodity futures trading by hedge funds and so-called long-only index funds (O'Hara, 2006; Acworth, 2006). At face value, the structure of open interest indicates that reporting non-commercials have accounted for a larger portion of open interest following the increase in speculative position limits. Because some

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fund traders who might traditionally be viewed as speculative traders can receive hedge exemptions, the reports of open interest by category of trader may actually understate the activity of traders considered non-commercials. One piece of evidence in this regard is provided by CFTC reports on bank participation in futures markets, available starting in September 2004 on a monthly basis. While it cannot be stated with certainty, the banks tracked in these reports are thought to: 1) have hedge exemptions and therefore their positions are counted in the commercial totals and 2) the positions are largely related to over-the-counter-instruments offered by or financed through the banks. Figure 4 presents the net long open interest of banks from September 2004 through September 2006 for corn, soybeans and wheat. Growth in open interest during that period was especially large in corn and wheat. Open interest in corn grew from about 30,000 contracts to nearly 150,000. Bank open interest as a percentage of total open interest reached 20 percent for wheat and 12 percent for corn in March 2006.

Starting with January 2006, the CFTC began reporting open interest for commodity index traders of which the bank positions are a subset (figure 5). In the corn and soybean markets, index fund participation increased steadily in terms of the number of contracts, and registered about 28 percent of the open interest in both markets. In the wheat market, index activity increased steadily in contract numbers to May 2006 and then declined. Index fund participation ranged from 50 to 35% of open interest and appeared to stabilize at nearly 40% at the end of the period.

Due to the limited history of public data available from the CFTC, it is difficult to draw definitive conclusions about the structure of open interest. However, it is clear that activity in these markets increased significantly in 2006, apparently led by non-traditional market participants. The increases in speculative limits initiated in 2005 appear to have accommodated the increased interest of non-traditional traders in late 2005 and particularly in 2006, contributing significantly to liquidity and market depth. The change in speculative limits by the CBOT accommodated the participation of non-traditional traders in these markets and contributed to the significant rise in open interest. To the

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degree that the new trading activity consists of long-only index funds, a larger percentage of the trade and open interest is likely held by traders who may be more price insensitive to individual commodity conditions than are traditional market participants.

Volatility

Volatility of futures prices is a measure of the emergence of new and unexpected market information. Hieronymus (1971, p.297) notes that, "If all things were foreseeable and their effects on prices perfectly discounted, the results would be unchanging prices at equilibrium levels and relationships." Some level of price volatility is desirable and necessary to attract trading activity, but extreme volatility can also discourage participation by some sectors of the market.

To examine volatility, the pattern and magnitude of return volatility is calculated prior to and after the change in speculative limits using the daily change in returns—percentage change in nearby settlement prices from September 4, 2001 through August 31, 2006, for corn, soybeans and wheat (figure 6). The average absolute daily return is calculated for the periods prior to and following the implementation of Phase I in 2005. For corn, the range of daily returns after the change was not outside the experience of the period prior to the change, but the average absolute return was slightly higher in the post-change period. For soybeans and wheat, the range of daily returns after the change in speculative limits was within the experience of the period prior to the change, while the average absolute return was lower in the post-change period.

Similar patterns of volatility (but not presented) were also encountered when measuring volatility in terms of the monthly standard deviations of daily nearby futures returns and daily standard deviation of nearby futures returns calculated by contract month (i.e., when the contract is nearby). For example, the magnitude of monthly standard deviations of returns in the post-change period was within the range of the pre-change period except for one month for both corn and wheat.

The average standard deviation in the post-change period was slightly higher for corn and lower for soybeans and wheat than during the pre-change period.

With limited observations available for the period following the change in speculative limits in 2005, conclusions about the impact on volatility are tentative. Additional observations will be required across varying scenarios of supply, demand, and price level, to have full confidence in the conclusions. However, there is little to suggest that the change in speculative limits has had a meaningful impact on price volatility.

Convergence

Convergence generally refers to the pattern of cash and futures prices tending to come together, that is, basis approaching zero, at the delivery market as the futures contract expires. In theory, arbitrage in the cash and futures market should force the prices to converge. If futures were above the cash price, the cash commodity would presumably be bought, futures sold, and delivery made. If the cash price exceeded futures, users could buy futures and stand for delivery. Problems with convergence emerged following the change to Illinois River delivery system for corn and soybeans, and were the motivation for changes to contract specifications in 2001. Convergence issues for corn, soybeans and wheat emerged again in the last half of 2005 and particularly in 2006.

A brief conceptual discussion about convergence is useful at this point. Hranaiova and Tomek, 2002, p.784) note that, "Assuming a frictionless market and a futures contract with no implicit options, the basis for the par commodity will converge to zero at expiration. Thus, a firm hedging the par asset is exposed to no basis risk and earns the exact convergence: no forecast of convergence is needed. Delivery options specified in futures contracts and costs of arbitrage result in imperfect convergence: in practice, there is basis risk." Peck and Williams (1991, pp. 99-100) observe that, "Lack of convergence of a particular basis in any particular month need not indicate a problem with the contract but the natural workings of a contract with more than one delivery point."

The existence delivery options and costs of arbitrage means that convergence should be thought of as some range of basis, not necessarily a zero basis.

For each commodity and delivery location over November 2001 – September 2006 the pattern of convergence was plotted. Each figure presents the 5-year basis pattern for a specific contract at a particular location, using available cash price data from the USDA's Agricultural Marketing Service. For corn, cash prices were available for Chicago, Illinois River North of Peoria, and Illinois River South of Peoria. For soybeans, cash prices were available for the same three delivery locations and for the delivery market at St. Louis. For wheat, cash prices were available for Chicago and Toledo, but not for the delivery market at St. Louis.[2] The first observation each year for November soybean and December corn contract basis analysis is the first business day after October 1st and the last observation is for the last day of trading. For all other contracts, the first observation is the day after the preceding contract expires and the last observation for each contract is the day of expiration. For wheat, this process means that early basis observations for the July contract each year may reflect old crop cash prices rather than prices of the crop being harvested. These prices were included to provide more observations and to acknowledge that the wheat harvest does not begin uniformly across time and space. Finally, since the total number of plots is rather large, we present only three representative sets of plots here (July corn, March soybeans, and September wheat).

Analysis of the basis plots shows that convergence did not occur in the corn market in July 2005 (figure 7) and was clearly prevented for the September 2005 contract due to the disruptive effects of hurricane Katrina. Convergence was not an issue for corn in December 2005. Lack of convergence is apparent for the March, May, and July 2006 contracts at the Illinois River locations and the March, July, and September 2006 contracts at Chicago. Following lack of convergence early in the year at the Illinois River locations, corn basis at expiration of the September 2006 approached zero. The picture that unfolds for corn is one of basis weakness since mid-2005, but not an overall

failure of convergence. For each delivery month from March 2006 through September 2006, convergence or near convergence was observed for at least one delivery location.

For soybeans, issues with convergence began with the January 2006 contract and continued in March (figure 8), except for the St. Louis market. Lack of convergence at the Illinois River existed in May, July, August and to some degree in September of 2006. Non-convergence was observed in Chicago for the July and September contracts. For St. Louis, lack of convergence was observed for the August 2006 contract. The same picture unfolds for soybeans as for corn, with a general weakness in basis, but not a failure of convergence at all locations for every contract. Only the July 2006 contract experienced very poor convergence at all locations.

For wheat, convergence failed beginning with the July 2005 contract and persisted through September 2006 (figure 9). The magnitude of non-convergence was large and increasing, reaching 90 cents per bushel under the expiring September 2006 contract in Toledo. In addition, the magnitude of non-convergence was greater and the duration of the weakness was longer for wheat than for corn and soybeans.[3]

Using regression analysis, convergence also is examined by assessing the ability of basis immediately after expiration of the previous contract to predict the change in basis to the first day of the delivery month and to expiration. This approach was originally proposed by Working (1953) and has been used in several previous studies of the performance of commodity futures markets to assess the degree of convergence (Peck and Williams, 1991; Williams, 2001; Hranaiova and Tomek, 2002). For the present study, the dependent variable in the regressions is the change in the delivery location basis from the day after the preceding contract expires (except new crop corn and soybean contracts, which start on the first trading day of October) to the first day of delivery or the last day of delivery. The independent variable is the delivery location basis on the day after the preceding contract expires (except new crop corn and soybean contracts, which start on the first trading day of October). Hranaiova and Tomek (2002) note that hedgers are likely most interested in the relationship for the

first day of delivery since hedges held past this date would normally be rolled to the next contract. Hence, we focus the discussion on regression results for the first day of delivery.

Figure 10 provides examples of the data and the estimated relationship for the first day of the delivery month for the corn contract (excluding September 2005 due to the effects of hurricane Katrina) at the Illinois River Peoria North, the soybean contract at the Illinois River Peoria South, and the wheat contract at Toledo. Table 2 provides a more complete set of estimated relationships by commodity and delivery point for basis changes through the first day of the expiration month. Interpretation of the estimated relationships is facilitated by recalling that basis is in cents per bushel and considering the corn contract in figure 10. The slope of the initial basis variable for corn is -0.83, implying a less than one-to-one relationship between the size of the initial basis and its change to the first day of delivery. The intercept at this par delivery point does not differ appreciably from zero, indicating the absence of significant transaction costs. The R^2 is 0.80; therefore, initial basis explains or predicts 80 percent of the basis change.

Inspection of the plots for corn and soybeans in figure 10 shows that data points since July 2005 (open triangles) generally fall to the left of data points before July 2005 (filled diamonds), consistent with the weak basis and convergence problems discussed earlier. In addition, all F-statistic tests for corn and soybeans reject the null hypothesis that the intercept is zero and the slope is negative one, which would occur in the case of optimal forecasts and zero transaction costs. While there is evident weakness in corn and soybean convergence since July 2005, it is important to point out that overall convergence performance since July 2002 is nonetheless reasonably strong. More specifically, the initial basis for corn and soybeans over the entire sample provides relatively accurate forecasts of the basis change to the first day of the expiration month, with R^2s ranging between 0.64 in Chicago for corn and 0.80 for both the Illinois River Peoria North for corn and Chicago for soybeans. These compare favorably with R^2s reported in previous studies of convergence in commodity futures markets.[4]

In contrast to the results for corn and soybeans, regression results for wheat offer very little evidence of predictive ability at either the Chicago or Toledo delivery location. The R^2s are low, slope coefficients do not differ from zero, and the (0,-1) null hypothesis is soundly rejected. The poor performance is dramatically illustrated in the lower left plot in figure 10, where the estimated slope is actually slightly positive and R^2 is a miniscule 0.09. The most generous interpretation of convergence performance is provided in the lower right plot. Excluding the December 2005 through September 2006 contracts results in a downward sloping regression line but R^2 is still only 0.51. Of course, there is no obvious justification for excluding these observations and this only serves to highlight the dismal convergence performance in wheat since December 2005.

Results from the final expiration-day analysis (not presented) do not differ dramatically for corn from those presented in table 2, but for soybeans they show a general tendency for R^2s to increase marginally and for slope coefficients to approach -1.0. For wheat, the predictive ability continues to be very poor, with R^2 at the Toledo market declining to 0.02.

Corn and Soybean Convergence Factors

For corn and soybeans, three factors are related to the weak basis and convergence problems since mid-2005. These are: 1) sharply higher barge rates, 2) high futures valuations and 3) a large carry in the futures market that influenced delivery and load-out decisions. From September 2001 through August 2004, nearby barge rates on the Illinois River varied from 110 percent to 325 percent of tariff (or base rate). The disruption caused by hurricane Katrina in late August 2005 resulted in a sharp rise in nearby barge rates, peaking at about 800 percent of tariff in mid-October 2005. Barge rates per bushel for corn (calculated as the product of $0.135 and the percent of tariff) and soybeans (calculated as the product of $0.144 and the percent of tariff) from Peoria to the Gulf were also generated. Rates increased from the $0.20 to $0.30 per bushel range prior to the fall of 2004, to the $0.70 to $0.80 per bushel range in early September 2006. Higher barge rates alone, however, do not

necessarily lead to weak basis levels at delivery locations on the Illinois River. Basis at those locations is also a function of basis at the Mississippi Gulf and the freight cost to the port which can be approximated by a basis value of corn and soybeans loaded on a barge at Peoria.

Using one daily observation per week, the difference between the Gulf basis and the freight cost to Peoria, Illinois was calculated to approximate the basis value of corn and soybeans loaded on a barge at Peoria. For corn, the difference between the Gulf basis and the barge rate to Peoria was generally negative during the time that the March, May and July 2006 contracts were the nearby contracts (figure 11). For example, on July 6, 2006, the Gulf price of corn was $0.4625 per bushel above July futures and the barge rate to Peoria was calculated at $0.6075 per bushel, suggesting that the value of a loaded barge at Peoria was $0.145 per bushel under July futures. Negative values persisted until near maturity of the September 2006 contract. For soybeans, the difference between the Gulf basis and transportation costs was generally negative when the March, May, July August and September 2006 contracts were nearby. Some convergence toward zero, however, was observed in September 2006. The basis and barge rate data indicate that while the Gulf basis strengthened as transportation costs increased, the strengthening did not completely offset the higher costs, contributing to a lack of convergence at Illinois River delivery markets.

On the surface, the failure of the Gulf basis to consistently offset higher transportation costs tends to support the second factor identified above, that futures prices were supported above fundamental value during this period. During much of this period, futures prices reflected higher crop values than could be explained by historic relationships between year-ending stock-to-use ratios and average farm prices (e.g., Good, 2006) and than forecast by the USDA's World Agricultural Outlook Board.[5] For example, in January 2006, a model developed in the Marketing and Outlook Program at the University of Illinois between historic stocks-to-use ratios and average farm price suggested that the average farm price of corn from February 2006 through August 2006 should be near $1.85 per bushel. The USDA was forecasting a price near that same level. The futures market

forecast an average price of $2.05 per bushel for that same period. Some have argued that the wave of fund interest in commodities, particularly the long-only index funds, contributed to a "bubble" or "risk premium" in corn and soybean futures prices at times over the past couple of years (e.g., Morrison, 2004; Evans, 2005). This influx of trading was at least in part accommodated by the increase in speculative limits. To the extent that new entrants obtained hedge exemptions, however, much of the increase may have occurred without the change in limits. For corn, an expansion of ethanol plants could also have justified higher values particularly at more distant contracts. It is noteworthy that the decline in futures prices from mid-August through mid-September 2006 brought values back in line with fundamental value. For example, on September 12, 2006, the USDA's forecast for the 2006-07 marketing year average price centered on $2.35 per bushel, the stocks-to-use model projected an average of $2.36 per bushel, and the futures market forecast an average of $2.40 per bushel. For soybeans those projections were $5.40, $5.49 and $5.41 per bushel, respectively. More normal convergence was observed with the September 2006 contracts of corn and soybeans.

A third development during late 2005 through August 2006 was a general increase in the magnitude of the carry in both the corn and soybean markets. The magnitude of the spread in cents per bushel per month from the second nearest to maturity contract to the nearest to maturity contracts for corn and soybeans from September 2001 through August 2006 tended to increase. For example, spreads in corn futures increased from around $0.04 per bushel per month in early 2005 to near $0.06 per month in 2006 (figure 12). A similar pattern unfolded for soybeans. The size of the carry is important because it influences the decision to make and take delivery. Consider a merchant regular for delivery, where the delivery decision depends on available alternatives for current sales and alternatives for continued storage in order to sell later. The large carry relative to the cost of storage in 2006 provided such a merchant incentive to hold for later delivery. It also provided incentive for takers of delivery to hold the delivery instrument and sell deferred futures to earn the carry rather than to immediately load out. While corn deliveries were large in May and July and soybean

deliveries were large in May, July and August (figure 13), they were apparently not sufficient to force convergence. The larger carry in the corn and soybean markets in the past year likely resulted from large crop inventories, increased commercial long hedging in deferred contracts by exporters and ethanol producers, and the large increase in speculative interest in owning corn and soybean futures. Open interest data suggest that there was significant interest in owning deferred contracts. Spreads, however, narrowed from mid- August 2006 into late September 2006 as futures prices also declined, a period when deliveries increased sharply and much better convergence was observed at the Illinois River.

Wheat Convergence Factors

For wheat, the factors contributing to lack of convergence generally center on three issues: (1) futures prices for soft red winter (SRW) wheat that exceeded fundamental value of that class of wheat, (2) a large carry in the futures market, and (3) insufficient deliveries. A change in the vomitoxin specifications for delivery satisfaction implemented with the September 2006 and subsequent contract months also had an apparent influence on the July–September 2006 spread. The change in specification reduced the level of vomitoxin that a taker of wheat can request at load out from five parts per million to four parts per million. That change was announced in January 2005 and should have allowed adequate time for issuers and takers of warehouse receipts to make the necessary adjustments, but the July-September 2006 spread indicates otherwise. In any case, the change should not have been a factor in March and May 2006 deliveries and convergence issues.

In the case of wheat futures values, wheat prices started moving higher in early 2006 amid concerns about conditions of the US hard red winter (HRW) wheat crop. Prices were further supported by confirmation of a small HRW crop, stress on the spring wheat crop, and poor conditions of the southern hemisphere crops. Prospects for significant tightening of U.S. and world stocks unfolded in 2006. Within this environment, however, the U.S. SRW wheat crop was large, at

390 million bushels. Even though the CBOT contract is effectively for SRW, the price of that contract was driven higher by the overall increase in wheat prices and the preference of many market participants to trade in the more liquid Chicago market rather than at other exchanges. Futures prices of SRW wheat were higher than could be supported by fundamentals of supply and demand, and therefore, higher than could be supported by the cash market. As an illustration, the USDA's September 2006 projection for the year-ending stocks-to-use ratio for the 2006-07 marketing year was 28.4% for soft red winter wheat. The average price of December 2006, March 2007, and May 2007 futures at the CBOT on October 3, 2006 was $4.52 per bushel. A year earlier the USDA's projection of the year-ending stocks-to-use ratio was 28.5% and the average price of the December 2005, March 2006 and May 2006 futures at the CBOT was only $3.57 per bushel. As a result, an extremely weak basis persisted at most markets, including delivery locations.

The role of the large carry in the wheat market was similar to that described for corn and soybeans. The monthly carry increased from about $0.05 per bushel in late 2005 to more than $0.06 in 2006, with a spike to about $0.15 associated with the carry from July to September 2006.

Even in a generally very weak basis environment, the magnitude of the basis at delivery markets from July 2005 through September 2006 was surprisingly large. For example, the basis at Toledo on the last day of delivery for the May, July, and September 2006 contracts was -$0.42, -$0.58, and -$0.90 per bushel, respectively. The persistence and growing magnitude of the delivery basis suggests a problem with the delivery process. Further evidence is provided by the delivery data shown in figure 13. Deliveries in wheat during 2006 were quite small compared to corn and soybeans. Perhaps even more surprising in light of the magnitude of arbitrage opportunities is the fact that wheat deliveries for the July and September 2006 contracts were smaller than year earlier levels. The limited extent of cash and futures price expiration arbitrage activity during 2006 indicates the presence of a constraint or bottleneck in the delivery system for CBOT wheat. Several possibilities exist, including a lack of available storage space for deliverable stocks, operations of the

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warehouse certificate system used for wheat (corn and soybeans use a shipping certificate system), or delivery locations out of the normal trade flows for soft red winter wheat.

Summary and Conclusions

In 2005, the Chicago Board of Trade (CBOT) and the Commodities Futures Trading Commission (CFTC) approved revisions to Regulation 425.01 to increase the CBOT's "Single Month" and "All Months" speculative position limits for its corn and mini-size corn, wheat and mini-size wheat, soybean and mini-size soybean, soybean oil, soybean meal and oat contracts. Since the change, market participants have expressed concern that this added speculative activity has caused futures prices to be artificially inflated and volatile, contributing to weak and erratic basis levels from late 2005 through the first half of 2006 and to a lack of convergence of cash and futures prices during delivery in the first half of 2006. Three attributes of futures contract behavior importance for market performance—liquidity, volatility, and convergence—are investigated in this study. Descriptive and statistical comparisons of these attributes for corn, soybeans, and wheat contracts before and after the 2005 change in speculative position limits are made to ascertain changes in behavior.

The analysis of liquidity and market depth reveals a sharp increase in open interest for corn, soybeans, and wheat beginning in late 2005 and particularly in 2006. A larger percent of the open interest was held by non-commercials in the period after the increase in speculative trading limits. That increase likely accommodated the increase in speculative interest in trading corn, soybean and wheat futures, but some of the increase would have occurred without the increase as new market participants received hedge exemptions. With the ambiguity about trader classification in the CFTC Commitment of Traders Report and only the recent availability of the CFTC Commodity Index Trader Report, it is difficult to draw definitive conclusions about the structure of the open interest. To the degree that the new trading activity consists of long-only index funds, a larger percentage of the trade and open interest is likely held by traders who may be relatively price insensitive to

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individual commodity conditions than traditional market participants. Domanski and Heath (2007) describe this process as the 'financialization" of commodity markets, which they argue can fundamentally alter price dynamics in these markets. A particular concern is that the huge inflow of commodities investment has raised prices, at least temporarily, to higher levels than can be justified by economic fundamentals.

The analysis of price volatility revealed no large change in measures of volatility after the change in speculative limits. A relatively small number of observations are available since the change was made, but there is little to suggest that the change in speculative limits has had a meaningful overall impact on price volatility to date.

The analysis of convergence revealed differences in the degree of convergence before and after the changes in speculative limits. Non-convergence was observed in some delivery markets for corn and soybeans beginning as early as July 2005, but non-convergence was most prominent in March, May, and July 2006. A return to more normal convergence was observed in September 2006, particularly for corn at Illinois River locations. The difference in convergence before and after July 2005 was likely only partially related to the change in speculative limits. Other factors that impacted the delivery process included higher futures values, higher barge rates, and a large carry. Despite the observed weakness, it is important to point out that overall convergence performance since July 2002 was reasonably strong, in the sense that corn and soybean basis before delivery provided relatively accurate forecasts of the basis change to expiration.

Non-convergence in the wheat market was also observed for the Chicago and Toledo markets after the change in speculative limits. The difference in convergence before and after July 2005 was likely only partially related to the change in speculative limits. Inflated values of Chicago futures associated with the small supply of wheat in classes other than soft red winter wheat and a large carry in the futures market likely contributed to the period of weak basis and poor convergence. However, unlike corn and soybeans, basis levels during delivery remained extremely weak for an extended

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period of time and became weaker over time. Furthermore, wheat basis before delivery over the entire sample provided very little evidence of predictive ability at either the Chicago or Toledo delivery locations.

For corn and soybeans, the picture that unfolds relative to recent convergence patterns is one of weakness, but not failure. While large deliveries are traditionally thought to be evidence of market failure, large deliveries of soybeans, and particularly, corn in 2006 were likely in reaction to a unique situation relative to futures prices, spreads, and high barge rates. The delivery process ultimately worked to provide more normal convergence behavior. Convergence issues should be carefully monitored, but current performance does not point to the need for major adjustments in contract provisions. Consideration of an increase in the CBOT storage rate that would make storage alternatives less attractive is likely warranted. Such an increase might be a fixed rate, a seasonally adjusted rate, or a rate adjustable to the market rate.

For wheat, the picture that unfolds relative to recent convergence patterns is not only one of weakness, but failure to accomplish one of the fundamental tasks of a futures market. The persistence and growing magnitude of the delivery location basis suggests a problem with the contract specifications. More specifically, the limited extent of cash and futures price expiration arbitrage activity during 2006 indicates the presence of a constraint or bottleneck in the delivery system for CBOT wheat. This prolonged period of weak basis suggests that the contract is not providing an effective hedging mechanism, may not be providing proper signals to wheat producers and consumers, and may be reducing the effectiveness of crop revenue insurance products based on CBOT wheat futures prices.

It is important to recognize that concerns about the performance of the CBOT wheat futures contract are not a recent phenomenon. Gray and Peck (1981) review concerns about delivery specifications of the wheat contract that stretch all the way back to the 1920s. The fundamental problem is that changes in wheat production patterns, transportation logistics, and trade flows have

left the contract with an increasingly narrow flow of stocks to draw upon in the delivery process. Given this history, it is not surprising that the CBOT wheat contract now appears to reflect world conditions for generic 'wheat" rather than soft red winter wheat market conditions. This has a marked influence on domestic basis patterns during periods of diverging market conditions across wheat classes. While the extent of trading suggests that the CBOT contract must be providing price discovery services and cross-hedging opportunities for some market participants, a key question that emerges is whether the benefits from these services outweigh the inevitable convergence problems associated with such an imprecise definition of price.

The CBOT recently approved several changes in the delivery specifications of the wheat contract.[6] Assuming approval by the CFTC, the changes will include: i) moving the delivery instrument from a warehouse receipt to a shipping certificate; ii) increasing the official storage rate for wheat from 15/100s of one cent per bushel per day (approximately 4.5 cents per bushel per month) to 16.5/100s of one cent per bushel per day (approximately 5 cents per bushel per month), iii) changing several items related to rail-load out at Chicago and Toledo delivery locations; and iv) lowering the vomitoxin limit for par delivery from 4 parts per million to 3 parts per million. While these changes are likely to be helpful, they do not address the underlying fundamental problem with the contract, i.e., the narrow base of the contract. More detailed research is warranted to investigate the need for and development of a new contract that more precisely reflects world supply and demand conditions for wheat.

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Endnotes

[1] COT reports can be found at:

http://www.cftc.gov/cftc/cftccotreports.htm?from=home&page=cotcontent.

[2] The cash price for corn is No. 2 yellow, the same as par delivery on futures contracts. It should be noted that the cash price is for No. 1 yellow soybeans, as opposed to the par delivery grade of No. 2 yellow soybeans. The cash price is for No. 2 soft red winter wheat, the same as the par delivery grade for the wheat futures contracts.

[3] While not included in the original analysis for this paper, convergence patterns for corn, soybean, and wheat contracts expiring between November 2006 and May 2007 generally were similar to the patterns discussed in the text for contracts expiring between July 2005 and September 2006. For corn, convergence or near convergence was observed for at least one delivery location in December 2006, March 2007, and May 2007. For soybeans, significant convergence issues were not observed for the November 2006 and January 2007 contracts. Some weakness was evident for the March and May 2007 contracts. For wheat, non-convergence at expiration continued to be a problem for the December 2006, March 2007, and May 2007 contracts. As an example, the cash price at Toledo was 49 cents per bushel under the May 2007 CBOT wheat futures price on the last day of delivery.

[4] Working (1953) studied Kansas City wheat futures over 1922-1952 and reported an R^2 of 0.70. Williams (2001) reports an R^2 of 0.62 in a study of New York coffee futures over 1993-1997. Hranaiova and Tomek (2002) find that R^2 ranges between 0.65 and 0.79 for Chicago corn futures over 1989-1997.

[5] World Agricultural Outlook Board forecasts can be found at:

http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1194.

[6] See http://www.cbot.com/cbot/pub/cont_detail/0,3206,1032+47942,00.html for complete details regarding proposed changes to the CBOT wheat contract.

Table 1. 2005 Changes in CFTC Speculative Position Limits for CBOT Corn, Soybean, and Wheat Futures Contracts

CBOT	Single Month Limit			All Months Limit			First Futures Month	
Contract	Old	Phase I	Phase II	Old	Phase I	Phase II	Phase I	Phase II
Corn	5,500	9,500	13,500	9,000	15,500	22,000	July 2005	March 2006
Soybeans	3,500	5,000	6,500	5,500	7,750	10,000	July 2005	January 2006
Wheat	3,000	4,000	5,000	4,000	5,250	6,500	July 2006	March 2006

Note: The first phase was effective on June 10, 2005 and the final phase was effective on December 10, 2005.

Table 2. Basis Predictability Regressions for CBOT Corn, Soybean, and Wheat Delivery Locations, November 2001 - September 2006 Contracts

Commodity/ Delivery Location	Regression Estimates				
	Intercept	**Slope**	**R^2**	**DW**	**F-Statistic**
Corn					
Chicago	1.73 (1.33)	-0.62 ** (-6.25)	0.64	2.10	9.21 **
Illinois River Peoria North	-1.58 (-0.81)	-0.83 ** (-9.32)	0.80	1.54	5.93 *
Illinois River Peoria South	-0.08 (-0.05)	-0.77 ** (-8.15)	0.75	1.85	5.89 **
Soybeans					
Chicago	-2.30 (-1.79)	-0.70 ** (-11.49)	0.80	1.58	14.06 **
Illinois River Peoria North	-7.93 ** (-4.02)	-0.78 ** (-9.15)	0.72	1.53	15.75 **
Illinois River Peoria South	-6.88 ** (-3.90)	-0.83 ** (-10.25)	0.76	1.65	13.06 **
St. Louis	4.82 * (2.34)	-0.96 ** (-9.54)	0.73	1.72	3.47 *
Wheat					
Chicago	6.21 * (2.32)	-0.09 (-0.67)	0.02	1.76	28.98 **
Toledo	6.78 ** (3.60)	0.12 (1.51)	0.09	1.60	145.34 **

Notes: The dependent variable in the regressions is the change in the delivery location basis from the day after the preceding contract expires (except new crop corn and soybean contracts, which start on the first trading day of October) to the first day of delivery. The independent variable is the delivery location basis on the day after the preceding contract expires (except new crop corn and soybean contracts, which start on the first trading day of October). N is 24 for corn, one less than the total sample size because the September 2005 observation is deleted from these regressions. N is 35 for soybeans and 25 for wheat. DW is the Durbin-Watson statistic. The F-statistic tests the joint null hypothesis that the intercept equals zero and the slope equals negative one. Two stars indicate statistical significance at the one-percent level and one star at the five-percent level.
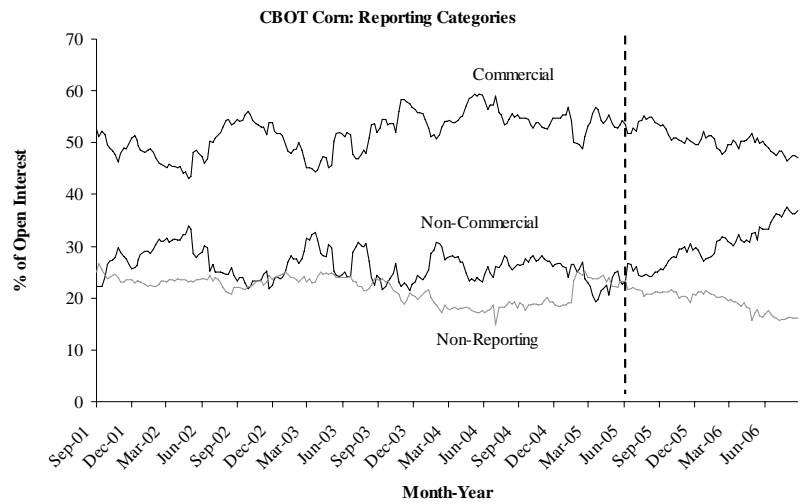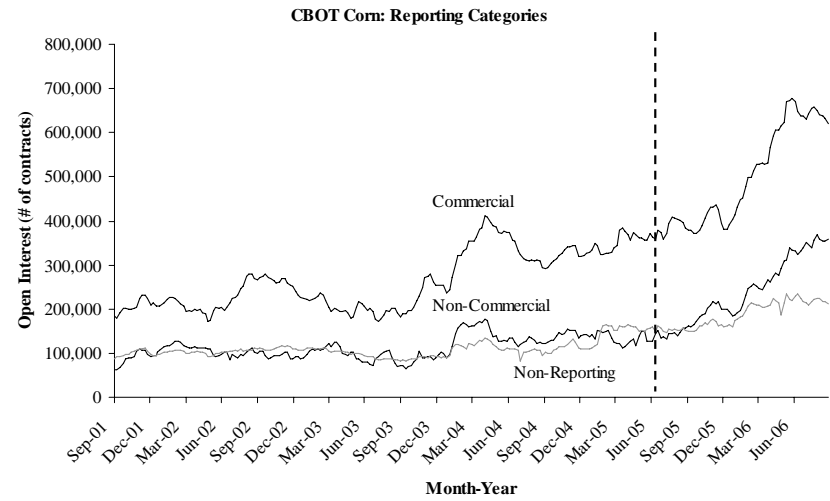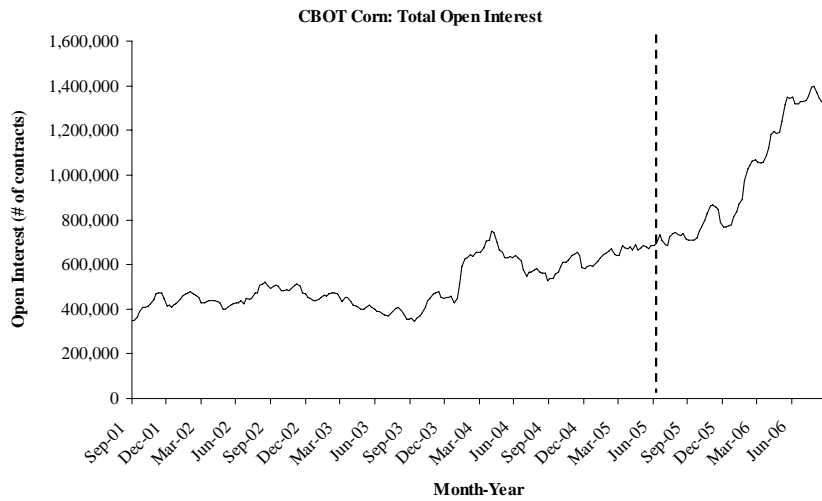
CBOT Corn: Total Open Interest

CBOT Corn: Reporting Categories

Commercial

Non-Commercial

Non-Reporting

CBOT Corn: Reporting Categories

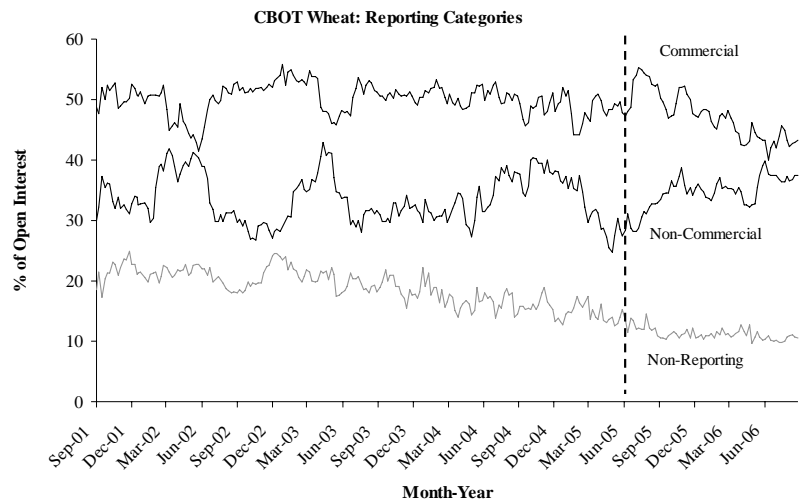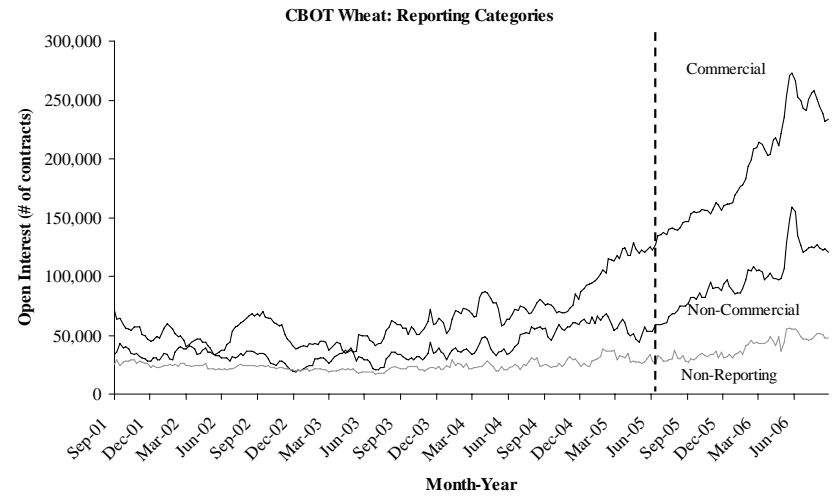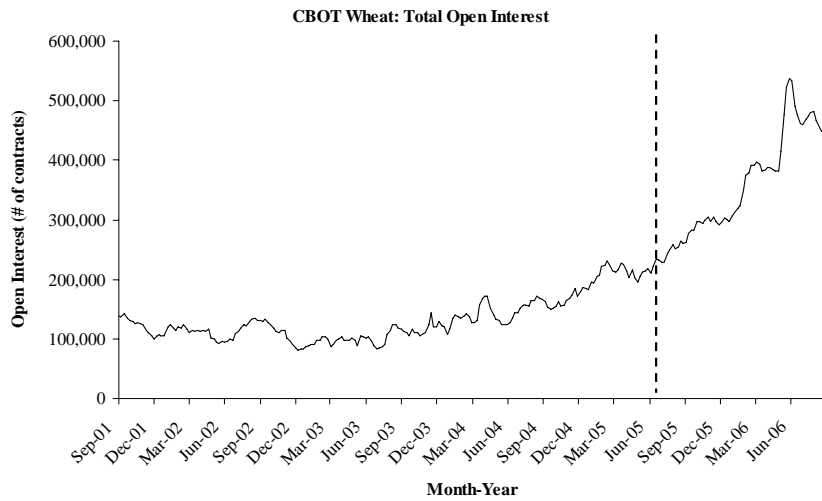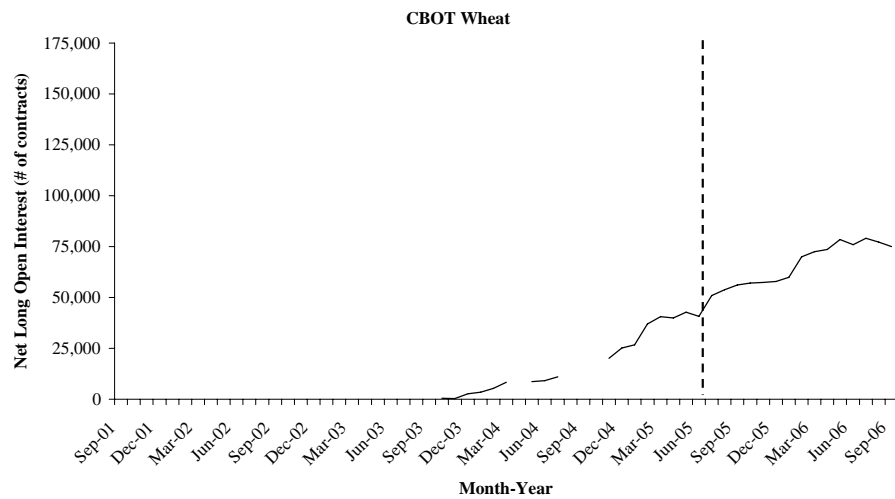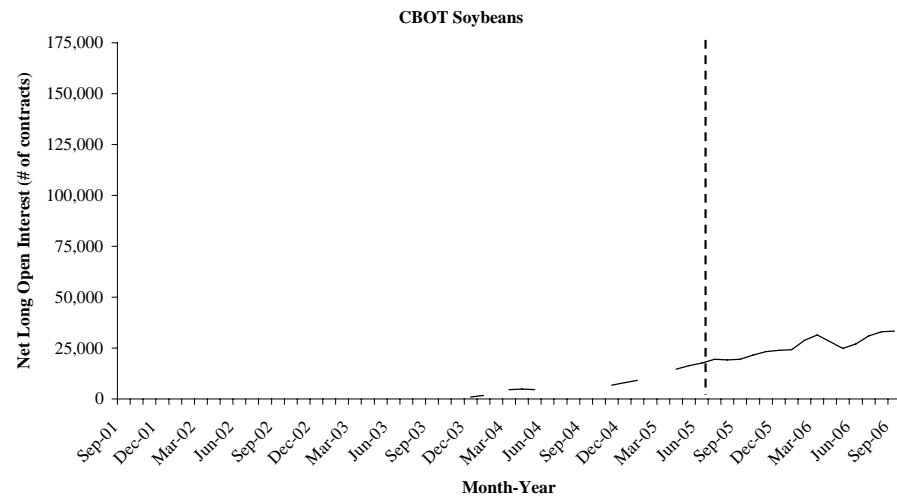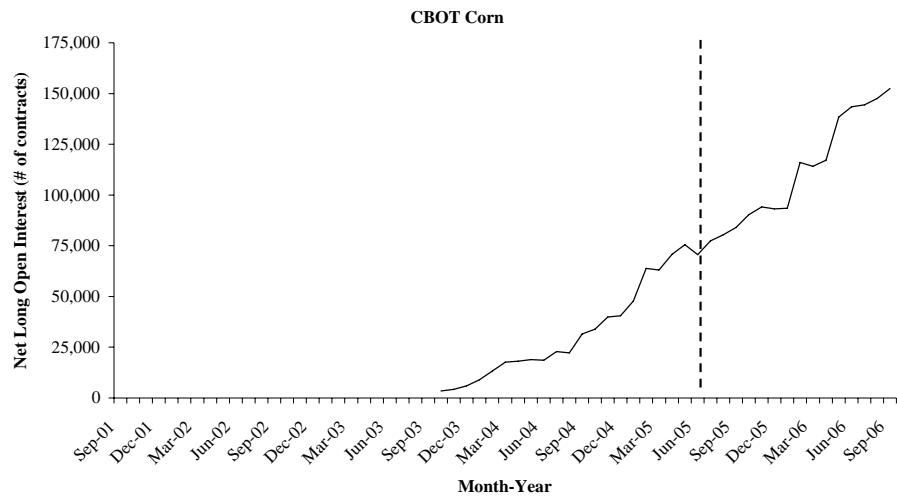Commercial

Non-Commercial

Non-Reporting

Notes: The dashed vertical line separates the period before and after speculative position limits were changed. The source is CFTC Commitments of Traders Reports (http://www.cftc.gov/cftccotreports.htm).

Figure 1. Open Interest for CBOT Corn Futures Contracts, Weekly for All Contracts, September 4, 2001 - August 29, 2006.
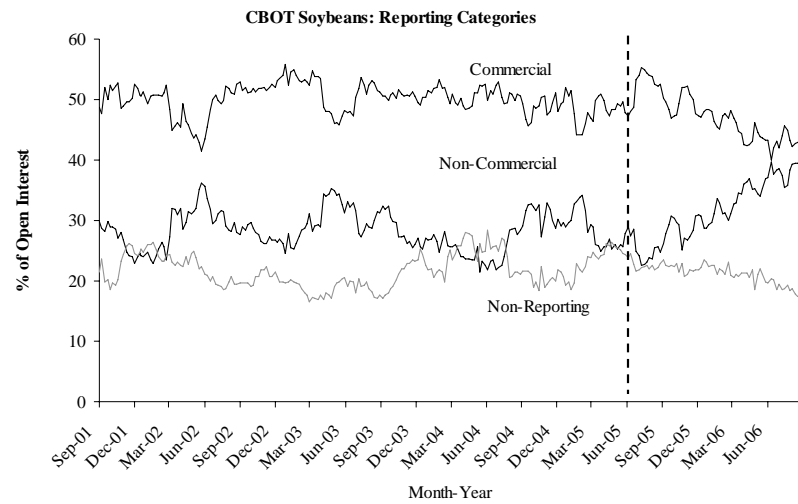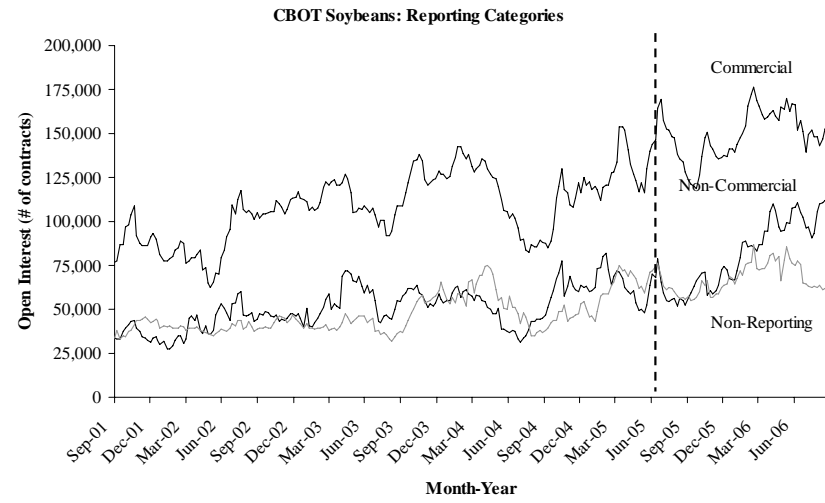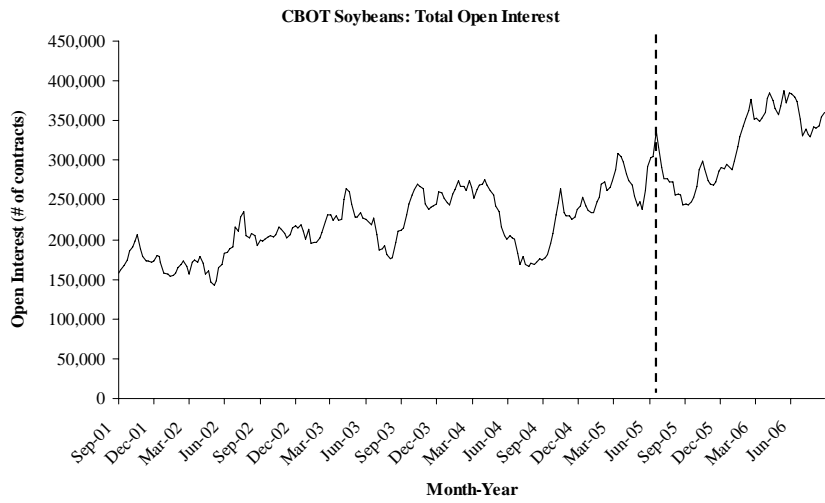
CBOT Soybeans: Total Open Interest

CBOT Soybeans: Reporting Categories

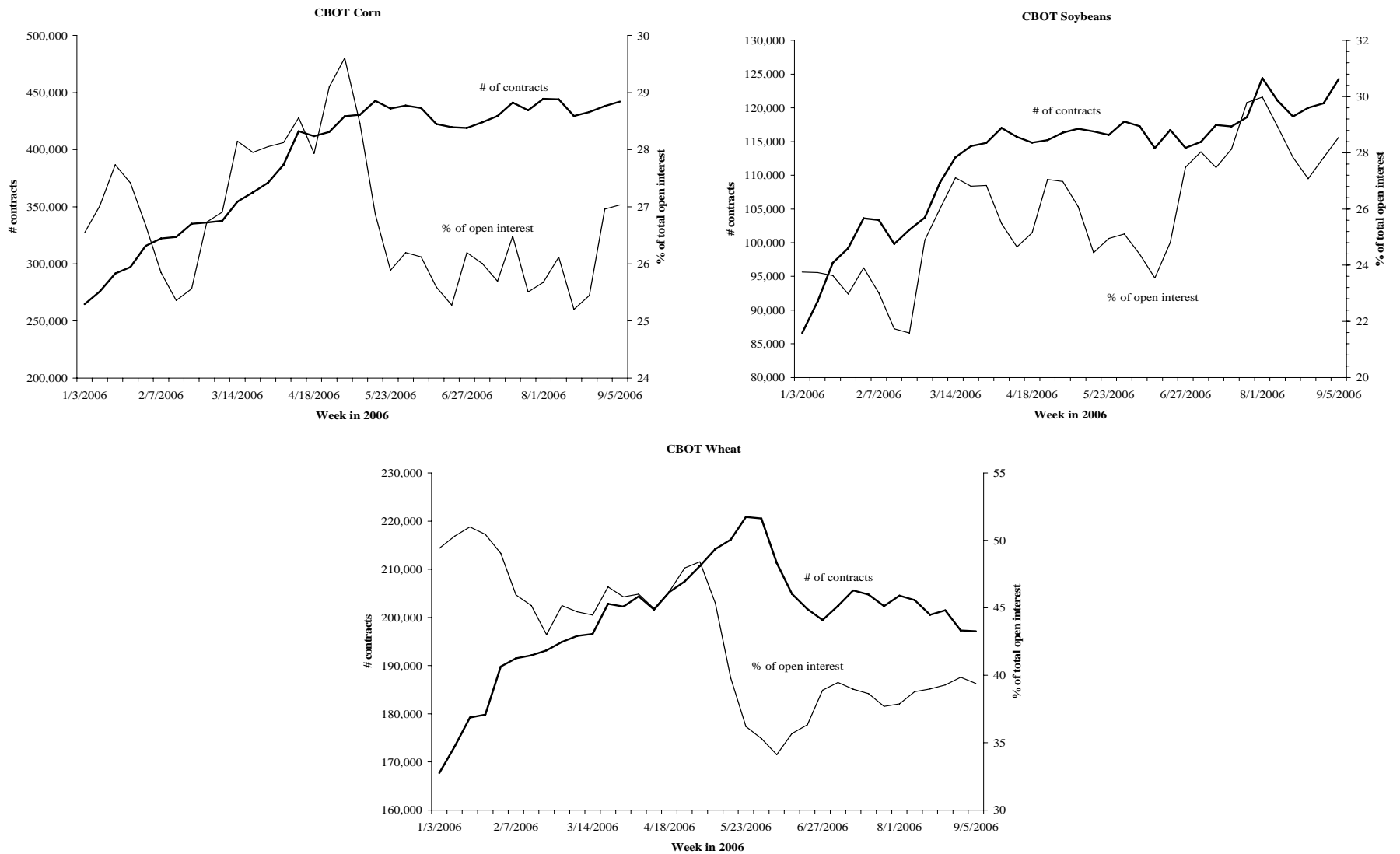**CBOT Soybeans: Reporting Categories**

Notes: The dashed vertical line separates the period before and after speculative position limits were changed. The source is CFTC Commitments of Traders Reports (http://www.cftc.gov/cftccotreports.htm)

Figure 2. Open Interest for CBOT Soybean Futures Contracts, Weekly for All Contracts, September 4, 2001 - August 29, 2006.

CBOT Wheat: Total Open Interest

CBOT Wheat: Reporting Categories

CBOT Wheat: Reporting Categories

Notes: The dashed vertical line separates the period before and after speculative position limits were changed. The source is CFTC Commitments of Traders Reports (http://www.cftc.gov/cftccotreports.htm)

Figure 3. Open Interest for CBOT Wheat Futures Contracts, Weekly for All Contracts, September 4, 2001 - August 29, 2006.
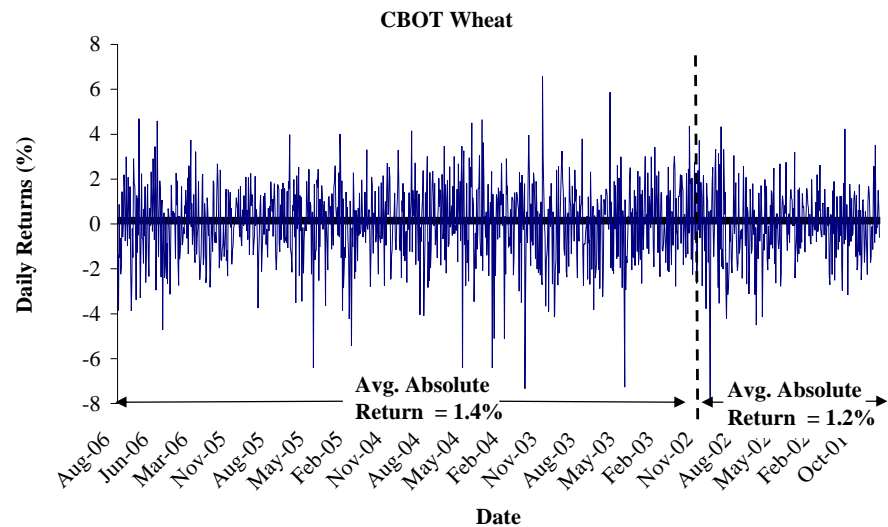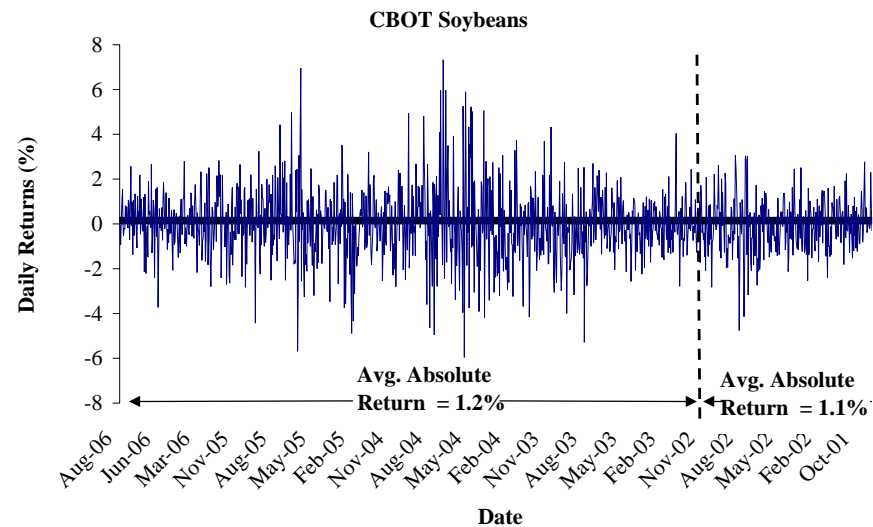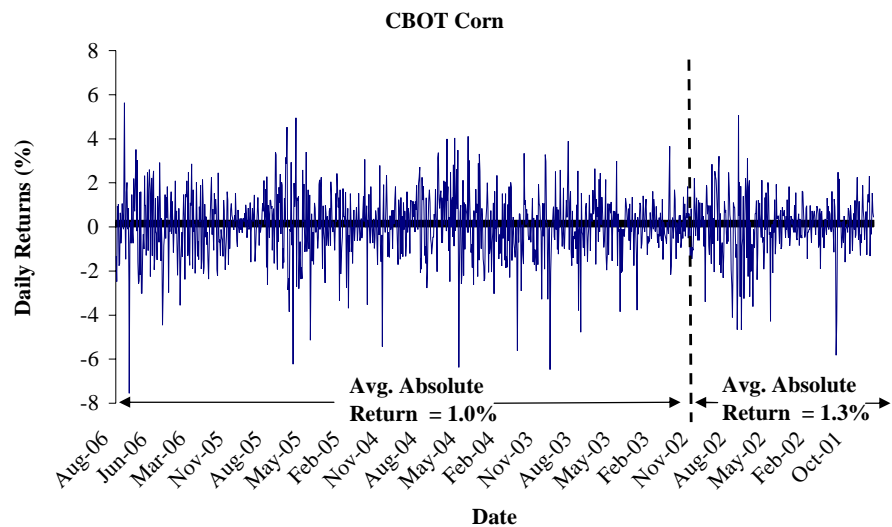
CBOT Corn

CBOT Soybeans

CBOT Wheat

Notes: The dashed vertical line separates the period before and after speculative position limits were changed. The source is CFTC Bank Participation in Futures and Options Reports (http://cftc.gov/dea/bank/deabank.htm).

Figure 4. Bank Open Interest in CBOT Corn, Soybean and Wheat Futures Contracts, Monthly for All Contracts, September 2001 - September 2006.
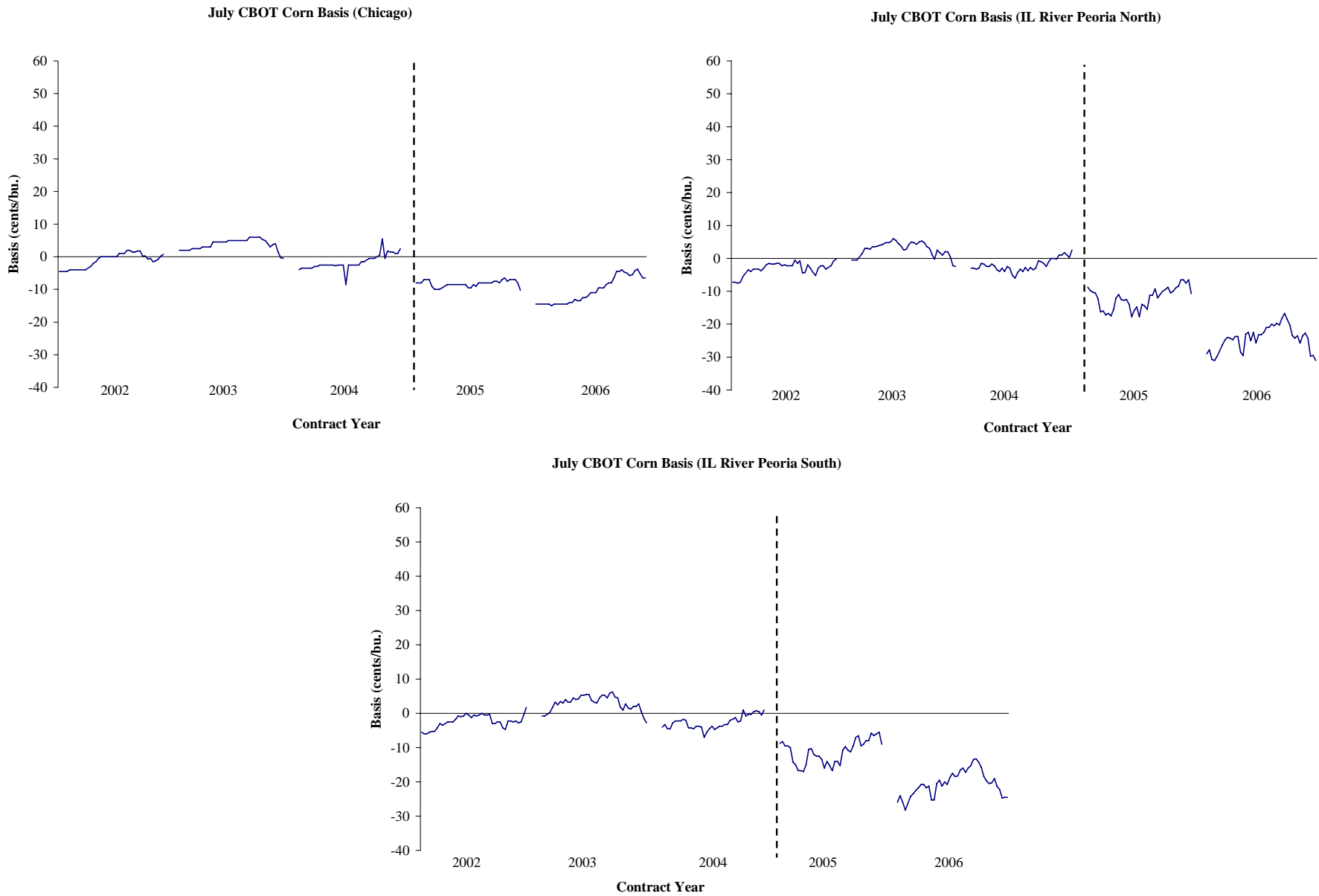
CBOT Corn

CBOT Soybeans

CBOT Wheat

Notes: The source is CFTC Historical Commitments of Ttraders Commodity Index Trader Supplement Reports (http://www.cftc.gov/dea/history/deahist-cit.htm).

Figure 5. Commodity Index Trader Open Interest in CBOT Corn, Soybean and Wheat Futures and Options Contracts, Weekly for All Contracts, January 3, 2006 - September 5, 2006.

CBOT Corn

CBOT Soybeans

CBOT Wheat

Notes: The dashed vertical line separates the period before and after speculative position limits were changed. Daily returns are computed as ln[p(t)/p(t-1)]*100, where p(t) is the settlement price for the nearby futures contract. The futures price source is Commodity Systems Inc. (http://www.csidata.com/).

Figure 6. Nearby CBOT Futures Returns, Daily, September 4, 2001 - August 31, 2006

July CBOT Corn Basis (Chicago)

July CBOT Corn Basis (IL River Peoria North)

July CBOT Corn Basis (IL River Peoria South)

Notes: Basis is plotted daily and computed as cash minus futures. The first observation for each contract year is the day after the preceding contract expires, around the 15th of the month. The last observation for each contract year is the expiration day for the given contract, again around the 15th of the month. The dashed vertical line separates the period before and after speculative position limits were changed. The cash price source is Agricultural Marketing Service (http://marketnews.usda.gov/portal/lg/) and the futures price source is Commodity Systems Inc. (http://www.csidata.com/).

Figure 7. Basis at Delivery Points for CBOT Corn Futures Contracts, July 2002 - 2006

March CBOT Soybean Basis (Chicago)

March CBOT Soybean Basis (IL River Peoria North)

March CBOT Soybean Basis (IL River Peoria South)

March CBOT Soybean Basis (St. Louis MS River)

Notes: Basis is plotted daily and computed as cash minus futures. The first observation for each contract year is the day after the preceding contract expires, around the 15th of the month. The last observation for each contract year is the expiration day for the given contract, again around the 15th of the month. The dashed vertical line separates the period before and after speculative position limits were changed. The cash price source is Agricultural Marketing Service (http://marketnews.usda.gov/portal/lg/) and the futures price source is Commodity Systems Inc. (http://www.csidata.com/).
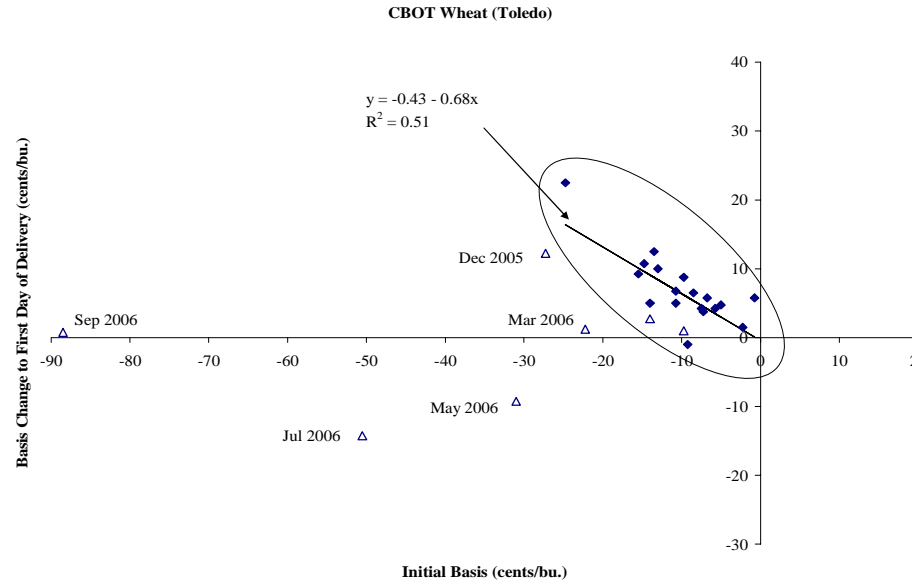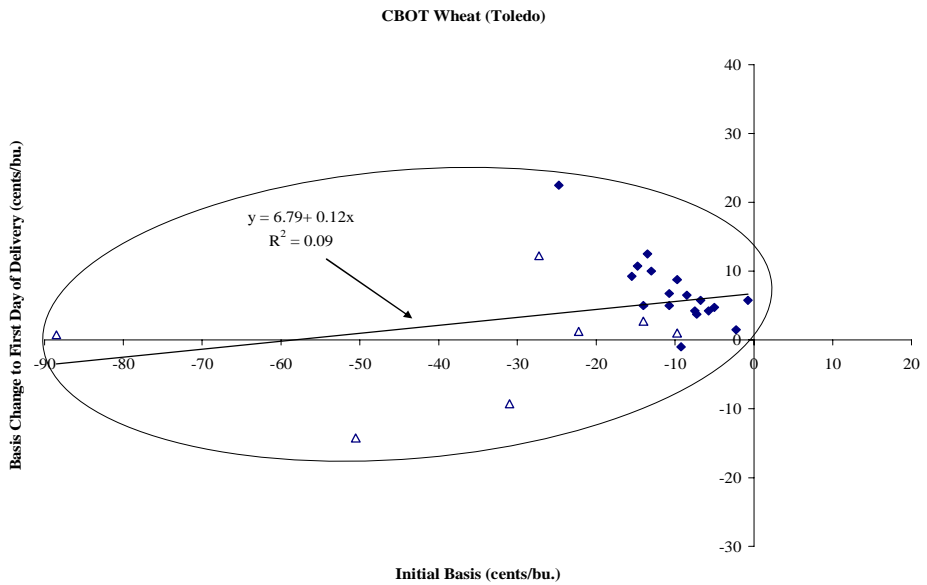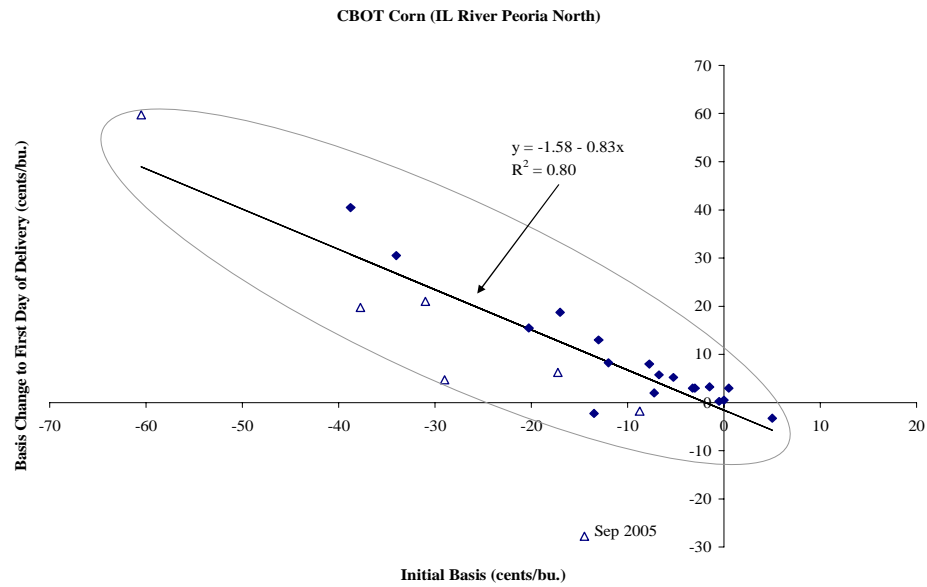
Figure 8. Basis at Delivery Points for CBOT Soybean Futures Contracts, March 2002 - 2006
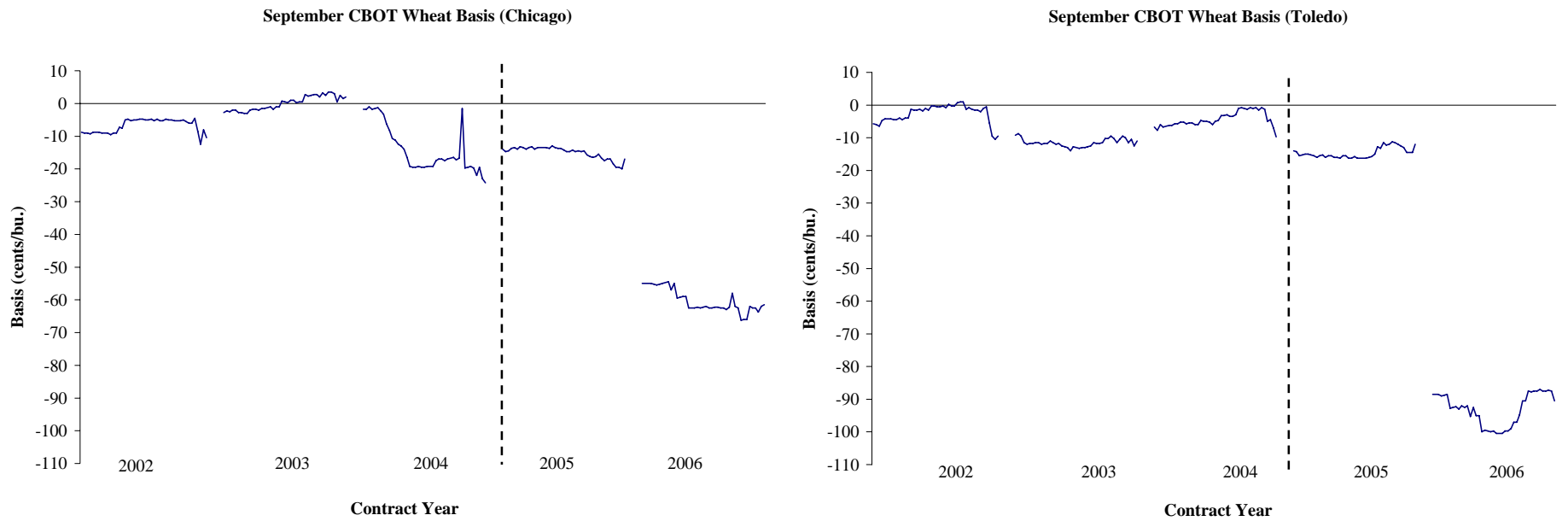
September CBOT Wheat Basis (Chicago)

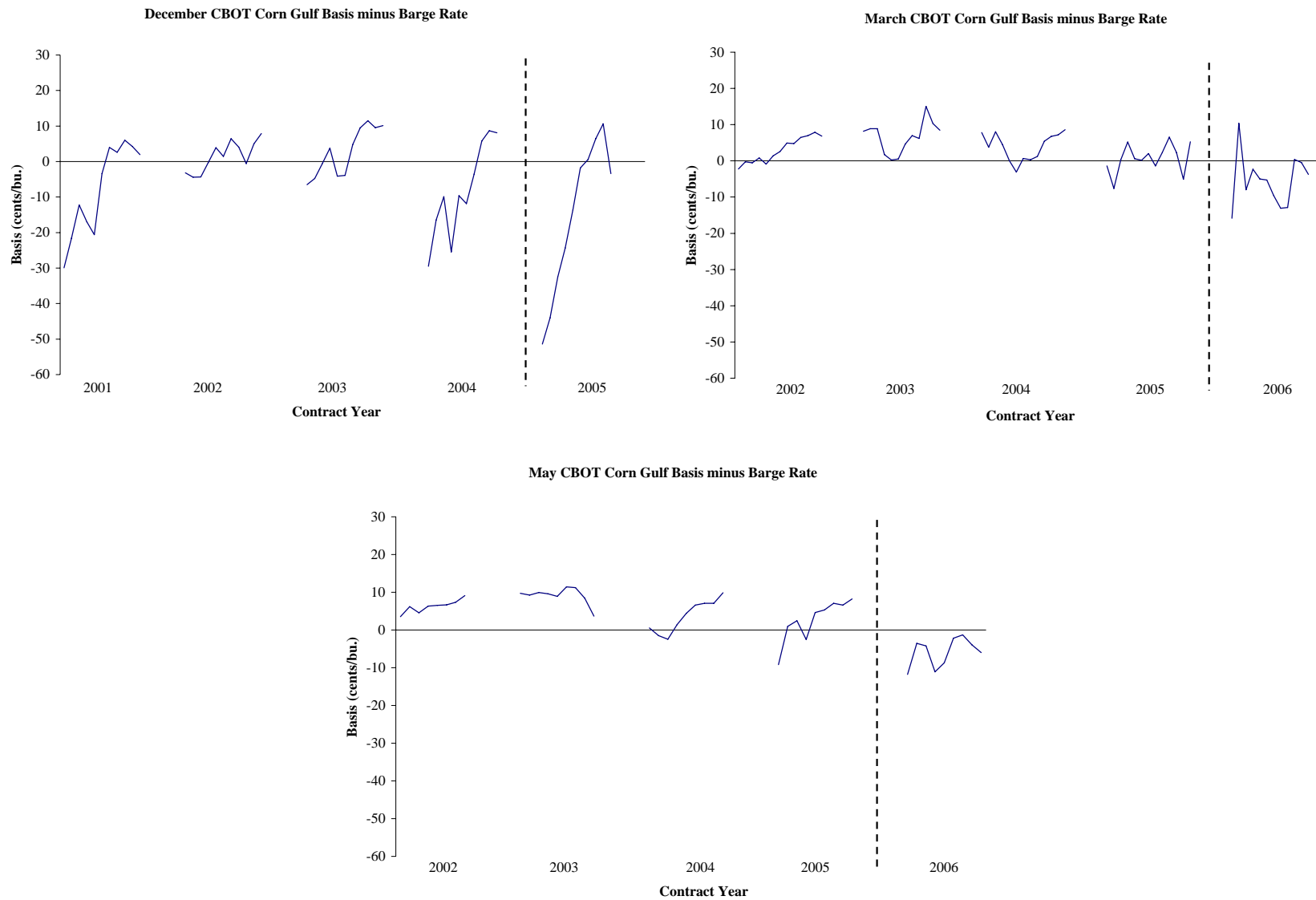**September CBOT Wheat Basis (Toledo)**

Notes: Basis is plotted daily and computed as cash minus futures. The first observation for each contract year is the day after the preceding contract expires, around the 15th of the month. The last observation for eacl contract year is the expiration day for the given contract, again around the 15th of the month. The dashed vertical line separates the period before and after speculative position limits were changed. The cash price source is Agricultural Marketing Service (http://marketnews.usda.gov/portal/lg/) and the futures price source is Commodity Systems Inc. (http://www.csidata.com/).

Figure 9. Basis at Delivery Points for CBOT Wheat Futures Contracts, September 2002 - 2006

CBOT Corn (IL River Peoria North)

$y = -1.58 - 0.83x$
$R^2 = 0.80$

Basis Change to First Day of Delivery (cents/bu.)

Initial Basis (cents/bu.)

Sep 2005

CBOT Soybeans (IL River Peoria South)

$y = -6.88 - 0.83x$
$R^2 = 0.76$

Basis Change to First Day of Delivery (cents/bu.)

Initial Basis (cents/bu.)

CBOT Wheat (Toledo)

$y = 6.79 + 0.12x$
$R^2 = 0.09$

Basis Change to First Day of Delivery (cents/bu.)

Initial Basis (cents/bu.)

CBOT Wheat (Toledo)

$y = -0.43 - 0.68x$
$R^2 = 0.51$

Basis Change to First Day of Delivery (cents/bu.)

Dec 2005

Sep 2006

Mar 2006

May 2006

Jul 2006

Initial Basis (cents/bu.)

Notes: Basis is computed as cash minus futures. Initial basis is computed for the day after the preceding contract expires, around the 15th of the month (except new crop corn and soybean contracts, which start on the first trading day of October). Triangles indicate observations that occur after the change in speculative position limits

Figure 10. Examples of Basis Predictability at Delivery Points for CBOT Corn, Soybean, and Wheat Futures Contracts, July 2002 - 2006

December CBOT Corn Gulf Basis minus Barge Rate

March CBOT Corn Gulf Basis minus Barge Rate

**May CBOT Corn Gulf Basis minus Barge Rate**

Notes: The series is plotted weekly and computed as Gulf cash minus futures minus barge rates. Barge rates refer to shipping between Peoria, Illinois and the Mississipi Gulf. The first observation for each December contract year is the first trading day in October. The first observation for each March and May contract year is the week after the preceding contract expires, around the 15th of the month. The last observation for all contract years is the expiration week for the given contract, again around the 15th of the month. The dashed vertical line separates the period before and after speculative position limits were changed. The cash price source is Agricultural Marketing Service (http://marketnews.usda.gov/portal/lg/) and the futures price source is Commodity Systems Inc. (http://www.csidata.com/). Barge rates (cents/bu.) were computed as 0.135 times the quoted percentage of tariff for corn.

Figure 11. Basis at the Gulf Minus Barge Rate for December, March, and May CBOT Corn Futures Contracts, 2001 - 2006
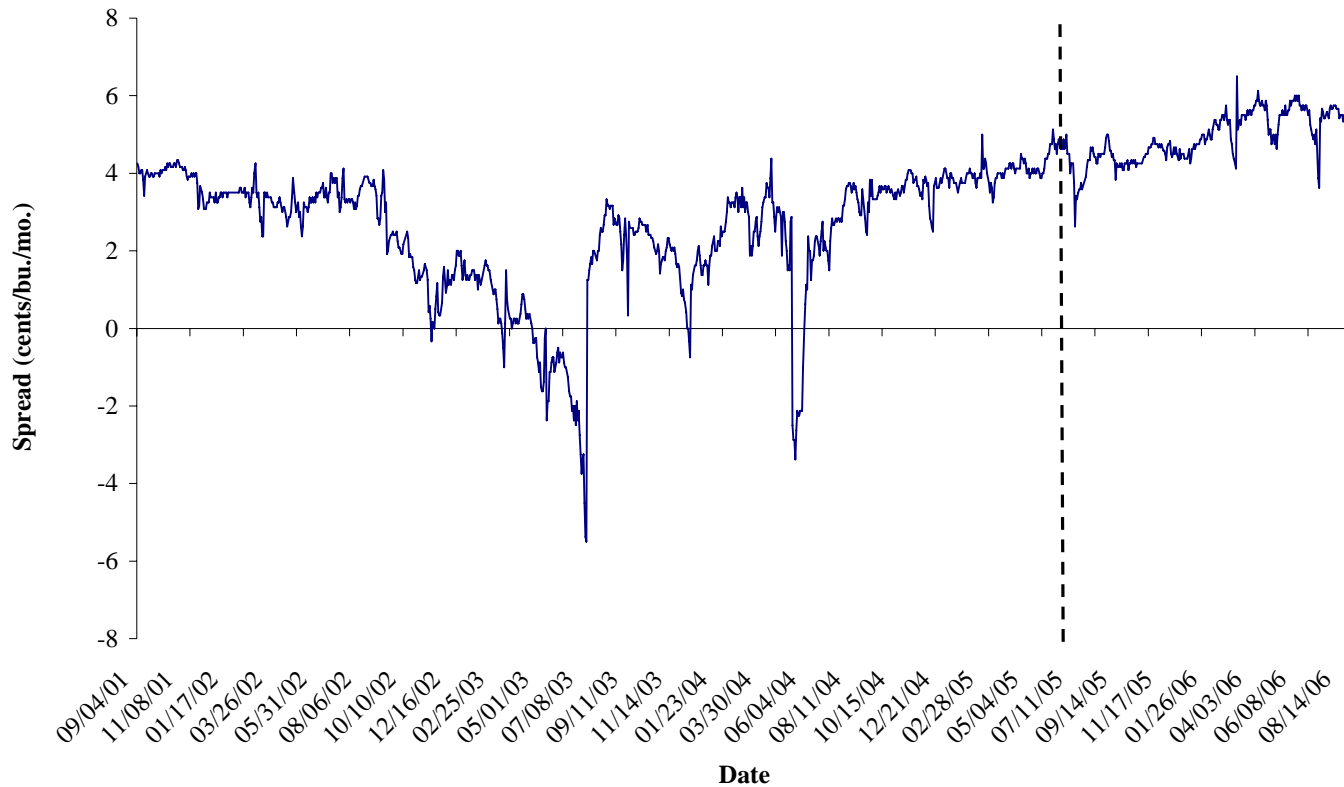
Notes: Spreads are computed daily as the second nearest to maturity contract minus the nearest to maturity contract. Each day's spread is adjusted to a monthly basis by dividing the observed spread by the number of months between the two contracts used in the computation. Spreads are computed through the expiration date of the nearest to maturity contract. The dashed vertical line separates the period before and after speculative position limits were changed. The futures price source is Commodity Systems Inc. (http://www.csidata.com/).

Figure 12. Spread Between the Two Nearest to Expiration CBOT Corn Futures Contacts, September 4, 2001 - August 31, 2006

CBOT Corn

CBOT Soybeans

CBOT Wheat
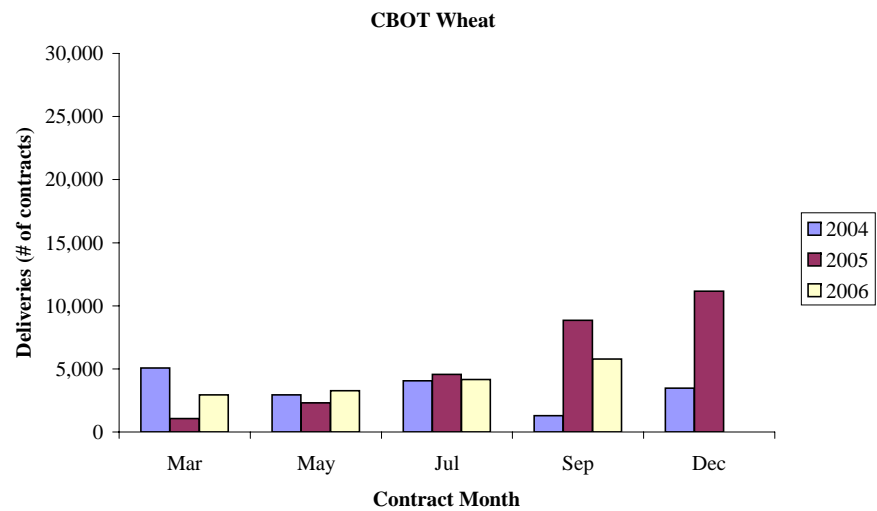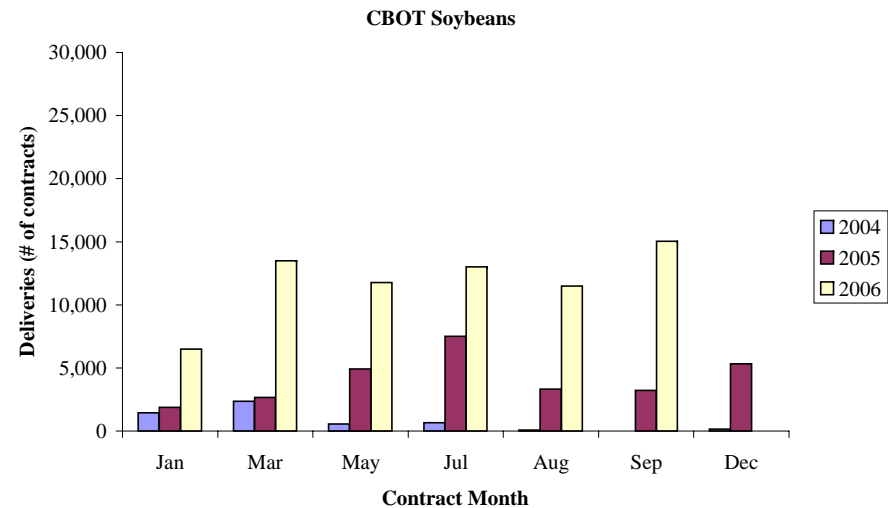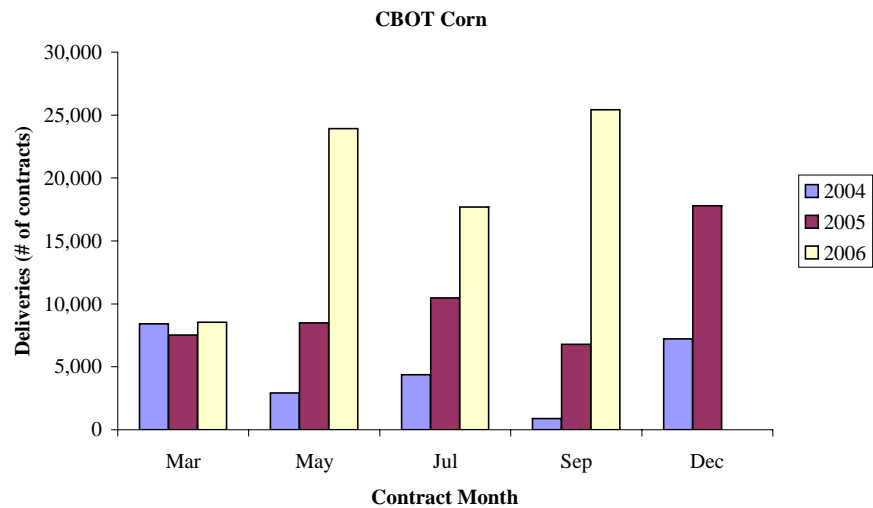
Note: Source of delivery data is the CBOT Issues and Stops Year to Date Report (http://cbot.com/cbot/pub/page/0,3181,1216,00.html)

Figure 13. Total Volume of Deliveries for CBOT Futures Contracts, 2004 - 2006