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Recent Convergence Performance of Futures and Cash Prices for Corn, Soybeans, and Wheat

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Abstract

Convergence between futures and cash prices is important for market risk transfer, price discovery, and inventory allocation. Market participants and policymakers grew concerned when, from 2005 to 2011, wheat futures contracts—and to a lesser extent corn and soybean futures—were affected by growing discrepancies ("non-convergence") between expiring futures and cash prices. Recent research found the reasons for non-convergence to be associated with contract design and market conditions. From 2008 to 2011, the Chicago Board of Trade (CBOT) and Kansas City Board of Trade (KCBT) modified their contracts to better reflect market conditions for these commodities by (1) aligning contract storage rates with industry storage costs; (2) adding delivery locations to sufficiently fulfill the soft red winter (SRW) wheat contract during the delivery period; (3) strengthening wheat quality requirements, such as reducing vomitoxin levels to conform to industry standards; and (4) limiting the number of shipping certificates for CBOT contracts that an individual firm can hold at any one time. These changes appear to have contributed to an improved convergence between expiring futures and cash prices.

Keywords: Agricultural commodity futures, convergence, futures and cash prices, futures contract, delivery markets, storage rates.

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Contents

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Linwood Hoffman is an agricultural economist with USDA's Economic Research Service. Nicole Aulerich is an associate at Cornerstone Research in Washington, DC. Her contributions to this report were completed while she was a graduate student working under a Cooperative Agreement with ERS.

Introduction

From 2005 to 2011, market participants, commodity exchanges, and policymakers grew concerned about the discrepancies—or "non-convergence"—between futures and cash prices in several markets, specifically the Kansas City Board of Trade (KCBT) and Chicago Board of Trade (CBOT) wheat futures contracts and to a lesser extent CBOT corn and soybean futures. During this period, questions arose about the relationship between futures and cash markets and the ability of traditional market players to manage risk (Coyle, 2008), discover price, and allocate inventories through time. A weakened link between futures and the underlying cash price impaired "normal convergence" (by which futures prices move toward the cash prices to eventually become the same, or very close to same). From 2008 to 2011, the commodity exchanges, with oversight from the Commodity Futures Trading Commission (CFTC), changed contract specifications to address lack of convergence during the delivery period of expiring futures contracts.[1]

This report examines whether changes made to contract specifications have facilitated stronger convergence of expiring futures and cash prices. ERS researchers also briefly review the importance of convergence for futures markets and the reasons for convergence failures starting in the mid-2000s. Four major agricultural commodity futures contracts form the focus: corn (Chicago Mercantile Exchange (CME Group, CBOT)), soybeans (CME Group, CBOT), soft red winter wheat (SRW) (CME Group, CBOT), and hard red winter wheat (HRW) (CME Group, KCBT).[2]

[1]CFTC oversaw all changes to contract specifications (mentioned in this report) by commodity exchanges.

[2]The Chicago Mercantile Exchange (CME) and CBOT merged in July 2007 to form the CME Group. On December 3, 2012, KCBT became part of the CME Group.

Why Convergence Matters

Because futures markets are crucial to commodity price discovery, risk management, and allocation of inventories through time (Peck, 1985), a lack of price convergence between futures and cash markets compromises these vital functions (Irwin et al., 2011).[3] Without convergence, futures prices inaccurately represent cash prices at the time of contract expiration. Irwin et al. (2008) find that uncertain behavior of the basis (cash price minus futures price) leads to less effective storage hedging[4]—that is, storage of a priced commodity for future delivery. Futures markets for storable commodities largely depend on hedging for their existence (Working, 1954)[5], and a primary indicator of a contract's success is its usefulness for hedging (Gray, 1966).

In the long run, an efficient hedging mechanism for producers, merchants, and processors is necessary for a viable commodity futures market. The lack of an efficient hedging mechanism will disrupt markets as disadvantaged parties cease trading (Hieronymus, 1977). Futures exchanges strive to structure contracts to reflect cash market activity and maintain hedging effectiveness.

[3]To better understand the need for convergence and the contract settlement process involved with these contracts see Aulerich et al. (2011), Irwin et al. (2011), or Adjemian et al. (2013).

[4]Irwin et al. (2008) find delivery period basis in 2006-08 to be weaker and less predictable for corn, soybeans, and wheat than in 2001-05. Thus, these futures markets became increasingly inefficient for making storage decisions and managing the risk of market positions. Irwin et al. (2008) go on to explain that trading volume set records during the later period and offset the hedgers' concern to some degree because of the increased liquidity (ease of buying and selling) available in these markets. However, they caution that, if the advantages of liquidity do not outweigh the inefficiencies of hedging, hedging may decrease because commercial hedgers would seek alternative mechanisms for transferring and managing price risks.

[5]Hedging is the purchase or sale of a futures contract as a temporary substitute for a cash market transaction to be made at a later date, usually involving simultaneous and opposite positions in the cash market and futures market.

Convergence Issues with Corn, Soybeans, and Wheat

Theoretically, futures prices should converge with cash prices during the contract delivery period, but in reality, this has not always occurred.[6] Convergence may fail during the delivery period because of transaction costs, market congestion, or imperfect information limiting arbitrage. The cost of participating in the delivery process is thought to create a range of convergence between cash and futures prices because of the delivery options provided by the futures contracts to the seller, such as timing, location, and grade to be delivered. Thus, convergence is defined as the coming together of cash and futures prices—or the basis (cash minus futures price) approaching zero—as contracts expire. However, transaction costs such as trading, barge load-out, storage, and interest opportunity costs affect each arbitrage transaction designed to take advantage of a basis relationship. Typically, normal convergence is considered to have occurred if the basis during the delivery period is either $0.10/bushel (bu.) above or below zero.

Historically, market participants have dealt with inadequate convergence for short periods, but in the long run expect acceptable levels of convergence. Minor convergence issues arose in 2000 and 2001 for all four commodities (corn, soybeans, SRW, and HRW) but became more pronounced during 2005 to 2011.[7] Market arbitrage—the simultaneous purchase and sale of equivalent goods across markets to profit from price differences—failed to produce normal convergence between cash and futures prices during the contract delivery periods for corn, soybeans, and wheat at CBOT and for wheat at KCBT.

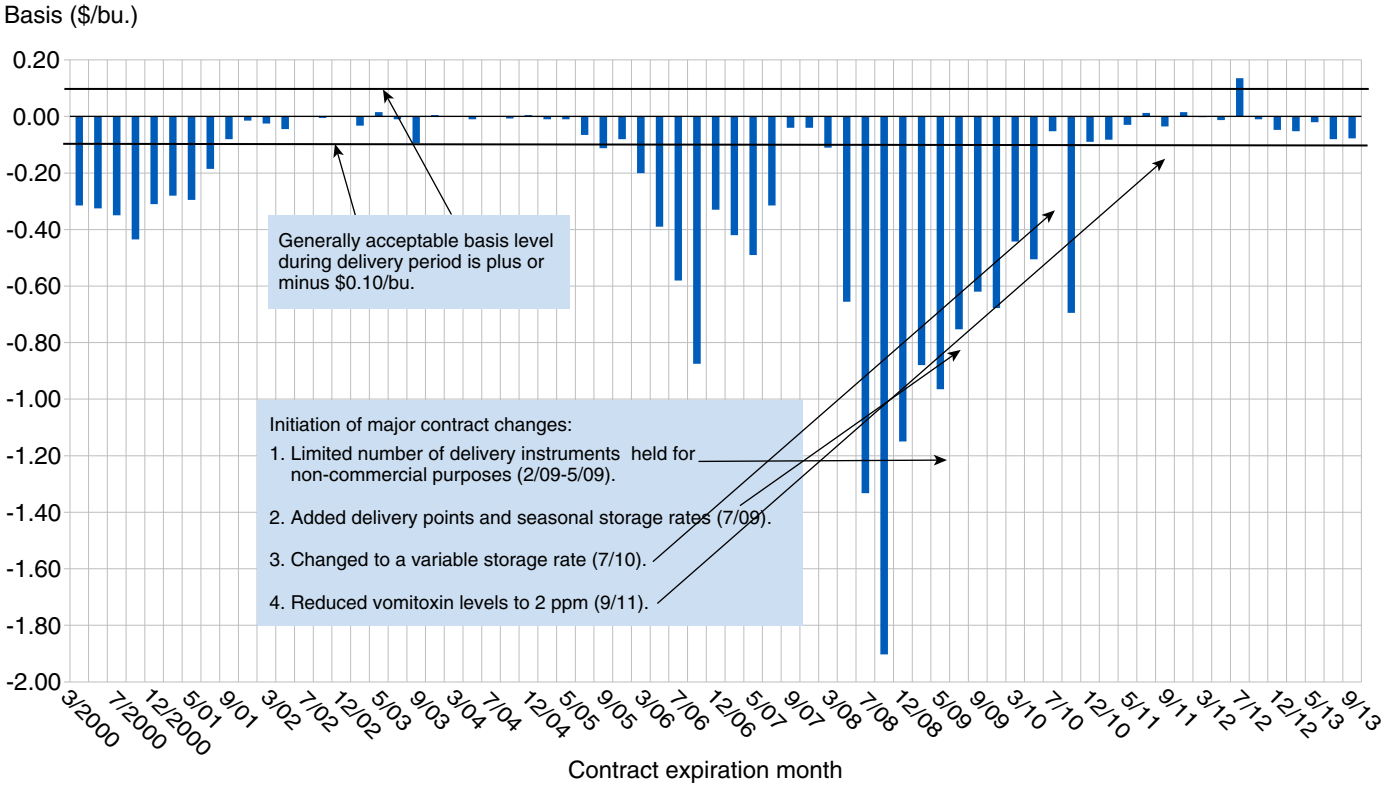
During 2005-2011, SRW (fig. 1) showed the poorest convergence performance of all four commodities, with futures prices at times exceeding delivery location cash prices by $1.00/bu., a level not previously shown (Irwin et al., 2009). The KCBT HRW contract also began showing sustained non-convergence beginning in March 2008 and generally through May 2011 (fig. 2). However, the level and consistency of non-convergence during 2005-2011 was less severe for corn (fig. 3) and soybeans (fig. 4).

[6]For example, Paul et al. (1981) document a decline in the Maine potatoes due to contract performance. Gray and Peck (1981) discuss problems with delivery specifications for the Chicago wheat futures contract. Peck and Williams (1991) cover delivery performance of CBOT wheat, corn, and soybean futures contracts.

[7]It should be noted that each contract has more than one delivery point. ERS researchers (see figs. 1-4) chose a major delivery point to illustrate the issue of poor convergence, but a more in-depth analysis would consider all delivery points for each specified contract. Local economics can affect the local basis but only for that market. The data used to examine convergence in addition to the futures price are publicly available bid prices from USDA's Agricultural Marketing Service. Although these prices do not represent actual transaction prices, they are the only price data available to the public. It is entirely possible that actual transaction price data could differ from the bid price, and thus, the basis could be weaker or stronger than indicated, but overall, the issue of poor convergence would still be illustrated.

Figure 1

Changes in daily SRW wheat basis between contract delivery periods, Toledo, OH, March 2000-September 2013

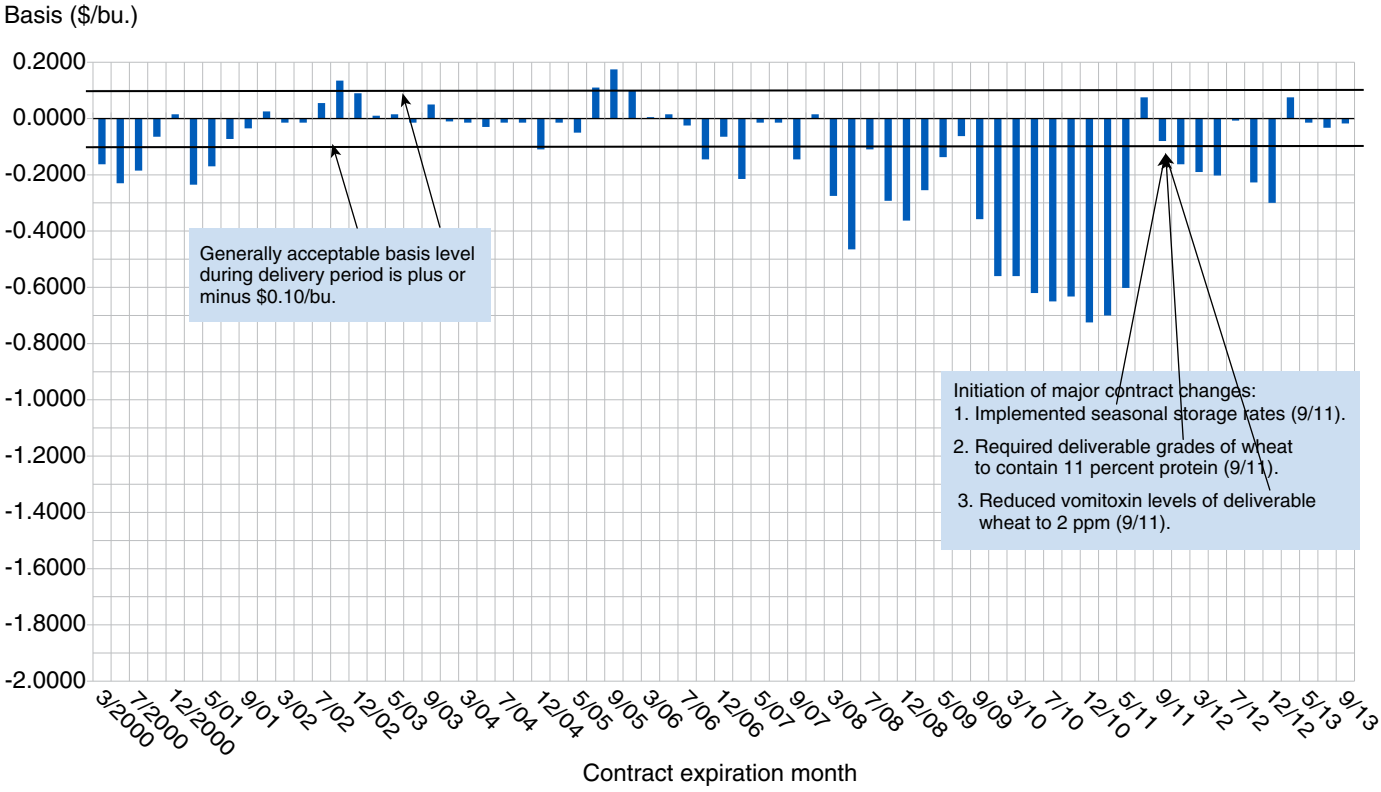


Note: Basis represents the daily cash price less futures price that is closest to convergence during the delivery period for each contract expiration month. bu. = Bushel. SRW = Soft red winter. ppm = Parts per million.

Source: Cash prices represent U.S. No. 2 SRW wheat truck bids from Toledo, OH. Based on contract specification from the CME Group (previously, Chicago Board of Trade (CBOT)), this deliverable grade and location is on par with the contract price (http://www.cme-group.com/rulebook/CBOT/II/14/14.pdf). These prices can be obtained from USDA, Agricultural Marketing Service, Springfield, IL, Grain Report (GX_GR111) (http://marketnews.usda.gov/portal/lg). SRW wheat futures prices are from CME Group (previously, CBOT). There are five contracts traded in any calendar year: March, May, July, September, and December (http://www.cmegroup.com/market-data/datamine-historical-data/).

Figure 2

Changes in daily HRW wheat basis between contract delivery periods, Kansas City, MO, March 2000-September 2013

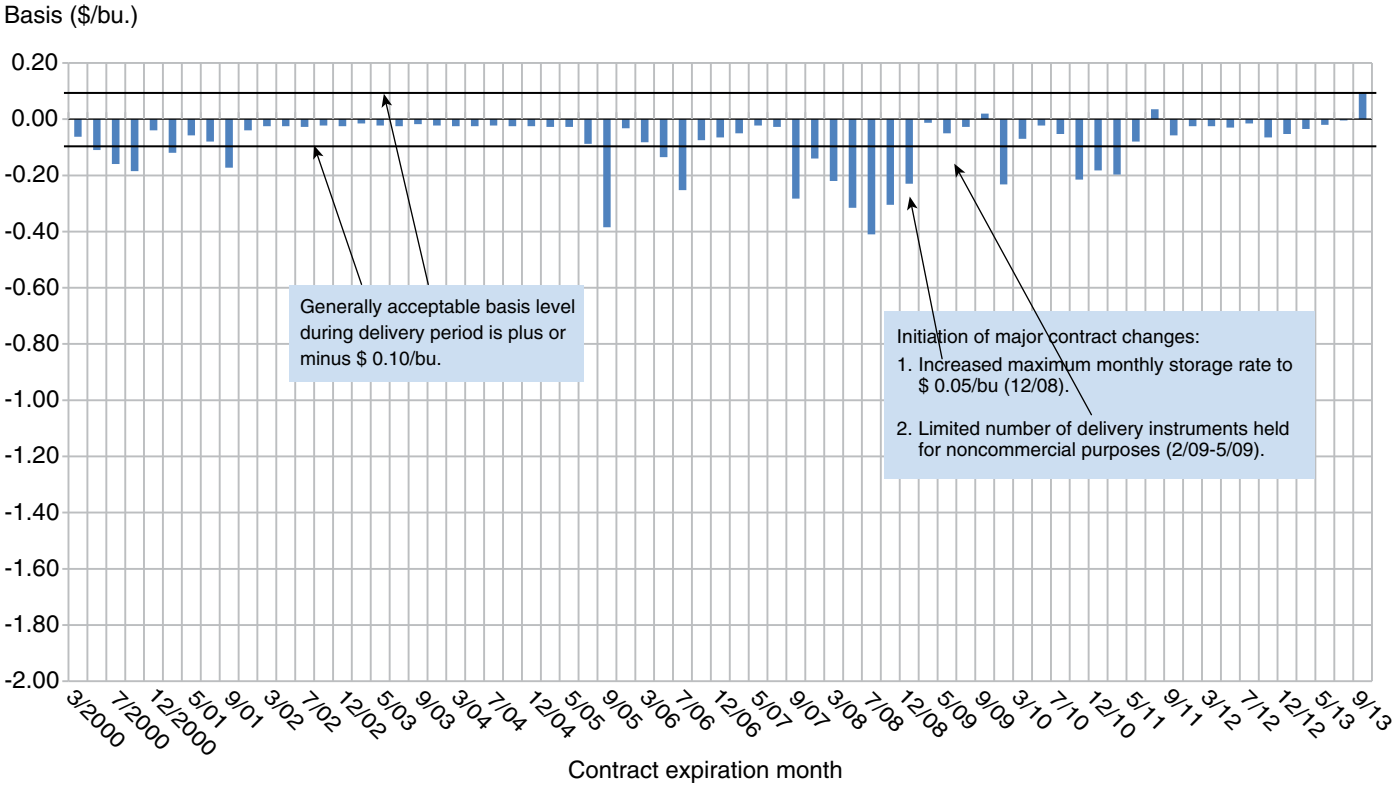


Note: Basis represents the daily cash price less futures price that is closest to convergence during the delivery period for each contract expiration month. bu. = Bushel. HRW = Hard red winter. ppm = Parts per million.

Source: Cash prices represent No. 1 Ordinary HRW wheat truck bids from Kansas City, MO. Based on contract specifications from the CME Group (previously, Kansas City Board of Trade (KCBT)), this deliverable grade has a $0.015 per bushel premium to the contract price (www.kcbt.com/contract_wheat.html). The par delivery cash price is represented, so the locational premium is subtracted from the cash price. These prices are available from USDA, Agricultural Marketing Service, St. Joseph, MO, Grain Report (SJ_GR851) (http://marketnews.usda.gov-/portal/lg). HRW wheat futures prices are from CME Group (previously, KCBT). There are five contracts traded in any calendar year; March, May, July, September, and December (http://www.kcbt.com/historical_data.asp).

Figure 3

Changes in daily corn basis between contract delivery periods, Illinois River, north of Peoria, IL, March 2000-September 2013

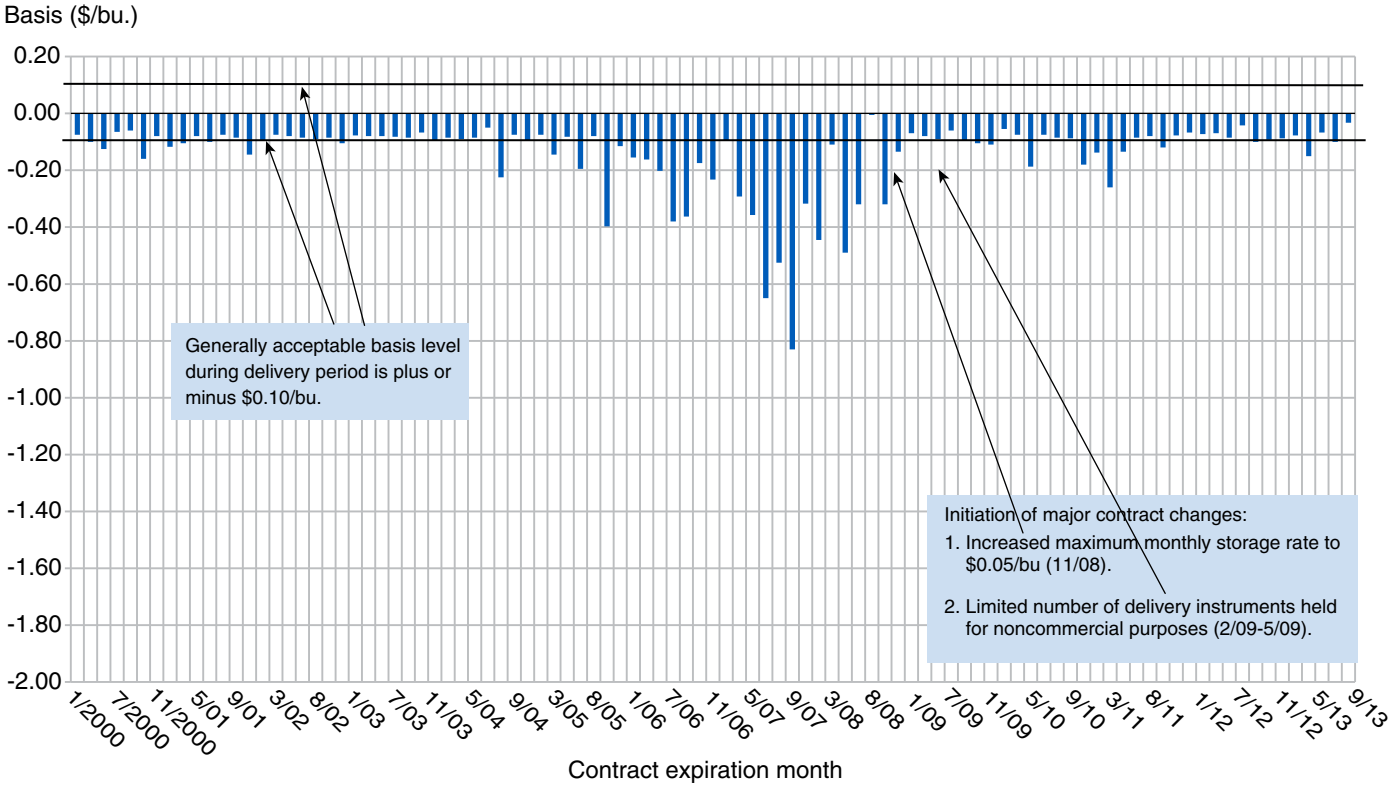


Note: Basis represents the daily cash price less futures price that is closest to convergence during the delivery period for each contract expiration month. bu. = bushel

Source: Cash prices represent U.S. No. 2 yellow corn truck bids from barge loading elevators north of Peoria, IL. Based on contract specification from the CME Group (previously, Chicago Board of Trade (CBOT)), this location has a $0.025 per bushel premium to the contract price. The par delivery cash price is represented, so the locational premium is subtracted from the cash price (http://www.cmegroup.com/rulebook/CBOT/II/10/10.pdf). These prices may be obtained from USDA, Agricultural Marketing Service, Springfield, IL: Grain Report (GX_GR112) (http://marketnews.usda.gov/portal/lg). Corn futures prices are from CME Group (previously, CBOT). There are five contracts traded in any calendar year: March, May, July, September, and December (http://www.cmegroup.com/market-data/datamine-historical-data/).

Figure 4

Changes in daily soybean basis between contract delivery periods, Illinois River, north of Peoria, IL, March 2000-September 2013



Note: Basis represents the daily cash price less futures price that is closest to convergence during the delivery period for each contract expiration month. bu. = bushel.

Source: Cash prices represent U.S. No. 1 yellow soybean truck bids from barge loading elevators north of Peoria, IL. Based on contract specification from the CME Group (previously, Chicago Board of Trade (CBOT)), this location has a $0.025 per bushel premium and a grade premium of $0.06/bu. to the contract price (http://www.cmegroup.com/rulebook/CBOT/II/11/11.pdf). The par delivery cash price is represented, so both the grade and the location premium, $0.085, is subtracted from the cash price. These prices may be obtained from USDA, Agricultural Marketing Service, Springfield, IL: Grain Report (GX_GR112) (http://marketnews.usda.gov/portal/lg). Soybean futures prices are from CME Group (previously, CBOT). There are seven contracts traded in any calendar year: January, March, May, July, August, September, and November (http://www.cmegroup.com/market-data/datamine-historical-data/).

Causes of Non-Convergence

When non-convergence worsened, market participants were uncertain whether changes in the commodity markets or the design and terms of the futures contracts were the cause. Research focused on both market and contract design factors, with evidence supporting the need for changes in contract design.[8] For example, a need for an increased delivery area for the SRW wheat contract was identified; storage rates associated with futures contracts were found to lag actual industry storage rates for the commodity; and the quality specifications listed in the futures contracts did not conform to those in the cash market.

Irwin et al. (2009) and Seamon (2010) suggest that changes in wheat production patterns, logistics, and trade flows reduced the amount of wheat the contract could draw on during the delivery period. Irwin et al. (2009) proposed that the SRW wheat contract needed a change in delivery structure to address lack of convergence, and suggested setting the Mississippi River Gulf as a par[9] delivery location with other delivery locations ranging from the Illinois River to the Gulf at differentials based on the cost of barge shipment to the Gulf for each delivery location. Seamon (2010) recommended expanding the delivery territory to include areas in the primary production and marketing area of SRW wheat: northwest Ohio, the Ohio River from Cincinnati to the Mississippi River, and the Mississippi River from south of St. Louis to Memphis. The expansion would double the contract's delivery capacity.

Roll et al. (2007) claimed that one reason for the lack of a normal convergence process was the lack of liquidity in the cash market stemming from an under-sized delivery area. Grain and transactions need to be available at these locations, if firms seek to implement arbitrage trades. In contrast to these findings and recommendations, Aulerich et al. (2011) found little evidence that a lack of liquidity in the SRW wheat market posed a convergence problem. However, such evidence does not negate the need for an expanded delivery area.

Other research focuses on a contract design issue—futures contract storage rates lagging market storage rates. For example, Seamon (2010) reports that the cost to store additional wheat increased in 2008. Because the return from storage was fixed in the futures market spreads, the market expressed this increasing cost of storage through a weak, non-converging basis. Irwin et al. (2011) demonstrate how large spreads in futures markets contribute to a lack of convergence by uncoupling cash and futures markets. They suggest that several factors may have created these rising spreads, such as CBOT contract storage rates that lagged industry storage rates, structural problems in the design of the delivery mechanism (in the case of wheat), and significant changes in the storage market. Aulerich et al. (2011) show that futures contract design was a fundamental problem for corn, soybeans, and wheat. Garcia et al. (2011) show that non-convergence arises in equilibrium when the industry storage rate exceeds the cost of holding delivery instruments—documents used to effect delivery on a futures contract, such as a warehouse receipt or shipping certificate.[10]

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[8]See (CME Group (CBOT and KCBT)) for specifics on individual futures contract specifications.

[9]Par refers to the standard delivery point(s) and/or standard quality of a commodity that is deliverable on a futures contract at contract price.

[10]Findings by Garcia et al. (2011) are explained in detail along with alternative policy remedies for non-convergence in a recent publication by Adjemian et al. (2013).

Most of this research—Seamon (2010), Aulerich et al. (2011), Garcia et al., (2011) and Irwin et. al. (2011)—can be summarized as follows: the nearby spread, or return from storage, is constrained by the financial full carry and the maximum storage charge that the futures contract allows issuers of shipping certificates to charge the holders of its outstanding shipping certificates. If an elevator's physical cost to store the actual commodity exceeds the return from storage (the spread), then the elevator will make up for the lack of return in the spread by dropping its bids and making the necessary return in both the basis and the spread. In other words, when supplies are sufficient and elevators have filled their allotment of a particular commodity (e.g., wheat), they have to give up opportunities to handle other commodities (corn and soybeans) if they continue to receive wheat. This increases their opportunity cost, and elevators drop their bids so that both the basis and the spread do cover their cost (Hieronymus, 1971, p. 152). If no warehouse space is available, then the cash price may fall short of the contract price by the cost of holding grain until space is available. Storing wheat in planned corn and soybean space can become quite expensive (opportunity cost) until those extra supplies can be drawn down. In summary, as a means of facilitating convergence, futures market spreads must be able to respond to increasing storage costs in the same way the basis responds to increasing storage costs.

In a report on the non-convergence issues created by KCBT HRW wheat futures contracts, O'Brien and Barnaby (2010) find similar issues and causes to those of Irwin et al. (2011). For example, large spreads in futures markets contribute to a lack of convergence by uncoupling cash and futures markets caused, in part, by KCBT contract storage rates that lagged industry storage rates. Furthermore, O'Brien and Barnaby (2010) make three observations: (1) delivery-point elevators do not grant warehouse receipts to farmers that are needed to make delivery on the wheat because these elevators are reluctant to fill their storage space with wheat, which may disrupt their normal grain merchandising activity; (2) farmers are motivated to deliver grain to fulfill short (sale) positions of wheat, but cannot because of the lack of necessary warehouse receipts; and (3) KCBT futures prices represent price levels arrived at through an open, competitive market process. The researchers conclude that—since all economic parties appear to be serving their best interest—the structure of the KCBT wheat futures contract must change to preserve the contract's effectiveness as a hedging instrument for the wheat industry.

Researchers cite different quality specifications between the futures contract and the cash market as another reason for inadequate convergence. For example, the domestic and export markets had stricter quality requirements for vomitoxin than did the CBOT and KCBT wheat contracts. The CBOT SRW wheat contract had a 3-parts-per-million (ppm) restriction on vomitoxin, and the KCBT HRW wheat contract had a 4-ppm restriction, but the domestic and export markets had a 2-ppm restriction. Thus, cash wheat markets for either contract would have been valued higher than the futures price because of lower vomitoxin levels, thereby contributing to a wider basis. Another quality-related issue is the lack of a protein requirement for par delivery in the KCBT HRW wheat contracts. Without a guaranteed delivery of adequate protein to meet their market needs, domestic millers or export customers had to include a risk premium in the cash price paid for U.S. wheat, which tended to be lower than the futures price. Wilson and Miljkovic (2011) find that quality factors, notably vomitoxin, significantly affect basis values.

Other Factors Deemed Insignificant

Researchers cite two other factors as possible causes of non-convergence: long-only index funds and a rule change that allowed greater net position limits in these contracts. A number of observers (e.g., Masters and White, 2008) assert that buying pressure from index funds created a bubble in

commodity prices during 2007-08, which caused market prices to far exceed fundamental values and created excess volatility. This argument states that the size of index fund investment is "too big" for the current size of commodity futures markets. It is often suggested that the trading activities of institutional investors can weaken the relationship between cash and futures prices (Stallman, 2008; Coyle, 2008) by inflating futures prices and/or expanding spreads between futures prices. A report by the U.S. Senate's Permanent Subcommittee on Investigations (U.S. Senate, 2009) corroborates this view.

Irwin et al. (2011) show how large spreads in futures markets contributed to non-convergence by uncoupling cash and futures markets. However, they find no statistical evidence that the rolling of positions by index funds or the initiation of large index positions helped expand the spreads. Garcia et al. (2011) also find no evidence that index traders caused a futures bubble that spurred non-convergence.

The other factor identified as possibly contributing to non-convergence was CBOT changes to net position limits for corn, soybeans, and wheat contracts. These changes—which allowed larger positions[11] in single-month contracts as well as the total number of contracts spanning all contract months—began in June 2005 and concluded in December 2005. Aulerich et al. (2011) found little evidence to suggest that this rule change affected convergence at contract expiration.

[11]Position limits were expanded. Position limits are the maximum number of speculative futures contracts one can hold as determined by the Commodity Futures Trading Commission and/or the exchange upon which the contract is traded.

The Commodity Futures Trading Commission's Role in Convergence Issues Affecting Agricultural Futures Markets

The Commodity Futures Trading Commission (CFTC) is the Federal regulatory agency that oversees commodity futures markets in conjunction with each of the individual commodity exchanges. One goal of CFTC is to assure the industry that cash and futures prices converge at the par delivery points on or near contract expiration. CFTC maintains an active involvement in agricultural futures markets partly by way of the Agricultural Advisory Committee (AAC). The AAC was created in 1985 to advise CFTC on issues involving the trading of agricultural commodity futures and options; members include representatives of national farm organizations, major commodity groups, agribusiness concerns, and agricultural bankers (CFTC 2011b).

The CFTC formed the Subcommittee on Convergence in Agricultural Commodity Markets on March 9, 2009. The committee's goal was to identify causes of poor cash-futures convergence in select agricultural commodity markets and advise AAC on actions to achieve convergence. The following AAC activities addressed the non-convergence problem:

- An October 2009 meeting of AAC focused on Chicago Board of Trade (CBOT) wheat futures market convergence issues and the recommendations from the Subcommittee on Convergence in Agricultural Commodity Markets (CFTC, 2009c). AAC supported the variable storage rate (VSR) solution eventually chosen by CBOT.
- An August 2010 meeting addressed lack of convergence in the Kansas City Board of Trade (KCBT) wheat futures market. It reviewed solutions, including (i) higher storage rates for the delivery instrument; (ii) limiting terms of warehouse receipts, such as expiration, devaluation over time, and non-transferability; and (iii) additional delivery options (CFTC, 2010 and Auler-ich, 2010). KCBT ultimately decided to implement a seasonal storage rate beginning with the September 2011 contract.
- A May 2011 meeting reviewed convergence issues for the CBOT wheat and the KCBT wheat futures market (CFTC, 2011a).[1] The convergence of the CBOT wheat contract appeared accept-able at that time based on the convergence performance of the December 2010 through July 2013 contracts (see fig. 3). In contrast, convergence was not acceptable for the KCBT wheat contract, but proposed changes of a seasonal storage rate increase did not take effect until the September 2011 contract (see fig. 4).

[1]Also reviewed were the rice futures contracts and their convergence during the delivery periods, which was found to be unacceptable. On June 4, 2012, the CBOT proposed an increase in the storage rates of the rice contract after the close of the September 2012 contract.

Actions Taken To Improve Convergence

In response to concerns about poor convergence, the commodity exchanges revised affected futures contracts.[12] These changes included broad revisions to affected commodity contracts, as well as narrower commodity-specific contract changes. However, even when non-convergence is identified and an exchange is engaged with an issue, changes take time. Exchanges have to receive feedback from a broad cross-section of market participants before enacting any changes. Once an exchange decides to enact changes, it must work with CFTC on implementation, which can take months or years. The slow timetable helps explain why more changes were not made to corn and soybean futures, because many convergence issues have tended to self-correct before action was warranted.

Limitations on Delivery Instruments

One broad action that CBOT took was to limit the number of delivery instruments an entity can hold for noncommercial—or speculative—purposes for the corn, soybean, wheat, and other CBOT contracts (CFTC, 2009a). The limits were intended to prevent participants from accumulating delivery instruments that might negatively impact contract performance. Implementation began on February 17, 2009, with a deadline of May 31, 2009 for affected parties to comply with the amendment. CFTC, in approving this CBOT proposal, indicated that these changes alone were unlikely to significantly address the convergence issue, noting that industry participants were concerned that further action was required by CBOT to address the convergence issues.

Changes to CBOT Corn and Soybean Contracts

CBOT increased the maximum monthly storage rates to $0.05/bu. for delivery instruments for soybeans beginning with the November 2008 contract and to the same rate for corn beginning with the December 2008 contract. These changes took effect following a 2008 CBOT-sponsored survey of industry storage costs, which found industry rates for corn were $0.043/bu. per month and for soybeans $0.046/bu. per month, compared to the CBOT contract storage rate of $0.045/bu. per month for both corn and soybeans (Irwin et al., 2009). These findings did not support the contention that low contract storage rates contributed to non-convergence in the case of corn and soybeans.

Nevertheless, the increases in storage rates coincided with improved convergence for the corn and soybean contracts for most of 2009 (figs. 3 and 4). Irwin et al. (2009) state that the reason for improved convergence of corn and soybeans in 2009 is not fully known and the increase in storage rates for these delivery instruments may not explain all of the improvement. A pattern of non-convergence reappeared for many corn and soybean contracts beginning later in 2010, through part of 2011. Convergence during the delivery period improved later for many of the corn and soybean contracts beginning in May 2011 through September 2013 (table 1).

Changes to CBOT Wheat Contracts

Of all the commodities considered here, the CBOT SRW wheat contract showed the greatest non-convergence. The SRW wheat basis (cash price minus futures price) reached -$1.90/bu. for September 2008 delivery (see fig. 1). A 2008 CBOT-sponsored survey of industry storage costs found wheat industry rates to be $ 0.071/bu. per month, compared to the CBOT contract storage rate of $0.045/bu. (Irwin et al., 2009). These findings supported the contention that low contract storage rates contributed to non-convergence.

[12]Many alternative policy options can be followed to improve non-convergence. Adjemian et al. (2013) discuss alternative policies to address non-convergence, along with their likely consequences.

Table 1

Changes in daily basis (absolute value) for four commodities

Exchange/ commodity	Futures contract expiration month	Pre-contract change period, Crop year 2004-05	2005-06	2006-07	2007-08	2008-09	Avg. basis/ contract
CME Group/CBOT		*Dollars per bushel*					
Corn	December	0.025	0.033	0.065	0.140	0.230	0.099
	March	0.028	0.083	0.050	0.220	0.013	0.079
	May	0.028	0.135	0.023	0.315	0.050	0.110
	July	0.088	0.253	0.028	0.410		0.195
	September	0.385	0.075	0.283	0.305		0.262

	Post-contract change period, Crop year 2008-09	2009-10	2010-11	2011-12	2012-13	Avg. basis/ contract
	Dollars per bushel					
December		0.233	0.183	0.025	0.053	0.123
March		0.070	0.198	0.025	0.035	0.082
May		0.023	0.080	0.030	0.020	0.038
July	0.028	0.053	0.035	0.015	0.005	0.027
September	0.020	0.215	0.058	0.065	0.095	0.091

Soybeans	Pre-contract change period, Crop year 2004-05	2005-06	2006-07	2007-08	2008-09	Avg. basis/ contract
	Dollars per bushel					
November	0.095	0.115	0.233	0.318	0.135	0.179
January	0.075	0.155	0.095	0.445	0.070	0.168
March	0.145	0.163	0.293	0.110	0.080	0.158
May	0.083	0.203	0.358	0.490	0.090	0.245
July	0.195	0.380	0.650	0.320		0.386
August	0.080	0.363	0.525	0.005		0.243
September	0.398	0.175	0.830	0.320		0.431

	Post-contract change period, Crop year 2008-09	2009-10	2010-11	2011-12	2012-13	Avg. basis/ contract
	Dollars per bushel					
November		0.110	0.180	0.078	0.093	0.115
January		0.055	0.138	0.068	0.088	0.087
March		0.075	0.260	0.073	0.078	0.121
May		0.188	0.135	0.070	0.150	0.136
July	0.060	0.075	0.085	0.085	0.068	0.075
August	0.095	0.085	0.080	0.043	0.100	0.081
September	0.105	0.088	0.120	0.100	0.030	0.089

——continued

Table 1

Changes in daily basis (absolute value) for four commodities—Continued

Exchange/ commodity	Futures contract expiration month	Pre-contract change period							
		Crop year							
		2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	Avg. basis/ contract
CME Group/CBOT		*Dollars per bushel*							
Soft red winter wheat	July	0.065	0.580	0.315	1.333	0.753	0.053	0.013	0.444
	September	0.113	0.875	0.040	1.903	0.620	0.695	0.035	0.611
	December	0.080	0.330	0.040	1.150	0.678	0.090		0.395
	March	0.200	0.420	0.110	0.880	0.443	0.083		0.356
	May	0.390	0.490	0.655	0.965	0.505	0.030		0.506

	Post-contract change period			
	Crop year			
	2011-12	2012-13	2013-14	Avg. basis/ contract
	Dollars per bushel			
July		0.135	0.080	0.108
September		0.010	0.078	0.044
December	0.015	0.048		0.031
March	0.003	0.053		0.028
May	0.013	0.020		0.016

		Pre-contract change period							
		Crop year							
		2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	Avg. basis/ contract
CME Group/KCBT		*Dollars per bushel*							
Hard red winter wheat	July	0.110	0.025	0.015	0.110	0.063	0.650	0.075	0.150
	September	0.175	0.145	0.145	0.293	0.358	0.633	0.080	0.261
	December	0.100	0.065	0.015	0.363	0.560	0.725		0.305
	March	0.005	0.215	0.275	0.255	0.560	0.700		0.335
	May	0.015	0.015	0.465	0.138	0.620	0.603		0.309

	Post-contract change period			
	Crop year			
	2011-12	2012-13	2013-14	Avg. basis/ contract
	Dollars per bushel			
July		0.008	0.033	0.020
September		0.228	0.018	0.123
December	0.163	0.300		0.231
March	0.190	0.075		0.133
May	0.203	0.015		0.109

Note: The basis represents the daily cash price less futures price that is closest to convergence during the delivery period for each contract expiration month. CBOT = Chicago Board of Trade. KCBT = Kansas City Board of Trade

In response, the CBOT altered the wheat contract in June 2009 by (1) adding three delivery locations (effective for existing and newly listed contract months beginning with the July 2009 contract); (2) implementing a seasonal storage rate of $0.08/bu. for July 18 through December 17 and $0.05/bu. for the remainder of the year (effective for existing and newly listed contract months starting with the July 2009 contract); and (3) reducing the vomitoxin level to 2 ppm to align with industry standards for the domestic milling and export market (CFTC, 2008) (effective starting with the September 2011 contract).[13] Beginning with the July 2010 contract, the seasonal storage rate was replaced by a variable storage rate (VSR) mechanism that raises and lowers storage rates based on a percentage of full carrying charges—the cost of storage space, insurance, and finance charges incurred by holding a physical commodity (Seamon, 2009). VSRs allow the storage rate specified in the wheat futures contract and, hence, futures price spreads to better reflect industry storage costs, which is expected to result in improved convergence.

Following these contract changes and since the December 2010 contract, the basis for the CBOT wheat contract has generally moved toward convergence during the delivery periods (see table 1 and fig. 1). The VSR mechanism has taken CBOT storage rates from $0.05/bu./month up to $0.20/bu./month and back again. These data suggest that the VSR mechanism does allow the futures contract storage rate (and the spreads) to reflect industry storage costs and that convergence can be achieved by ensuring that contract storage costs reflect industry storage costs.

Changes to KCBT Wheat Contracts

As convergence improved for the CBOT SRW wheat contract beginning in December 2010, the conditions for the KCBT HRW wheat contract continued to deteriorate for several months. The average basis during crop year 2005-06 was $0.081/bu./month, but fell to -$0.47/bu./month in May 2008 (see fig. 2). Convergence improved during May-July 2009, but problems reappeared in late 2009 and worsened in 2010, with the basis falling to -$0.73 per bushel in December 2010.

KCBT made several changes to its HRW wheat contract in response to non-convergence. First, the exchange raised seasonal storage rates from $0.045/bu./month to $0.090/bu./month for July-November and to $0.060/bu./month for December-June, effective with the September 2011 contract (KCBT, 2010). Also, effective with that contract, KCBT enacted several quality-related changes. For example, it established a protein requirement for par delivery Kansas City wheat: deliverable grades were to contain a minimum of 11 percent protein. Previously there was no protein requirement for par delivery Kansas City wheat. Such a change was expected to make the wheat industry more efficient by guaranteeing milling- or export-quality wheat at delivery. Next, vomitoxin restrictions were tightened from a 4-ppm to a 2-ppm maximum, which aligns par delivery wheat for Kansas City with domestic and export industry standards. Both changes are expected to align futures and market cash prices.

The average delivery period basis has improved for each of the contracts since the implementation of contract changes (see table 1, fig. 2). The success of these changes—for the KCBT wheat contract, as well as for the SRW, corn, and soybean contracts—will need to be determined with more time and monitoring.

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[13]This action by the CBOT reduced the vomitioxin level for par delivery to 2 ppm from 3 ppm and established a discount for wheat with 3 and 4 ppm at rates of $0.12 and $0.24/bu., respectively. Thus, lowering the acceptable vomitoxin level would contribute to narrowing the basis.

Additional delivery points had the potential to increase deliverable supplies, delivery capacity, and the number of shipping certificate issuers for the wheat futures contract, thereby strengthening the relationship between cash and futures prices.

Implications

The CME Group (CME, CBOT, and KCBT), with oversight from the Commodity Futures Trading Commission, has identified convergence problems and made contract changes that better reflect cash market activities. In turn, these changes have improved convergence and hedging effectiveness and helped preserve the futures market's vital functions: commodity price discovery, risk management, and allocation of inventories through time.

Despite the need for continued monitoring and improvement, all three of the CBOT contracts (corn, soybeans, and wheat) have generally achieved more acceptable convergence levels. More time may be needed to assess whether convergence will continue to improve or whether more changes are needed. Areas of additional research could include assessing the incentives and behavior of those economic agents involved in the delivery process; monitoring industry storage rates and factors affecting them; and monitoring industry storage rates required to adjust fixed contract storage rates or to adopt a flexible contract storage rate rule like CBOT's VSR for wheat.

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