United States Department of Agriculture

Economic
Research
Service

Economic
Information
Bulletin
Number 115

August 2013

Non-Convergence in Domestic Commodity Futures Markets: Causes, Consequences, and Remedies

Michael K. Adjemian, Philip Garcia, Scott Irwin,
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Economic Research Service

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Recommended citation format for this publication:

Adjemian, Michael K., Philip Garcia, Scott Irwin, and Aaron Smith. *Non-Convergence in Domestic Commodity Futures Markets: Causes, Consequences, and Remedies,* EIB-115. U.S. Department of Agriculture, Economic Research Service, August 2013.

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Abstract

During most of 2005-10, the price of expiring U.S. corn, soybeans, and wheat futures contracts settled much higher than corresponding delivery market cash prices. Because futures contracts at expiration are commonly thought to be equivalent to cash grain, this commodity price non-convergence appeared inconsistent with the law of one price. In addition, sustained non-convergence concerns market participants, exchanges, and policy-makers because it can make hedging less effective, send confusing signals to the market, threaten the viability of a contract, and ultimately lead to a misallocation of agricultural resources. This report summarizes prominent theories that have been offered to explain non-convergence, including a new model that explains how the structure of a competitive delivery market can generate a positive expiring basis. The data support this delivery market theory over alternative explanations. Finally, we discuss various policy levers that have been offered to address non-convergence, as well as their likely impacts.

Keywords: commodity futures, index funds, grains, non-convergence, price discovery, risk management, speculation, storage

Acknowledgments

The authors thank the following reviewers: Linwood Hoffman, Mark Jekanowski, Steve MacDonald, and Danny Pick, U.S. Department of Agriculture, Economic Research Service; Irene Xiarchos, USDA, Office of the Chief Economist; Roger Cryan, USDA Agricultural Marketing Service; Randy Fortenberry, Professor of Agricultural Economics, Washington State University; Robert Myers, Professor of Agricultural Economics, Michigan State University; and anonymous reviewers. Thanks to Priscilla Smith and Curtia Taylor of ERS for editorial and design assistance.

About the Authors

Michael K. Adjemian is an economist at the U.S. Department of Agriculture, Economic Research Service (ERS). Philip Garcia is the T.A. Hieronymus Distinguished Chair in Futures Markets and Director of the Office for Futures and Options Research in the Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign. Scott H. Irwin is the Laurence J. Norton Professor of Agricultural Marketing in the Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign. Aaron Smith is an Associate Professor in the Department of Agricultural and Resource Economics at the University of California, Davis.

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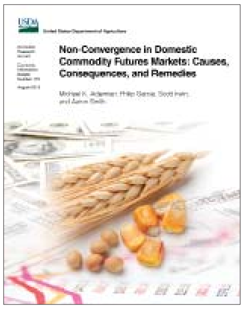

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Non-Convergence in Domestic Commodity Futures Markets: Causes, Consequences, and Remedies

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What Is the Issue?

From 2005 to 2010, many corn, soybean, and wheat futures contracts repeatedly expired at prices much higher than corresponding delivery market cash prices. In principle, these futures contracts can be exchanged for the physical commodity at expiration, so their prices should converge with the price of the underlying cash commodity. This sustained period of non-convergence, as well as its magnitude, was unprecedented in domestic commodity markets. This was a cause of concern for many market participants, policymakers, and economists, who worried that those convergence failures signaled a weakening of the traditional price discovery and risk management roles of these futures markets, and ultimately, a less efficient allocation of agricultural resources.

What Did the Study Find?

Market observers offered several explanations for the non-convergence puzzle, but none was tested rigorously and shown to explain the problem. One theory is that “excessive speculation” by nontraditional financial firms, like Commodity Index Traders (CITs), overpowered the ability of arbitrageurs to balance derivative and cash prices, leading to non-convergence in wheat markets. While it is true that CIT trading increased substantially during the time when non-convergence became a problem, this theory suffers from several theoretical limitations. For example, if purchasing behavior by these firms drove up the derivative price relative to the cash price, their equally sizable selling behavior before contract expiration should serve to force those prices together, leading to convergence. To maintain portfolio exposure, CITs enter one contract and then roll to the next, buying at first and holding it until it almost expires, then selling it to buy the next expiration.

In another account, production and trade patterns for these commodities shifted away from long-established delivery markets, limiting the ability of firms to arbitrage away the price difference between the two markets by engaging in the delivery process. On the other hand, the commercial flow for wheat in particular has bypassed these delivery markets for decades, so this theory does not adequately explain convergence problems observed since 2005.

We conclude that recent convergence failures in grain markets are attributable to inconsistent storage rates for the physical commodity and its derivative, a delivery instrument. Specifically, the exchange-set storage rate of the delivery instrument was too low relative to the true price of storage. The resulting wedge between the costs of holding delivery instruments and storing physical grain led to an expansion of the delivery month basis, preventing convergence even in a competitive market. The available empirical evidence fits this storage rate argument: inventories, which drive the wedge, are the most important factor in explaining the change in the expiring basis. In contrast, no empirical support was found for the CIT theory: trading activities by these firms are not found to affect the change in the basis over time, at any acceptable level of statistical significance.

How Was the Study Conducted?

This report summarizes the basic theory of how the storage-rate problem caused expiring futures to diverge from cash prices and shows how the wedge explains the large magnitudes of recent non-convergence. We also discuss prominent alternative explanations for non-convergence and show why they are not supported theoretically or empirically. Based on these findings, we discuss the likely impact of various proposed policy options on the prospect of achieving convergence in grain and soybean markets.

Non-Convergence in Domestic Commodity Futures Markets: Causes, Consequences, and Remedies

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Introduction

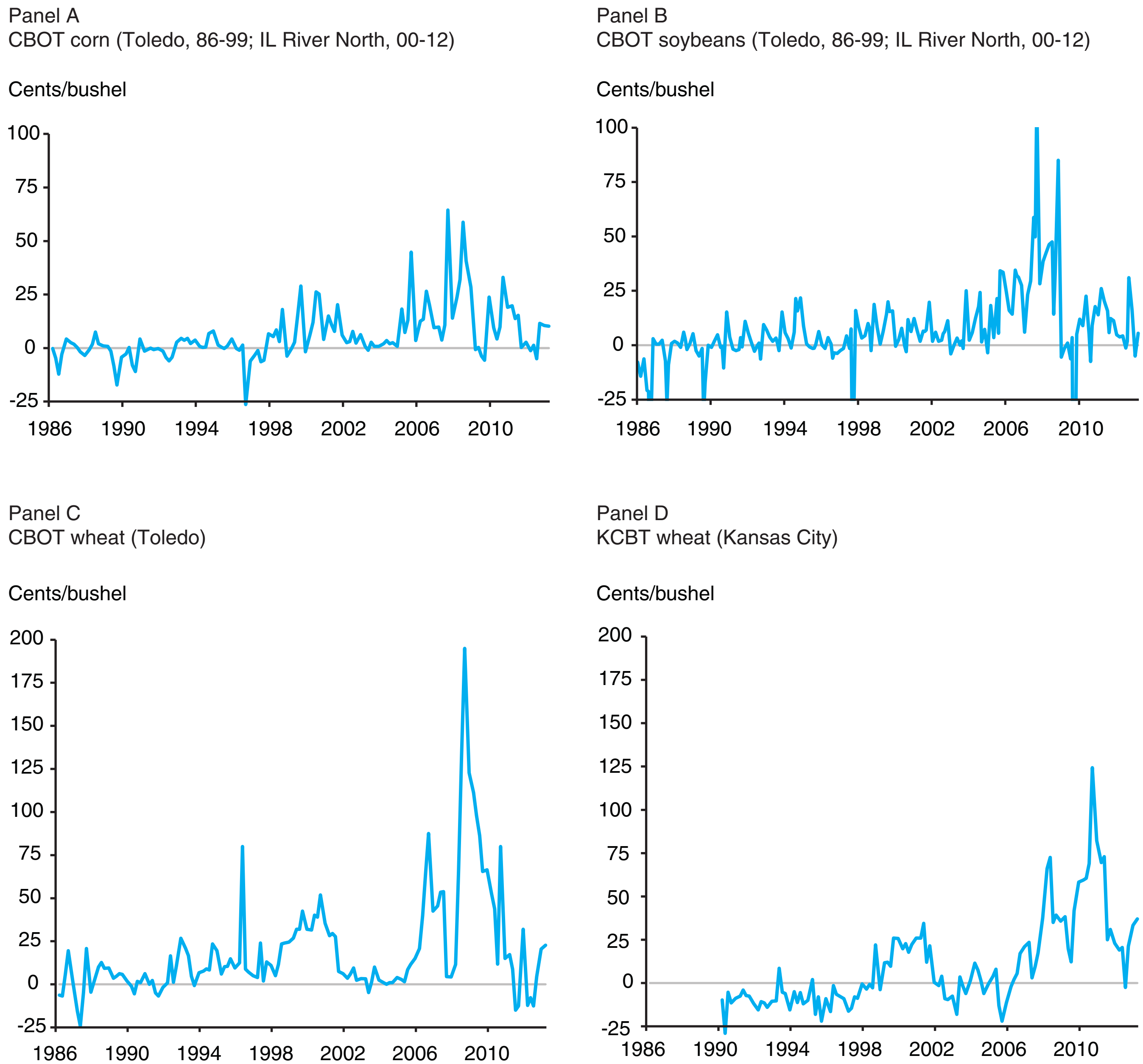
A futures contract represents the obligation to trade a standardized quantity and quality of a given commodity at a specified future period for an agreed-upon price. Commodities such as grains and oilseeds are traded in many locations across the United States, so futures exchanges have designated certain markets as delivery markets, identifying those areas where the liquidation of futures contracts by delivery is allowed. A cash price is the price for immediate exchange between buyer and seller, so the price of a futures contract, or the futures price, is generally conceived of as representing the expected cash price of the commodity in the delivery market, during the specified delivery period.[1] Convergence implies that these prices draw together when the futures contract expires.

Under non-convergence, however, the price of the expiring futures contract does not equilibrate with the cash market price in the delivery period. For example, on July 1, 2008, the price for a July 2008 Chicago Board of Trade (CBOT) wheat futures contract closed at $8.50 per bushel. Even though that contract was eligible for immediate physical delivery, the going cash price in the Toledo, Ohio, delivery market was only $7.18 per bushel. An expiring basis of $1.32 is much larger than the normally observed range of 6 to 8 cents per bushel often attributed to delivery market frictions associated with the cost of load-out (Irwin et al., 2008; Kunda, 2010). During 2005 to 2010, U.S. corn, soybeans, and wheat markets failed to converge at these unprecedented levels for a sustained period, as shown in figure 1. From 1986 to 2005, the average expiring basis at the cash markets in the chart was 1.8 cents, 1.8 cents, 10.8 cents, and -1.5 cents, for CBOT corn, soybeans, and wheat, and Kansas City Board of Trade (KCBT) wheat, respectively. From 2005 to 2010, the average expiring basis at these same locations and markets was 18.2 cents, 20.3 cents, 49.2 cents, and 32.8 cents.

Because an expiring futures contract should be equivalent to cash market grain, non-convergence appears to be inconsistent with the law of one price and, therefore, to present an arbitrage opportunity. During 2005-10, the expiring futures price often exceeded the cash price for these commodities, so riskless profits apparently could be achieved by acquiring grain at low cash market prices

[1]Notably, Keynes (1930) and Hicks (1939) argued that hedgers compensated speculators for providing them with risk management services; in a market with short hedgers, for example, the futures price would understate the expected future cash price. As the market converged (and the futures price increased relative to the expected cash price), the speculator would earn a premium for shielding the hedger from price risk. However, the empirical evidence for this risk premium in agricultural futures markets is weak (Chang, 1985; Fishe and Smith, 2011; Frank and Garcia, 2009; Hartzmark, 1987; and Hartzmark, 1991).

Figure 1
Futures price at expiration minus cash price, 1986-2013[1]



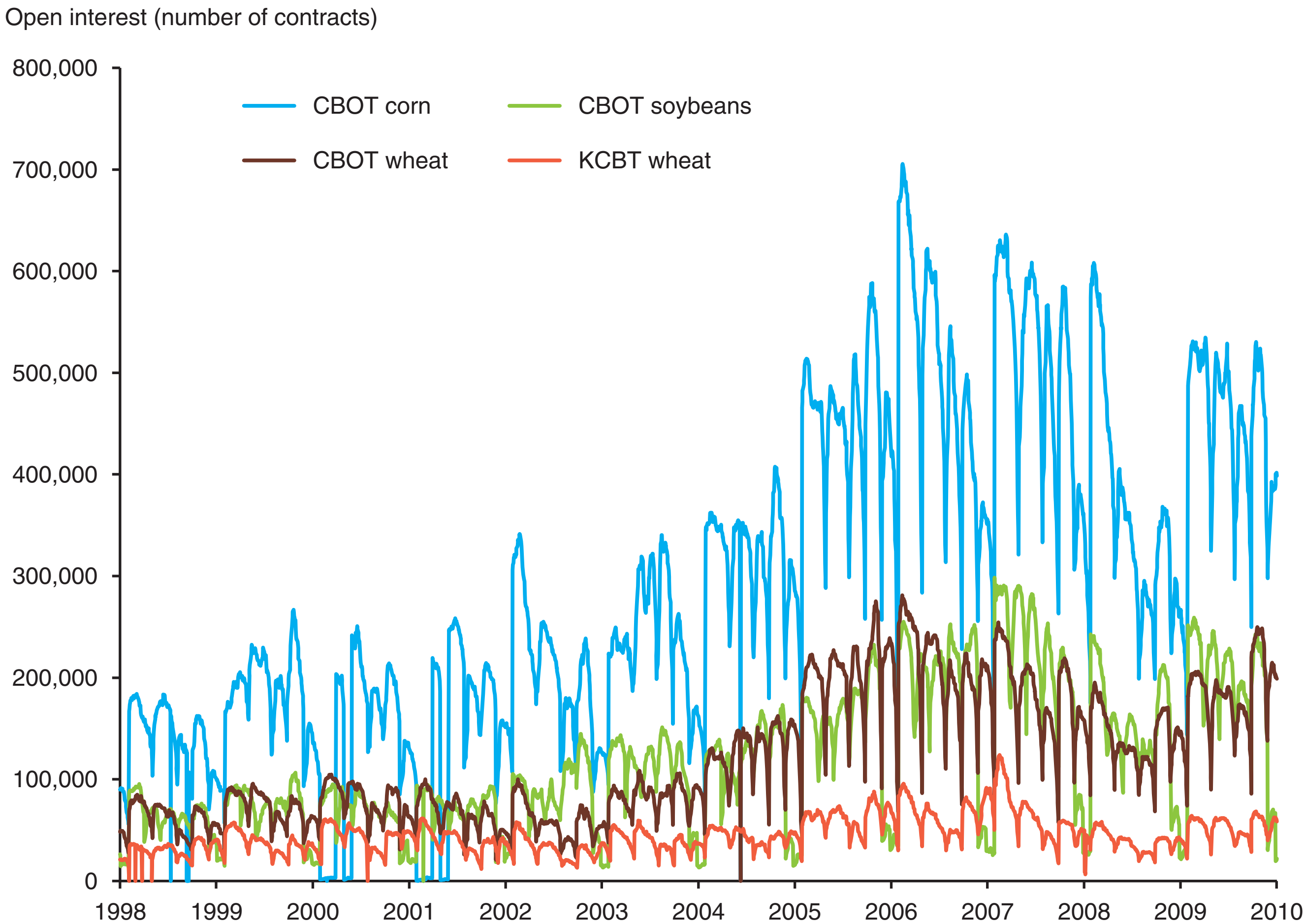
[1]City in parentheses is cash price location. Toledo ceased to be a delivery location for corn and soybeans in 1999, so we switch to the Illinois River North of Peoria at that time.

CBOT = Chicago Board of Trade. KCBT = Kansas City Board of Trade.

Source: Garcia, Irwin, and Smith, 2011; and USDA, Agricultural Marketing Service.

and delivering it at high prices through short futures market positions in the expiring contract. Done simultaneously, this trading strategy would place downward pressure on the futures price, and upward pressure on the cash price, until the two converged (Hieronymus, 1977). However, starting in late 2005, as more and more expirations failed to achieve convergence between futures and cash prices, some observers began to worry that recent changes in the structure of the market weakened the capacity for arbitrage and that the contract was "broken" and unable to fulfill its traditional role.

Figure 2
Daily open interest, 1998-2010



Note: The figure represents the end-of-day outstanding contracts for the nearby series in each market, rolled over 30 calendar days prior to contract expiration.

CBOT = Chicago Board of Trade. KCBT = Kansas City Board of Trade.

Source: Chicago Mercantile Exchange Group (CME) and Kansas City Board of Trade.

The Role of Futures Markets Under Non-Convergence

Futures markets provide several important economic functions for agricultural commodities: price discovery, the opportunity for risk management, and the transmission of storage signals via the term spread. Unpredictable convergence undermines confidence in the market's ability to perform each of these functions and can lead to significant economic damage. When the market fails to converge, a commodity's expiring futures price lies somewhere above or below its corresponding price in the cash market. As a result, non-convergence implies that prices discovered in a futures market are an inaccurate representation of expected cash market prices in the expiration month.

If convergence failure is further characterized by futures and cash price series that bear an unpredictable relationship, the risk management benefits of hedging may be compromised. As an example, consider a short futures hedge, which involves a long cash position—say for a producer who expects to reap a harvest—and a short position in the futures market. This sort of strategy is designed to reduce risk exposure by compensating cash market losses (when cash prices fall) with short futures position gains (when futures prices fall). Now consider a "normal" market (i.e., a market in which the futures price exceeds the cash price by an amount equal to the price of storing the commodity from now until the futures contract expires). In this case, the market has set the futures price to equal the expected cash price at expiration and it is expecting the cash price to increase at a rate equal to the price of storage so that convergence occurs at expiration. In the interim, news may enter the market—say about the size of the harvest—and shift prices. In a converging market, such news affects the cash and futures prices equally (holding constant the price of storage). For each dollar lost by a lower expected cash price, the hedger gains an offsetting dollar on his futures position.

In a non-converging market, the hedger is still protected from price risk as long as the futures and cash prices trend one-for-one in the same direction. Cash market gains and losses are exactly offset by futures market gains and losses. Under this scenario, cash and futures prices do not converge to each other, but they converge to a predictable basis. On the other hand, if the basis at expiration exhibits random fluctuations, then a hedger is not insulated from price risk. Because the utility of hedging depends on predictable basis relationships, novel or unpredictable basis phenomena can make hedging much less attractive.

Persistent non-convergence that sufficiently degrades hedging effectiveness threatens the viability of a futures market, since its hedgers lose interest in trading (Irwin et al., 2011; Peck and Williams, 1991; Working, 1953; Working, 1970). Moreover, unhedged merchandisers and producers face substantial price risks and welfare losses that jeopardize the conventional operation of the food production, marketing, and consumption chain. Of course, non-convergence need not threaten hedging effectiveness as long as its degree is predictable and participants are well-informed. When non-convergence is erratic, the timing of the placing and lifting of hedges will impact hedges' profitability, making hedging risky. It is useful to note that the unprecedented level of recent corn, soybean, and wheat market non-convergence has not affected the level of futures trading noticeably. Compared to the previous 5-year period, figure 2 shows that the average amount of contracts held by traders in each market increased by about a factor of two in 2005-10. At the same time, trading volume for commercial traders, who engage in hedging, also increased substantially.[2]

[2]See the Commodity Futures Trading Commission (CFTC) website for a graphical depiction of historical trading volume by trader type in the CBOT markets, at http://www.cftc.gov/OCE/WEB/index.htm.

The Delivery Process

For many agricultural commodities, such as corn, soybeans, and wheat, terms of futures contracts are satisfied through a process that is closely related to physical delivery but does not require the movement of any grain.[3] As the contract nears expiration, the short side of a futures contract initiates the delivery sequence by choosing to make delivery rather than offset its position and notifies the exchange accordingly. See figure 3 for an explanation of the contract termination choices available to a short trader. The exchange then informs the oldest outstanding long position holder of the responsibility to take delivery from the short. The futures contract is terminated when the short provides the long with delivery instruments in return for payment. Delivery instruments for KCBT wheat are warehouse receipts, which give the holder title to actual grain in storage at a storage facility. Shipping certificates are used in CBOT markets; these represent for the holder the right, but not the obligation, to demand load-out of the commodity from a particular shipping station. Shipping certificates also give the short more flexibility in the delivery process because they do not represent physical grain in a regular warehouse, which takes up storage space that they might otherwise use. Instead, shipping certificates represent a commitment to provide grain when the certificate is canceled.

Delivery instruments provide the holder with access to grain, are transferrable, and do not require load-out within a specified timeframe, so long as the holder pays a storage fee. Importantly, the maximum fee for holding a delivery instrument is set by the exchange. This fee, which is assessed daily, is paid to the regular-for-delivery warehouse, or "regular firm," that originated the delivery instrument. In return, the regular firm is responsible for presenting the grain to the holder, once load-out is requested. Regular firms regulate the delivery process: only they are able to create original delivery instruments. Before initiating delivery, other short position holders must acquire either new instruments from regular firms or existing instruments from other parties.

Typically, few deliveries are executed because trading the commodity through the delivery process is more expensive than offsetting the futures position and transacting directly with a trading partner. Grain and soybean futures markets are better suited to facilitate risk management and price discovery than to serve as a vehicle for exchange of physical title. In fact, extensive deliveries are a sign that a contract is out of balance, meaning that the delivery terms favor one side of the market or the other; contract design problems that encourage substantial deliveries cause futures markets to fail (Hieronymus, 1977). In the extreme case, favored traders may attempt to use market power during the delivery period to artificially alter the price of the futures contract and make sizable profits (Pirrong, 1993; Pirrong, 2001). When the contract is in balance and the market works properly, short and long position holders usually prefer to offset their futures positions. In doing so, both sides avoid the costs associated with the delivery process (e.g., placing grain in and out of storage, weights and grading fees, storage fees, interest costs, and the opportunity cost of backing the delivery instruments).

The price difference between futures contracts with different delivery dates is commonly referred to as the term spread or "carry." In a well-functioning market, this difference represents the return to physically storing the commodity between those dates. To market observers, that return is also

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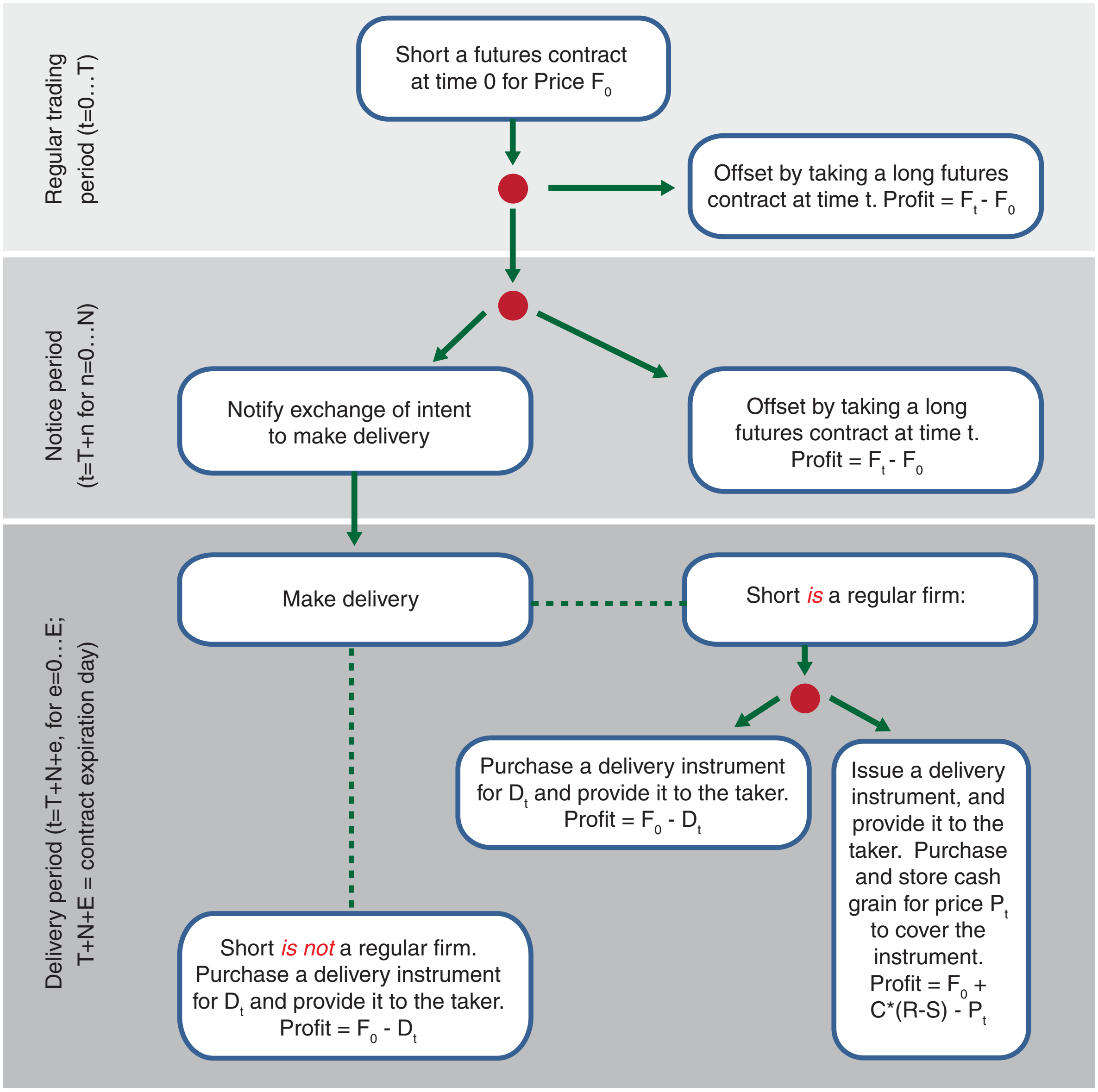
[3]CBOT and KCBT rulebooks explain the delivery processes for grains in detail and can be found at www.cmegroup.com/rulebook/CBOT and http://www.kcbt.com/rule_book_kcbt.html, respectively. Futures contracts for many other commodities require immediate load-out or are settled in cash at a benchmark cash market price; as a result, convergence in these markets is assured.

Figure 3
Contract termination for a short trader



NOTE: In the figure, nodes represent decision points, F is a futures price, P is a cash price, C is the expected number of months until cancelation of the delivery instrument, S is the monthly cost of physical storage, D is the price of the delivery instrument, and R is the contract storage rate on that instrument. For simplicity, the time value of money is not considered (i.e., the real interest rate is zero).

known as the price of storage. Working (1949) and Brennan (1958) showed that the price of storage is determined by the storage market equilibrium, which occurs at the intersection of the demand and supply of storage. Assuming a fixed supply of storage, a large harvest produces large inventories and high demand for storage services, which in turn increases the price of storage. In contrast, the storage fee for delivery instruments is written into futures contracts and set by the exchange; it does not necessarily represent the price of storage.

Because term spreads provide, in Working's words, a "direct measure of the return to storing the commodity," market participants use them as a guide to time their purchase or sales decisions. But, because futures contracts convert to delivery instruments upon expiration, the term spread cannot exceed full carry, the point at which it reflects the total cost of holding the delivery instrument over time, including financing costs.[4] When the cost of holding delivery instruments understates the cost of storing grain, the term spread understates the price of physical storage. One effect is that uninformed participants may misinterpret the resulting term spread, triggering a potential misallocation of resources by storing less than the optimal amount of grain.

[4]Otherwise, an arbitrageur could earn a riskless profit by purchasing a delivery instrument, shorting a futures contract, storing the instrument, and then delivering it at contract expiration.

Why Did Contracts Fail To Converge?

This section begins by summarizing the work of Garcia, Irwin, and Smith (2011) (referred to as GIS, from here), who attribute non-convergence to the institutional structure of the delivery market.[5] Next, alternative explanations for non-convergence are described. Finally, we share important results of GIS' empirical tests, which support the delivery market explanation for non-convergence.

Delivery Market Design

GIS shows how non-convergence can arise through the interaction of rational, competitive market participants. If the "wedge," or the price of physical storage minus the cost of holding a delivery instrument, is positive, the cost of holding delivery instruments is cheaper than storing grain physically. However, both represent the same amount of future grain. A firm that is short and makes delivery on a futures contract will not earn a large enough storage fee from the delivery instrument as compensation for the cost of storing the grain that backs the instrument. Such a firm therefore seeks compensation by issuing the delivery instruments at a high price relative to the price of cash grain. Recall that the price of a futures contract represents the market value of the delivery instrument at contract expiration, which can differ from the cash market grain price. As a result, firms are only willing to make futures market deliveries if the expiring futures price exceeds the price of cash grain by an amount sufficient to compensate them for the artificially low storage fees they will receive on their outstanding instruments, for as long as the grain is expected to remain in storage.[6]

To see formally why non-convergence works this way, imagine a market with two types of traders. Regular firms can store grain and can satisfy the short side of expiring futures contracts by making delivery, originating transferable delivery instruments that entitle the holder to a claim on grain that can be exchanged at any time, in return for the immediate-delivery futures price. Financial firms cannot store grain or issue delivery instruments, but they may settle the long side of an expiring futures contract by taking delivery, accomplished by paying the futures price for immediate delivery and accepting the delivery instrument. Financial firms can hold the delivery instrument indefinitely, so long as they pay an exchange-set storage fee to the regular firm. Regular firms and financial firms face borrowing costs, although the latter's may be lower due to possible advantages in capital markets. To describe the causes of non-convergence in the simplest possible terms, GIS specifies that one rational representative firm of each type interacts over two trading periods, and both firms operate competitively and have identical information. The two firms trade in cash, futures, and delivery markets in the first time period, and futures and cash prices converge in the second period.[7]

Regular firms choose among three commodity storage options: (1) holding unhedged physical grain until sale at the period 2 cash price; (2) hedging grain by entering the short side of a futures contract for delivery in the following period; or (3) making delivery on a futures contract in period 1 by issuing a delivery instrument to the financial firm and repurchasing the delivery instrument in period 2. Given the expectation of convergence in period 2, the absence of arbitrage using options 1 and 2

[5]Others, such as Heath (2009) and Aulerich et al. (2011), have also attributed non-convergence to market design issues. We focus on Garcia, Irwin, and Smith (2011) because it is the most complete explanation of the problem.

[6]See figure 4 (and its explanation on page 10) for a graphical representation of how the wedge generates non-convergence in a competitive market.

[7]In addition to introducing a more complete version of the two-period model that we describe, GIS expand it to an infinite horizon that does not arbitrarily impose convergence at some future date.

equates the futures price for later delivery to the period 1 cash price plus the total cost of physically storing the commodity. In effect, option 3 is equivalent to storing grain in the delivery market: when the financial firm delivers the instrument back in period 2, the regular firm converts it into grain for sale in the cash market.

If the storage fee is set low enough, the return to option 3 becomes attractive to the financial firm, which will demand as many delivery instruments as the regular firm is willing to offer.[8] By taking delivery, the financial firm pays the futures price for immediate delivery and the storage fee in period 1, but earns the futures price for later delivery, discounted by its capital cost, once it redelivers the instrument back to the regular firm in the following period.[9] This strategy remains attractive to the financial firm as long as the deferred futures price exceeds the price for immediate delivery by enough to cover the storage fee and capital costs. Because it behaves competitively, the financial firm would bid down the term spread until it reaches full carry, which removes the opportunity for making excess profits. From the perspective of the financial firm, a term spread at full carry represents equilibrium.

The supply of delivery instruments is determined by the regular firm. If the expiring futures price plus the storage fee is larger than the cost of issuing delivery instruments plus the discounted futures price for later delivery, the regular firm will choose to make delivery on futures contracts, issuing delivery instruments and storing grain in the delivery market. From the regular firm's perspective, this option partially subsidizes the storage costs for its grain, which never even needs to leave the warehouse. Furthermore, by issuing these delivery instruments, the regular firm effectively gains access to credit at the rate available to the financial firm.

Non-convergence occurs when the storage fee is set too low. For example, say a large harvest leads to relatively plentiful inventories and therefore creates a high demand for storage space. This high demand forces the physical price of storage to exceed the cost of holding delivery instruments thereby creating a positive wedge. At the competitive market equilibrium, the wedge generates convergence failure because it creates a demand for delivery instruments that would increase the unconstrained futures term spread beyond the level of full carry. But because the term spread is capped at full carry, it understates the true price of physical grain storage. As both cash grain and the delivery instrument represent the same amount of period 2 grain, their present price must differ by the difference of the storage costs over the interim (i.e., the expiring futures price must rise above the current cash price to compensate the regular firm for receiving too low a storage fee on the delivery instruments it issues).

In effect, the wedge creates a non-convergence by decoupling the expiring futures contract from the cash grain market, since the delivery instruments will not be converted to grain until the second period. The low storage fee leads expiring futures contracts to instead reflect the price of issuing delivery instruments—the price of period 2 grain rather than period 1 grain. GIS shows also that the

[8]In the model, the demand for delivery instruments is perfectly elastic. In a market with warehouse receipts, such as the KCBT, the number of delivery instruments is capped at the amount that accounts for all the space in regular-for-delivery warehouses. For corn and soybeans, the Chicago Mercantile Exchange Group (CME) limits the amount of shipping certificates that each regular firm may issue based on its throughput and net worth; the exchange adds a storage capacity requirement for wheat contracts. In 2009, the CME placed limits on the number of shipping certificates a financial firm may hold. See www.cmegroup.com/rulebook/files/CBOT_RA0903-1.pdf.

[9]Aulerich, Fishe, and Harris describe the embedded real option that non-convergence assigns to delivery instruments (2011).

magnitude of convergence failure increases as the financial firm's borrowing costs become cheaper relative to the regular firm, since that reduces the value of full carry and expands the wedge.

Figure 4 is a graphical depiction of a simplified version of the model. In each panel, the first figure represents the storage market. The second shows the cash market (*C*) prices over three or four time periods along with futures (F_i) delivered in each intervening time period (t_i). Each time period, the cash price increases by an amount equal to the price of physical storage. This increase compensates the owners of the commodity for the cost of storage. We construct the figures so that all prices converge in the final period for every panel in the chart.

Panel A depicts a market in which the price of storage is positive but not as large as the delivery instrument storage rate (P_{bar}). The term spread is large enough to compensate for the price of storage (P_I), and the market converges at all periods. Convergence is represented by the gray and orange dashed lines (futures prices on two contracts) converging to the green dashed line (cash price). In panel B, a large harvest at t_0 leads to an excess commodity supply that drives the demand for storage services higher (to D_{II}) and increases the market price of storage (to P_{II}) and thus causes cash prices to increase at a higher rate. Because the delivery instrument storage rate (P_{bar}) is sufficiently high, the term spread (the difference between F_2 and F_1) is able to expand sufficiently to express the market price of storage, and futures and cash prices still converge.

In Panel C, the maximum storage rate on the delivery instrument is set too low, so the wedge is positive. This wedge is not expected to persist after t_2, so the futures price converges to cash in t_2 (the dashed orange line converges to the green spot price line). Between t_1 and t_2, the term spread is capped at P_{bar} to prevent arbitrage on delivery instruments. The term spread cannot expand to the price of grain storage (P_{II}), so it understates the true price of storage. Therefore, the price of delivery instruments at t_1, F_1, must rise above the current cash price, *C*, to compensate the regular firm for the low storage rate it earns by issuing delivery instruments. Now, F_1 is "decoupled" from the cash price—the futures contract for delivery in t_1 no longer represents the expected cash price at t_1, but instead, the expected price of the delivery instrument at expiry: the cash price plus *w*.

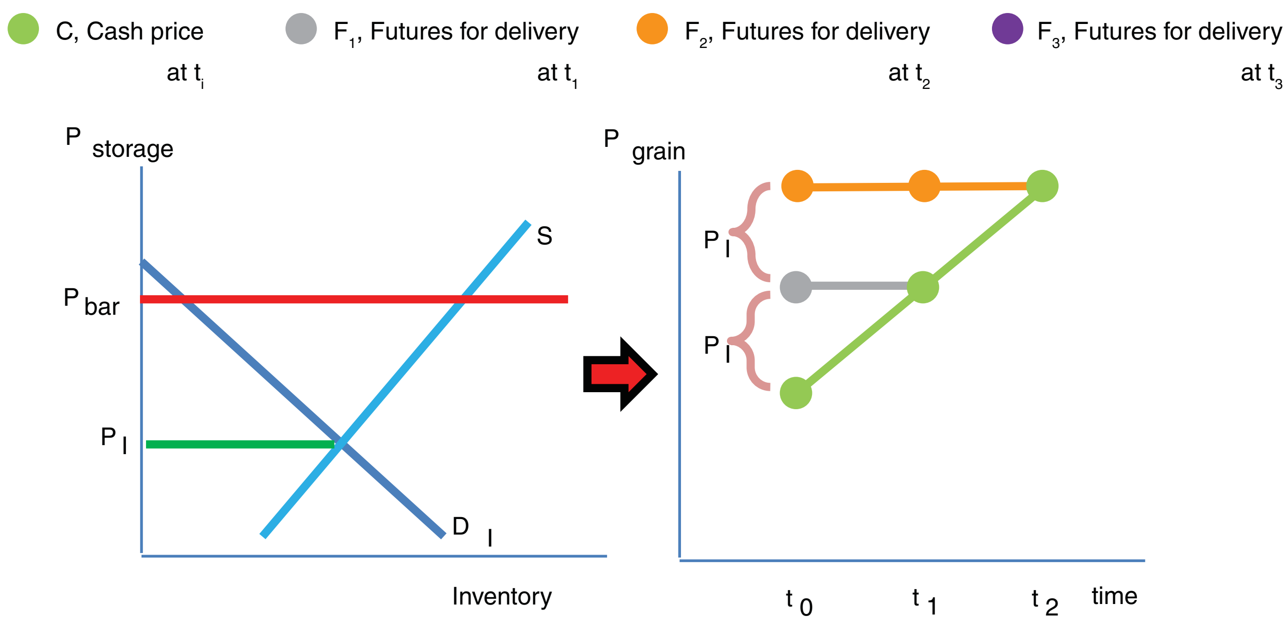
In panel C, the wedge expires after period 1; panel D shows how the magnitude of non-convergence increases as the expected life of the wedge rises (now, through period 2). Once again, the no-arbitrage condition caps the term spread between all futures prices at P_{bar}, so it cannot expand to reflect P_{II}. Now, F_2 does not converge with the cash price, but instead realizes the cash price at t_2 plus *w*. And when F_1 delivers at t_1, the expiring basis is even larger than it is in Panel C—now 2*w*—reflecting the fact that the wedge is expected to last over two periods from t_0 to t_2.

On the other hand, if the wedge is not positive, the grain market converges. For example, if an unexpectedly small harvest drives the price of physical storage below the level required for the financial firm to demand delivery instruments, any delivery instruments issued would immediately be converted to grain (i.e., load-out would occur). Without a positive wedge, the term spread reflects the price of physical storage, and the expiring futures price is able to adjust to the current cash price. The basis for the expiring futures contract is zero, so the market converges. A negative wedge generates a term spread that is lower than full carry, and the market likewise converges (see panels A and B in figure 4).

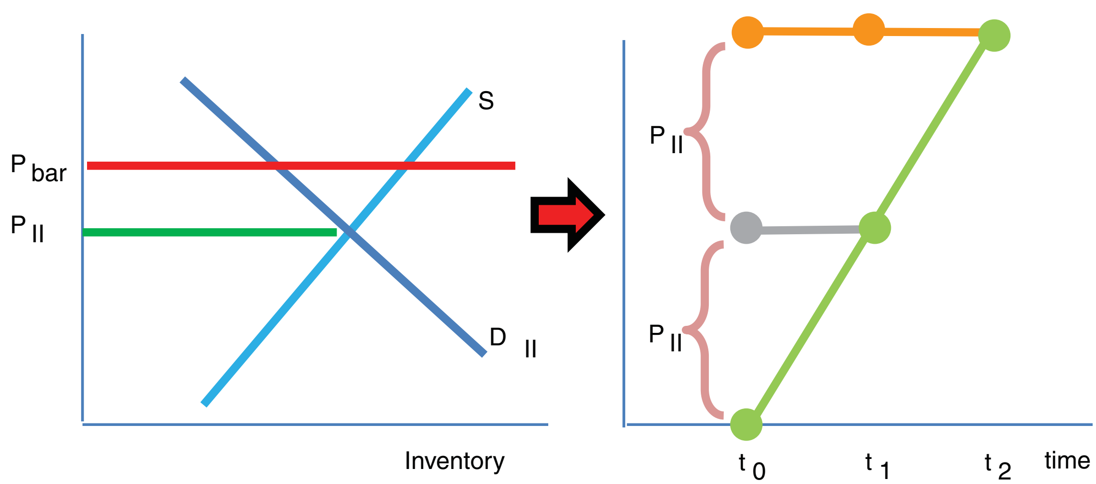
In addition to inventory levels, the model predicts that other variables can affect convergence. An increase in the maximum delivery instrument storage rate lowers the demand for delivery instruments, reducing the disparity between futures and cash prices, as does a higher borrowing cost for financial firms. Likewise, the expiring basis is reduced if the regular firm faces smaller physical

Figure 4
Non-convergence is caused by the wedge

Panel A: Convergence when the demand for inventories is normal



Panel B: Convergence when the demand for storage increases, and the delivery instrument storage rate is high enough

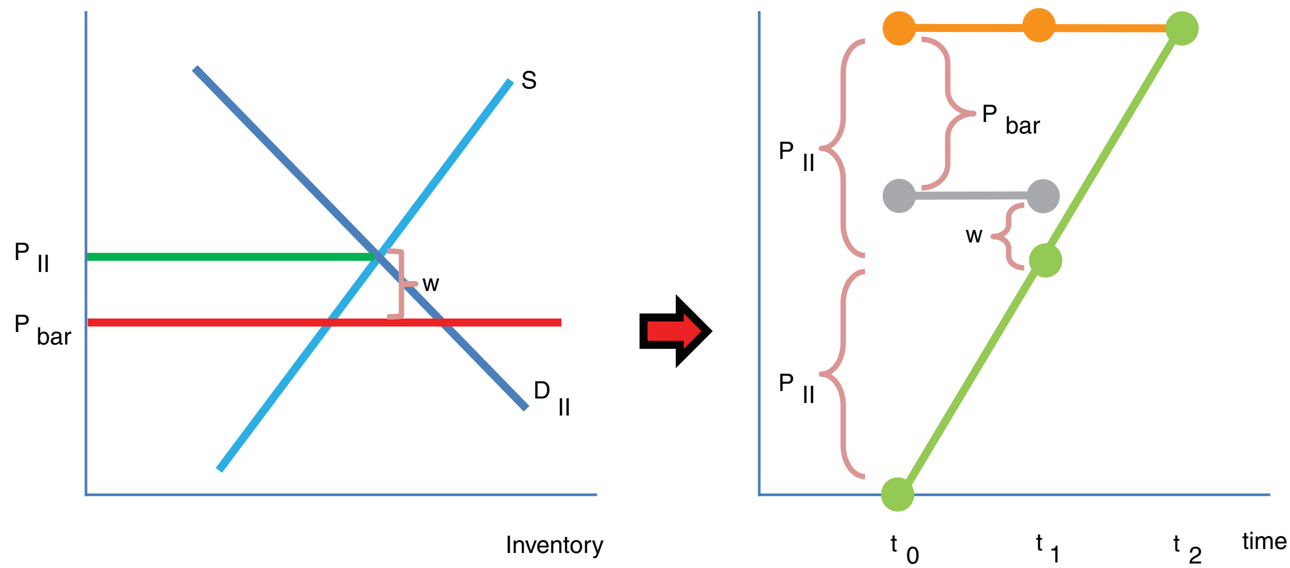


—continued

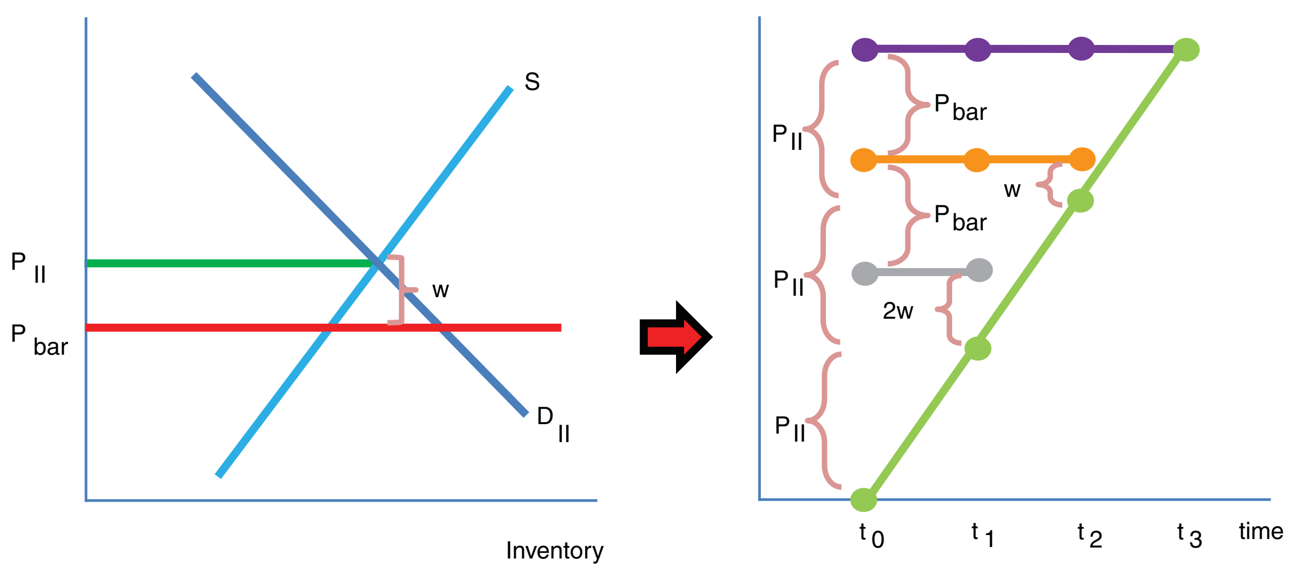
Figure 4

Non-convergence is caused by the wedge, continued

Panel C: Non-convergence at t_1 when the demand for inventories increases and the delivery instrument storage rate is too low



Panel D: The magnitude of non-convergence at t_1 increases when the wedge is expected to last for a longer period of time



Note: P_I and P_{II} represent the price of storage under demand levels D_I and D_{II}; storage supply is given by S. P_{bar} is the maximum storage rate on the delivery instrument. C is the cash market price; F_i is the futures contract price for delivery at t_i for i=1,2,3. The wedge is represented by w. A positive wedge signifies non-convergence. For simplicity, the chart assumes no time value of money.

How Non-Convergence Occurs in a Competitive Market

1. The market price of physical storage is high (e.g., a large harvest generates a high demand for storage). In figure 4, panel C, demand increases to D_{II}.
2. The exchange-set futures contract storage fee is too low, leading to a "wedge" between the price of storage and the cost of holding delivery instruments (*w* in figure 4).
3. The wedge makes the physical storage of grain unattractive to the regular firm, who instead seeks to issue a delivery instrument for a high price—effectively store grain in the delivery market—earning the return from issuing delivery instruments (the expiring futures price plus the storage fee).
4. With a low storage fee, taking delivery becomes appealing for the financial firm, which demands as many delivery instruments as the regular firm will issue as long as the term spread is sufficient to compensate it for the storage fee plus its borrowing costs (full carry).
5. The equilibrium futures term spread is capped at full carry (P_{bar} in figure 4), which is lower than the true price of physical storage (P_{II} in figure 4).
6. Because the cash grain and the delivery instrument represent the same amount of future grain, their present price must differ by the present value of their storage costs over the interim, so the futures price fails to converge to the cash price. In figure 4, panel C, $F_1 > C$ at t_1. In panel D, the expiring futures price exceeds the cash price at both t_1 and t_2.

The Wedge Drives the Basis and the Futures Term Spread

Non-convergence:	$Wedge > 0 \Rightarrow Basis > 0$ and $Spread = Full\ Carry$
Convergence:	$Wedge = 0 \Rightarrow Basis = 0$ and $Spread = Full\ Carry$
Convergence:	$Wedge < 0 \Rightarrow Basis = 0$ and $Spread < Full\ Carry$

A Small Wedge Can Generate a Large Degree of Non-Convergence

(a) Delivery instrument storage rate/month	5 cents	5 cents	5 cents
(b) Market price of storage/month	10 cents	10 cents	10 cents
(c) Wedge/month = maximum[(b) – (a), 0]	5 cents	5 cents	5 cents
(d) Expected length of time that wedge > 0	6 months	12 months	24 months
(e) Basis at expiration = (c) x (d)	30 cents	60 cents	$1.20

Note: For simplicity, the calculation in (e) does not account for the time value of money.

storage costs or capital costs, since those costs shift the supply of storage curve to the right. Providing the regular firm with monopoly power in grain storage raises the expected price of storage and expands the wedge, although the latter is still determined by the difference between the price of physically storing grain and the cost of holding delivery instruments.

Extending this framework to a multiple-period model, GIS shows that the expiring basis in any period becomes the present value of the expected stream of future wedges for as long as they are predicted to remain positive (see panel D in figure 4). The basis must be large enough to compensate the regular firm for the too-low storage rate for as long as the financial firm is projected to hold the instrument. Consequently, even a relatively small wedge can generate a large degree of non-convergence if it is expected to persist long enough, accounting for the remarkably wide basis observed during recent non-convergence episodes. For example, a wedge of just 5 cents per month that is expected to persist for 2 years implies a basis of about $1.20 (see box, "A Small Wedge Can Generate a Large Degree of Non-Convergence," p. 13).

Alternative Explanations for Non-Convergence

One theory is that large long positions held by passive commodity index traders (CITs) led to a breakdown between the Chicago futures market and the cash market for wheat (United States Senate Permanent Subcommittee on Investigations, 2009). This theory is part of a larger movement that argues firms who trade futures in large volume but do not have a directional interest in the underlying commodity price bias derivatives prices away from their fundamental level (Masters, 2011; Soros, 2008; UNCTAD, 2011). CITs sell financial instruments like index swaps and facilitate the sale of exchange-traded notes and exchange-traded funds to customers who seek investment exposure to commodity prices. To offset their risk, CITs purchase long positions in commodity futures contracts. Because they tend to hold these positions for a relatively long period of time and roll them over from one contract expiration to the next, CITs are said to trade "passively" and are referred to by observers as "passive longs." Several of these firms have applied for and received "hedge exemptions" from normal speculative position limits, as they trade commodity futures contracts to manage the risks associated with financial investment portfolios. Since the early 2000s, CITs have rapidly increased their presence in commodity futures markets; from 2003 to 2008, the value of these traders' holdings increased by a factor of 10. Likewise, Irwin and Sanders (2011) show that the share of corn, soybeans, and wheat open interest held by CITs increased significantly over the same time period. Notably, the rise of CIT trading coincides with the convergence problems observed in the futures markets for these commodities.

According to this theory, CIT trading activity constituted a major new source of demand for long commodity futures contracts, unrelated to underlying market fundamentals. By entering a large amount of long futures contracts, CITs boosted the "demand" for these contracts without increasing the demand for the underlying physical commodity. As a result, CITs inflated a speculative bubble, driving the price of these contracts higher than the cash market price and increasing the futures term spreads above the level justified by a rational market. The resulting price differentials distorted traditional storage signals, leading commodity holders to store grain for profit rather than imposing convergence by arbitraging the difference between futures and cash prices.

However, the speculative bubble theory suffers from numerous limitations. First, the idea that CIT traders' order flows can even consistently impact futures prices relies on important assumptions that are not necessarily consistent with the way that these firms are known to operate (Irwin and Sanders, 2011). Moreover, many empirical studies have failed to find evidence of a causal link between CIT trading and futures prices or term spreads (Buyuksahin and Harris, 2011; Irwin and Sanders, 2011; Stoll and Whaley, 2010), and those few that suggest such a relationship suffer from important weaknesses (Fattouh, Kilian, and Mahaveda, 2012; Irwin and Sanders, 2001). The bubble theory also fails a logical test with respect to convergence: if CIT behavior widens term spreads to the degree that grain elevators choose to "hoard" the commodity and take it off the market, then its cash price should increase as current available supply falls. At the same time, the tendency of CITs to roll their positions should (according to this theory) put downward pressure on expiring futures prices. These two forces should act to force the cash and expiring futures prices together, shrinking the delivery month basis and generating convergence.

Another explanation for non-convergence is that changes in commodity production patterns and transportation logistics rendered traditional delivery points out of the commercial flow of the commodity (Irwin et al., 2011). According to this hypothesis, regular warehouses were "out of position" in relation to commodity production and trade. As a result, they found it too expensive to draw a sufficient amount of the commodity to arbitrage the basis and effect convergence by initiating enough deliveries. In practice, this theory is most applicable to the CBOT soft red wheat (SRW) contract. When the CBOT was established in the mid-19th century, Chicago was the most important cash grain market in the United States. Over time, as the production and marketing channels for the commodities shifted away from the Great Lakes region, the original delivery markets became less commercially important. In 2000, CBOT revised the delivery points for corn and soybeans to better represent the commercial flow of the commodity. CBOT maintained the traditional delivery points for wheat, however, until 2009 when persistently small commercial activity at these locations prompted a concern that deliverable supplies were "out of position." At that time, CBOT added Northwest Ohio, Ohio, and Mississippi River barge shipping stations to the established delivery locations for soft red wheat: Chicago (Illinois), Toledo (Ohio), and St. Louis (Missouri). Irwin et al. point out that because these structural problems existed before the recent episode, it is unclear how this theory explains recent non-convergence problems (2011).

Empirical Evidence

The best available test of the competing non-convergence theories is performed in GIS, which estimates an econometric model of the KCBT wheat, and CBOT corn, soybean, and wheat markets. Using relevant futures and cash market prices, the expiring basis series for these markets is calculated over the last two decades.[10] The authors approximate the wedge using the change in the basis, and test which variables explain the series. Given a constant storage fee, the delivery market design theory predicts that the wedge increases with aggregate inventories at deliverable locations; an unexpectedly good harvest that produces a temporarily negative price shock can induce non-convergence as deliverable inventories ramp up. Besides inventories, important variables to include in the econometric model to explain the wedge include credit spreads and the delivery instrument storage rate. To account for the possibility that financial firms generated a speculative bubble that overpowered the ability of arbitrageurs to impose convergence, the "net long" open interest held by commodity index traders, or the number of long minus short contracts, is included as an explanatory variable.

[10]For soybeans and corn, the authors use cash prices from Toledo until 1999 and the Illinois River thereafter; for CBOT and KCBT wheat, they use cash prices from Toledo and Kansas City, respectively. Corn and soybean prices from the Chicago market produce similar results.

Confirming the delivery market design theory's predictions, inventories are the most important factor in explaining the change in the expiring basis and prove to be highly economically significant.[11] The authors estimate that the CBOT wheat market wedge expanded by over 2.6 cents per month, given the doubling in deliverable stocks from 2004 to 2008. That expansion represents 60 percent of the value of the CBOT contract storage fee, which was 4.5 cents per month at the time. As expected, the wedge is highly seasonal for all commodities: it is largest near the harvest and falls as the marketing year progresses and inventories draw down. Coefficients on other variables are not significant, although they generally exhibit the expected signs. Conspicuously, the data do not support the index trader/speculative bubble theory. Commodity index trader positions are not found to affect the change in the basis over time: the coefficient on their open interest is not at all significant in explaining the change in the basis over time, and the sign is not consistent across commodities.

In addition to the econometric results, GIS provides compelling graphical evidence to support the contention that non-convergence is an unintentional product of delivery market structure. In figure 5, the authors show an example of how non-convergence is closely tied to the wedge, which drives the accumulation of inventories in the delivery market.[12] For those market episodes in panel A where inventories surge sufficiently, the price of physical storage rises above the storage fee in panel B, and non-convergence occurs in panel C. Figure 6 shows that the expiring basis value implied by the model (estimated using two different techniques) matches the observed magnitude of non-convergence very closely for all commodities except CBOT soybeans, although the model captures the incidence of the latter quite well. This result validates the model prediction that even a small wedge can generate a high degree of non-convergence.

Implications of Empirical Evidence

Recent episodes of non-convergence are explained well by competitive, rational participants acting within the structure of existing delivery markets. Furthermore, the data show that the expiring basis is a good approximation of the present value of the sum of future positive wedges. Appealing to alternative explanations, like irrational speculative bubbles or limits to arbitrage, is not necessary to explain the incidence or magnitude of non-convergence. What's more, the alternative theories lack empirical support.

Traditionally, the futures term spread has been interpreted as the return to storing the commodity (Working, 1949). However, the delivery market design theory shows that a wedge caps the futures term spread below the true price of storage. As a result, when the market fails to converge, the futures term spread represents only the downward biased return to storage. In GIS's model, both participant firms are equally informed, so there are no negative welfare effects associated with non-convergence. But if some participants in the market are not as well informed and they use the term spread to guide physical storage decisions, they may store less than is optimal under non-convergence, leading to an inefficient allocation of agricultural resources. Similarly, if farmers interpret the magnitude of non-convergence as an indication of the direction of future cash grain prices—rather than as an artifact of the difference in asset storage costs—then they may plant more acres to the crop than is optimal.

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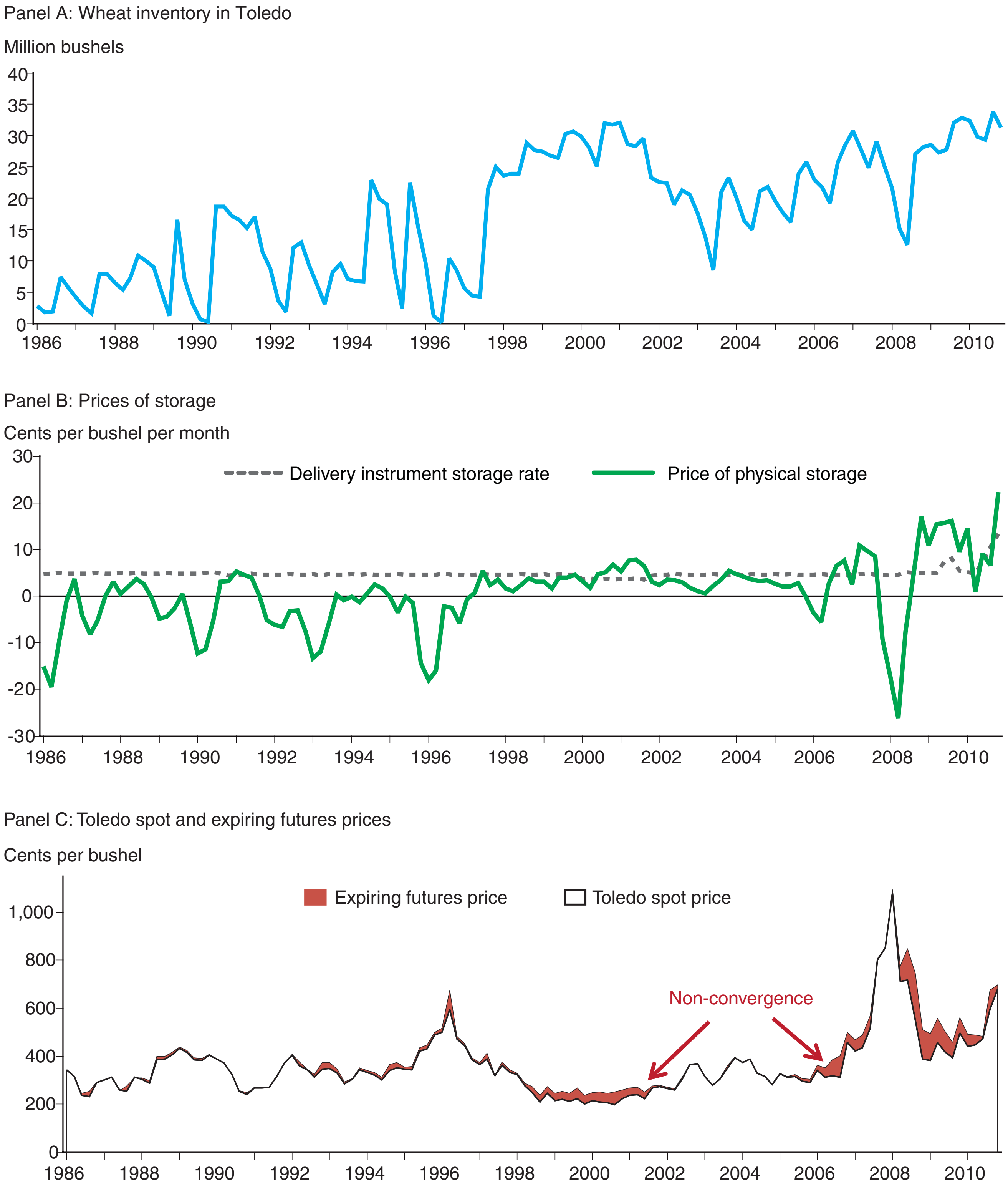
[11]GIS uses an instrumental variables technique to verify that inventories drive the wedge and not the other way around.

[12]CBOT wheat at Toledo is used as an example.

Figure 5

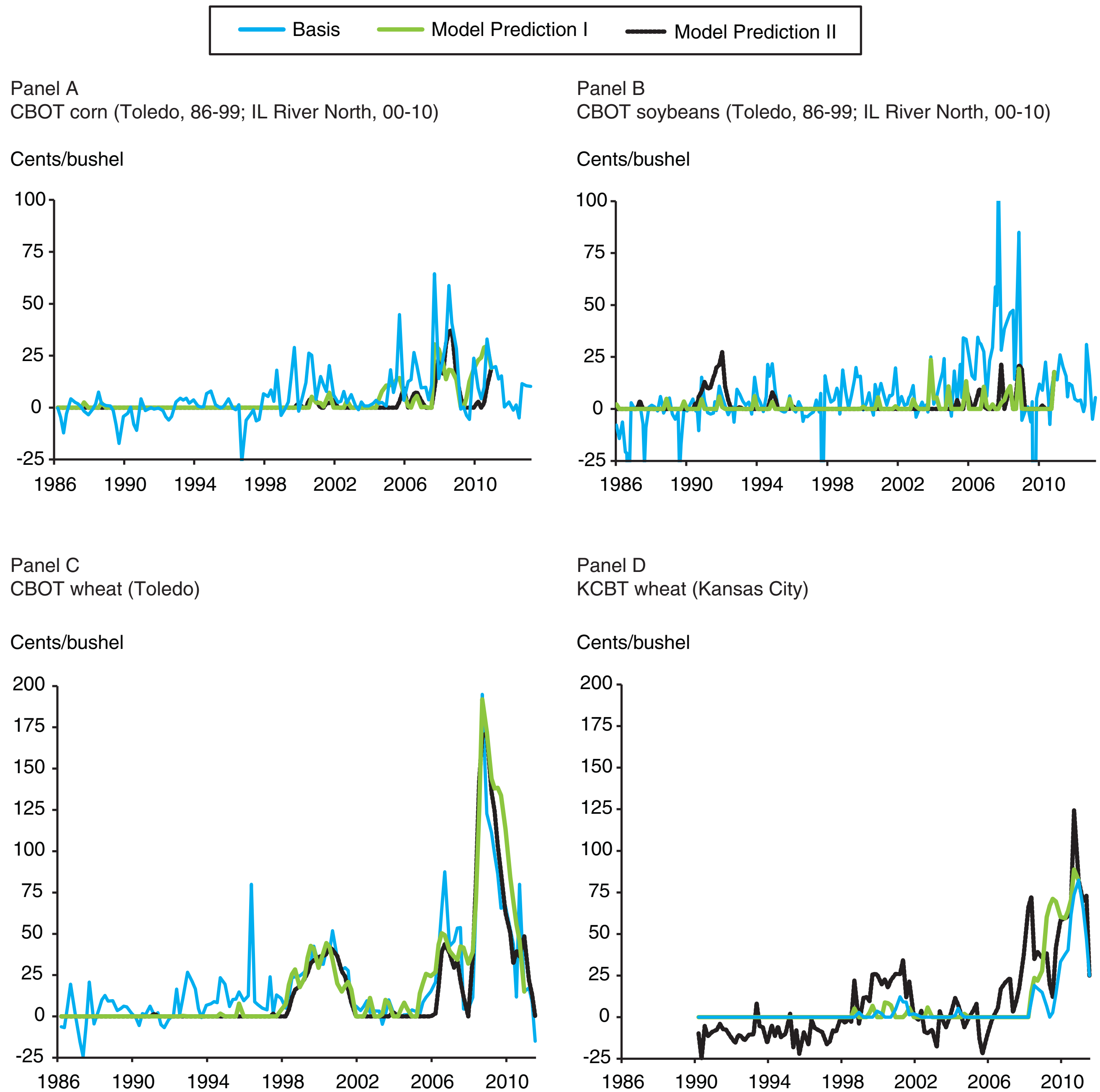
Elements of non-convergence in Chicago Board of Trade (CBOT) wheat, 1986-2010



NOTE: Panel A shows total wheat inventory in deliverable locations in Toledo, OH. Panel B decomposes the wedge. Panel C shows data for the CBOT wheat futures contract and the Toledo delivery location on the first day of delivery on each contract from 1986 to 2010.

Source: Garcia, Irwin, and Smith, 2011.

Figure 6
Actual basis versus model predictions: 1986-2010



NOTE: This figure shows the difference between actual cash and futures prices (the basis) on the first day of the delivery month alongside Garcia, Irwin, and Smith's predictions from their perfect foresight model, using two different methods.

CBOT = Chicago Board of Trade. KCBT = Kansas City Board of Trade.

Source: Garcia, Irwin, and Smith, 2011.

Policy Options To Improve Convergence

Exchanges and policymakers have a strong interest in preserving confidence in futures markets, which is undermined when convergence becomes unpredictable. Several general solutions have been proposed to address the non-convergence problem in order to maintain the market's ability to perform its economic functions (Irwin et al., 2008). We describe and evaluate these below, based on the model and empirical evidence discussed in this report; figure 7 summarizes the options along with their potential benefits and costs.

Change the Delivery Instrument Storage Rate

Under the delivery market design theory, non-convergence is caused by a positive wedge between the price of storage and the cost of holding delivery instruments. Therefore, the exchange can drive the wedge to zero and impose convergence by increasing the storage fee to a level that makes holding delivery instruments unattractive. This can be done by setting a fixed rate so high that it will not permit a wedge even when the demand for storage—and thus the price of storage—is very high, or by creating a variable storage rate that changes based on market conditions.

To address the problem of non-convergence, in 2009 the Chicago Mercantile Exchange Group (CME) replaced its previously fixed CBOT wheat shipping certificate storage rate with a new Variable Storage Rate (VSR) system (Seamon, 2009). The CBOT wheat VSR makes storing delivery instruments more expensive when the market nears full carry, but decreases storage rates as the term spread narrows. Under the VSR, the per bushel cost of holding delivery instruments for a month increases by about 3 cents if the expired nearby term spread averaged more than 80 percent of the full carry value, does not change if the expired spread average between 50 and 80 percent of full carry, and decreases by around 3 cents if that spread averaged below 50 percent of full carry, until it reaches a floor of 1 cent per bushel, per month. Since its introduction, the VSR has increased the storage rate for CBOT wheat and restored convergence to that market.

Because the VSR aligns the storage fee with the price of storage, it effectively eliminates the wedge in a non-converging market over time. Although it operates incrementally and shifts the storage fee based on lagged observations, a variable storage rate limits the degree to which the price of storage can depart from the cost of holding delivery instruments in a converging market. In this way, even if non-convergence between cash and futures prices is still theoretically possible, the VSR ensures that it will be small in size and short-lived, since rational traders know that the cost of holding delivery instruments will quickly adjust to correct a wedge. Another advantage of the VSR, besides the fact that it is shown to work in practice, is that it maintains the traditional delivery process, helping prevent price manipulation like corners (Pirrong, 1993; Pirrong, 2001).

One disadvantage of the VSR is that its complicated method of calculation makes it prone to misinterpretation. Although they acknowledge the VSR has achieved price convergence, some traders still find the CBOT wheat VSR to be controversial. These participants have expressed a concern that higher storage fees established by the VSR will cause regular firms to choose to hoard wheat by issuing shipping certificates and earning storage fees, rather than transacting grain as part of their normal operations (Stebbins, 2011). To make this theory work, a long-side trader is required, one who is willing to purchase these shipping certificates and hold them for a long time, paying very high storage rates. In addition, holding SRW wheat off the market in this way would boost its cash prices relative to other grains whose futures markets do not employ the VSR. In fact, the opposite

Figure 7
Policy options to improve grain market convergence

	How to do it	What the policy would do	Potential benefits	Potential costs
Increase the delivery instrument storage rate	Increase the maximum storage fee for delivery instruments using a (i) fixed rate or (ii) variable storage rate system.	A fixed-rate (FR) regime would set a relatively high rate, to be reviewed periodically, while a variable storage rate system would adjust the storage rate in response to market conditions. Holding instruments would become unattractive.	The cost of holding delivery instruments would more accurately reflect the cost of physically storing grain. If successful, the futures contract price would not diverge from the underlying price of grain in the cash market.	The method used to update the variable rate could be overly complicated. A high FR is transparent and easily understood, but the exchange would need to review it regularly to ensure it meets (or exceeds) the price of physical storage.
Force load-out	Change exchange rules to prohibit firms from holding delivery instruments beyond a specified period.	Traders who hold futures contracts until expiry would be required to load-out. The delivery process would require the physical transfer of grain; instruments could no longer be held indefinitely.	The price of futures contracts would more accurately reflect the price of grain in the cash market.	Erodes existing delivery system protections against market manipulation. When some firms are required to take a particular action (in this case, to load out), other firms may be able to exploit this requirement by charging excessive loading and transportation fees.
Make the futures contract cash settled	Create a benchmark cash price index for the commodity. Change the terms of the futures contract so that its value at expiration equals the price of the index on that day.	Traders who hold futures contracts until expiry would exchange payments based on the value of the cash index.	The price of the expiring futures contract will always converge to the value of the cash index, by construction.	Removes existing delivery system protections against market manipulation. Devising the appropriate benchmark cash price index can be difficult.
Make the delivery process easier	Increase the amount of warehouse space available for physical deliveries, expand the allowable delivery territory, and/or reduce existing limits on issuing delivery instruments.	Encourage greater participation in the delivery process: more futures contracts would be settled using delivery instruments.	Fewer restrictions allow more traders to balance cash and futures prices through arbitrage (assuming the existing structure prevents these trades right now).	Scant evidence to support the claim that the existing number of deliveries is too low, or that more/easier deliveries will generate convergence. Does not address incentive to hold delivery instruments.
Crack down on speculators	Apply speculative position limits to commodity index traders (CITs). Phase out existing hedging exemptions that have been awarded to these firms.	Limiting the trading capacity of CITs reduces their presence in futures markets, on an individual basis. It's possible that the current aggregate CIT interest could be split among many new, smaller traders, although they would lose existing economies of scale.	Position limits are intended to prevent market concentration, manipulation, and "excessive speculation," although this term is not well-defined, and empirical evidence of their benefits is sparse.	Market design problems are not addressed. Further, limiting CIT positions can decrease liquidity, making risk management efforts more expensive. Also, these changes could lead CITs to trade in the cash markets, directly affecting grain prices.

has occurred with respect to corn (Gillam, 2011). Another drawback to the VSR is that it incorporates some uncertainty into futures prices, and the spreads between them, since the delivery instrument storage rate can be updated in real time. Therefore, prices for deferred delivery contracts are less reliable, and the spreads between them are a less reliable indicator for storage signals than they would be under a fixed storage rate.

Like the VSR, a high fixed storage rate would maintain the traditional delivery process. A fixed-rate system is currently used in the CBOT corn, soybeans, and KCBT wheat markets.[13] Because it is fixed, this type of storage rate is more transparent than the VSR, is more easily understood by traders, does not add extra uncertainty about futures spreads, and is even less likely to offer incentives for manipulation at contract expiry. To set an appropriate fixed rate, the exchange could consider the market price of physical storage over the last decade and choose a level at or just above its peak. Until recently, exchanges maintained fixed delivery instrument storage rates for long periods of time.[14]

It is important to note that, whatever storage rate system is employed, the exchange only sets the maximum storage rate for delivery instruments—individual regular firms are free to charge a lower rate. In a competitive market, a high contract storage rate maximum wouldn't bind under normal conditions, so a regular firm would charge a delivery instrument storage rate in line with the physical price of storage. One drawback is that this maximum rate could act as a magnet for delivery instrument storage rates among regular firms: as a price ceiling, it may serve as a signal for regular firms to collude and charge higher storage rates (Knittel and Stango, 2003). The possibility for this type of collusion has always existed, but we know of no instances of it occurring. Moreover, the potential for onfarm storage and for small elevators to undercut firms by charging artificially high storage rates makes such collusion unlikely to occur.

Force Load-Out

Strictly limiting the life of the delivery instrument, say to the end of the delivery month, ensures that the long side will load-out soon after taking delivery. By eliminating the ability to hold delivery instruments, forcing load-out compels expiring futures prices to reflect those in the cash market, guaranteeing convergence. This solution would produce a similar result as a high fixed storage rate on delivery instruments, with the additional complication that individual firms would not be allowed to charge a lower rate (everybody has to load-out). One advantage to arranging storage rates this way is that an unusually large demand for storage services cannot cause futures and cash prices to diverge, which could happen if the maximum fixed rate is not sufficiently high.

However, forcing load-out makes manipulation more attractive to short traders with monopoly power in the delivery market. Traders holding short positions wish to lower the price of the expiring futures contract and widen the term spread. If a trader is large enough, it can accomplish this objective by exercising market power to temporarily increase the deliverable supply of the commodity (Pirrong, 1993) or increase the costs associated with loading-out. Under the delivery instrument system, long

[13]Although the Kansas City wheat market allows for a seasonal rate premium, it is classified as a fixed-rate system because all rates are set a priori—under the VSR, rates respond to market conditions.

[14]Current rates for corn and soybeans were updated in 2008, but aside from a brief period from 2000-2001, have remained unchanged for decades; prior to the introduction of the VSR, the storage rate for CME wheat remained effectively unchanged dating back to the early 1980s. Before moving to a seasonal system in 2011, storage rates for KCBT wheat delivery instruments were frozen for just as long.

traders have the flexibility to wait and load-out under more favorable cash market conditions, counteracting the market power of large short traders. On the other hand, a forced load-out scheme would prevent longs from using the delivery process to accumulate delivery instruments. Still, forcing load-out represents more change to the existing contract than aligning storage rates, and it also fails to preserve the current delivery instrument system, making price manipulation more likely.

Change the Futures Contract Terms To Require Cash Settlement

As opposed to settlement by physical delivery, under *cash settlement*, an expiring futures contract is terminated by a payment exchange between long and short, based on the final settlement price. Rules for obtaining this price are determined by the exchange and are written into the futures contract terms. For example, the Minneapolis Grain Exchange (MGEX) lists cash-settled futures contracts for soft red winter wheat, hard red winter wheat, corn, and soybeans. These contracts are all settled to an average of the national cash price bids for the commodity during the delivery month, as calculated by the Data Transmission Network (DTN), so convergence always occurs by definition. Although they were introduced in December 2004, practically no trading occurs on any of the cash-settled MGEX contracts.[15]

Likewise, making CBOT corn, soybean, and wheat contracts cash settled would ensure convergence to an index of cash prices. However, because they are storable, abandoning the longstanding physical delivery process for these commodities leaves them more susceptible to manipulation by large long traders (Pirrong, 2001). Under physical delivery, an exchange can and typically does offer short traders a variety of delivery options in terms of grade and location, which reduces the attractiveness to the long traders of forcing excessive deliveries. On the other hand, large long traders can more easily increase the price of a cash-settled contract by purchasing the appropriate varieties of the commodity in the cash market based on the formula used to calculate the settlement index.

Arguably, cash settlement is well suited to trading termination for many futures contracts, most notably the Standard & Poor's 500 index but also for livestock contracts like lean hogs. An important feature of the indices that these contracts settle to, though, is that the prices of the underlying assets that comprise them are publicly reported. Prices for stocks in the S&P 500 index are available to the latest second, while livestock cash markets are subject to mandatory price reporting requirements. Conversely, grain and oilseed markets do not report their cash prices publicly. As a result, cash settlement for corn, soybeans, and wheat contracts would probably be tied to cash price bids (the method used by the related index contracts on the MGEX). Compared to actual cash prices, bids are far more easily manipulated, since they do not represent the execution of an actual transaction between buyer and seller. Finally, changing the contract terms to require cash settlement represents a more drastic change to the existing grain and oilseed contracts than aligning the storage rates for the physical commodity and the delivery instrument.

Make Delivery Easier

If limits to arbitrage inhibit convergence, enhancing the capacity of the delivery market should help arbitrageurs engage in the type of trading that will force expiring futures and cash prices together. This could be accomplished by increasing the amount of regular-for-delivery warehouse space at existing locations, expanding the allowable delivery territory, or increasing the maximum number

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[15]See www.mgex.com/download.html.

of delivery instruments a regular firm may issue. In 2009, CME added three delivery points to its SRW wheat contract, which better represented primary production and marketing areas for the commodity (Seamon, 2010). But GIS shows that although high delivery costs on their own may affect the number of delivery instruments the regular firm is willing to issue, they will not affect the basis, and therefore not improve convergence. Reducing the cost of issuing delivery instruments by, for example, expanding the regular-for-delivery warehouse space or adding deliverable territories encourages the regular firm to simply issue additional instruments until the marginal cost of delivery increases back to its previous level.

Tighten Speculative Position Limits

One way to address "excessive speculation" by CITs is to place limits on their trading ability. Speculative limits have been used in agricultural futures markets for decades: those traders who do not have a commercial interest in the underlying commodity ordinarily face caps on the number of positions they may hold.[16] Until recently, CITs were regularly awarded exemptions from these limits.

Besides the fact that evidence for the benefits of position limits is scarce, the speculative bubble/index trader theory suffers from theoretical weaknesses (as described on pp. 14-15). Furthermore, the empirical evidence shows that CIT positions do not correlate with basis changes in the corn, soybeans, and wheat markets. That is, the data do not support the contention that speculative activities by CITs caused convergence problems. For all these reasons, imposing position limits on index traders is unlikely to improve convergence. Indeed, doing so may actually generate other unintended, negative consequences with respect to risk transfer and price discovery (Pirrong, 2010).

[16]For a legislative history of position limits in futures markets, see: www.cftc.gov/PressRoom/SpeechesTestimony/berkovitzstatement072809

Conclusion

From 2005 to 2010, sustained, unprecedented non-convergence levels in domestic corn, soybean, and wheat futures markets led many observers to wonder if the traditional price-discovery and risk-management functions of these markets had weakened. Popular explanations for the non-convergence problem involved constraints to arbitrage (whether or not they were caused by an irrational speculative bubble) or delivery markets that no longer regulated the commercial flow of the commodity. However, convergence failures in grain and soybean markets are most likely an unintended result of the delivery market structure for these commodities. Specifically, the storage rate of the delivery instrument was set too low relative to the true price of storage: the wedge between the costs of holding delivery instruments and storing physical grain caused non-convergence.

GIS shows theoretically and empirically that recent episodes of non-convergence are well explained by competitive, rational participants acting within the structure of existing delivery markets. Predictions from their competitive model match the incidence and magnitude of non-convergence very well. Alternative claims like irrational speculative bubbles lack both theoretical and empirical support as an explanation for recent convergence problems. Therefore, tightening the enforcement of speculative position limits would likely not improve convergence and could produce unintended consequences that negatively impact the ability of futures markets to discover prices and transfer risk efficiently.

Because non-convergence confuses traditional storage signals, it may lead to welfare losses among less informed market participants, so futures exchanges and policymakers have an interest in preventing future episodes. Changing the futures contract terms to align the storage rates in the physical and delivery instrument markets, via either a variable storage rate or a high maximum fixed rate, represents less change to the existing contract than forcing load-out or switching to cash settlement. Maintaining the storage rate system also preserves the traditional delivery process along with its built-in protection against manipulation. The fixed rate has worked well until recently and has an additional advantage of being easier to understand than a variable storage rate.

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