Journal of Agricultural and Applied Economics, 44,3(August 2012):371–396

Financialization and Structural Change in Commodity Futures Markets

Scott H. Irwin and Dwight R. Sanders

The first decade of the 21st century has perhaps witnessed more structural change in commodity futures markets than all previous decades combined. Not only have trading volumes and open interest increased markedly, but this time period also saw historic changes in both trading and participants. The available literature indicates that the irrational and harmful impacts of the structural changes in commodity futures markets over the last decade have been minimal. In particular, there is little evidence that passive index investment caused a massive bubble in commodity futures prices. There is intriguing evidence of several other rational and beneficial impacts of the structural changes over the last decade. In particular, the expanding market participation may have decreased risk premiums, and hence, the cost of hedging, reduced price volatility, and better integrated commodity markets with financial markets.

Key Words: bubble, commodity, futures markets, index funds, prices, speculation

JEL Classifications: D84, G12, G13, G14, Q13, Q41

Since their modern inception in Chicago during the 1850s, dozens of commodity futures contracts have been launched and countless alterations have been made to the relatively few contracts that have survived over time. Nonetheless, the basic structure of the markets has been remarkably stable over time—a trader from the latter part of the 19th century magically transported to the trading pits of the waning years of the 20th century might have been surprised by the size of the commodity futures markets but not by the way trading was conducted or the main types of participants.[1] This stability was not fated to last however.

The first decade of the 21st century has arguably witnessed more structural change in commodity futures markets than all previous decades combined. Not only have trading volumes and open interest increased markedly, but this time period also saw historic changes in both trading and participants. Commodity futures markets transitioned from a primarily telephone/open outcry trading platform to a computer/electronic order matching platform. As a result, market access expanded greatly and trading costs declined. Perhaps not coincidently,

Scott H. Irwin is Lawrence J. Norton Chair, Agricultural Marketing, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, Urbana, Illinois. Dwight R. Sanders is professor, Department of Agribusiness Economics, Southern Illinois University Carbondale, Carbondale, Illinois.

The authors thank Paul Peterson and John Hill of the CME Group and Hongxia Jiao at the University of Illinois for their assistance in collecting the data for this study.

[1] This observation only applies to commodity futures markets. There has been a revolution in futures markets due to the rise of financial futures trading (see Lambert, 2010). This article focuses exclusively on commodity futures markets such as corn, soybeans, wheat, cattle, and hogs.

the same period saw new financial participants enter the commodity futures arena. Investments that track a commodity index became an accepted alternative investment for institutions and pension funds. The increasing importance of these nontraditional participants has been labeled the "financialization" of commodity futures markets (Domanski and Heath, 2007). Finally, exchange traded funds were introduced that tracked commodity indices or even single futures markets. These changes undoubtedly contributed to the increase in the volume of trade on commodity futures markets.

The structural shifts seen in commodity futures markets during the last decade can impact the marketplace along both rational and irrational avenues. Rational market impacts—such as improved market liquidity and potentially reduced risk premiums—stem from broader market participation and more active trade. Irrational impacts—such as a commodity price bubble—would stem from the markets' inability to adjust to these changes. In this article, we first review recent trends in open interest and volume for important commodity futures markets in agriculture. Next, we examine the forces of structural change within the commodity futures markets driving the trends in market participation over the last decade. Finally, we provide an overview of the literature on rational and irrational market impacts. The emphasis in this part of the paper is on the potential irrational impacts of financialization since this has received the most attention in terms of public policy and academic research.

Trends in Open Interest and Volume

There is little doubt that something happened from 2003–2011 in the commodity futures markets. For example, combined futures and option (delta-adjusted) open interest in Chicago Board of Trade soybeans over 1995–2002 was relatively stable at an average of 223,000 contracts (Figure 1).[2] In 2003, open interest started to build and moved up to a peak of 878,000 contracts by February 2008. Open interest declined during the financial crises of late 2008 and 2009, but then moved higher again in 2011, with a February peak in excess of one million futures and options contracts. A similar story can be told for the other commodity futures such as Chicago Board of Trade wheat (Figure 1), and Chicago Mercantile Exchange live cattle and lean hogs (Figure 2). Across these markets, open interest still appears to be on a solid upward path.

Not surprisingly, trading volumes over the same time period increased rather dramatically. From 2000–2003, soybean futures had a monthly average trading volume of just under 1.2 million contracts (Table 1 and Figure 3). Over the next six years, trading volume nearly tripled with a record 4.4 million futures contracts exchanging hands in February 2011. Similar proportional increases in trading volume were seen in wheat (Figure 3). However, in the livestock futures markets, the increases in futures trading volume are even more dramatic (Figure 4). Lean hog futures contracts have seen a nearly fivefold increase in monthly volume, and live cattle futures volume increased from an average of 338,000 contracts in 2000–2003 to 925,000 in 2009–2011 (Table 1).

Despite some of the marked increases in the absolute levels of volume and open interest, the proportion of trading activity to market size remained relatively constant. One measure of activity or turnover is the trading volume-to-open interest ratio. Bessembinder and Seguin (1993) have shown that greater trading volume can be associated with greater price volatility, but market price volatility can be mitigated by large open interest. A market trending toward higher volume-to-open interest might be more susceptible to volatility shocks.

The data for commodity futures suggest remarkably steady volume-to-open interest ratios for the commodity futures markets studied (Table 1). Among the grain markets (Figure 5), soybean futures averaged a ratio of 6.35 from 2000–2003 and 6.35 from 2009–2011. Likewise, corn and wheat have ratios that are relatively stable with averages of 3.62 and 4.28 over the entire sample. In the livestock markets, the volume-to-open interest ratios are even more

[2] Unless otherwise noted, options refer to options on the corresponding futures contracts. All option open interest is on a delta-adjusted basis and all option volume is in absolute contracts.

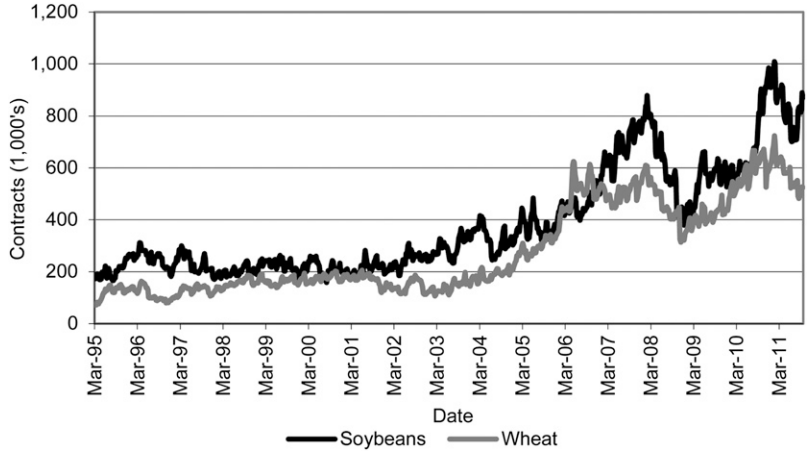

Figure 1. Soybean and Wheat Futures and Options Open Interest, 1995–2011

stable. Live cattle and live hog ratios have been consistently between 3.0 and 4.0 with live cattle averaging 3.08 and lean hogs 3.72 over the entire 2000–2011 period (Figure 6 and Table 1). These data suggest that despite the large increases in market participation, trading volume and open interest have remained in fairly constant proportions. Overall, this may suggest no general change in the markets' ability to absorb price shocks (Bessembinder and Seguin, 1993).

The large increases in futures and options open interest could be driven by an expanded use of futures, options, or both. While there is no theoretical reason to anticipate that this would create a market impact, it could provide clues as to the nature of the increase in activity. To gauge the relative positions in the options market, the options open interest (delta-adjusted) is simply expressed as a percentage of the total open interest in each market. The data are plotted to observe any changes over the last decade and a summary is provided in Table 1.

As shown in Figure 7, the percent of open interest that is held in the options markets has been relatively stable over 2000–2011 with corn, wheat, and soybeans averaging 26%, 20%, and 25%, respectively. There has been a gradual increase in corn options' share of total open interest, increasing from 23.8% in 2000–2003 to 31.5% in 2009–2011 (Table 1). Conversely, the share of open interest held in wheat options

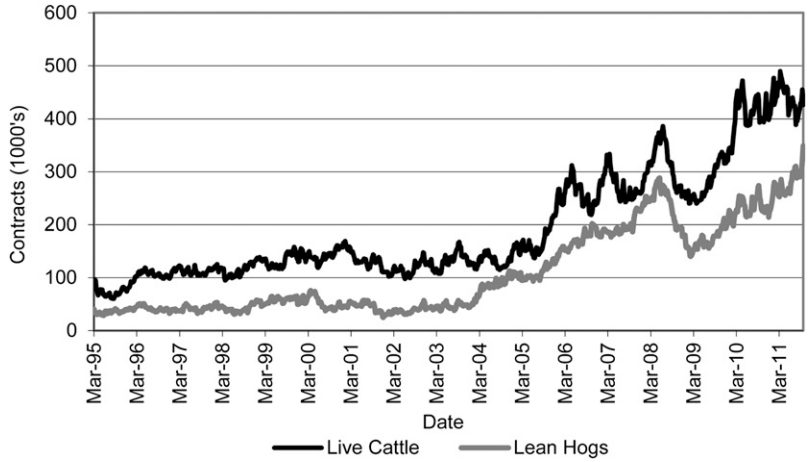

Figure 2. Live Cattle and Lean Hogs Futures and Options Open Interest, 1995–2011

Table 1. Summary Market Statistics, 2000–2011

Time Period	Monthly Futures Volume (1,000s)	Futures Volume on Electronic (%)	Futures and Options Open Interest (1,000s)	Futures Volume-to-Open Interest (ratio)	Options Share of Open Interest (%)	Open Interest in Deferred Contracts (%)
Panel A: Corn						
2000–2003	1,483	1	571	3.42	23.8	6
2004–2008	3,405	37	1,396	3.30	25.9	14
2009–2011	5,316	92	1,703	4.51	31.5	14
Panel B: Soybeans						
2000–2003	1,184	1	240	6.35	22.1	3
2004–2008	2,075	35	490	5.81	25.8	7
2009–2011	3,070	92	675	6.35	27.3	8
Panel C: Wheat						
2000–2003	564	1	158	4.71	22.7	2
2004–2008	1,198	36	390	3.88	18.6	7
2009–2011	1,797	96	517	4.37	21.9	10
Panel D: Live Cattle						
2000–2003	338	0	131	3.01	14.0	11
2004–2008	615	7	228	3.11	11.6	10
2009–2011	925	62	370	3.15	18.3	11
Panel E: Lean Hogs						
2000–2003	171	0	46	4.18	8.5	10
2004–2008	493	11	159	3.38	6.9	10
2009–2011	684	68	223	3.67	13.6	12

Note: Volume and open interest are measured in contracts.

actually declined from 22.7% in 2000–2003 to a low of 18.6% in 2004–2008.

While there has been some trend toward higher relative option participation over 2009–2011 in the grain markets, it has been a gradual increase and not uniform across markets. In contrast, the livestock markets show a clear upward move in option participation. In particular, lean hog options accounted for 5% of total open interest in 2005–2007, and by 2011 options totaled over 15% of the market (Figure 8). While less dramatic, live cattle options have also

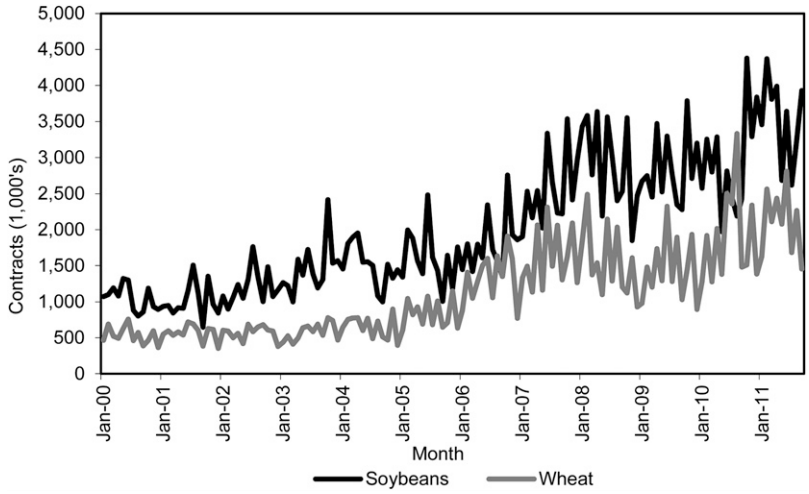

Figure 3. Soybeans and Wheat Monthly Trading Volume, 2000–2011

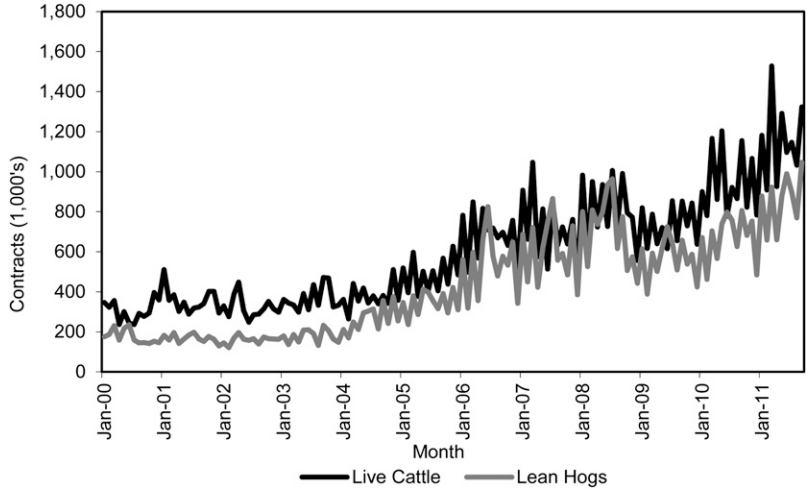

Figure 4. Live Cattle and Lean Hogs Monthly Trading Volume, 2000–2011

increased their share of the open interest from the lows in 2004–2008 of under 11.6% to over 18% in 2009–2011(Table 1 and Figure 8). The timing of the increases (2008–2011) tends to coincide with the increase in trading volume and open interest that occurred in 2009–2011. The reason for the increase in the share of open interest held in options markets for livestock is not clear. It may be related to improved market-making services or trading platforms or other exchange-related issues.

Finally, it is important to consider the distribution of open interest across listed calendar months. That is, has the growth in trading been concentrated in the nearby contract months or has there also been an increase in trading activity in deferred contracts? To measure this, the percent of open interest held in deferred contracts is recorded on the first day of the crop marketing year for the grains and on first trading day of the calendar year for livestock. In grains, deferred contracts are defined as those that are greater than one year from maturity and listed for the subsequent crop marketing year. For livestock, deferred contracts are defined as those that are greater than six months from maturity.

The percent of open interest held in deferred contracts is summarized in the far right

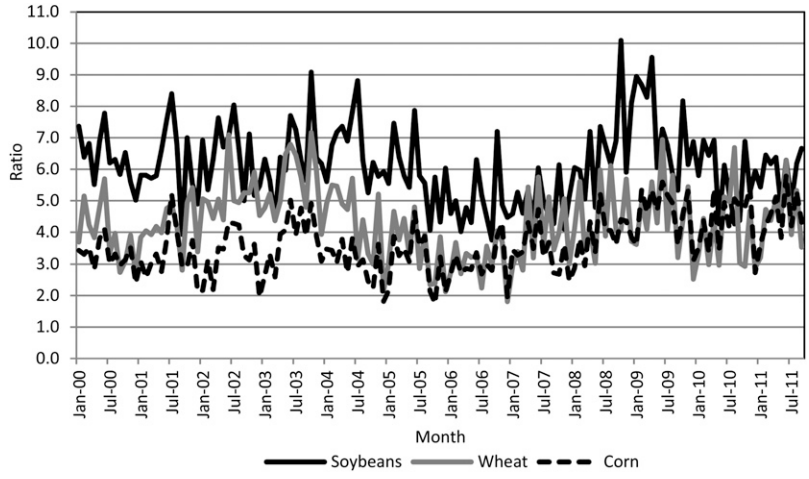

Figure 5. Futures Volume-to-Open Interest Ratios, Grains, 2000–2011

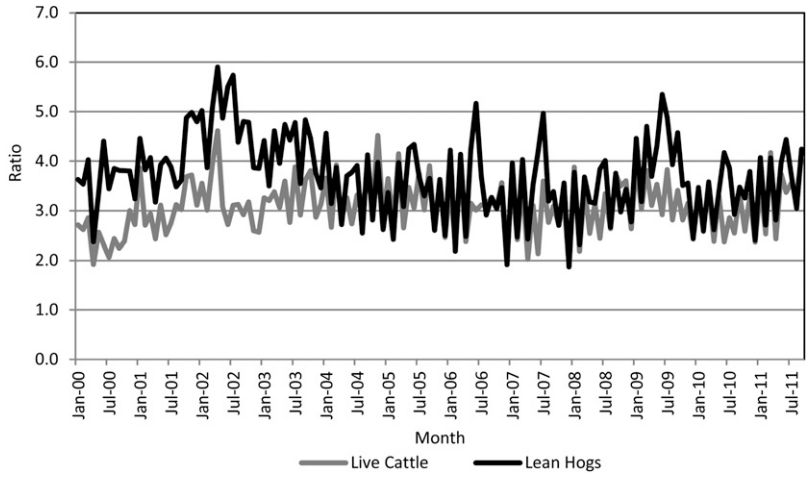

Figure 6. Futures Volume-to-Open Interest Ratios, Livestock, 2000–2011

column of Table 1. All of the grain contracts showed an increase in the relative amount of open interest held in deferred contracts. For example, in 2000–2003 deferred wheat contracts only contained 2% of the open interest in wheat. By 2009–2011, deferred wheat contracts held 10% of the open interest. Similar increases are shown for corn and soybean futures. The livestock markets show much more muted increases in deferred open interest with lean hogs increasing from 10% to 12% over the sample period and live cattle recording no increase. Collectively, these results suggest that trade—and presumably liquidity—generally increased in deferred futures contracts over this sample period. Improved liquidity in deferred futures contracts could be beneficial to commercial traders desiring to place longer horizon hedges.

The collective futures and options data clearly suggest that the markets began to grow rapidly around 2004 and continued to show growth in 2011. The rapid growth was in volume and open interest simultaneously, with the ratio of volume-to-open interest remaining relatively constant across the 2000–2011 time periods. Likewise, the growth was not isolated to just futures or just options. The share of total

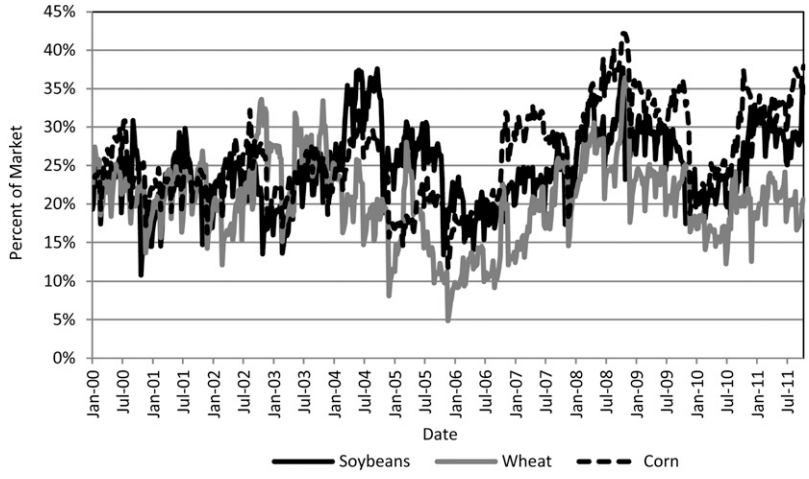

Figure 7. Options Percent of Total Open Interest, Grains, 2000–2011

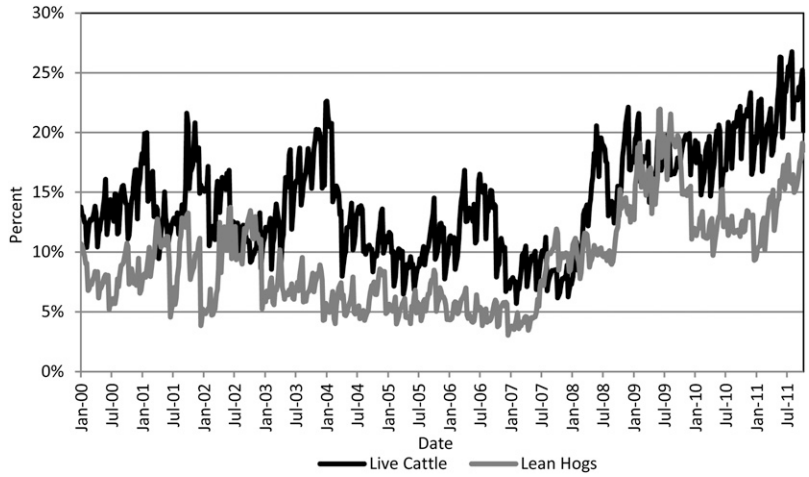

Figure 8. Options Percent of Total Open Interest, Livestock, 2000–2011

open interest held in the options market remained relatively stable for the grain markets. While there was an increase in the role of options in livestock futures markets, the increase was in the latter portion of the sample. The relative amount of open interest in deferred futures contracts increased in the grain markets in 2004–2011 and remained essentially stable in the livestock futures markets. Generally, the futures markets became much larger from 2004 forward with only modest shifts in these internal measures of market structure.

As noted above, greater trading volume can be associated with greater price volatility (Bessembinder and Seguin, 1993). There is no doubt that uncertainty has increased dramatically in commodity markets over the last decade and this has been an important contributor to the groundswell in trading volumes. There have also been several historically large structural changes during the same time period and these have also undoubtedly contributed to the increase in market activity. We turn to a discussion of these structural changes.

Structural Changes

Electronic Trading

After floundering with less than 2% of the futures trading volume from 2000–2005, electronic trading on commodity markets took hold in 2006 and expanded quickly.[3] In July 2006, electronic trading volume was less than 5% of total monthly volume in soybean futures contracts (Figure 9). Eighteen months later over 80% of the monthly trade had migrated from the trading pit to the electronic platform. In the first nine months of 2011, only 7% of soybean futures trade was transacted through open outcry in the trading pit. Similar trends are seen for corn and wheat (Figure 10 and Table 1).

The livestock futures markets have been a little slower to adopt electronic trading.[4] In the live cattle futures market, trading volume on the electronic platform was under 5% of the total in April 2007 (Figure 11). The growth was fairly rapid in 2008 and early 2009 as the electronic platform's share of live cattle futures trade rose to over 50%. Growth continues to be steady for the electronic system and the percent

[3] In this paper, electronic trading volumes are for futures only. Electronic trading in the options market has been slower to expand due partially to a more complicated order and strategy system. We appreciate the assistance of Paul Peterson and John Hill of the CME Group, Inc. for providing the open outcry and electronic trading volume data and assistance in understanding adoption trends across the grain and livestock markets.

[4] The livestock futures slower move to electronic trading may reflect the more domestic nature of these markets and the more consolidated flow of information among market participants and the cash trade.

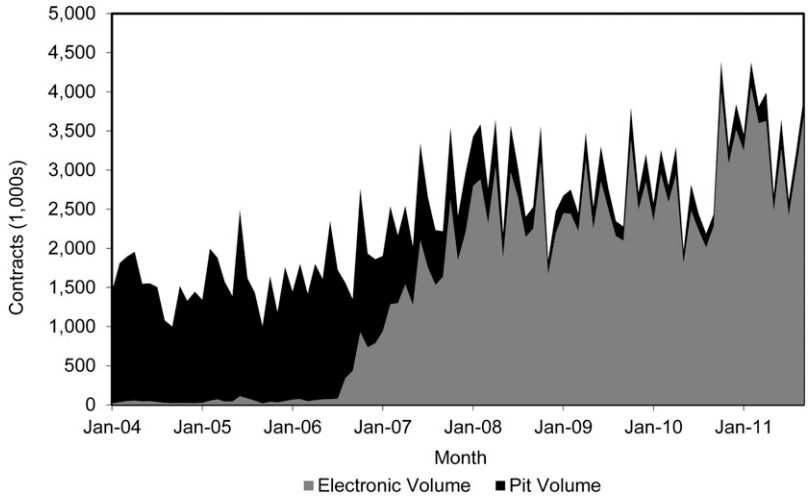

Figure 9. Monthly Trading Volume, Soybean Futures, Pit and Electronic, 2004–2011

of live cattle futures contracts traded in the pit declined to less than 20% by mid-2011. Lean hog futures show a similar rate of migration to the electronic platform (Figure 12 and Table 1).

It is clear that commodity futures markets underwent a fairly dramatic shift in 2006–2008 as a 150-year old trading mechanism (open outcry pit trading) was largely replaced by an electronic order routing and matching engine. The historic change in how trades were executed certainly could have contributed to the increased trading activity. Moreover, electronic trading may have had a considerable influence on market performance as trading costs likely fell and information transmission improved.

Shah and Brorsen (2011) find that in a side-by-side comparison electronic order matching at the Kansas City Board of Trade has considerably lower liquidity costs compared with open outcry (floor) trading. Frank and Garcia (2011) find that livestock futures markets also benefited from lower liquidity costs with electronic trading. Studies in financial futures markets suggest that electronic trading can improve efficiency and information transmission (Ates and Wang, 2005). Moreover, with the lower cost structure

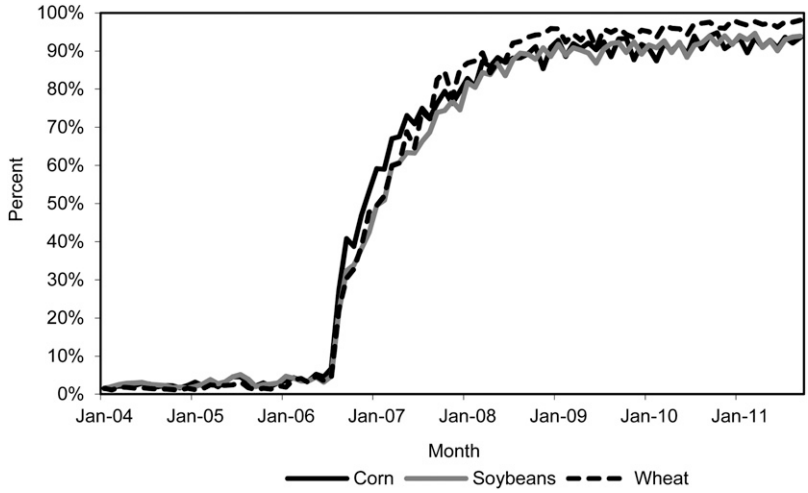

Figure 10. Percent of Futures Volume Transacted on Electronic Platform, Grains, 2004–2011

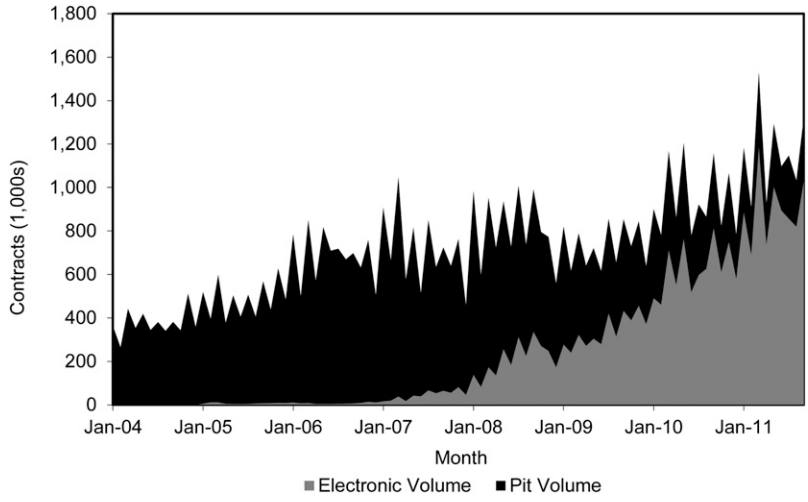

Figure 11. Monthly Trading Volume, Live Cattle Futures, Pit and Electronic, 2004–2011

inherent in electronic trading, brokerage commissions associated with trading have declined. In the early 2000s, broker commissions from "discount" brokers were as high as $50 per round turn (buy and sell). Now, fully electronic brokers offer commissions well under $10 per round turn.

Collectively, the move to electronic trading lowered trading costs (liquidity and commission), and as a result, likely improved information flow. Furthermore, it is possible that overall market efficiency improved, bid-ask spreads narrowed, and the commodity futures markets may have been more fully integrated with other markets, including financial markets.

Market Access

Access to futures markets improved dramatically as the trade shifted to an electronic platform. The improved market access stems from two sources. First, the combination of a revolutionary improvement in communication tools (software and hardware) and the rise of electronic trading allowed much easier and direct access to the markets. A potential market

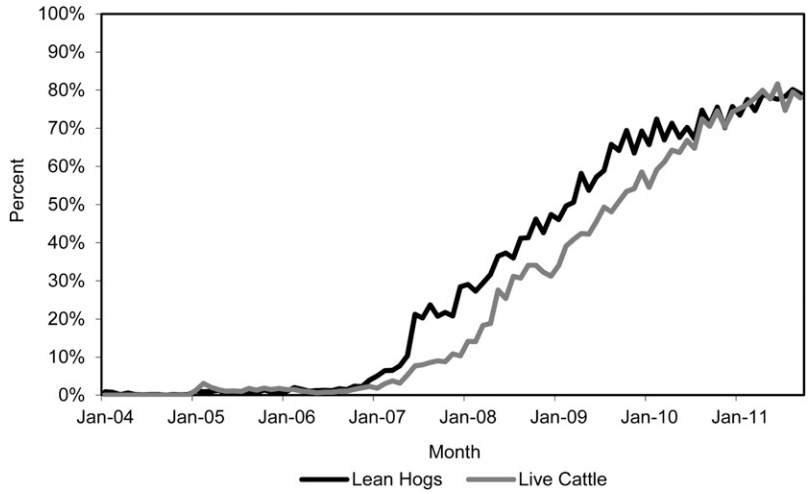

Figure 12. Percent of Futures Volume Transacted on Electronic Platform, Livestock, 2004–2011

participant can open a futures account, deposit and withdraw funds, and trade without ever talking to a broker. Moreover, electronic trading interfaces can be accessed on mobile devices, which allow 24-hour access to electronic markets that are open nearly 24 hours per day. New market participants, both domestically and internationally, have visibility of the trading book (bid, offer, and quantity) and receive nearly instant feedback on trade execution. The degree of market transparency and access far exceeds that available under the older broker-based open outcry system. Ease of access at lower cost likely encouraged new participants to enter the market, spawned greater trading by existing participants, and led to potentially more arbitrage-style computer-generated trading.

Second, financial tools were developed that provided easy, but indirect, access to the commodity futures markets. While technological innovation increased direct access to the futures markets, financial innovation provided indirect avenues to participate in commodity futures markets. Specifically, financial instruments were developed by investment banks that gave indirect exposure to a specific commodity futures market or groups of futures markets. Of the exchange traded products (ETPs), the most common forms are exchange traded funds (ETFs).

ETFs are investment companies that are legally classified as open-end companies. The companies initially sell creation units to a financial institution (e.g., Barclays). The financial institution pays for those creation units with securities that mirror the portfolio that the ETF wishes to target. Then, the financial institution essentially sells shares of the creation units in the secondary market, which are the ETF shares available to retail investors. Another common ETP is exchange traded notes (ETNs). ETNs are similar to ETFs, except the financial institution is selling a debt instrument in the secondary market where the pay-out is indexed to the security bundle being tracked.[5] Regardless of the financial structure, the ETPs share a common goal, which is to provide retail and institutional investors a pay-off tied to the underlying commodity futures market(s).

As an example, the Teucrium Corn Fund (symbol: CORN) is an ETF that tracks corn futures prices. The creation units for this fund are essentially backed by positions in the three front month corn futures contracts. According to the database ETFdb.com, the fund had a notional investment of $107 million on October 20, 2011, which would equate to approximately 3,242 corn futures contracts at a price of $6.60 per bushel.[6] A less focused ETF is the PowerShares DB Agricultural Fund (symbol: DBA), which holds a portfolio of agricultural commodity futures contracts. On October 20, 2011, DBA held $2.6 billion in assets with an average daily trading volume of 1.5 million shares. DBA allocates 9.4% of the investment funds to corn futures contracts representing approximately 7,406 contracts. In total, the ETFdb.com database lists 27 ETFs that are focused on agricultural commodities with a combined notional value of nearly $3.6 billion (Table 2).

Beyond the ETPs that focus on agricultural commodities, there are also broader based ETPs that mirror popular commodity indices such as the Standard and Poor's Goldman Sachs Commodity Index™ (S&P GSCI) (Table 3). These ETPs are often heavily weighted toward energy and metals markets; however, their sheer size results in relatively large holdings in agricultural commodities. As an example, the PowerShares DB Commodity Index Tracking Fund (symbol: DBC) has $5.5 billion under management. So, even with just 4.03% allocated to corn futures, the resulting position is equivalent to 7,167 contracts.

Importantly, ETPs provide a tool by which retail and institutional investors can essentially trade commodity futures markets as though they are equities. This is sometimes referred to as the securitization or equitization of commodity futures. A retail investor with a standard stock account (e.g., Charles Schwab) can essentially

[5] For a full discussion of exchange traded products see the U.S. Securities and Exchange Commission website: http://www.sec.gov/answers/etf.htm.

[6] See http://dbfunds.db.com/Notes/Agriculture/index.aspx for full details.

Table 2. Exchange Traded Products Tracking Agricultural Commodities

Symbol	Name	Assets ($1,000s)	Volume (shares)
DBA	PowerShares Deutsche Bank Agriculture Fund	2,560,550	1,729,900
JJG	iPath Exchange Traded Notes Dow Jones – American International Group Grains Total Return Sub-Index Exchange Traded Note Series A	226,785	152,556
JJA	iPath Exchange Traded Notes Dow Jones – American International Group Agriculture Total Return Sub-Index Exchange Traded Note Series A	155,940	48,656
CORN	Teucrium Corn Fund	107,075	130,840
COW	Dow Jones-UBS Livestock Subindex Total Return	96,065	71,827
SGG	iPath Dow Jones-American International Group Sugar Total Return Sub-Index Exchange Traded Note	68,099	49,994
BAL	iPath Dow Jones-American International Group Cotton Total Return Sub-Index Exchange Traded Note	65,262	81,865
RJA	Elements Exchange Traded Notes Rogers International Commodity Index – Agriculture Total Return	49,549	616,836
FUD	UBS E-TRACS Constant Maturity Commodity Index Food Total Return Exchange Traded Note	45,275	11,165
JJS	iPath Dow Jones-American International Group Softs Total Return Sub-Index Exchange Traded Note	36,446	534
JO	iPath Dow Jones-American International Group Coffee Total Return Sub-Index Exchange Traded Note	30,456	42,836
GRU	ELEMENTS Exchange Traded Notes Merrill Lynch Commodity Index eXtra Grains Index-Total Return	19,031	72,150
SGAR	iPath Pure Beta Sugar	14,543	5,666
NIB	iPath Dow Jones-American International Group Cocoa Total Return Sub-Index Exchange Traded Note	14,327	16,531
UAG	UBS E-TRACS Constant Maturity Commodity Index Agriculture Total Return Exchange Traded Note	14,250	6,154
AGF	Deutsche Bank Agriculture Long Exchange Traded Note	11,057	7,238
WEET	iPath Pure Beta Grains	7,853	2,648
LSTK	iPath Pure Beta Livestock	7,579	3,407
CAFE	iPath Pure Beta Coffee	7,331	2,781
GRWN	iPath Pure Beta Softs	6,843	2,198
DIRT	iPath Pure Beta Agriculture	6,547	1,863
CTNN	iPath Pure Beta Cotton	6,205	1,645
UBC	UBS E-TRACS Constant Maturity Commodity Index Livestock Total Return Exchange Traded Note	5,159	1,258
CHOC	iPath Pure Beta Cocoa	4,382	2,215
CANE	Teucrium Sugar Fund	2,615	n/a
SOYB	Teucrium Soybean Fund	2,294	n/a
WEAT	Teucrium Wheat Fund	2,282	n/a
	Total	3,573,800	

trade corn futures in that account by trading the Teucrium Corn Fund (CORN). Likewise, an institution that is not permitted in their by-laws to hold derivatives positions may be able to gain exposure to agricultural futures by trading in the PowerShares DB Agricultural Fund. The development of these exchange-traded instruments has provided market access to a segment

Table 3. Exchange Traded Products Tracking Broad Commodity Indices

Symbol	Name	Assets ($1,000s)	Volume (shares)
DBC	PowerShares Deutsche Bank Commodity Index Tracking Fund	5,545,984	2,909,512
DJP	iPath Exchange Traded Notes Dow Jones – American International Group Commodity Index Total Return Medium-Term Notes Series	2,485,630	401,286
GSG	iShares Goldman Sachs Commodity Index Commodity-Indexed Trust	1,334,946	357,573
RJI	Elements Exchange Traded Notes Rogers International Commodity Index – Total Return	649,226	620,054
GCC	GreenHaven Continuous Commodity Index Fund	609,792	208,982
USCI	United States Commodity Index Fund	421,383	65,953
UCI	UBS E-TRACS Constant Maturity Commodity Index Total Return Exchange Traded Note	126,997	36,727
GSP	iPath Standard & Poor's Goldman Sachs Commodity Index Total Return Index Exchange Traded Note	110,174	32,998
GSC	Goldman Sachs Connect Standard & Poor's Goldman Sachs Commodity Index Enhanced Commodity Total Return Strategy Index Exchange Traded Note	70,325	17,097
DJCI	UBS E-TRACS Dow Jones-UBS Commodity Index Total Return Exchange Traded Note	22,653	3,785
BCM	iPath Pure Beta Broad Commodity	10,125	2,237
DPU	Deutsche Bank Commodity Long Exchange Traded Note	6,624	3,123
SBV	iPath Pure Beta Standard & Poor's Goldman Sachs Commodity Index-Weighted	5,075	1,667
GRN	iPath Global Carbon Exchange Traded Note	1,592	591
	Total	11,400,526	

of traders that might have otherwise been prohibited or at least reluctant to participate.[7]

It is important to note that not all ETP positions result in long futures positions. Indeed, investors can sell short ETPs in their stock accounts (subject to the standard rules on short selling). Also, a number of reverse or inverse ETPs exist where the creation units are funded by short positions in the tracked market (Table 4). Inverse ETPs are still a small, but growing, part of the ETP universe. As an example, the PowerShares DB Agriculture Short ETN (symbol: ADZ) indexes to a basket of agricultural futures markets such that the share price increases when commodity prices decline. So, an investor can easily go short commodities by simply purchasing one of these "inverse" ETPs within their traditional stock account. The issuing financial institution will maintain a zero net exposure by taking the same position in the underlying futures markets. It follows that if retail investors are net buyers of a long ETP, it forces the institution to be a net buyer in the underlying futures. Likewise, if retail investors buy an inverse ETP, then the issuing institution must sell the underlying futures. Therefore, the information underlying the buying or selling of commodity ETPs is ultimately transmitted to the underlying commodity futures market.

Passive Investment

Several academic studies published over 2004–2007 touted futures market portfolios as viable alternative investments. Key among these studies were Gorton and Rouwenhorst (2006) and

[7] A few cynical market participants have suggested that commodity ETFs are a favorite of traditional stock brokers because they generate considerable brokerage fees and allow customers access to commodity futures markets without the customer needing to open a separate brokerage account with a potential brokerage competitor.

Table 4. Inverse or Short Exchange Traded Products

Symbol	Name	Assets ($1,000s)	Volume (shares)
DGZ	Deutsche Bank Gold Short Exchange Traded Note	25,564	370,490
DNO	U.S. Short Oil Fund	16,440	28,183
SZO	PowerShares Deutsche Bank Crude Oil Short Exchange Traded Note	13,485	17,038
BOS	PowerShares Deutsche Bank Base Metals Short Exchange Traded Note	3,655	23,565
PTD	UBS E-TRACS Constant Maturity Commodity Index Short Platinum Excess Return Exchange Traded Note	3,428	823
ADZ	Deutsche Bank Agriculture Short Exchange Traded Note	2,275	5,612
DDP	Deutsche Bank Commodity Short Exchange Traded Note	1,325	15,178
	Total	66,172	

Erb and Harvey (2006), which claimed equity-like returns to portfolios of commodity futures. These studies also highlighted the diversification benefits relative to traditional asset classes. This academic stamp of approval helped to spur a movement among institutions and pension plans to allocate investment dollars to commodity futures markets. Barclays reports nearly $400 billion had flowed into commodity-linked investments by early 2011. More dollars are expected to flow into the commodity markets as pension funds increase their allocation to commodity futures markets. For instance, the California State Teachers Retirement System (CALPERS) added nearly $2.5 billion to their commodity allocation in 2010 and other institutions are expected to follow suit (Krishnan and Sheppard, 2010). While these numbers sound large in absolute terms, they represent a fairly small allocation for pension plans. For instance, CALPERS targets a 1% commodity allocation to the S&P-GSCI linked investments, with a permissible range of 0.5–3.0%. Pension plans purportedly view these investments as providing an inflation hedge and diversification against their core portfolios of equities and fixed-income investments.

Institutional holdings of commodity-linked investments are most likely to occur through swap agreements with a major financial institution. For instance, CALPERS may simply enter a swap agreement with a major bank where the swap is indexed to the S&P GSCI. However, some institutional money may flow directly into futures positions, ETPs, or traditional open-ended mutual funds. For example, PIMCO's Commodity Real Return Strategy Fund is an open-ended mutual fund that offers institutional shares that requires a million dollar minimum investment. Morningstar reports that this fund has $22.8 billion under management as of October 20, 2011.[8]

In contrast to ETPs, where the funds are often actively traded over relatively short horizons, commodity holdings by institutions and pension funds are generally passive in nature. While there are periodic inflows and outflows for portfolio rebalancing and allocation purposes, the positions generally follow an indexing approach with no active management (in the trading sense). Moreover, passive investments by institutions are long-only. The rather mundane buy-and-hold strategy pursued by most passive commodity investments is important to understanding potential impacts on the market.

Trends in Market Composition

With greater market access, passive investments, and new tools to access the futures market, it is not surprising that the mix of market participants has changed as well. The only publically-available data on the changing makeup of market participants is provided by the Commodity Futures Trading Commission's (CFTC) *Commitment of Traders* (COT) report. This report comes in different formats that provide somewhat different views of the trader groups

[8] See http://etfs.morningstar.com/quote?t=dba for full details.

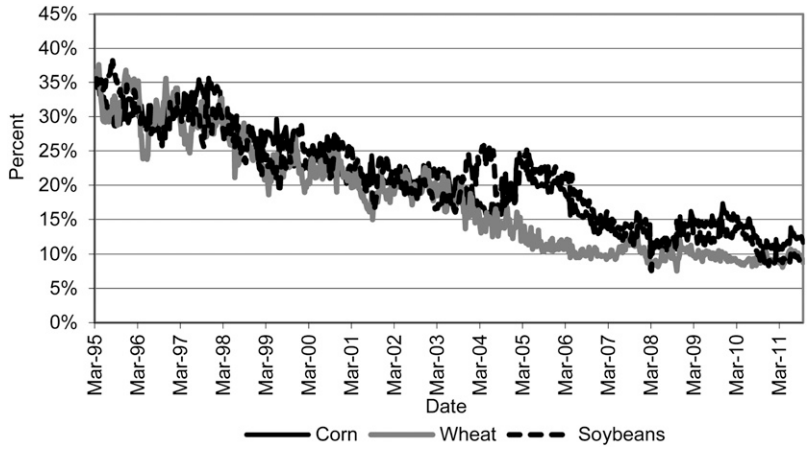

Figure 13. Non-Reporting Traders Percent of Total Open Interest, Grains, 1995–2011

holding reportable positions within commodity futures markets (Irwin and Sanders, 2012).

The legacy COT report breaks down open interest into reporting commercial and non-commercial traders as well as non-reporting traders. The imprecise definitions surrounding commercial and noncommercial classifications are well known and make these particular classifications problematic when analyzing changing market participation (Ederington and Lee, 2002; Sanders, Boris, and Manfredo, 2004; Sanders, Irwin, and Merrin, 2010). The non-reporting segment—traders with positions less than the predetermined reporting level—is also a mix of trading motives. But, it may provide a window on the relative activity of non-professional speculators and small commercial hedgers.

As shown in Figures 13 and 14, the role of non-reporting traders in the commodity futures markets has been on a consistent downward trend (Table 5). In the grain futures markets (Figure 13), non-reporting traders comprised as much as 35% of open interest in the soybean, corn, and wheat futures markets in 1995. By 2011, these "small" traders were only 10% of the participators in these same markets. Livestock futures tell a similar story (Figure 14). Nearly 50% of the open interest in live cattle and lean hog futures and options markets were held by non-reporting traders in 1995. That percentage has declined markedly and now

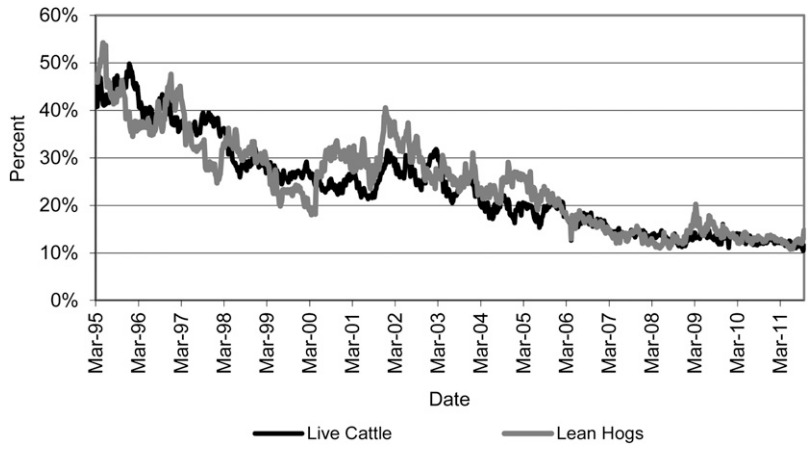

Figure 14. Non-Reporting Traders Percent of Total Open Interest, Livestock, 1995–2011

Table 5. Percent of Total Open Interest by Trader Category, 2004–2011

Time Period	Index Traders (%)	Processors and Merchants (%)	Swap Dealers (%)	Managed Money (%)	Other Reportables (%)	Non-reporting Traders (%)
Panel A: Corn						
Jan 2004–May 2005	11.1					18.9
June 2006–Dec 2008	11.6	33.4	12.5	15.3	25.5	13.4
Jan 2009–Oct 2011	15.0	29.0	15.1	18.2	24.3	13.4
Panel B: Soybeans						
Jan 2004–May 2005	9.5					21.8
June 2006–Dec 2008	13.1	31.6	13.1	18.3	23.0	14.0
Jan 2009–Oct 2011	15.3	30.4	14.9	19.3	24.1	11.4
Panel C: Wheat						
Jan 2004–May 2005	20.5					13.0
June 2006–Dec 2008	21.9	24.0	21.9	22.3	21.7	10.1
Jan 2009–Oct 2011	24.7	22.9	24.3	21.1	22.3	9.5
Panel D: Live cattle						
Jan 2004–May 2005						19.4
June 2006–Dec 2008	21.0	26.4	18.8	24.4	16.0	14.5
Jan 2009–Oct 2011	17.7	27.3	15.3	25.7	19.0	12.7
Panel E: Lean hogs						
Jan 2004–May 2005						22.6
June 2006–Dec 2008	22.0	26.4	19.3	22.1	18.3	14.0
Jan 2009–Oct 2011	20.2	25.2	17.1	23.8	20.2	13.7

Note: The time periods are arranged to reflect the starting point for the *Disaggregated COT* reports.
The index trader positions are from the *Supplemental COT* reports. The data are not mutually exclusive between the index traders and the other categories.

hovers at just over 10%. In recent years, this trend could be an artifact of static reporting levels in a growing marketplace. But the trend has been in place since the early 1990s, well before the rapid growth documented in Table 1. Within the commodity futures markets, this is one of the clearest trends–the relative importance of non-reporting or small traders has diminished markedly over the last decade.

The decline in the relative size of non-reporting traders could suggest that other groups have grown in relative importance. However, the trends among reporting trader groups do not clearly suggest that any single category has grown in importance. The best data to view in this regard is the CFTC's *Disaggregated COT* report. In this report, the commercial category is further subdivided into processors/merchants and swap dealers while the noncommercial category is split into money managers and other reportables (not captured in the other groups).

Figures 15 and 16 show the trends in these groups' percent of total open interest since June 2006 (when the data became available) for two representative markets. In Figure 15, the market composition for soybeans is shown. Although the percent of reporting open interest does fluctuate some across the groups, there is not a clear trend for a single group either markedly increasing or decreasing as a percent of open interest. There does appear to be some increase in swap dealer size in soybeans over this interval, but on the flipside, swap dealers' percent of lean hog open interest declines modestly (Figure 16). Overall, there is not a clear increase or decrease in the relative size of a particular trading group (Table 5). The decline in the relative importance of non-reporting traders is mostly attributed to a fairly steady absolute level of open interest for this group while the overall size of the marketplace increased.

Finally, the CFTC provides a glimpse of the size of index fund positions emanating from passive investments as well as ETPs in their *Supplemental COT* (SCOT). Irwin and Sanders (2012) have shown that the SCOT report provides

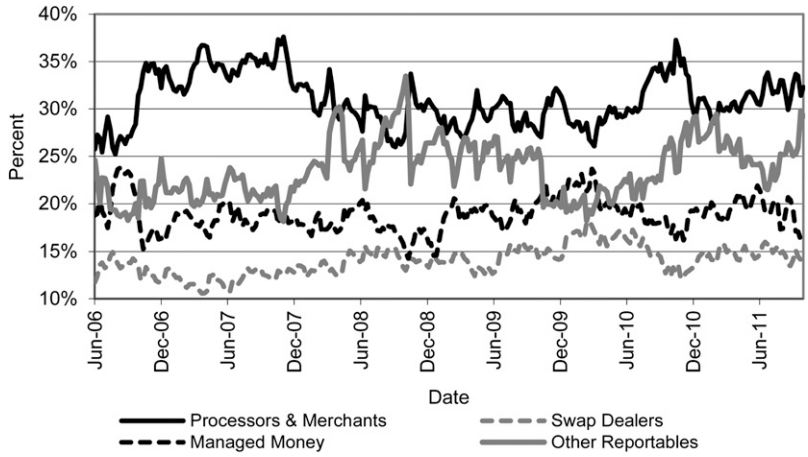

Figure 15. Soybean Futures, Trader Composition, 2006–2011

reasonable estimates of index positions for the 12 agricultural commodities covered in the report. Public data for all 12 commodities are available beginning in 2006 and data for corn, wheat, and soybeans for the period from 2004–2006 were provided by the CFTC.

Not surprisingly, the participation in these commodity futures markets by CFTC designated index traders has increased over time. Figure 17 shows the percent of total open interest (long + short positions) held by index traders from 2004 through 2011 for corn, soybean, and wheat futures markets.[9] As documented by Sanders and Irwin (2011a), the initial increase in index trader participation was from 2004 through early 2006. For example, index traders held less than 5% of the open interest in soybeans in early 2004, but that share increased to over 15% by the end of 2005. The corn market shows a similar increase, and both corn and soybean index traders have stabilized at around 15% of the market since hitting that level in 2005. The wheat market displays the same rapid increase in positions through 2004–2005, but the wheat share has stabilized at a higher level of around 25%. Importantly, the participation of index funds has been fairly steady since the relative peaks reached in late 2005.

Unfortunately, the livestock commodity index data are not available prior to 2006. So, the initial increase in index positions is not observable. Somewhat surprisingly, the lean hog data shows a mild decline in index participation from a high of 25% in 2006 and 2008 to a recent low of 15% (Figure 18). As shown in Table 5, index traders' share of live cattle open interest was 22% in 2006–2008 and declined to 20% in the 2009–2011. It appears that the initial increase in index trader positions in the livestock futures markets was likely at the same time as in grain futures (2004–2005), although the positions may have peaked a bit later. Both relative and absolute levels of long index positions peaked in the livestock futures markets in early 2008 and have since stabilized or even declined.

The view of market participants from the COT database is fairly limited due to the lack of data prior to 2006. However, the following conclusions can be reached based on the data that is available. First, the relative importance of small, non-reporting, traders has declined uniformly across the grain and livestock markets. In the 1990s these traders held as much as 50% of the open interest in some markets and that share declined to around 10% in recent years. Second, commodity index traders emerged as a major participant in these markets between

[9] Position data for 2004–2005 were prepared by the CFTC at the request of the U.S. Senate Permanent Subcommittee on Investigations (United States Senate/ Permanent Subcommittee on Investigation, 2009). We thank the staff of the subcommittee for allowing us to use this data.

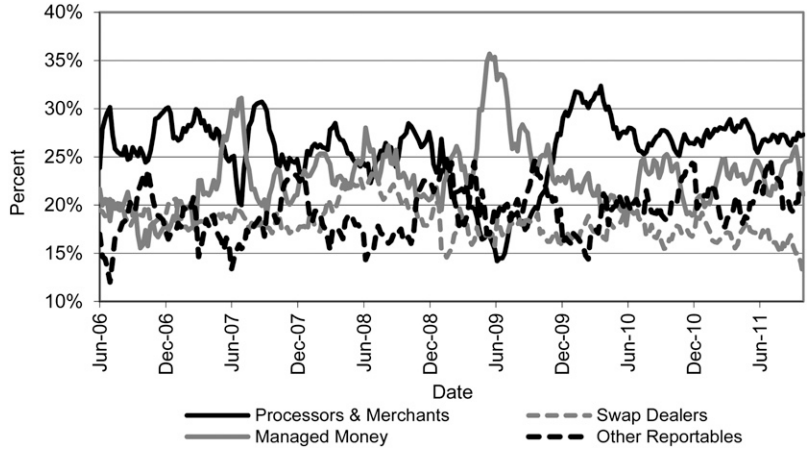

Figure 16. Lean Hog Futures, Trader Composition, 2006–2011

2004 and 2006. Index traders comprise approximately 15% of the total open interest in grain and livestock markets, except wheat where it is closer to 25%. For the 2006–2011 sample, there were no discernible trends in the relative importance of commercials (processors/merchants and swap dealers) or non-commercials (managed money and other reportables) in the markets examined.

It is also important to consider the number of traders and the average size of the reported positions by trader category. These data are compiled for two sub-periods (June 2006 to December 2008 and January 2009 to October 2011), reflecting the availability of the data and creating consistent samples across markets and measures. The data for long reporting traders are presented in Table 6 and short reporting traders are shown in Table 7. Importantly, the data are not mutually exclusive. The index trader data are embedded in the other categories because they are taken from different COT reports. Likewise, traders may appear in both Table 6 and Table 7 if they have reportable long and short positions.

In Table 6, it is clear that the largest positions are generally held by swap dealers. For example, in the corn market from June 2006 to December 2008 there were 19 swap dealers with reportable long positions averaging 19,139

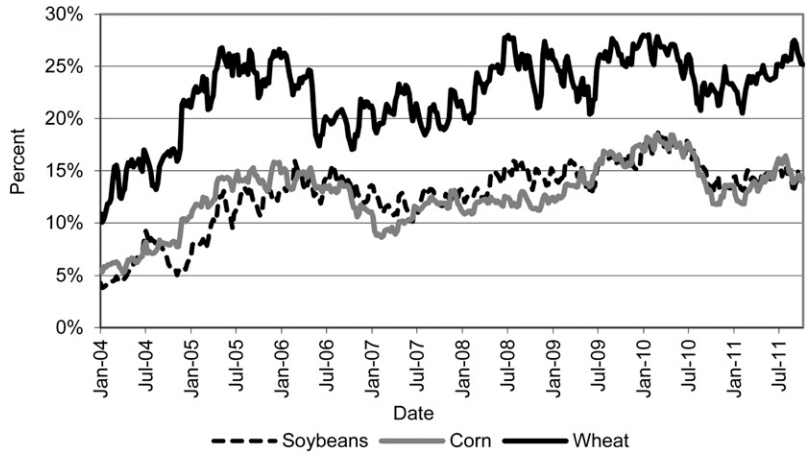

Figure 17. Index Traders Percent of Total Open Interest, Grains, 2004–2011

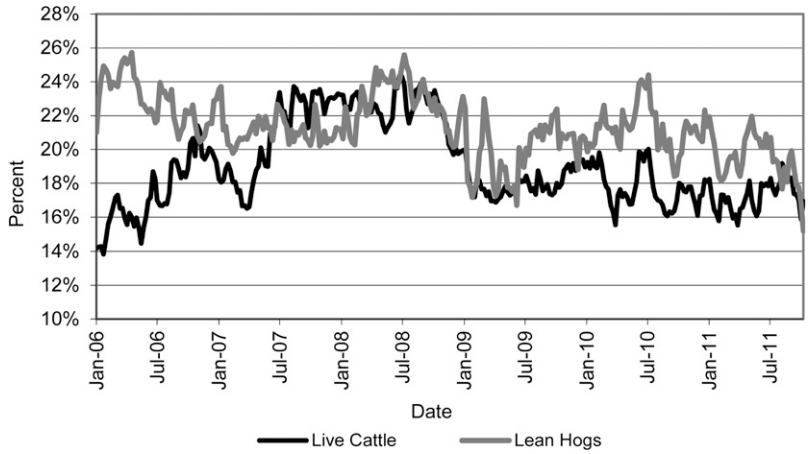

Figure 18. Index Traders Percent of Total Open Interest, Livestock, 2006–2011

contracts. In that same period, there were 25 index traders with an average long position of 15,998 contracts. While one cannot be certain, it is likely that of the 25 index traders, 19 of them are swap dealers and the other six are dispersed in the managed money and other reportables categories.

Within Table 6, a couple of trends are apparent. First, the number of index traders is fairly consistent at around 25. Second, the number of reportable swap dealers averages fewer than 20 traders. Third, each market increased the number of reportable index traders, swap dealers, and money managers across the subperiods—which could stem from either more participants or simply from fixed reporting thresholds in a growing marketplace. Fourth, the average position size held by swap dealers declined across the two time periods in each market.

Table 7 shows the number of traders with reportable short positions and the average size of those short positions across the same subperiods. For example, from January 2009 to October 2011, there was an average of 315 processors and merchants with reportable short positions holding 2,157 contracts in corn. Over the same time period, the number of reportable swap dealers was just seven but they had the largest average short position in the corn market at 3,900 contracts.

From Tables 6 and 7 a few observations are striking. First, the number of short index traders with reportable positions increased by at least three (live cattle) to as much as six (soybeans, corn, and wheat) across the sub-periods and the average position size held increased. This is consistent with Table 4 and the increase in inverse ETPs. Second, the number of swap dealers also increased in each market, except for lean hogs where there was a notable absence of reporting short positions held by swap dealers. Third, there are fewer reportable short index traders and swap dealers across all markets and time periods than there are with reportable long positions. This is consistent with the notion that these traders are primarily representing long-only index investments in the agricultural markets. Finally, reportable processors and merchants are more prominent on the short side of the market, consistent with classical short hedging by producers.

Clearly, the commodity futures markets have undergone a sea change over the last decade. Trading volume and open interest increased dramatically beginning in 2004 and continues to increase. Undoubtedly, part of the increase in trading activity is linked to the emergence of passive index investments, which also increased markedly from 2004 through 2006. However, trade interest also benefited from a more efficient electronic trading platform that lowered brokerage and liquidity costs at approximately the same time. Electronic trading and subsequent declines in trading costs

Table 6. Number of Long Reporting Traders and Position Size, 2004–2011

Time Period	Index Traders	Processors and Merchants	Swap Dealers	Managed Money	Other Reportables
			Number of traders		
Panel A: Corn			Position size		
June 2006–Dec 2008	25	271	19	95	115
	15,998	1,423	19,139	2,301	541
Jan 2009–Oct 2011	28	225	21	100	116
	15,720	1,309	15,216	540	609
Panel B: Soybeans					
June 2006–Dec 2008	25	107	17	82	74
	6,047	1,010	7,974	1,102	224
Jan 2009–Oct 2011	27	98	21	90	82
	6,800	1,171	6,437	1,179	284
Panel C: Wheat					
June 2006–Dec 2008	25	61	16	59	48
	8,095	839	10,803	1,170	264
Jan 2009–Oct 2011	29	64	19	59	64
	7,713	858	9,076	1,156	264
Panel D: Live cattle					
June 2006–Dec 2008	24	75	15	60	32
	4,825	369	6,438	954	331
Jan 2009–Oct 2011	26	80	19	85	39
	4,916	453	5,346	1,090	273
Panel E: Lean hogs					
June 2006–Dec 2008	22	24	15	42	28
	4,011	783	5,359	710	367
Jan 2009–Oct 2011	24	35	17	57	31
	3,595	478	4,005	718	265

Note: The time periods are arranged to reflect the starting point for the *Disaggregated COT* reports.
The index trader positions are from the *Supplemental COT* reports. The data are not mutually exclusive between the index traders and the other categories. The data are also not mutually exclusive between Tables 6 and 7, as a single trader can have both a reportable long and short position.

undoubtedly narrowed arbitrage bands and may have accelerated the use of computer-based or algorithmic trading strategies. Finally, market access was revolutionized by technological innovations (smart phones) and financial innovations (ETPs) that vastly broadened the scope of participation in these markets. It would be amazing if such tectonic shifts did not impact the rational pricing of risk, volatility, liquidity, and storage (spreads). However, it is much less clear if there should or would be an irrational re-pricing of the underlying commodity.

Market Impacts

Concerns about irrational pricing impacts have overwhelmingly focused on the positions of long-only passive investors (De Schutter, 2010; United States Senate/Permanent Subcommittee on Investigations, 2009). Hedge fund manager Michael W. Masters has led the charge that commodity index investment created a massive bubble in commodity futures prices. He has testified numerous times before the U.S. Congress and Commodity Futures Trading Commission with variations of the following argument:

> "Institutional Investors, with nearly $30 trillion in assets under management, have decided en masse to embrace commodities futures as an investable asset class. In the last five years, they have poured hundreds of billions of dollars into the commodities futures markets, a large fraction of which has gone

Table 7. Number of Short Reporting Traders and Position Size, 2004–2011

Time Period	Index Traders	Processors and Merchants	Swap Dealers	Managed Money	Other Reportables
			Number of traders		
Panel A: Corn			Position size		
June 2006–Dec 2008	13	339	3	34	109
	1,659	2,451	4,963	1,219	385
Jan 2009–Oct 2011	18	315	7	41	114
	3,262	2,157	3,900	1,465	414
Panel B: Soybeans					
June 2006–Dec 2008	10	158	4	28	78
	673	1,752	1,770	542	236
Jan 2009–Oct 2011	16	158	6	29	92
	1,374	1,854	1,519	637	226
Panel C: Wheat					
June 2006–Dec 2008	12	96	6	51	69
	1,319	1,983	2,386	896	290
Jan 2009–Oct 2011	18	91	9	67	77
	1,776	2,009	2,094	915	347
Panel D: Live Cattle					
June 2006–Dec 2008	5	136	4	42	27
	431	890	1,109	552	330
Jan 2009–Oct 2011	8	155	5	38	37
	475	1,045	1,066	583	258
Panel E: Lean Hogs					
June 2006–Dec 2008	4	44	0	39	31
	363	2,137	0	559	219
Jan 2009–Oct 2011	9	52	0	33	29
	453	1,853	0	513	271

Note: The time periods are arranged to reflect the starting point for the *Disaggregated COT* reports.
The index trader positions are from the *Supplemental COT* reports. The data are not mutually exclusive between the index traders and the other categories. The data are also not mutually exclusive between Tables 6 and 7, as a single trader can have both a reportable long and short position.

into energy futures. While individually these Investors are trying to do the right thing for their portfolios (and stakeholders), they are unaware that collectively they are having a massive impact on the futures markets that makes the Hunt brothers pale in comparison. In the last 4½ years assets allocated to commodity index replication trading strategies have grown from $13 billion in 2003 to $317 billion in July 2008. At the same time, the prices for the 25 commodities that make up these indices have risen by an average of over 200%. Today's commodities futures markets are excessively speculative, and the speculative position limits designed to protect the markets have been raised, or in some cases, eliminated. Congress must act to reestablish hard and fast position limits across all markets" (Masters and White, 2008, p. 1).

In essence, Masters argues that buy-side demand from index funds created a massive bubble in commodity futures prices, with the result that prices, and crude oil prices in particular, far exceeded fundamental values. Irwin and Sanders (2012) use the term "Masters hypothesis" as a short-hand label for this argument. Testing the validity of the Masters hypothesis is equivalent to testing for the irrational and harmful effects of financialization, so long as one limits the definition of financialization to the rise of index investment in commodity futures markets.

Given the ongoing world-wide debate about the market impact of passive investment, it is not surprising that a burgeoning number of studies have been completed on this topic. Some

studies find evidence that commodity index investment increased the level of commodity futures prices.[10] Gilbert (2009) reports evidence of a significant relationship between index fund trading activity and price changes in three commodity futures markets—crude oil, aluminum, and copper. He estimates the maximum impact of index funds in these markets to be a price increase of 15%. In subsequent work, Gilbert (2010) finds evidence of a significant relationship between index fund trading and food price changes. Singleton (2011) estimates a regression model of crude oil futures prices and finds that index investment flows are an important determinant of price changes along with several other conditioning variables. His estimates indicate that a one million contract increase in index fund positions in West Texas Intermediate (WTI) crude oil over the previous 13-week period results in a 0.272% increase in nearby crude oil futures prices in the next week.

Alternatively, Brunetti and Buyuksahin (2009) conduct a battery of Granger causality tests and do not find a statistical link between swap dealers positions (a proxy for commodity index fund positions) and subsequent price changes in the crude oil, natural gas, and corn futures markets. Stoll and Whaley (2010) also use a variety of tests, including Granger causality tests, and find no evidence that the position of commodity index traders increased prices in agricultural futures markets. Sanders and Irwin (2010, 2011a, b) report similar results for agricultural and energy futures markets. Buyuksahin and Harris (2011) do not find a statistical link between swap dealers positions and changes in crude oil futures prices. Irwin and Sanders (2012) use new data on the positions of index investors in a broad cross-section of commodity futures markets and also fail to find evidence of a link with price movements.

Irwin and Sanders (2011) survey this literature and conclude that the weight of the available empirical evidence tilts decisively against the Masters hypothesis. They argue that the data and methods used in studies that find evidence of a link between index positions and commodity futures price levels are subject to a number of important criticisms that limit the degree of confidence one can place in their results. In contrast, the results of the studies failing to find a link are robust across combined on- and off-exchange index fund positions, netted or non-netted swap dealer positions, and individual ETF positions, as well as a variety of statistical tests, sample periods, and time horizons. Since the linkage between the level of commodity futures prices and market positions of index funds should be clearly detectable in the data, Irwin and Sanders (2011) argue that no smoking gun has been found with regard to index investment causing a massive bubble.

While most of the attention has been riveted on whether passive index investment caused a massive bubble in commodity futures prices—the Masters hypothesis—other studies have examined rational impacts of structural changes over the last decade. These studies purport to focus on financialization but generally do not try to disentangle financialization from the other structural changes highlighted earlier in this article.

A first and obvious place that the structural changes may have changed rational pricing in commodity futures markets is risk premiums. The traditional Keynesian risk premium or normal backwardation theory predicts that hedgers pay speculators to shift the risk that they do not want to bear in the form of downward biased futures prices, that is, futures prices are systematically below the expected spot price. In this framework, the premium that accrues to the long positions of speculators is a cost associated with the short positions of hedgers. A more flexible version of theory allows for a time-varying risk premium (Bjornson and Carter, 1997; Carter, Rausser, and Schmitz, 1983; Cootner 1960), where the bias in futures prices changes in relation to the position of hedgers or financial market conditions. There is a long

[10] Other studies test for the existence of price bubbles (Einloth, 2009; Phillips and Yu, 2010) or investigate the general impact of speculation in the recent commodity price movements without directly testing for statistical linkages between index fund positions and price movements (Kilian and Murphy, 2010; Lombardi and Robays, 2011; Juvenal and Petrella, 2011). Conclusions are mixed as to whether a price bubble occurred or if speculation was a main driver of prices.

and vigorous debate in the literature about the existence and magnitude of risk premiums, but whatever the level, expanding market participation should decrease premiums, and hence, the cost of hedging (Hirshleifer, 1990). And there is indeed some evidence this happened during the last decade. Hamilton and Yu (2011) present evidence that risk premiums in crude oil futures declined sharply after 2005, coinciding with the increasing participation of passive index investors in the market.

A similar logic can be applied to the volatility of commodity futures prices. Increasing the risk-bearing capacity of the markets may result in reduced price volatility, with all else constant. Brunetti and Buyuksahin (2009) find that increasing swap dealer positions are significantly associated with subsequent drops in price volatility for crude oil and natural gas (but not corn) futures markets. Sanders and Irwin (2011b) report a consistent tendency of index trader positions leading reductions in market volatility across a number of position and volatility measures in 12 agricultural and two energy futures markets. The direction of the impact is routinely negative. However, they caution that while index positions lead to lower volatility in a statistical sense, it is possible that trader positions coincide with some other fundamental variable that is actually causing the lower market volatility. Irwin and Sanders (2012) find mixed evidence that index positions are associated with decreasing volatility.

Another potential avenue of rational impact is market integration. Tang and Xiong (2010) argue that commodity markets were not fully integrated with financial markets prior to the development of commodity index investments and, "The increasing presence of index investors in commodities markets precipitated a fundamental process of financialization amongst the commodities markets, through which commodity prices now become more correlated with the prices of financial assets and each other" (p. 2). The increased correlation, and hence, market integration, implies that commodity futures markets more efficiently reflect shocks to the general economy. Statistical tests confirm that the correlation of commodity futures returns with crude oil returns post-2004 is greater for commodities included in major commodity indices compared with commodities not included in the indices. Buyuksahin and Robe (2010, 2011) also find increasing correlation between commodity futures and financial returns but attribute the improvement in market integration to hedge funds rather than commodity index funds.

The final avenue of rational impact we will consider here is the market for storage. Classical economic writers such as Cootner (1961) and Weymar (1968) argued that the introduction of futures trading in a commodity market flattens the supply of storage curve because the activity of futures speculators increases risk-bearing capacity (similar to the arguments above for risk premiums and volatility). It could therefore be argued that the dramatic increase in futures market participation shifted the supply of storage curve to the right so that at any given level of demand for storage the price of storage (or cost of carry) was lower and inventory higher. Some have argued that the impact actually is better conceptualized as a rightward shift in the demand for storage. Todd Petzel, Chief Investment Officer for Offit Capital Advisors, makes the following interesting argument:

> "Seasoned observers of commodity markets know that as noncommercial participants enter a market, the opposite side is usually taken by a short-term liquidity provider, but the ultimate counterparty is likely to be a commercial. In the case of commodity index buyers, evidence suggests that the sellers are not typically other investors or leveraged speculators. Instead, they are owners of the physical commodity who are willing to sell into the futures market and either deliver at expiration or roll their hedge forward if the spread allows them to profit from continued storage. This activity is effectively creating synthetic long positions in the commodity for the index investor, matched against real inventories held by the shorts. We have seen high spot prices along with large inventories and strong positive carry relationships as a result of the expanded index activity over the last few years," (Petzel, 2009, pp. 8–9).

This discussion indicates one can construct a reasonable argument that financialization and

related structural changes increased or decreased the costs of carry in commodity futures markets.[11]

Several studies conduct empirical tests of the impact of passive index investment on the cost of carrying inventories. Spreads between prices for different futures contracts on the same date are examined because theory suggests these spreads provide efficient estimates of the cost of carry (Working, 1948, 1949).[12] Brunetti and Reiffen (2010), Irwin et al. (2011), and Garcia, Irwin, and Smith (2011) conduct various regression tests and do not find a systematic tendency for spreads in corn, soybean, and wheat futures to increase or decrease over time as commodity index positions increase. However, there is some evidence that index trading pushes out spreads during the narrow window when index positions are rolled from one nearby contract to the next. Mou (2010) finds that the rolling of positions by long-only index funds leads to a substantial expansion in spreads in energy and livestock futures markets, but more modest expansion in grain futures markets. Stoll and Whaley (2010) find evidence that spreads increase during roll windows for energy futures but not agricultural futures. Finally, Irwin et al. (2011) report that spreads for corn, soybean, and wheat futures increase during roll windows, but the increase is temporary as spreads quickly return to the level prevailing before the roll window.

In sum, the extant literature indicates that the irrational and harmful impacts of financialization and structural change in commodity futures markets over the last decade have been minimal. In particular, there is little evidence that passive index investment caused a massive bubble in commodity futures prices, and therefore, the Masters hypothesis has almost no empirical support. There is intriguing evidence of several other rational and beneficial impacts of the structural changes over the last decade. In particular, the expanding market participation may have decreased risk premiums, and hence, the cost of hedging, reduced price volatility, and better integrated commodity markets with financial markets. To date, there is only limited evidence that the changes have permanently impacted the market for storage.

Summary and Conclusions

Commodity futures and options markets began to grow rapidly around 2004 and continued to grow through 2011. For example, combined futures and option (delta-adjusted) open interest in Chicago Board of Trade soybeans was relatively stable at an average of 223,000 contracts from 1995–2002. By February 2008, open interest had built to a peak of 878,000 contracts and in February 2011 exceeded one million contracts. The growth was not isolated to just futures or just options. The share of total open interest held in the options market remained relatively stable for the grain markets. While there was an increase in the role of options in livestock futures markets, the increase was in the latter portion of the sample.

It is well known that greater trading volume can be associated with greater price volatility (Bessembinder and Seguin, 1993). There is no doubt that uncertainty has increased dramatically in commodity markets over the last decade and this has been an important contributor to the groundswell in trading volumes. There have also been several historically large structural changes during the same time period and these have also undoubtedly contributed to the increase in market activity.

The first structural change is the fairly dramatic shift in 2006–2008 from a primarily telephone/open outcry trading platform to a computer/electronic order matching platform. The historic change in how trades are executed certainly could have driven increased trading activity. Moreover, electronic trading may have had a considerable influence on market performance as trading costs likely fell and information transmission improved.

[11] Buyuksahin et al. (2008) show that the linkages between nearby and deferred crude oil futures contracts increased from 2001–2004. However, it is not clear if this was due to greater liquidity in deferred contracts or changes in the storage market and cost of carry for crude oil.

[12] Garcia, Irwin, and Smith (2011) show the conditions under which this assumption may be violated.

The second structural change is that access to futures markets improved dramatically as the trade shifted to an electronic platform. A potential market participant can open a futures account, deposit and withdraw funds, and trade without ever talking to a broker. In parallel, new financial tools were developed that provided easy, but indirect, access to the commodity futures markets. While technological innovation increased direct access to the futures markets, financial innovation provided indirect avenues to participate in commodity futures markets. Specifically, financial instruments were developed by investment banks that gave indirect exposure to a specific commodity futures market or groups of futures markets. The most common form of the exchange traded products is the exchange-traded fund (ETF).

The third structural change is the entry of new financial participants in the commodity futures arena. Investments that track a commodity index have become an accepted alternative investment for institutions and pension funds. While there are periodic inflows and outflows for portfolio rebalancing and allocation purposes, these new types of positions generally follow an indexing approach with no active management (in the trading sense). Moreover, passive investments by institutions are long-only. Data from the Commodity Futures Trading Commission (CFTC) document the substantial increase in passive index positions in commodity futures markets. For example, index traders held less than 5% of total open interest (long + short) in soybeans in early 2004, but that share increased to over 15% by the end of 2005. The corn market shows a similar increase, and both corn and soybean index traders have stabilized at around 15% of the market since hitting that level in 2005. The wheat market displays the same rapid increase in positions through 2004–2005, but the wheat share has stabilized at a higher level of around 25%. Importantly, the participation of index funds has been fairly steady since the relative peaks reached in late 2005 and early 2006.

The available literature indicates that the irrational and harmful impacts of these structural changes in commodity futures markets over the last decade have been minimal. In particular, there is little evidence that passive index investment caused a massive bubble in commodity futures prices. There is intriguing evidence of several other rational and beneficial impacts of the structural changes over the last decade. In particular, the expanding market participation may have decreased risk premiums, and hence, the cost of hedging, reduced price volatility, and better integrated commodity markets with financial markets.

References

Ates, A., and G.H.K. Wang. "Information Transmission in Electronic Versus Open-Outcry Trading Systems: An Analysis of U.S. Equity Index Futures Markets." *Journal of Futures Markets* 25(2005):679–715.

Bessembinder, H., and P.J. Seguin. "Price Volatility, Trading Volume, and Market Depth: Evidence from Futures Markets." *Journal of Financial and Quantitative Analysis* 28(1993): 21–39.

Bjornson, B., and C.A. Carter. "New Evidence on Agricultural Commodity Return Performance under Time-Varying Risk." *American Journal of Agricultural Economics* 79(1997):918–30.

Brunetti, C., and B. Buyuksahin. "Is Speculation Destabilizing?" Working Paper. Carey Business School, Johns Hopkins University, 2009.

Brunetti, C., and D. Reiffen. "Commodity Index Trading and Hedging Costs." Working Paper. Carey Business School, Johns Hopkins University, 2010.

Buyuksahin, B., M.S. Haigh, J.H. Harris, J.A. Overdahl, and M. Robe. "Fundamentals, Trader Activity and Derivative Pricing." 2009 Bergen Meetings Paper. European Finance Association, 2008.

Buyuksahin, B., and J.H. Harris. "Do Speculators Drive Crude Oil Futures Prices?" *The Energy Journal (Cambridge, Mass.)* 32(2011):167–202.

Buyuksahin, B., and M.A. Robe. "Speculators, Commodities, and Cross-Market Linkages." Working Paper. U.S. Commodity Futures Trading Commission, 2010.

———. "Does 'Paper Oil' Matter? Energy Markets' Financialization and Equity-Commodity Co-Movements." Working Paper. U.S. Commodity Futures Trading Commission, 2011.

Carter, C.A., G.C. Rausser, and A. Schmitz. "Efficient Asset Portfolios and the Theory of

Normal Backwardation." *The Journal of Political Economy* 91(1983):319–31.

Cootner, P.H. "Common Elements in Futures Markets for Commodities and Bonds." *The American Economic Review* 51(1961):173–83.

———. "Returns to Speculators: Telser vs. Keynes." *The Journal of Political Economy* 68(1960):396–404.

De Schutter, O. "Food Commodities Speculation and Food Price Crises: Regulation to Reduce the Risks of Price Volatility." Briefing Note 02. United Nations Special Rapporteur on the Right to Food, 2010.

Domanski, D., and A. Heath. "Financial Investors and Commodity Markets." *Bank for International Settlements Quarterly Review* March(2007):53–67.

Ederington, L., and J.H. Lee. "Who Trades Futures and How: Evidence from the Heating Oil Market." *The Journal of Business* 75(2002): 353–73.

Einloth, J.T. "Speculation and Recent Volatility in the Price of Oil." Working Paper. Division of Insurance and Research, Federal Deposit Insurance Corporation, 2009.

Erb, C.B., and C.R. Harvey. "The Strategic and Tactical Value of Commodity Futures." *Financial Analysts Journal* 62(2006):69–97.

Frank, J., and P. Garcia. "Bid-Ask Spreads, Volume, and Volatility: Evidence from Livestock Markets." *American Journal of Agricultural Economics* 93(2011):209–25.

Garcia, P., S.H. Irwin, and A. Smith. "Futures Market Failure?" Working Paper. Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, 2011.

Gilbert, C.L. "How to Understand High Food Prices." *Journal of Agricultural Economics* 61(2010):398–425.

———. "Speculative Influences on Commodity Futures Prices, 2006–2008." Working Paper. Department of Economics, University of Trento, 2009.

Gorton, G.B., and K.G. Rouwenhorst. "Facts and Fantasies about Commodity Futures." *Financial Analysts Journal* 62(2006):47–68.

Hamilton, J.D., and J.C. Yu. "Risk Premia in Crude Oil Futures Prices." Working Paper. Department of Economics, University of California at San Diego, 2011.

Hirshleifer, D. "Hedging Pressure and Futures Price Movements in a General Equilibrium Model." *Econometrica: Journal of the Econometric Society* 58(1990):411–28.

Irwin, S.H., P. Garcia, D.L. Good, and E.L. Kunda. "Spreads and Non-Convergence in CBOT Corn, Soybean, and Wheat Futures: Are Index Funds to Blame?" *Applied Economic Perspectives and Policy* 33(2011):116–42.

Irwin, S.H., and D.R. Sanders. "Index Funds, Financialization, and Commodity Futures Markets." *Applied Economic Perspectives and Policy* 33(2011):1–31.

———. "Testing the Masters Hypothesis in Commodity Futures Markets." *Energy Economics* 34(2012):256–69.

Juvenal, L., and I. Petrella. "Speculation in the Oil Market." Working Paper 2011-027A. Federal Reserve Bank of St. Louis, 2011.

Kilian, L., and D. Murphy. "The Role of Inventories and Speculative Trading in the Global Market for Crude Oil." Working Paper. Department of Economics, University of Michigan, 2010.

Krishnan, B., and D. Sheppard. "Analysis: Commodities Supercycle? Pensions Loath to Commit." Reuters, October 13, 2010.

Lambert, E. *The Futures: The Rise of the Speculator and the Origins of the World's Biggest Markets*. Philadelphia, PA: Basic Books, 2010.

Lombardi, M.J., and I.N. Robays. "Do Financial Investors Destablize the Oil Price?" Working Paper Series No. 1346. European Central Bank, 2011.

Masters, M.W., and A.K. White. *The Accidental Hunt Brothers: How Institutional Investors are Driving Up Food and Energy Prices. Special Report*. 2008 Internet site: http://accidentalhuntbrothers.com/index.php?s=%22How+institutional+investors+are+driving+up+food+and+energy+prices%22 (Accessed October 11, 2011).

Mou, Y. "Limits to Arbitrage and Commodity Index Investment: Front-Running the Goldman Roll." Working Paper. Columbia School of Business, 2010.

Petzel, T.E. "Testimony before the Commodity Futures Trading Commission." July 28, 2009.

Phillips, P.C.B., and J. Yu. "Dating the Timeline of Financial Bubbles during the Subprime Crisis." Cowles Foundation Discussion Paper No. 1770. Yale University, 2010.

Sanders, D.R., K. Boris, and M. Manfredo. "Hedgers, Funds, and Small Speculators in the Energy Futures Markets: An Analysis of the CFTC's Commitments of Traders Reports." *Energy Economics* 26(2004):425–45.

Sanders, D.R., and S.H. Irwin. "A Speculative Bubble in Commodity Futures Prices? Cross-Sectional

Evidence." *Agricultural Economics* 41(2010): 25–32.

———. "New Evidence on the Impact of Index Funds in U.S. Grain Futures Markets." *Canadian Journal of Agricultural Economics* 59(2011a): 519–32.

———. "The Impact of Index Funds in Commodity Futures Markets: A Systems Approach." *Journal of Alternative Investments* 14(2011b): 40–49.

Sanders, D.R., S.H. Irwin, and R.P. Merrin. "The Adequacy of Speculation in Agricultural Futures Markets: Too Much of a Good Thing?" *Applied Economics Perspectives and Policy* 32(2010):77–94.

Shah, S., and B.W. Brorsen. "Electronic vs. Open Outcry: Side-by-Side Trading of KCBT Wheat Futures." *Journal of Agricultural and Resource Economics* 36(2011):48–62.

Singleton, K.J. "Investor Flows and the 2008 Boom/Bust in Oil Prices." Working paper. Graduate School of Business, Stanford University, 2011.

Stoll, H.R., and R.E. Whaley. "Commodity Index Investing and Commodity Futures Prices." *Journal of Applied Finance* 20(2010):7–46.

Tang, K., and W. Xiong. "Index Investing and the Financialization of Commodities." Working Paper. Department of Economics, Princeton University, 2010.

United States Senate, Permanent Subcommittee on Investigations (USS/PSI). *Excessive Speculation in the Wheat Market*. Washington, DC: U.S. Government Printing Office, 2009.

Weymar, F.H. *Dynamics of the World Cocoa Market*. Cambridge, MA: The M.I.T. Press, 1968.

Working, H. "Theory of Inverse Carrying Charge in Futures Markets." *Journal of Farm Economics* 30(1948):1–28.

———. "The Theory of Price of Storage." *The American Economic Review* 39(1949):1254–62.