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CME Group

Christal Lint
Director and Associate General Counsel
Legal Department

March 28, 2011

VIA E-MAIL

David Stawick
Secretary
Commodity Futures Trading Commission
Three Lafayette Center
1155 21st Street NW
Washington, DC 20581

Re: Position Limits for Derivatives (RIN 3038–AD15 and 3038 AD16) (Federal Register Vol. 76, No.17, Page 4752)

Dear Mr. David Stawick:

In addition to our comment letter dated March 28, 2011, we are submitting copies of studies and reports to be included in the Commission's official record on this important matter.

Sincerely,
/s/ Christal Lint

Enclosure

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Commodity Index Investing and Commodity Futures Prices

Hans R. Stoll and Robert E. Whaley

Recently, commodity index investing has come under attack. A Staff Report by the US Senate Permanent Subcommittee on Investigation (hereafter, the "subcommittee report") "...finds that there is significant and persuasive evidence to conclude that these commodity index traders, in the aggregate, were one of the major causes of 'unwarranted changes'—here increases—in the price of wheat futures contracts relative to the price of wheat in the cash market." The purpose of this study is to provide a comprehensive evaluation of whether commodity index investing is a disruptive force not only in the wheat futures market in particular but in the commodity futures market in general. We conclude that: a) commodity index investing is not speculation; b) commodity index rolls have little futures price impact, and inflows and outflows from commodity index investment do not cause futures prices to change, and, c) the failure of the wheat futures price to converge to the cash price at the contract's expiration has not undermined the futures contract's effectiveness as a risk management tool.

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Recently, commodity index investing has come under attack. A Staff Report by the US Senate Permanent Subcommittee on Investigation (hereafter, the "subcommittee report") "...finds that there is significant and persuasive evidence to conclude that these commodity index traders, in the aggregate, were one of the major causes of 'unwarranted changes'—here increases—in the price of wheat futures contracts relative to the price of wheat in the cash market." (See subcommittee report (2009, p.2). The purpose of this study is to provide a comprehensive evaluation of whether commodity index investing is a disruptive force not only in the wheat futures market in particular but in the commodity futures market in general.

The study has four main sections. In the first, we examine the practice of commodity index investing, beginning with an explanation of the economic rationale for including a commodity index investment in institutional portfolios such as those of pension funds and university endowments. The rationale is simple. The returns of commodity index investments are uncorrelated with the returns of traditional assets such as stocks and bonds, and, therefore, provide a significant opportunity to reduce the risk of traditional investment portfolios. This diversification opportunity together with the advent of deep and highly active commodity futures markets has led to considerable growth in commodity index investment over the past decade. Commodity index products have a variety of forms including managed funds, ETFs, ETNs, and OTC return swaps. Many are benchmarked to well-diversified and transparent commodity indexes like the Standard & Poor's-Goldman Sachs Commodity Index (S&P-GSCI) and the Dow Jones-UBS Commodity Index (DJ-UBSCI) and nearly all of them are based on

passive, long-only, fully collateralized commodity futures positions. Based on the composition of these indexes, CFTC Commitments of Traders (COT) Supplemental reports that include the positions of Commodity Index Traders (CIT), and futures prices from the respective exchanges, we estimate the total commodity index investment in the US is currently about $174 billion, which is roughly consistent with the CFTC (2008) estimate of $161 billion. About 24% of commodity index investors are index funds, 42% institutional traders, 9% Sovereign wealth funds, and 25% retail investors holding exchange-traded commodity index products.

The second section focuses on the general issue of whether commodity index investing "causes" futures price changes. Since commodity index investing involves a portfolio of commodities, we include a broad range of commodities in our analyses. Six analyses are performed. First, we examine the co-movements of futures prices for commodities known to be part of commodity index investing programs. Since the commodity index investing involves the simultaneous purchase of a portfolio of commodities, we should expect to see a high degree of contemporaneous correlation in futures price movements through time. Second, we examine the co-movements of futures prices known not to be part of commodity index investing programs. If non-index commodity futures prices behave like index commodity futures, commodity index investing is unlikely the cause. Third, we examine prices of five spot commodities that do not have futures contracts listed on them. Again, if spot commodities with no futures contracts and hence no involvement in commodity index investment programs have similar price behavior to index commodity futures, flows into commodity index investment portfolios are unlikely the cause. Fourth, we examine the impact of futures prices resulting from the periodic futures contract rolls that are necessary to mimic well-known commodity indexes such as the S&P-GSCI and DJ-UBSCI. In a roll month, the nearby futures contracts are sold and the second nearby contracts are purchased. If commodity index investing has futures price impact, the return of the second nearby futures contract should exceed the return of the nearby contract. Fifth, we examine whether the demand for long commodity index portfolios (measured by changes in open interest) "causes" futures prices to rise and vice versa. To test for causality, we examine whether weekly futures returns are related to lagged flows into commodity index investing. Sixth, we examine the contemporaneous relation between weekly futures returns and the flows of speculators and commodity index traders during periods when commodity index traders are known to be entering and exiting the market.

The third section focuses specifically on the Chicago Board of Trade's wheat futures contract market, which is at the heart of the subcommittee report analysis. We begin by showing how the definition of the basis used in the subcommittee report exaggerates the degree of divergence between the futures and cash prices. After correcting for the methodological problems, we show that the wheat futures price did not always converge in the 2006-2009 period, particularly in late 2008. We then go on to examine the CBT's wheat convergence over a longer period of time and show that wheat has failed to converge in periods when the amount of commodity index investing is known to be negligible. In addition, we examine the convergence behavior of the CBT's corn and soybean futures contracts over the same period and find that, while neither corn nor soybeans have had as great of divergence as wheat, grain commodity futures in general seem to experience convergence anomalies at the same points in time. Finally, we address the issue whether the failure of the wheat futures price to converge to the cash price has any meaningful economic consequences and show that the CBT's wheat futures remains an effective tool for managing the price risk of wheat.

In the fourth and final section, we summarize our main conclusions. In brief, we conclude: a) commodity index investment is not speculation, b) commodity index rolls have little futures price impact, and inflows and outflows from commodity index investment do not cause futures prices to change, and c) failure of the wheat futures price to converge to the cash price at the contract's expiration has not undermined the futures contract's effectiveness as a risk management tool.

I. Commodity Index Investing

Commodity index investing refers to the practice of buying baskets of commodities, albeit synthetically, to diversify an investment portfolio. The purpose of this section is to provide the backdrop for the analyses contained in the next two sections. This section has five parts. In the first, we provide the motives of commodity index investing. In the second, we discuss common forms in commodity index funds including managed funds, exchanged-traded funds and notes, as well as commodity return swaps. We also show how the demand for commodity index investment flows through to the commodity futures market. The third part then discusses two common benchmarks for commodity index portfolios. Just as the S&P 500 and Russell 1000 indexes serve as well-known benchmarks for the stock market, the S&P-GSCI and DJ-UBSCI serve as well-known benchmarks for the commodity market. These indexes also serve as reference assets in OTC commodity swaps. The fourth section describes in detail how we go about measuring the notional value of commodity index investing and the flow of funds into commodity index portfolios. The key source of data is the Commitment of Traders (COT) reports published

weekly by the CFTC. These data serve as the basis of our analysis in Sections II and III of this report. The final section describes the results of a special call survey of swap dealers and commodity index funds conducted by the CFTC in June 2008 to understand better the nature of commodity futures trading and, in a sense, audit the information provided in its weekly Supplemental reports.

A. Motives for Commodity Index Investing

Markowitz (1952), who is considered the father of "modern portfolio theory," developed a decision-making framework within which investors decide their investment portfolio allocations by considering the expected return and expected risks of all possible combinations of risky assets.[1] The investor's investment goal, he argues, is to identify the set of portfolios that maximize expected return for a given level of risk, so-called "efficient portfolios."[2] Then, based on the investor's risk tolerance, a particular portfolio with its unique set of allocation weights is chosen from the efficient set.

Traditionally, the investments considered by institutional investors included only stocks, bonds, and cash. The reason is, of course, that these asset classes had deep and liquid markets with relatively low trading costs. Over the decades since the inception of modern portfolio theory, trading costs in all markets including stocks and bonds fell, thereby promoting market liquidity and depth and the advent of so-called "alternative investments."

Traditionally, the investments considered by institutional investors included only stocks, bonds, and cash. The reason is, of course, that these asset classes had deep and liquid markets with relatively low trading costs. Over the decades since the inception of modern portfolio theory, trading costs in all markets including stocks and bonds fell, thereby promoting market liquidity and depth and the advent of so-called "alternative investments." One such alternative investment is physical commodities. Its appeal is driven not by the promise of high expected returns. Indeed, the expected return of this asset class is closely tied to the expected rate of inflation, which is not typically high. The primary advantage of including commodities in an investment portfolio is that commodity returns are relatively uncorrelated with the returns of traditional asset classes. The absence of correlation is attributable in part to inflation. During periods of rising inflation, traditional asset categories like stocks and bonds languish and perform poorly. Commodities, on the other hand, generally perform well. Increased demand for goods and services (i.e., rising inflation) usually implies increased demand for the commodities used in the production of those goods and services (i.e., commodity returns). In other words, holding commodities in an investment portfolio is risk-reducing, induced in part from the fact that a commodity futures position is an inflation hedge.[3]

B. Forms of Commodity Index Investing

Prior to the development of deep and liquid exchange-traded futures markets, physical commodities were seldom included in investment portfolios. The reason is simple. Physical commodities such as grain or crude oil are costly to buy and sell as well as store. After accounting for trading and storage costs, the expected returns from commodity investments were so low they outweighed the diversification benefits. What made commodity investment a viable asset class was the growth in trading volume of exchange-traded commodity futures contracts. During the period 1998 through 2007, the trading volume in exchange-traded commodity futures and futures options experienced a five-fold increase, with growth spread fairly uniformly across underlying asset categories.[4]

With deep and liquid commodity futures contracts, the returns of physical commodities can be generated synthetically. In place of buying a physical commodity such as wheat, we buy an equivalently-sized futures position and place the cash that we would have spent on the physical

[1] Based on this work, Markowitz received the Nobel prize in economics in the year 2000.

[2] The same set of portfolios is identified by minimizing risk for a given level of expected return.

[3] The diversification advantage of commodity investment is featured prominently in the promotional materials for commodity index funds. A description of PIMCO's Commodity Real Return Fund, for example, says "Because the performance of stocks and bonds can be affected by similar market factors, diversifying into non-correlated assets, or assets that have returns that are impacted by differing market factors such as commodities, may offset losses, hence reducing portfolio risk."

[4] See CFTC (2008, p.8).

commodity in money market instruments. In an efficiently-functioning marketplace, the rate of return and risk of the fully-collateralized futures position should be the same as the underlying commodity.

Trading commodity futures seems to have replaced one problem (i.e., the illiquidity and costs of trading in the commodity market directly) with another (i.e., most institutional investors do not have the sophisticated trading operations necessary to manage a diversified commodity index portfolio using futures contracts).[5] The solutions were twofold—commodity index funds and commodity return swaps. With commodity index funds, institutional investors pool their commodity investment with a single fund manager and the manager agrees to manage the portfolio in a manner that mimics a well-diversified commodity index portfolio benchmark. With OTC commodity return swaps, institutional investors do similarly by entering an agreement to receive the rate of return on a specified commodity index portfolio and posting the investment funds as collateral. In both cases, the investment is passive in the sense that there is no attempt to beat the market through market timing or identifying under-priced commodities. The trading rules for index replication are well-defined, with expiring futures contract positions rolled into new contract positions on a pre-determined basis. The specific allocations to the different commodity futures are also pre-determined, with the weights varying by the importance of the commodity in the marketplace (e.g., the physical production of the commodity) and the liquidity of the futures contracts written on the commodity. This practice has become known as commodity index trading although the expression is a misnomer. Trading carries with it a connotation of buying and selling of securities or commodities, hoping to make a quick profit. Given the buy-and-hold, fully-collateralized nature of this investment allocation, a more accurate term is commodity index investing.

Diversifying traditional investment portfolios with commodity investment has been practiced by large institutional investors such as pension funds and endowment funds for more than a decade, and the practice continues to grow. In recent years, an attempt has been made to capture the individual investor demand for commodity-like investment using exchange-traded funds and notes. Exchange-traded funds (ETFs) are like mutual fund shares that trade on a stock exchange and are structured in such a way that the price of the shares reflects the value of the index upon which it is based. Commodity-based exchange-traded notes (ETNs) are debt securities whose price is linked to an underlying index. On the maturity date of the note, the issuer of the note promises to pay the holder of each share of the note the value of a specified commodity index less a management fee.

Figure 1 is a schematic showing the relation between the institutional and individual demand for commodity index portfolios and the supply of commodity index portfolio replication contracts as provided by the commodity futures market. In general, institutions channel their commodity index investment to managed funds or OTC swap agreements. Individuals, on the other hand, generally have only exchange-traded commodity index products in their investment opportunity set. Managed funds, OTC swap dealers, and exchange-traded funds are then required to provide the return of a commodity index benchmark. The OTC dealer does so directly by buying commodity futures contracts to hedge its short commodity exposure. Managed funds and exchange-traded funds can, like the OTC swap dealer, synthetically replicate the returns of a commodity index using futures contracts, or they can simply enter into an agreement with a commodity swap dealer that provides such returns, whichever is cheaper. In the latter case, the swap dealer, again, hedges the demand from commodity funds directly in the futures market. The sizes of the leftmost and rightmost boxes in Figure 1 are identical. The demand for expected return/expected risk characteristics of commodity index portfolios equals the supply of those characteristics with fully-collateralized positions in the futures market. While the conduits for gathering the commodity exposure may vary, the effect is the same.

C. Commodity Index Portfolios

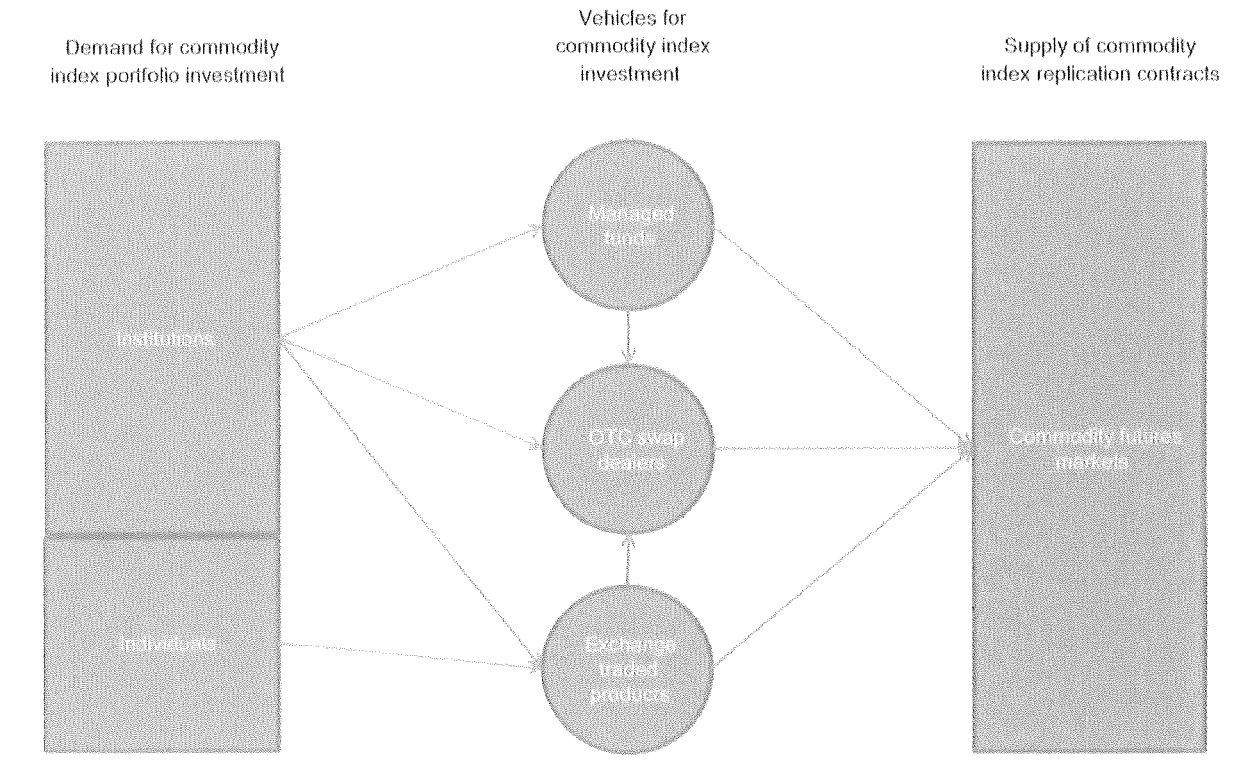
Up to this point, the term "commodity index portfolio" has been used in a generic sense. Over the past decade, two commodity indexes have emerged as industry benchmarks—the Standard and Poor's–Goldman Sachs Commodity Index (S&P-GSCI) and the Dow Jones–UBS Commodity Index (DJ-UBSCI).[6] The S&P-GSCI index is the oldest commodity index with its price levels dating back to August 1989. Its weights are determined on the basis of world production of the underlying commodities. Because the index is designed to be "tradable," futures markets representing each particular commodity are deep and liquid. Data for the DJ-UBSCI are available dating back to October 1991. Dow emphasizes the tradability of its index by placing higher weights on commodities with highly active futures markets. To avoid overexposure to any particular commodity, Dow limits sector investment to 33% of the index. Conversely, no commodity included in the index can constitute less than 2% of its market value.

[5] Indeed, many institutional traders are barred from trading futures contracts.

[6] This index was formerly known as the Dow Jones–AIG Commodity Index or DJ-AIGCI.

Figure 1. Schematic of the relation between the demand for commodity index portfolio products and the supply of commodity index replication contracts by the futures market.

The vehicles for commodity index investment include managed funds, OTC swaps, and exchange-traded products.



Both the S&P-GSCI and the DJ-UBSCI are reasonably well-diversified. Table 1 shows the market value weights of the commodities in the index as of July 2009. The S&P-GSCI weights are actual market value weights as of the close of trading on July 14, 2009. The DJ-UBSCI weights are the targets market value weights for the index set by Dow Jones at the beginning of the year. The S&P-GSCI has 24 different commodities included in it, compared to the DJ-UBSCI's 19. That is not to say that the S&P index is better diversified than the DJ index, however. Over the period January 3, 2000 through August 10, 2009, the annualized standard deviation of the daily total returns of the S&P-GSCI was 25.9%, compared with 17.8% for the DJ-UBSCI index. The reason is that the S&P-GSCI, as noted above, is production-weighted and therefore very heavily in the energy sector, with 68% of its market value coming from crude oil, crude oil products, and natural gas. The DJ-UBSCI, on the other hand, limits its exposure in any one commodity sector to 33%. The energy sector is the largest, and, as the table shows, is at its cap. Agricultural commodities such as grains and livestock account for nearly as large a portion at 29%. Differences in the weights assigned to each commodity make the indexes less than perfect substitutes. During the period January 3, 2000 through August 10, 2009, the correlation between their daily returns was 0.918. Also included in the table are the exchange where the specific commodity futures contracts used in the indexes are traded and the futures ticker symbol.

Unlike stock indexes whose membership stays relatively constant through time, the composition of commodity price indexes changes as futures contracts expire. Before this happens, the nearby futures contracts in a particular commodity are sold and more distant futures contracts are purchased. For the S&P-GSCI and DJ-UBSCI, the hedge roll period is defined as the fifth through ninth business days of a month. During this five-day "roll period," the index mechanically rolls from one contract to the next at a

Table I. Market Value Weights of the Commodities in the S&P-GSCI and DJ-UBSCI commodity indexes as of July 2009.

Sector	Commodity	Exchange	Ticker	S&P - GSCI	DJ - UBSCI
				Actual weights	Target weights
Agriculture	Cocoa	CSC	CC	0.40%	
Agriculture	Coffee "C"	CSC	KC	0.76%	2.97%
Agriculture	Corn	CBT	C	3.55%	5.72%
Agriculture	Cotton #2	NYC	CT	1.19%	2.27%
Agriculture	Wheat (Kansas)	KCBT	KW	0.82%	
Agriculture	Soybean oil	CBT	BO		2.88%
Agriculture	Soybeans	CBT	S	2.64%	7.60%
Agriculture	Sugar	CSC	SB	2.33%	2.99%
Agriculture	Wheat (Chicago)	CBT	W	3.90%	4.80%
Energy	Oil (Brent crude)	IPE	LO	13.25%	
Energy	Oil (WTI crude)	NYM	CL	37.51%	13.75%
Energy	Oil (GasOil)	IPE	QS	4.54%	
Energy	Oil (#2 Heating)	NYM	HO	4.19%	3.65%
Energy	Natural gas	NYM	NG	4.14%	11.89%
Energy	Oil (RBOB)[1]	NYM	RB	4.75%	3.71%
Industrial metals	Aluminum (High grade primary)	LME	AH	2.33%	7.00%
Industrial metals	Copper	LME	CA	3.22%	7.31%
Industrial metals	Lead	LME	PB	0.45%	
Industrial metals	Nickel	LME	NI	0.78%	2.88%
Industrial metals	Zinc (Special high grade)	LME	ZS	0.60%	3.14%
Livestock	Feeder cattle	CME	FC	0.61%	
Livestock	Lean hogs	CME	LH	1.51%	2.40%
Livestock	Live cattle	CME	LC	3.19%	4.29%
Precious metals	Gold	CMX	GC	3.01%	7.86%
Precious metals	Silver	CMX	SI	0.32%	2.80%
Total weights				99.99%	100.00%
Total number of commodities				24	19

Sector	S&P - GSCI	DJ - UBSCI
	Actual weights	Target weights
Agriculture	15.59%	29.23%
Energy	68.38%	33.00%
Industrial metals	7.38%	20.33%
Livestock	5.31%	6.68%
Precious metals	3.33%	10.75%
Total	99.99%	100.00%

[1]Both the S&P GSCI and DJ-UBSCI rolled from the NYM's unleaded gasoline futures contract (HU) to the RBOB gasolines futures contract (RB) in 2006.

uniform rate.[7] In general, the next out contract will be the second nearby contract, however, for certain commodities, the second nearby may have insufficient liquidity for the roll, in which case the third or fourth nearby contract may be used. Both Standard and Poor's and Dow Jones have made deliberate judgments regarding the specific calendar months to use in each commodity futures market, and these are summarized in Table II. The table entries designate what calendar month is held in the index at the beginning of the month. Consider the February entry for the CBT's wheat futures contract. The number 3 indicates that the March futures contract is included in the index at the beginning of February (in both the S&P-GSCI and DJ-UBSCI indexes). The fact that the March entry is 5 indicates that the May futures is included in the index at the beginning of March, so the wheat futures position is rolled from the March to the May contract months during the February roll period. Note that, for most commodities, S&P-GSCI and DJ-UBSCI roll contracts in the same manner. For some commodities, however, the roll patterns are different. With crude oil (CL) and natural gas (NG), the DJ-UBSCI does not use the even-numbered contract months, presumably due to greater trading activity and market depth in the odd-numbered months.

Unlike stock indexes whose membership stays relatively constant through time, the composition of commodity price indexes changes as futures contracts expire. Before this happens, the nearby futures contracts in a particular commodity are sold and more distant futures contracts are purchased.

D. Notional Value of Commodity Index Investments

Measuring the total notional value of commodity index investment is critical in developing an understanding of the relation between net flows into commodity index programs and price movements in the underlying commodity markets. Measuring the value of commodity index investment, in its many forms, can be problematic. While detailed information about exchange-traded commodity funds and notes is available, detailed information about managed funds and OTC swap agreements is not. But, since demand for commodity index portfolios must equal supply (as shown in Figure 1), we can use information from the futures markets to infer not only the size of the commodity investment market, but also the inflows and outflows from the market. Below we describe how such inferences can be made.

1. Commitment of Trader Reports

The timeliest source of information regarding commodity index investing in the US is the Commitments of Traders (COT) reports published weekly by the Commodity Futures Trading Commission (CFTC). These reports show the aggregate trader positions in certain futures and options markets. The COT reports contain a breakdown of each Tuesday's open interest for markets in which 20 or more traders hold positions equal to or above the reporting levels established by the CFTC. Trader position information is collected daily from reporting firms, clearing members, futures commission merchants, and foreign brokers. Reporting firms are required to file daily reports of the futures and option positions of traders who hold positions above specific reporting levels set by CFTC regulations. If, at the daily market close, a reporting firm has a trader with a position at or above the Commission's reporting level in any single futures month or option expiration, it must report that trader's entire position in all futures and options expiration months in that commodity, regardless of size. The aggregate of all traders' positions reported to the Commission usually represents 70 to 90% of the total open interest in any given market. The reporting levels are adjusted from time to time as the nature of trading in a particular market evolves. The CFTC's current reporting levels are shown in Table III. In the wheat futures and options contract market, for example, trader positions of 150 contracts or more are reported to the CFTC each day.

Three different COT reports are released every Friday at 3:30 p.m. Eastern time. The Futures-only reports have the longest history and are available electronically dating back to the beginning of 1986. The Futures-only report contains a breakdown of the open interest by commodity contract market. The report shows open interest separately by reportable and non-reportable positions. By definition, reportable positions are for large traders. Conversely, non-reportable positions are those of small traders. Reportable positions are then broken down by long and short commercial and noncommercial holdings and spreading. The CFTC staff classifies a trader as commercial or noncommercial when the trader's position first exceeds the commodity's

[7]Spreading the trades over a five-day period mitigates the price impact in the futures, as does the public disclosure of the mechanical trading rules.

Table II: Timing of futures contracts rolls for the S&P-GSCI and DJ-UBSCI commodity indexes.

Rolls are executed at a uniform rate over the fifth through ninth business days during the month. The numbers in the table designate the futures contract month in the index as of the beginning of the month (e.g., the CBT wheat contracts are rolled from the March contract to the May contract in February each year for both the S&P-GSCI and DJ-UBSCI).

Panel A. S&P-GSCI

Ticker	Exchange	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
W	CBT	3	3	5	5	7	7	9	9	12	12	12	3
KW	KCBT	3	3	5	5	7	7	9	9	12	12	12	3
C	CBT	3	3	5	5	7	7	9	9	12	12	12	3
S	CBT	3	3	5	5	7	7	11	11	11	11	1	1
KC	CSC	3	3	5	5	7	7	9	9	12	12	12	3
SB	CSC	3	3	5	5	7	7	10	10	10	3	3	3
CC	CSC	3	3	5	5	7	7	9	9	12	12	12	3
CT	NYC	3	3	5	5	7	7	12	12	12	12	12	3
LH	CME	2	4	4	6	6	7	8	10	10	12	12	2
LC	CME	2	4	4	6	6	8	8	10	10	12	12	2
FC	CME	3	3	4	5	8	8	8	9	10	11	1	1
HO	NYM	2	3	4	5	6	7	8	9	10	11	12	1
QS	IPE	2	3	4	5	6	7	8	9	10	11	12	1
XB	NYM	2	3	4	5	6	7	8	9	10	11	12	1
CL	NYM	2	3	4	5	6	7	8	9	10	11	12	1
LO	IPE	3	4	5	6	7	8	9	10	11	12	1	2
NG	NYM	2	3	4	5	6	7	8	9	10	11	12	1
LA	LME	2	3	4	5	6	7	8	9	10	11	12	1
LP	LME	2	3	4	5	6	7	8	9	10	11	12	1
LL	LME	2	3	4	5	6	7	8	9	10	11	12	1
LN	LME	2	3	4	5	6	7	8	9	10	11	12	1
LX	LME	2	3	4	5	6	7	8	9	10	11	12	1
GC	CMX	2	4	4	6	6	8	8	12	12	12	12	2
SI	CMX	3	3	5	5	7	7	9	9	12	12	12	3

Panel B. DJ-UBSCI

Ticker	Exchange	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
W	CBT	3	3	5	5	7	7	9	9	12	12	12	3
BO	CBT	3	3	5	5	7	7	12	12	12	12	1	1
C	CBT	3	3	5	5	7	7	9	9	12	12	12	3
S	CBT	3	3	5	5	7	7	11	11	11	11	1	1
KC	PIT	3	3	5	5	7	7	9	9	12	12	12	3
SB	PIT	3	3	5	5	7	7	10	10	10	3	3	3
CT	PIT	3	3	5	5	7	7	12	12	12	12	12	3
LH	CME	2	4	4	6	6	7	8	10	10	12	12	2
LC	CME	2	4	4	6	6	8	8	10	10	12	12	2
HO	NYM	3	3	5	5	7	7	9	9	11	11	1	1
XB	NYM	3	3	5	5	7	7	9	9	11	11	1	1
CL	NYM	3	3	5	5	7	7	9	9	11	11	1	1
NG	NYM	3	3	5	5	7	7	9	9	11	11	1	1
LA	LME	3	3	5	5	7	7	9	9	11	11	1	1
HG	CMX	3	3	5	5	7	7	9	9	12	12	12	3
LN	LME	3	3	5	5	7	7	9	9	11	11	1	1
LX	LME	3	3	5	5	7	7	9	9	11	11	1	1
GC	CMX	2	4	4	6	6	8	8	12	12	12	12	2
SI	CMX	3	3	5	5	7	7	9	9	12	12	12	3

Table III. Reporting levels of selected U.S. futures contracts as set by the Commodity Futures Trading Commission as of July 5, 2006.

If, at the daily market close, a trader has a position at or above the CFTC's reporting level in any single futures month or option expiration, his/her broker must report the entire position in all futures and options expiration months in that commodity, regardless of size.

Sector	Commodity	Number of contracts
Agriculture	Cocoa	100
Agriculture	Coffee	50
Agriculture	Corn	250
Agriculture	Cotton	100
Agriculture	Frozen concentrated orange juice	50
Agriculture	Oats	60
Agriculture	Rough rice	50
Agriculture	Soybean meal	200
Agriculture	Soybean oil	200
Agriculture	Soybeans	150
Agriculture	Sugar No. 11	500
Agriculture	Sugar No. 14	100
Agriculture	Wheat	150
Energy	Crude oil, sweet	350
Energy	Natural gas	200
Energy	No. 2 Heating oil	250
Energy	Unleaded gasoline	150
Industrial metals	Copper	100
Industrial metals	Gold	200
Livestock	Feeder cattle	50
Livestock	Lean hogs	100
Livestock	Live cattle	100
Precious metals	Platinum	50
Precious metals	Silver bullion	150

reportable level. A trading entity[8] generally gets classified as a commercial if the CFTC Form 40 that it is required to file with the Commission states that the entity is "… commercially engaged in business activities hedged by the use of futures or options markets." In order to ensure that traders are classified with accuracy and consistency, the Commission staff reviews this self-classification and may reclassify a trader if the staff has additional information about the trader's use of the markets. Spreading measures the extent to which each noncommercial trader holds equal long and short futures positions.

The Options-and-Futures reports, available electronically since 1995, contain the same fields as the Futures-only reports, except that open interest includes not only futures but also futures options contracts. In aggregating across open positions, option open interest is converted to a futures-equivalent basis using delta factors supplied by the exchanges. Long-call and short-put open interest are converted to long futures-equivalent open interest, and short-call and long-put open interest are converted to short futures-equivalent open interest.

Most important from our standpoint is the CFTC's Supplemental report. Since 2006, the CFTC has reported the holdings of commodity index traders (CIT) separately from the standard noncommercial and commercial categories for 12 agricultural and livestock commodity futures.[9] To understand how this works, consider Figure 2. The bar on the left shows the total long open interest of noncommercial and commercial traders as reported in the Futures and Options report. We are considering *long* open interest because commodity index traders (CIT, as labeled by the CFTC), are generally *long-only*. In the Options-and-Futures report, CIT positions were intermingled with other noncommercial (i.e., speculators) and commercial (i.e., traditional hedgers) traders.

In the Supplemental report, the total long open interest of noncommercial and commercial traders remains the same, however, the noncommercial category is partitioned into speculators and commodity index traders, and the commercial category is partitioned into traditional hedgers and commodity index traders. The commodity index traders classified as noncommercials are managed funds, pension funds, ETFs and ETNs, and other institutional investors seeking a long commodity index exposure. The commodity index traders classified as commercial are financial institutions such as OTC swap dealers who sell commodity index return swaps to institutional investors and then hedge by taking long positions in commodity futures.

To illustrate the mechanics of Figure 2, the open interest figures reported in the Options and Futures (*OF*) and Supplemental (*S*) reports for the CBT's wheat futures contract market on June 30, 2009. They are displayed in Panel A of Table IV. On Tuesday, June 30, 2009, the total open interest, reported in both the *OF* and *S* reports, was 383,387 contracts. Reported in the second row of Panel A are the open positions of long noncommercial traders (i.e., long speculators and long commodity index traders with direct positions in the futures market). The number drops from 80,569 in the *OF* report to 43,416 in the *S* report. The difference, 37,153, is the number of contracts of traders who are long noncommercials

[8]Note that it is the trader that is classified, not each individual transaction.

[9]See CFTC (2006, pp. 9-10).

Figure 2. Schematic of Reapportioning of the Open Interest Reported in the CFTC Commitment of Traders Reports for Long Noncommercial and Commercial Traders Into Speculator, Commodity Index Trader, and Hedger Categories.

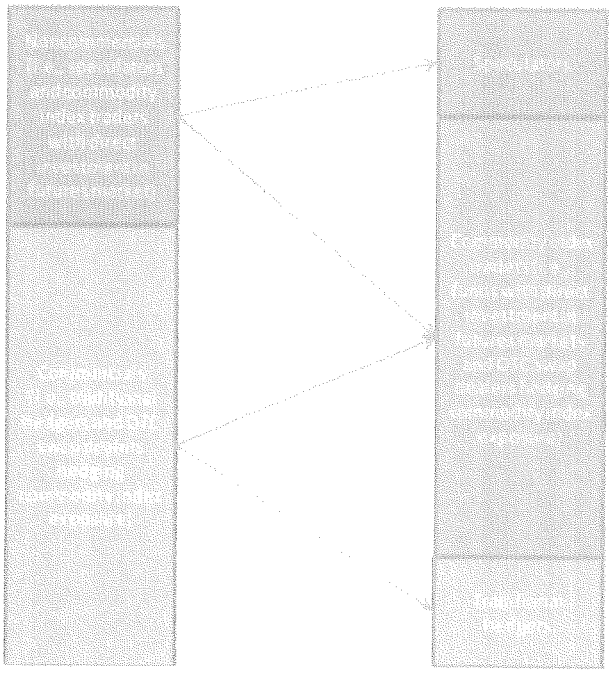


Table IV. Selected fields from the CFTC's Options and Futures and Supplemental reports for CBT's wheat options and futures on June 30, 2009.

Data are obtained from the web link, http://www.cftc.gov/marketreports/commitmentsoftraders/cot_historical.html.

Panel A. Data reported in CFTC reports

	Long-only open interest	
Market participant position	**From Futures and Options report**	**From Supplemental report**
Total open interest	383,387	383,387
Noncommercials	80,569	43,416
Spreaders	97,271	95,240
Commercials	176,016	44,944
Small traders	29,532	29,532
Commodity index traders		170,256

Panel B. Reconciliation between reports in number of contracts

	Long-only open interest	
Source of CIT trades	**Contracts**	**Percent of total**
Noncommercials	37,153	21.8%
Spreaders	2,031	1.2%
Commercials	131,072	77.0%
Small traders	0	0.0%
Total	170,256	100%

engaged in commodity index investing and is part of the total open interest of all long commodity index traders for that day, 170,256, as reported in the second last row of Panel A. Providing this breakdown of the noncommercial category is critical. Traditionally, the traders in the noncommercial category have been characterized as "speculators" by default since the traders in the commercial category are hedgers. But, with the advent and growth of commodity index investing, this characterization is misleading. Commodity index investors are not speculators. They do not take a directional view on commodity prices. They simply buy-and-hold futures contracts to take advantage of the risk-reducing properties they provide. Speculators, on the other hand, have a directional view, and take long (or short) positions accordingly. The Supplemental report now tells us the difference. On this day, 43,416 of the 80,569 long noncommercials were long speculators and 37,153 were long commodity index traders.

Traditionally, the traders in the noncommercial category have been characterized as "speculators" by default since the traders in the commercial category are hedgers. But, with the advent and growth of commodity index investing, this characterization is misleading. Commodity index investors are not speculators. They do not take a directional view on commodity prices. They simply buy-and-hold futures contracts to take advantage of the risk-reducing properties they provide. Speculators, on the other hand, have a directional view, and take long (or short) positions accordingly.

One of the more interesting results shown in Table IV (and in the Supplemental reports in general) is that the OTC swap dealers are by far the largest group of commodity index traders. To see this, note first that the total open interest of long commercials, as reported in the *OF* report is 176,016 contracts. After long commodity index traders are pulled from this category, the *S* report shows 44,944 contracts remain. This means that, of the 176,016 long commercial contracts, 131,072 were held by OTC swap dealers who are hedging short positions in commodity index rate-of-return swaps by going long the underlying futures contracts.

Panel B summarizes the results. Of the 170,256 long open interest categorized as commodity index trader (CIT) contracts, 37,153 or 21.8% are direct positions in the futures market by commodity index funds like managed funds, ETFs, and ETNs, and 77.0% are indirect positions conveyed through the hedging activities of OTC swap dealers.[10] In other words, in the wheat market on June 30, 2009, commodity index investing through return swaps in the OTC market was more than 3.5 times higher than through funds.

To see the relative trading activity across commodities and through time, we compute the ratio of CIT swap trading to CIT direct investments for each commodity each week and then average across commodities each week during the period January 2006 through June 2009. Figure 3 shows the results. Early in the period, the lion's share of CIT positions was held by swap dealers, seven times more than by direct investment. Over the three and a half year period, however, the ratio has dropped as a result of the growth in managed commodity funds, ETFs, and ETNs.

2. Monitoring Commodity Index Investment

The value of the COT reports in assessing not only the notional value of commodity index investment but also in determining the size of inflows and outflows quickly becomes apparent. In Figure 4, we plot the notional value of CIT positions on a week-by-week basis from January 2006 through July 2009. Two lines are shown. The first is the actual dollar value of long-only commodity index trader positions each week. This number is computed in two steps. First, we take the reported open interest for each commodity, multiply by its contract denomination, and then multiply by the futures price. Since the COT data does not specify futures contract months, we use the nearby futures contract price for all reported open interest. Second, we sum across the notional values of each commodity to determine the notional value of all contracts. At the beginning of 2006, the notional value of commodity index investing in these 12 agricultural and livestock commodity futures is shown to

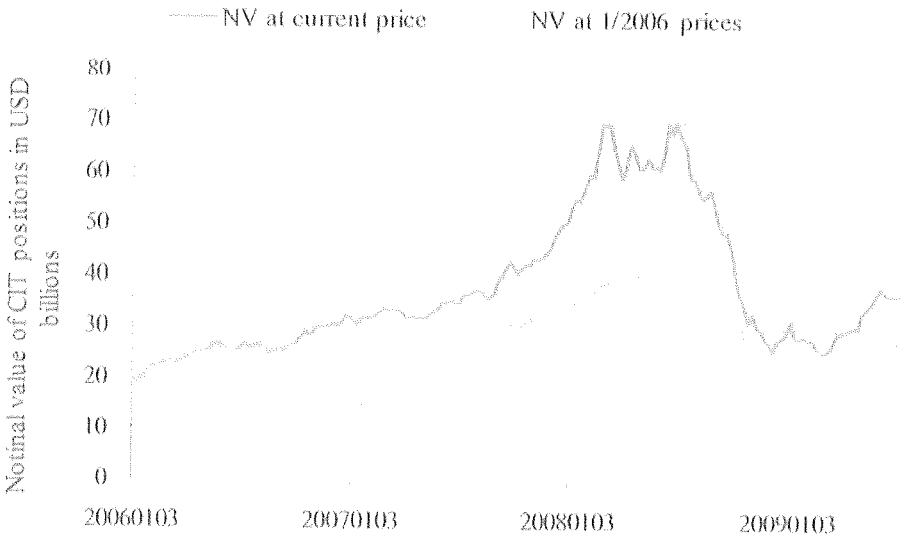
[10] The 2,031 accounted for by spreaders is inconsequential for our purposes. In most weeks, the number appears in the Supplemental report as 0.

Figure 3. Ratio of commodity index investing through commodity swaps to direct commodity index investing during the period January 2006 through June 2009.

Computed from data in the weekly CFTC Commitments of Trader Option and Futures and Supplemental files and futures prices from the CBT, CME, CSC, KCBT and NYC. Twelve agricultural and livestock commodity futures are tracked. Ratios are computed for each commodity each week, and are averaged across commodities.

Figure 4. Notional value (NV) of long-only CIT open interest using contemporaneous and January 3, 2006 futures prices during the period January 2006 through June 2009.

Notional value for each commodity is computed by taking the product of the long-open interest of the long-only commodity index traders reported in the weekly CFTC Commitments of Trader Supplemental report, the contract denomination, and the nearby futures contract price. The notional values are then summed across commodities to determine total notional value of commodity index investing. Twelve agricultural and livestock commodity futures are tracked.



be about $20 billion. The activity grew steadily through the beginning of 2008 to a level of about $50 billion, and then spiked up to $70 billion and stayed there for a few months. Then, as precipitously as it spiked up, it fell back to a level of at about $30 billion by the beginning of 2009.

On face appearance, this evidence appears to suggest that commodity index investing rose dramatically during the period and then backed off. But, part of it is illusion. Fact of the matter is that commodity prices rose precipitously in 2008. To separate growth in prices from inflows into commodity index investing, we again compute notional value, but this time using the commodity futures prices on the first date in the figure, January 3, 2006. A different picture emerges, as is shown in Figure 4. Commodity investment begins at a level of $20 billion in 2006, rises at slow steady rate through mid-2008, peaks at about $40 billion, slowly falls through the beginning of 2009, and begins to rise again. Overall the figure is instructive in at least two ways. First, while commodity index investing doubled over the two-year period from January 2006 to January 2008, it did not more than triple, as indicated by the red line in the figure. Great care must be taken in separating price movements from net flows. Second, the growth in commodity index investment is steady. Decisions regarding commodity index investment are very deliberate asset allocation decisions made by institutions trying to manage risk. As such, they take place slowly through time.

Documenting an increase in long-only commodity index investing in isolation, however, can be deceiving. While Figure 4 does show that long-only commodity index investing doubled from 2006 to 2008, it did not increase relative to the total open interest in the market. Both grew at about the same rate. To see this, consider Figure 5 which shows the average ratio of long-only CIT open interest to total open interest across commodities each week. At the beginning of 2006, commodity index traders accounted for about 26% of the total long open interest of a typical commodity. In June 2009, the number was only slightly higher at about 30%. The figure at the bottom shows short commodity index positions relative to total open interest. The line at the bottom of the figure shows that short-only commodity index investing activity is negligible through the beginning of 2008, and then begins to increase. The increase is attributable in part, no doubt, to a new generation of exchange-traded funds based on the inverse return of commodity indexes. It may also be attributable to certain institutional investors shorting futures against their long commodity index investment to reduce over-exposure to certain sectors.[11]

Table V contains the average ratios of the weekly long CIT positions to total positions by commodity across the 184 weeks in the January 2006 through June 2009 period. The single highest ratio is for the CME's lean hog market where CIT positions account for an average of 42.51% of total open interest, ranging from a low of 30.89% to a high of 51.42%. The CBT's wheat market is next highest with CIT positions accounting for 41.15% of total open interest. The lowest ratio is for the CSC's cocoa contracts where CIT positions are about 12.5% of total. Based on the information provided in Table I, this should not be surprising. Only the S&P-GSCI holds cocoa, and its allocation is 0.40%.

Table VI contains the notional value of the open interest of commodity index traders as of the close of trading on June 30, 2009. The figures reported for each commodity are computed as the product of open interest, contract denomination, and the 6/30/09 futures price. The total market value of $36.3 billion is the value of commodity index open interest across the 12 commodities followed by the CFTC in the Supplemental reports. This value can be used to estimate the total market value of all commodity index investing. If we assume that all commodity index investing in the Supplemental reports is based on the S&P-GSCI,[12] for example, and then use the fact that the 12 commodities account for 20.90% of the market value of the S&P-GSCI (see Table I), the total notional value of commodity index investing is $36.3/0.2090 or $173.8 billion. The implied index weight for the CBT's wheat futures contract, for example, is 2.53% if all commodity index investing is linked to the S&P-GSCI. Table I shows that this compares to Standard and Poor's actual weight for this wheat futures contract, 3.90%, which is reported in Table I.

A. Special Call Survey of Swap Dealers and Index Traders

The CFTC's Commitment of Traders Supplemental reports are very useful to the extent that they provide timely (i.e., weekly) snapshots of the level of commodity index investing. They have two weaknesses, however. First, they cover only 12 of the 33 US exchange-traded commodity futures markets that are used in the construction of the well-diversified commodity index portfolios. Second, the CIT positions contain error. As noted earlier, the long-only CIT open interest is drawn from the long-only open interest of noncommercials (e.g., index funds) and the long-only open interest of commercials (e.g., commodity swap dealers).

[11]Suppose that a pension fund currently has a return swap linked to the S&P-GSCI and that the price of crude oil has recently spiked upward. To make the swap have the return properties of a more diversified commodity index exposure, the pension fund can to sell crude oil futures contracts against the swap.

[12]Generally speaking, more commodity index funds are benchmarked against the S&P-GSCI than the DJ-UBSCI. The Dow index, however, is gaining in popularity because it is better diversified.

Figure 5. Percentage of total open interest held by long and short commodity index traders during the period January 2006 through June 2009.

Data are from weekly CFTC Commitments of Trader Supplement files. Twelve agricultural and livestock commodity futures are tracked. Percentages are average of ratios across commodities by week.

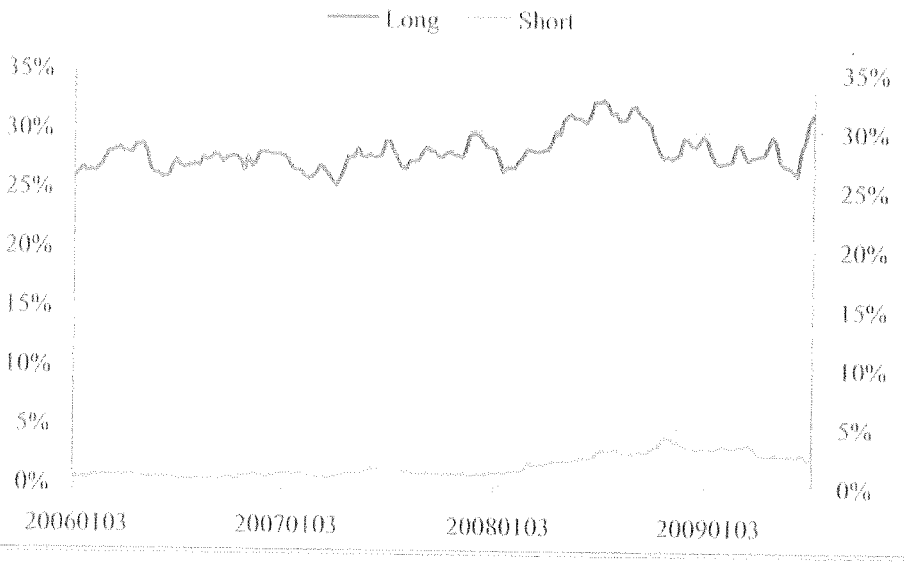


Table V. Percentage of total open interest held by long commodity index traders during the 184-week period January 2006 through June 2009.

Data are from weekly CFTC Commitments of Trader Supplement files. Twelve agricultural and livestock commodity futures are tracked.

		Percent of open interest held by long commodity index traders		
Commodity	Exchange	Average	Minimum	Maximum
Wheat	CBT	41.15%	32.05%	51.78%
Wheat	KCBT	22.03%	12.30%	32.66%
Corn	CBT	22.98%	16.68%	30.07%
Soybeans	CBT	25.31%	19.77%	30.58%
Soybean meal	CBT	23.34%	17.84%	31.70%
Cotton No.2	NYC	31.59%	21.13%	43.94%
Lean hogs	CME	42.51%	30.89%	51.42%
Live cattle	CME	38.97%	27.24%	47.22%
Feeder cattle	CME	25.08%	14.09%	35.16%
Cocoa	CSC	12.47%	6.19%	19.70%
Suger No.11	CSC	27.77%	15.50%	37.69%
Coffee C	CSC	24.21%	18.89%	34.61%

Table VI. Total Market Value of Contracts Outstanding for the 12 Commodity Futures Reported in the CFTC's Supplemental File on June 30, 2009.

The market value outstanding is the product of the total open interest, the contract denomination, and the nearby futures contract price.

Commodity	Exchange	Ticker symbol	Notional value of contracts outstanding	Percent of total notional value	Implied index weights S&P - GSCI	DJ - UBSCI
Wheat	CBT	W	4,392,604,800	12.09%	2.53%	4.34%
Wheat	KCBT	KW	794,089,062	2.19%	0.46%	0.78%
Corn	CBT	C	6,102,931,900	16.79%	3.51%	6.03%
Soybeans	CBT	S	9,522,782,500	26.21%	5.48%	9.41%
Soybean oil	CBT	BO	1,388,780,190	3.82%	0.80%	1.37%
Cotton No.2	NYC	CT	1,788,173,650	4.92%	1.03%	1.77%
Lean hogs	CME	LH	1,437,941,664	3.96%	0.83%	1.42%
Live cattle	CME	LC	3,116,530,872	8.58%	1.79%	3.08%
Feeder cattle	CME	FC	377,819,475	1.04%	0.22%	0.37%
Cocoa	CSC	CC	4,530,623	0.01%	0.00%	0.00%
Suger No.11	CSC	SB	5,550,311,894	15.27%	3.19%	5.49%
Coffee C	CSC	KC	1,862,498,156	5.13%	1.07%	1.84%
Total			36,338,994,786		20.90%	35.92%

The error arises from the manner in which the CFTC classifies traders as commercial or noncommercial and as index traders.

As noted earlier, the CFTC staff classifies a trader as commercial or noncommercial when the trader's position first exceeds the commodity's reportable level. A wheat farmer is typically a hedger who sells futures to lock in the price of his future harvest and is therefore designated as a commercial. That same farmer may, from time to time, buy wheat futures to attempt to profit from his directional view that the wheat price will rise in the short run. This wheat position, too, would be designated as commercial. At the same time, a trader may be classified as a commercial in some commodities and as a noncommercial in other commodities.

The classification of a trader as an index trader is done in a similar manner. If the trader appears to be replicating a commodity index by establishing long positions in the constituent commodity futures markets and then rolling the positions forward from futures to futures using a fixed methodology, he/she is earmarked as an index trader even though he may be engaged in other futures activity. At the same time, the commodity index trader category will not include some traders who are engaged in index investing, but for whom it does not represent a substantial part of their overall trading activity.

Due to the importance of measuring commodity index investing levels accurately, the CFTC issued a special call to large traders in June 2008. Specifically, they requested that 16 swap dealers known to have significant commodity index swap business, 13 swap dealers known not to have significant index swap business, and 14 commodity index funds (including asset managers and sponsors of ETFs and ETNs whose returns are based on a commodity index) provide detailed data about actual index investing for the month-ends December 2007 through June 2008, and then on an ongoing basis thereafter. While they received the data in a timely fashion, their analysis of the data was limited to only four commodities and the quarters ending December 31, 2007 through June 30, 2008.[13] We highlight some of the results for the quarter ending June 2008 in Table VII.

Among the special call survey results shown in Table VII is the total notional amount of commodity index investment. For the quarter ending June 30, 2008, it was $200 billion across all exchanges worldwide, with $161 billion being tied to commodities traded in US markets regulated by the CFTC. The total number of index commodities represented in the $161 billion is 33, and the total open interest in these

[13]The CFTC received that data after June 30, 2008, and were required to provide their staff report to Congress by September 15, 2008. Consequently, they limited their analyses to 4 of 33 commodities and 3 of the 7 months of the data collected.

Table VII. Summary of commodity index investing by the CFTC (2008) Staff Report on Commodity Swap Dealers and Index Traders with Commission Recommendations.

The reported values are for June 30, 2008.

Panel A. Notional amount of index open interest

	Index Trading Only		All Futures Open Interest	
Category	Billions of USD	Percent of U.S. Total	Billions of USD	Percent of U.S. Total
All exchanges	200			
U.S. exchanges	161		945	17.0%
NYMEX crude oil futures	51	31.7%	405	12.6%
CBT wheat futures	9	5.6%	19	47.4%
CBT corn futures	13	8.1%	74	17.6%
ICE cotton futures	3	1.9%	13	23.1%

Panel B. Percent of total commodity index open interest in U.S. by participant

	Percent of U.S. Total
Index funds	24%
Institutional investors	42%
Sovereign wealth funds	9%
Other traders	25%
Total	100%

Panel C. Notional amount of commodity index open interest by commodity

	Futures-Equivalent	Open Interest	
		Net CITs	Total
CBT wheat futures	194,000	177,817	444,081
CBT corn futures	350,000	417,279	2,049,965
ICE cotton futures	73,000	104,580	377,877

33 markets is $946 billion. Commodity index investing, therefore, accounts for 17% of the open interest in the relevant commodity futures markets. While the CFTC had data on all 33 commodity futures markets, they provided detail on only four as noted earlier. Index investing of crude oil futures accounts for 31.7% of all index investing, and 12.6% of all crude oil futures outstanding. Of the agricultural contracts, corn accounts for 8.1% of index investing and 17.6% of all corn futures contracts outstanding. Wheat is next with only 5.6% of all index investing, but with 47.4% of all contracts outstanding. Apparently index investing has a more concentrated presence in the wheat market.

Panel B breaks down index investing by market participant. Index funds account for 24% of the $161 billion of commodity index open interest in the US An index fund is defined as a client/counterparty with a fiduciary obligation to match or track the results of a commodity index, including ETFs and ETNs based upon a commodity index. Institutional investors have the single largest presence at about 42%. These are pension funds, endowment funds, or other similar types of investors. Sovereign wealth funds, non-US government entities such as a government investment company or a government-run pension fund, hold about 9%. Finally, the "other" category is about 25% and is largely made up of retail investors holding ETFs, ETNs, and similar instruments that are publicly traded.

The final panel in Table VII compares the survey's index position sizes with those reported in the CFTC's Supplemental

reports. The futures-equivalent of wheat reported in CFTC's (2008) Staff Report is 194,000 contracts on June 30, 2008. The net position of the CIT category reported in the July 1, 2008 Supplemental Report was 177,817. For corn and cotton, the numbers were 350,000 vs. 417,279 and 73,000 vs. 104,580, respectively. While the differences between these estimates reinforce the importance of collecting the survey information on a monthly basis moving forward, the special call survey time-series is currently too sparse and the number of commodities too small to serve as the basis of any meaningful empirical analysis. The CFTC's COT Supplemental report data remain the premier source for accurate and timely measurement of commodity index investment.

If the trader appears to be replicating a commodity index by establishing long positions in the constituent commodity futures markets and then rolling the positions forward from futures to futures using a fixed methodology, he/she is earmarked as an index trader even though he may be engaged in other futures activity. At the same time, the commodity index trader category will not include some traders who are engaged in index investing, but for whom it does not represent a substantial part of their overall trading activity.

II. Relation Between Commodity Index Investing and Futures Prices

The subcommittee report observes that both the level of commodity prices and the level of commodity index investing surged upward during the period 2006 and 2007 and concludes that the increased commodity index investing caused the futures price increase. This conclusion illustrates the well-known logical fallacy that correlation proves causation. Correlation does not imply causation; it is only a requirement for it. Among other things, to prove causation, one event must occur before the other. The subcommittee report presents no such evidence.

The purpose of this section is to examine the relation between commodity index investing and futures prices. In all, six analyses are carried out. First, we examine the co-movements of futures prices for commodities known to be part of commodity index investing programs. Since the commodity index investing involves the simultaneous purchase of a portfolio of commodities, we should expect to see a high degree of contemporaneous correlation in futures price movements through time. Second, we examine the co-movements of futures prices known not to be part of commodity index investing programs. If non-index commodity futures prices behave like index commodity futures during the investigation period, the conclusion that commodity index investing is the cause is undermined. Third, we examine prices of five spot commodities that do not have futures contracts listed on them. Again, if spot commodities with no futures contracts and, hence, no involvement in commodity index investment programs have price behavior similar to index commodity futures, flows into commodity index investment portfolios are unlikely the cause. Fourth, we examine the impact of futures prices resulting from the periodic futures contract rolls that are necessary to mimic well-known commodity indexes such as the S&P-GSCI and DJ-UBSCI. In a roll month, the nearby futures contracts are sold and the second nearby contracts are purchased. If commodity index investing has futures price impact, the return of the second nearby futures contract should exceed the return of the nearby contract. Fifth, we examine whether the demand for long commodity index portfolios (measured by changes in open interest) "causes" futures prices to rise and vice versa. To test for causality, we examine whether weekly futures returns are related to lagged flows into commodity index investing. Sixth, we examine the contemporaneous relation between weekly futures returns and the flows of speculators and commodity index traders during periods when commodity index traders are known to be entering and exiting the market.

A. Price Co-movements of Index Commodities

The first investigation focuses on daily returns of 18 different commodity futures that are included in the S&P-GSCI and DJ-UBSCI during the period January 2006 through July 2009. Daily open, high, low, and settlement prices as well as trading volume and open interest for each futures contract are from the futures exchanges. The logic

underlying this analysis is straightforward. Commodity index investing is a mechanical trading strategy based on a set of well-defined and well-known rules, as was laid out in the previous section. Net funds flowing into commodity index investments are immediately redeployed into the commodity index futures market through the simultaneous purchase of all index commodities. If the commodity index trades are large enough to push prices upward, the prices in all markets should move upward concurrently. Put differently, the returns of all futures contracts used in index replication should be highly correlated.

Table VIII contains the contemporaneous correlation matrix computed from the daily returns of 18 commodity futures contracts commonly included in commodity index investing. Surprisingly, the levels of correlation are quite low. Consider the column labeled W, the CBT's wheat futures contract. This wheat contract accounts for about 4% of well-diversified commodity indexes such as the S&P-GSCI and should be highly correlated with other futures that have a high weight in the index[15] like natural gas (NG), live cattle (LC), and gold (GC). As seen in the table, the correlations are quite low—0.134 (4% of the index), 0.178 (3%), and 0.197 (3%), respectively. The column labeled C, the CBT's corn futures contract, provides similar results. This evidence suggests that either commodity index trades have little effect on futures returns (because they fail to induce contemporaneous price movements) or the commodity return variability is being driven by factors other than commodity index investing.

Table VIII also confirms a number of obvious relations. The correlation between the returns of the wheat futures contract traded at the CBT (W) and the wheat futures contract traded at the KCBT (KW), for example, is 0.943. Since the underlying commodities are simply two different types of wheat, their price movements should be highly correlated. Crude oil (CL) returns are highly correlated with the returns of its processed products—0.769 for heating oil (HO) and 0.697 for gasoline (RB)—and soybeans (S) are highly correlated with soybean meal (BO), 0.811.

Figure 6 displays the CBT and KCBT wheat futures prices that were used to generate the correlation coefficient, 0.943. In addition, the MGEX wheat futures prices are shown. The figure is interesting in a number of respects. First, over the first year and a half, the lines are virtually on top of one another. This means that the three grades of wheat are virtually perfect substitutes from a rate of return perspective. In mid-2007 through the beginning of 2008, the prices of all wheat futures contract increase precipitously. During this interval, the CBT and KCBT futures prices remain close together; however, the MGEX price rises to a level 50% higher than the other two futures. The importance of this comparison is that the subcommittee report argues that the higher incidence of commodity index futures trading caused the abnormal price increase in wheat over this period. If such is the case, the CBT futures price should have risen to a level well in excess of the KCBT and MGEX contracts because the CBT contract is the primary contract used by commodity index traders in taking a wheat position. What the figure shows is that the behavior of the CBT price is like the KCBT price and well below the MGEX price—evidence that again suggests that the abnormal behavior is driven by factors other than commodity index investing.

Figure 7 displays the prices of several different agricultural futures that have significant weights in well-diversified commodity indexes. Again, in assessing these figures, recall that commodity index investing refers to buying (selling) all of these contracts simultaneously, so, if commodity index investing is responsible for the abnormal price increases, the abnormal price increases should be experienced together. As Figure 7 shows, they are not. The price of corn begins its ascent in late 2006, levels off for most of 2007, and then rises quickly to a level nearly 3.5 times its January 2006 price in June 2008. Wheat, like corn, experiences erratic price movements during this period. But, wheat's crisis appears to have started earlier than corn and reached its maximum price three months earlier. Soybeans, too, seem to have experienced tumultuous times, rising in price by nearly 150% by June 2008. The general pattern of increasing and then decreasing of prices during this period of time undoubtedly contributes to the modest positive levels of correlation reported in Table VIII—0.602 for wheat versus corn, 0.492 for wheat versus soybeans, and 0.661 for corn versus soybeans. But, the fact that the price shifts are not contemporaneous suggests, yet again, that commodity index investing is not the culprit.

Finally, the price behavior of the live cattle futures contracts (LC) is also displayed in Figure 7. Relative to the grains, live cattle has little price movement at all over the four-year period. This suggests that whatever was happening in the grains market was specific to the grain market sector and did not carry over into the livestock sector. It also suggests that commodity index investing is unrelated to futures price movements. Live cattle accounts for nearly 4% of the popular commodity indexes. During a period when flows into commodity index funds doubled, the live cattle futures price barely budged.

B. Price Co-movements of Index Versus Non-index Commodities

Another way to gather evidence regarding the relation between commodity index investing and futures prices is

[15]Recall the index weights are given in Table I.

Table VIII. Correlation in daily returns of 18 commodity futures included in the S&P-GSCI and DJ-UBSCI during the period January 2006 through July 2009.

Ticker symbols are: CC cocoa, KC coffee, C corn, CT cotton, KW Kansas City wheat, BO soybean oil, W Chicago wheat, CL crude oil, HO heating oil, NG natural gas, RB RBOB oil, FC feeder cattle, LH lean hogs, LC live cattle, GC gold, and SI silver.

	CC	KC	C	CT	KW	BO	S	SB	W	CL	HO	NG	RB	FC	LH	LC	GC	SI
CC	1																	
KC	0.328	1																
C	0.223	0.323	1															
CT	0.217	0.376	0.393	1														
KW	0.231	0.308	0.567	0.343	1													
BO	0.291	0.348	0.587	0.440	0.479	1												
S	0.288	0.353	0.661	0.382	0.493	0.811	1											
SB	0.236	0.305	0.299	0.369	0.281	0.365	0.324	1										
W	0.230	0.308	0.602	0.356	0.943	0.481	0.492	0.292	1									
CL	0.269	0.264	0.335	0.284	0.298	0.532	0.425	0.305	0.303	1								
HO	0.233	0.271	0.337	0.299	0.279	0.539	0.417	0.305	0.287	0.769	1							
NG	0.091	0.119	0.190	0.130	0.116	0.246	0.218	0.173	0.134	0.304	0.352	1						
RB	0.210	0.243	0.328	0.271	0.266	0.527	0.422	0.282	0.274	0.697	0.777	0.300	1					
FC	0.064	0.137	-0.063	0.114	-0.001	0.088	0.063	0.098	0.018	0.140	0.113	0.067	0.162	1				
LH	-0.003	0.157	0.017	0.112	0.073	0.088	0.071	0.023	0.059	0.052	0.023	0.001	0.031	0.197	1			
LC	0.195	0.211	0.157	0.234	0.180	0.195	0.180	0.162	0.178	0.177	0.174	0.088	0.175	0.645	0.102	1		
GC	0.272	0.173	0.238	0.166	0.183	0.317	0.271	0.184	0.197	0.270	0.278	0.098	0.227	-0.022	0.013	0.044	1	
SI	0.313	0.276	0.332	0.258	0.271	0.420	0.379	0.265	0.272	0.314	0.332	0.148	0.280	0.073	0.020	0.153	0.725	1

Figure 6. Daily index levels representing the nearby futures contract prices of the wheat futures contracts traded on the CBT, the KCBT, and the MGEX during the period January 2006 through July 2009.

Futures prices are from CBT, KCBT, and MGEX.

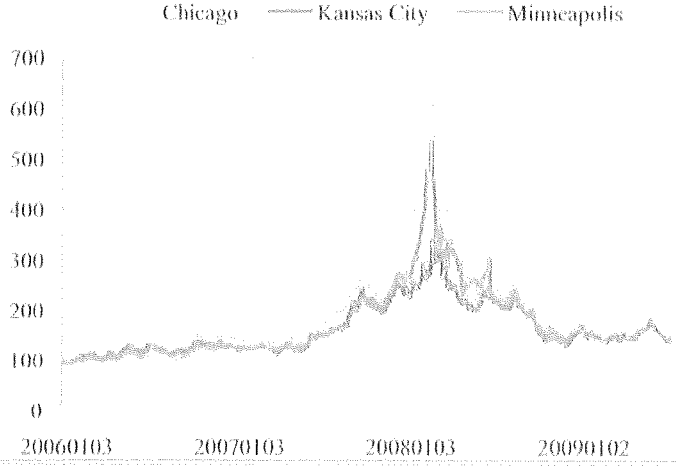
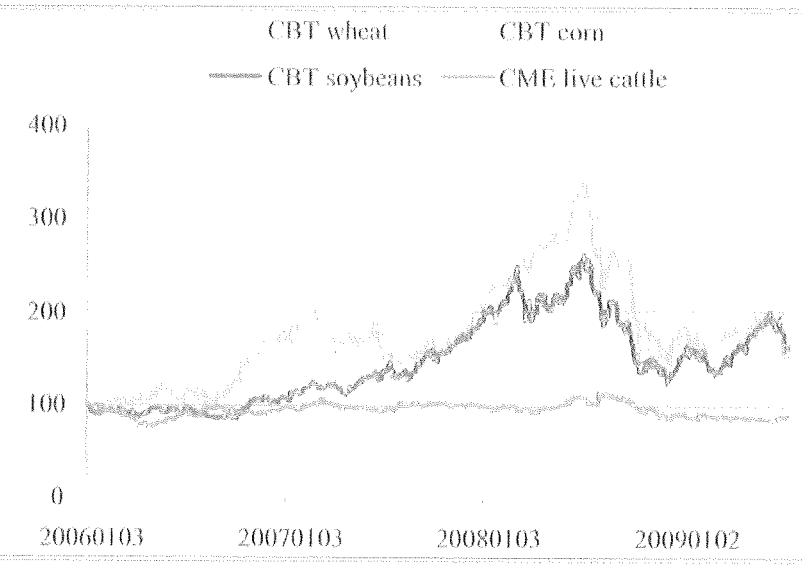


Figure 7. Daily index levels representing the nearby futures contract prices of the agricultural futures contracts traded on the CBT and the CME during the period January 2006 through July 2009.

Futures prices are from CBT and CME.



to examine the co-movements in prices of like commodities that are and are not included in the index. We have already examined one such case in Figure 6. The CBT's wheat futures contract is used by commodity index investors to capture the returns of the physical commodity wheat. The KCBT's wheat futures contract is used only in a minor way, and the MGEX's wheat futures contract is not used at all. As noted earlier, the co-movements in price are highly correlated, with the MGEX futures price rising the most. For the subcommittee report conclusion to hold, the reverse pattern should hold. Similar results can be found for other agricultural commodities. The CBT, for example, has futures markets in both soybeans and oats. The difference between the two contracts from our perspective is that soybeans is an index commodity while oats is not. Figure 8 shows the price behavior of the nearby futures contracts for both commodities over the period January 2006 through July 2009. As the figure shows, there is a close correspondence between the price movements of the two commodities, often rising and falling in unison as is expected if they were both part of a commodity index investing program and such a program had a significant price impact. But, oats is not included in any of the popular commodity indexes and is therefore, by definition, unaffected by index investing. In other words, the price co-movement must be dominated by factors related to the agricultural commodities market rather than commodity index investing.

The precious metal contracts traded on the Comex offer another opportunity to make an index versus non-index comparison. Gold and silver are included in the S&P-GSCI and DJ-UBSCI, and palladium and platinum are not. Figure 9 shows their price behavior over the January 2006 through July 2009 investigation period. Again, the degree of co-movement would seem to suggest that a common factor is influencing the prices of all of these commodities simultaneously. It cannot be commodity index investing, however, since palladium and platinum are not part of index programs.

C. Price Co-movements of Commodities With No Futures Markets

Our final examination of price co-movements identifies three important cash commodities—coal, cobalt, and rhodium—that do not have futures markets and are not part of commodity index investing programs. Figure 10 shows the weekly price behavior of these commodities over the period January 2006 through July 2009. Like so many other commodities shown in previous figures, there is a general price increase from the beginning of 2006 through the end of 2007. Prices then jump upward during the first half of 2008, and then fall. Again, commodity index investing cannot be the culprit, at least for these cash commodities, since these cash commodities are not part of index investing programs.

Figure 8. Daily index levels representing the nearby futures contract prices of soybean and oats futures contracts traded on the CBT during the period January 2006 through July 2009.

Futures prices are from CBT.

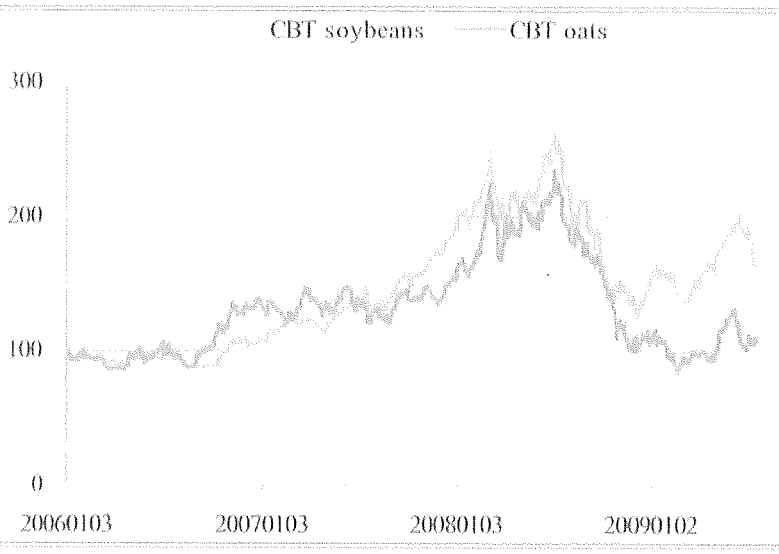


Figure 9. Daily index levels representing the nearby futures contract prices of the precious metal futures contracts traded on the CMX during the period January 2006 through July 2009.

Futures prices are from CMX.

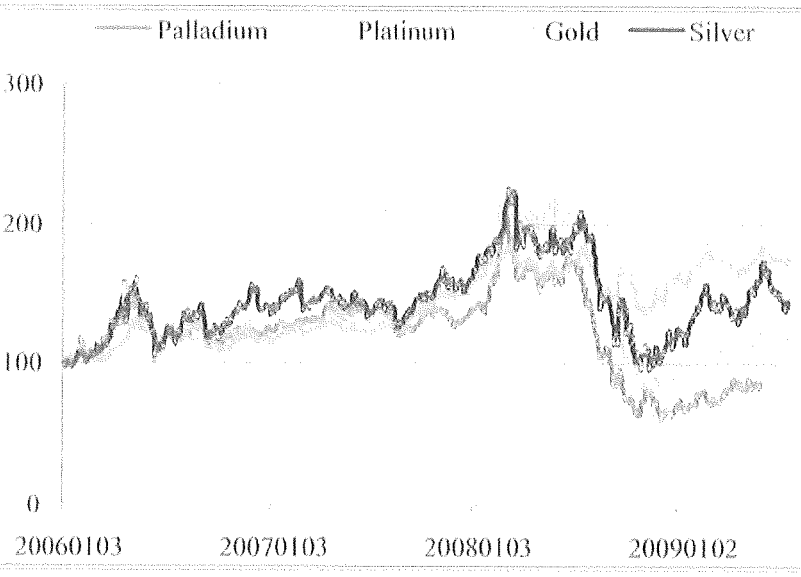
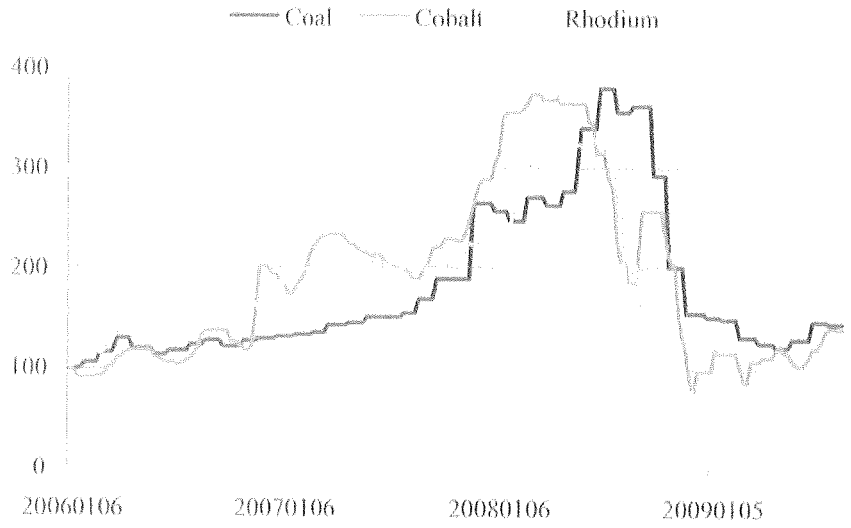


Figure 10. Spot prices of commodities with no futures markets and not included in commodity index portfolios during the period January 2006 through July 2009.

Weekly prices are from DataStream.



Indeed, they do not even have commodity futures contracts listed on them. The price patterns appear to be a reflection of some common macro-economic event that affected many commodity sectors during the beginning of 2008.

D. Analysis of Index Rolls

The first three analyses focused on commodity price co-movements and argued that their patterns are inconsistent with commodity index investing. Prices of index commodity futures contracts should move together, and they do not. Prices of index and non-index commodity futures should not move together, but they do. Prices of cash commodities with no futures markets and not included in commodity index investment programs should not move together, but they do. While the evidence that some other factor or set of factors is affecting commodity prices, the analysis would be more powerful if the futures returns were measured over an interval in which we know commodity index investing was being executed. One such interval of time is when commodity index funds and swap dealers must roll their futures positions from the nearby contract to the next nearby contract. Recall that the timing of such rolls for the S&P-GSCI and DJ-UBSCI, two indexes commonly used as benchmarks for commodity index funds and as a reference price in OTC commodity swap contracts, was provided in Table II of the last section.

In this investigation, we attempt to stack the cards in favor of finding that commodity index investing and futures returns are related. We do so by selecting the eight commodity futures contracts that are in both the S&P-GSCI and DJ-UBSCI, and are also followed in the CFTC's COT Supplemental reports. We require the commodity to be in both indexes in order to maximize the amount of index investing over the roll period. Both indexes have investment in the same commodity futures at the same time.[15] For the CBT's wheat futures contract, which is part of the sample, 3.90% of the market value of the funds/swaps is pegged to the S&P-GSCI and 4.80% of the market value of the funds/swap is pegged to the DJ-UBSCI. We also require the commodity to have open interest data in the CFTC's Supplemental report to allow comparison between the numbers of contracts rolled in mimicking the diversified portfolio indexes and the total commodity index investing in a particular commodity. The eight commodity futures contracts used in our sample are listed in Table IX. Five commodity futures are from the CBT, two are from the CSC, and one from the NYC. These eight commodities account for 19.1% and 33.0% of the market values of the S&P-GSCI and DJ-UBSCI indexes, respectively.

The methodology used to conduct the analysis is

[15]For other commodity futures contracts, for example, the metal contracts traded on the London Metals Exchange, contract months are not always the same.

Table IX. Commodity futures contracts included in the S&P-GSCI and DJ-UBSCI commodity indexes and the CFTC's Commitment of Traders Supplemental Reports during the period January 2006 through July 2009.

Weight in commodity index is percent of market value of index accounted for by the commodity.

Commodity futures	Exchange	Ticker symbol	Weight in commodity index S&P-GSCI	DJ-UBSCI
Wheat	CBT	W	3.90%	4.80%
Corn	CBT	C	3.55%	5.72%
Soybeans	CBT	S	2.64%	7.60%
Cotton No.2	NYC	CT	1.19%	2.27%
Lean hogs	CME	LH	1.51%	2.40%
Live cattle	CME	LC	3.19%	4.29%
Suger No.11	CSC	SB	2.33%	2.99%
Coffee C	CSC	KC	0.76%	2.97%
Total			19.07%	33.03%

straightforward. Under the hypothesis that commodity index investing has no effect on the underlying futures prices, the expected futures return of the nearby contract over the interval from the close on the day before the first roll date (i.e., the fifth business day of the month) to the close on the last roll date (i.e., the ninth business day of the month) should be equal to the expected futures return of the second nearby contract. Under the alternative hypothesis that the commodity index roll has price impact in the futures market, the nearby futures return will be less than the second nearby futures return because of the selling pressure on the nearby contract and the buying pressure on the second nearby. Assuming the null hypothesis is rejected in favor of the alternative, we should also find that the price impact is larger the greater the amount of commodity index investing during the interval.

Table X contains the results of the return tests by commodity. The returns are computed for the specific futures contracts rolled with the S&P-GSCI and DJ-UBSCI indexes. To understand the contents of the table, consider the wheat contract in the first row. Of the wheat futures contract rolls that occurred during the period January 2006 through July 2009, the average return of the nearby futures contract (being rolled from) was –0.03% from the settlement on the fourth business day of the roll month to the settlement on the ninth day. Over the same interval of time, the average return on the second nearby contract (being rolled into) was 0.06%. Thus, the return differential is 0.09%, less than one-tenth of one percent. Scanning down the column of return differentials for the different commodity futures, we find that all but one (soybeans) is positive, and three are significant in the statistical sense. In a practical sense, however, the roll returns and return differentials are not economically meaningful, on order of the typical bid/ask spreads observed in these markets.[16]

What is so remarkable about finding little or no price impact in these commodity futures rolls is the sheer size of the futures positions being rolled. To measure the number of contracts being rolled, we use the lesser of a) the number of nearby contracts sold (i.e., the reduction in the open interest of the nearby contract from the fourth through the ninth business days) and b) the number of second nearby contracts purchased (i.e., the increase in the open interest of the second nearby contract from the fourth through the ninth business days). We then divide this number by the open interest of the nearby and second nearby futures contracts at the beginning of the roll period, and then average the ratios through time to get the results reported in Table X. For wheat, the number of contracts rolled increased the open interest of the second nearby futures contract by 46.6%, and the futures price rose ever so slightly on average. For soybeans, 17.9% of the open interest of the first nearby contract was closed out and the futures price rose. Across the eight commodity futures reported in the table, the roll activity increased the open interest of the second nearby contract by an average of 39.21%. The last column of Table X places the transaction size in a different manner. Specifically, the number of contracts being rolled is multiplied by the contract denomination and the futures price to determine the notional

[16]On average, a cost of one-half of the bid/ask spread unwinding the nearby futures contract and one-half the bid/ask spread buying the second nearby futures contract is expected on each roll.

Table X. Average nearby and second nearby futures contracts returns on commodity index roll dates during the period January 2006 through July 2009.

Returns are computed over the interval from the fourth through the ninth business days each roll month. Futures price data are from the CBT, CME, CSC, and NYC. The return differential is defined as the second nearby return less the nearby futures return.

			Futures return			Percent change in OI		
Commodity futures	Ticker symbol	No. of rolls	Nearby contract	Second nearby	Return differential	Nearby contract	Second nearby	Notional value
Wheat	W	48	-0.0003	0.0006	0.0009	-0.2813	0.4664	707,528,382
Corn	C	48	0.0008	0.0020	0.0012**	-0.1806	0.2644	839,694,396
Soybeans	S	48	0.0113	0.0098	-0.0016	-0.1787	0.3138	1,072,256,880
Cotton No.2	CT	39	-0.0026	-0.0026	0.0000	-0.3089	0.4358	488,603,550
Lean hogs	LH	68	-0.0022	0.0015	0.0037	-0.2446	0.4528	342,776,056
Live cattle	LC	58	-0.0023	-0.0002	0.0021**	-0.2210	0.3759	646,944,744
Suger No.11	SB	39	-0.0013	0.0006	0.0019	-0.2759	0.3808	573,820,235
Coffee C	KC	48	-0.0170	-0.0151	0.0019**	-0.2953	0.4500	494,659,947
Average			-0.0017	-0.0004	0.0013	-0.2483	0.3925	645,785,524
Total								5,166,284,190

**Significant at the 0.05 level.

value of the trades. The values are high. For the CBT's wheat futures contract, about $708 million of contracts are being rolled and the return differential is 0.09%. For soybeans, an average of about $1.1 billion of contracts is being rolled and the return differential is –0.16%. In all, these commodity futures markets absorbed $5.2 billion of trades over five days. Clearly, the futures market has an enormous capacity to absorb commodity index roll activity.

In order to qualify for inclusion in Table X, we required that the commodity futures be included in both the S&P-GSCI and DJ-UBSCI and that the commodity index rolls were from and to the same futures contract expirations so as to maximize the dollar notional value of the commodity futures positions rolled in each roll period. Because the single commodity futures contract with the single largest presence in both the indexes (37.51% of the S&P-GSCI and 13.75% of the DJ-UBSCI) was eliminated as a result of index rolls being into different contract months (see Table I), the average returns of crude oil futures rolls within each index were measured separately. The results are reported in Table XI. As the table shows, the notional value of the index rolls is extremely large, with the crude oil futures rolls of the S&P-GSCI index accounting for $4.1 billion in trading activity. In contrast, all eight commodity futures in Table X account for only $1 billion more. Interestingly, the return differential is positive and statistically significant for both indexes, despite the fact that the nearby futures return is (surprisingly) positive not negative. The size of the return differential for the S&P-GSCI oil futures is 26 basis points, larger than typical bid/ask spreads in the NYME crude oil futures market. Apparently the crude oil futures market shows the effects of price impact during the index roll period due to the sheer size of the notional value of the futures contracts being rolled.

The price impact hypothesis also carries with it an assumption that the greater the amount of index investing the greater the price impact. To test whether there is a relation between the return differential and the amount of index investing, we regress the return differential on the number of contracts traded as part of the roll, that is,

$$R_t = \alpha_0 + \alpha_1 Roll_{OIL,t} + \varepsilon_t, \quad (1)$$

where R_t is the return differential and $Roll_{OIL,t}$ is the number of nearby futures contracts rolled into the second nearby contract. The results are reported in Table XII. As the table shows, the slope coefficients vary randomly around 0 and are not significantly different from 0 for the eight futures contracts with common contract rolls. For these contracts,

Table XI. Average nearby and second nearby crude oil futures contract returns for the DJ-UBSCI and S&P-GSCI on commodity index roll dates during the period January 2006 through July 2009.

Indexes are listed separately since crude oil futures rolls do not involve the same contract months. Returns are computed over the interval from the fourth through the ninth business days each roll month. Futures price data are from the NYME. The return differential is defined as the second nearby return less the nearby futures return.

			Futures return			Percent change in OI		
Commodity index	Ticker symbol	No. of rolls	Nearby contract	Second nearby	Return differential	Nearby contract	Second nearby	Notional value
DJ-UBSCI	CL	57	0.0092	0.0147	0.0055**	-0.0728	0.2512	957,223,557
S&P-GSCI	CL	115	0.0066	0.0092	0.0026**	-0.3360	0.5340	4,097,800,039

**Significant at the 0.05 level.

Table XII. Summary of results for regressions of the return differential of the nearby futures contracts over the roll period on the number of contracts rolled during the period January 2006 through July 2009.

Regression specification is:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 R_{t-2} + \varepsilon_t, \quad (1)$$

where R_t is the futures returns and $Roll_{CEA}$ is the number of nearby futures contracts rolled into the second nearby contract. For the crude oil futures, the two commodity indexes are listed separately since crude oil futures rolls do not involve the same contract months. Returns are computed over the interval from the fourth through the ninth business days each roll month. Futures price and open interest data are from the CBT, CME, CSC, NYC, and NYME. The return differential is defined as the second nearby return less the nearby futures return. The number of contracts rolled is the lower of the reduction in open interest of the nearby contracts and the increase of the open interest in the second nearby contract expressed in millions of contracts.

Commodity futures/index	Ticker symbol	No. of rolls	α_0	α_1	Adjusted R^2
Wheat	W	48	0.00053	0.01294	-0.0161
Corn	C	48	0.00088	0.00519	-0.0162
Soybeans	S	48	-0.00336	0.06594	-0.0082
Cotton No.2	CT	39	0.00179	-0.09844	-0.0185
Lean hogs	LH	68	0.00365	0.00336	-0.0151
Live cattle	LC	58	0.00183	0.01388	-0.0172
Suger No.11	SB	39	0.00552	-0.07462	0.0111
Coffee C	KC	48	0.00237**	-0.03208	-0.0034
DJ-UBSCI crude oil	CL	57	-0.00608	0.71844**	0.1829
S&P-GSCI crude oil	CL	115	-0.00473	0.10730**	0.0713

**Significant at the 0.05 level.

the magnitude of commodity index investing, at least as measured by the roll activity of the S&P-GSCI and DJ-UBSCI, appears to have no impact on futures prices. At the same time, the slope coefficient in the crude oil futures regression is positive and significant, indicating that the notional value of the roll varies directly with the relative futures price change.

E. Causation Tests

Considering the dollar value of commodity futures contracts trading hands in a concentrated period of time, the roll-period results are quite compelling. It is important to recognize, however, that the roll-period evidence is based on the rolling of *existing* long-only commodity index investment, not on *new flows* into long-only commodity index investment. Since we can measure flows into commodity index investment using differences in the long-only commodity index trader open interest reported in the CFTC's weekly Commitment of Trader Supplemental reports, we have the opportunity to conduct a second analysis, complementary to the first analysis, of whether inflows in commodity index investing "cause" futures prices to rise.

To provide a general sense for the analysis that we are about to conduct, consider Figure 11. In the figure, the total notional value of the net commodity index investment in the CBT's wheat futures contract in USD billions is shown.[17] Also Shown is the price of the CBT's nearby wheat futures contract during the same period of time. As the figure shows, commodity index investment in wheat increased during the first few months of 2006, at which time there is little or no increase in the wheat futures prices. Commodity index investing in wheat then falls through the summer of 2006, at which time the futures price rises from about $4.00 a bushel to $5.50 a bushel. From the end of 2006 through the summer of 2007, the wheat futures price increases at an alarming rate from $5.00 a bushel to over $9.00 a bushel—a whopping 80%! In the meantime, the level of commodity index investing in wheat falls from $3.3 billion to $3.0 billion. Other than the simultaneous decline in the commodity index investing and the wheat futures price in late 2008, there is little evidence to suggest any relation between commodity index investing and the futures price. The price behavior of wheat was erratic during the period from mid-2007 through the end of 2008; however, such bouts of volatility have been recorded in the wheat market for many years, well before the advent of commodity index investing.

Figures such as 11 are useful in uncovering potential causality between two time-series. In the end, however, formal statistical tests are necessary. Here we use the Granger (1969) causality test to determine whether commodity index investing activity (i.e., changes in open interest) causes futures price changes, as the subcommittee report concludes, and/or changes in futures prices cause changes in commodity index investing activity. The data underlying the analysis are the 12 different commodity futures contracts followed in the CFTC's COT Supplemental report.[18] The number of weekly CIT long open interest observations for each of the 12 commodities in the period January 2006 through July 2009 is 184.

To determine whether inflows into commodity index investment "Granger-causes" futures returns, we perform two regressions. In the first, we regress futures returns on lagged futures returns, that is:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 R_{t-2} + \varepsilon_t, \tag{2}$$

and, in the second, we regress futures returns on lagged futures returns and lagged flows into commodity index investment, that is:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 R_{t-2} + \alpha_3 Flow_{CIT,t-1} + \alpha_4 Flow_{CIT,t-2} + \varepsilon_t, \tag{3}$$

where R_t is the return of the futures contract and $Flow_{CIT,t}$ is the flow into commodity index investment in week t. If the addition of the lagged flow variables adds explanatory power, the flow variable "Granger-causes" the futures return. Then, to determine whether futures returns "Granger-cause" flows into commodity index investment, we perform two additional regressions. In the first, we regress commodity index investment flows on lagged flows, that is:

$$Flow_{CIT,t} = \alpha_0 + \alpha_1 Flow_{CIT,t-1} + \alpha_2 Flow_{CIT,t-2} + \varepsilon_t, \tag{4}$$

and, in the second, commodity index investment flows on lagged flows and lagged futures returns, that is:

$$Flow_{CIT,t} = \alpha_0 + \alpha_1 Flow_{CIT,t-1} + \alpha_2 Flow_{CIT,t-2} + \alpha_3 R_{t-1} + \alpha_4 R_{t-2} + \varepsilon_t. \tag{5}$$

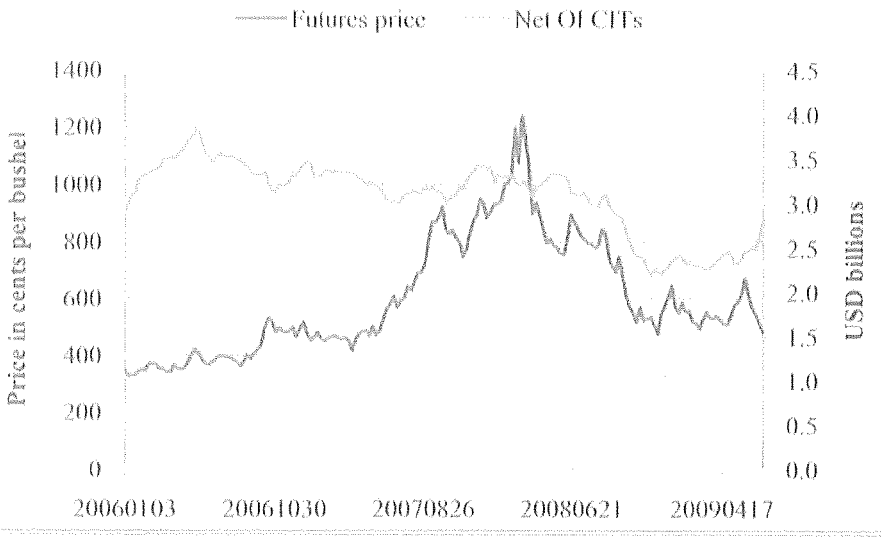
If the addition of the lagged futures returns adds explanatory power, the futures returns "Granger-cause" flows into commodity index investment.

[17] The notional amount is computed as the net commodity index trader positions times the contract denomination times the futures price on January 3, 2006.

[18] The significance of the Granger's work is attested to by the fact he received the Nobel prize in economics in 2003.

Figure 11. Total notional value of net open interest of commodity index traders in CBT's wheat futures contracts and wheat futures price by week during the period January 2006 through June 2009.

CIT data are from weekly CFTC Commitments of Trader Supplement files and futures prices are from the CBT.



The results of the Granger-causality tests are reported in Table XIII. Reported in the table are *F*-statistics (and their associated probability levels) corresponding to the hypothesis that commodity index investment flows "Granger-cause" futures returns and the hypothesis that futures returns "Granger-cause" commodity index investment flows. A probability level of less than 5% denotes Granger-causality. As the results indicate, there is scant evidence of causality in either direction. The only commodity for which commodity index investment flows "Granger-cause" futures returns is for cotton. But, the importance of this result is offset by the fact that, for Kansas City wheat, futures returns "Granger-cause" commodity index investment flows. Overall, the results of Table XIII refute the notion that investment flows affect futures prices.

Finally, it is worth noting that the notional values of the weekly flows into and out of commodity index investment pale by comparison to the roll-period flows. Table XIV reports both the average weekly flow into commodity index investment and the average absolute flow into commodity index investment by commodity. For the CBT's wheat futures contract, the average flow was $4.7 million, which means that each week during the sample period January 2006 through July 2009, commodity index investors pulled out an average of $4.7 million. This is consistent with Figure 11, which shows the notional value of the open interest in wheat trending downward over the period. More important, perhaps, is the average absolute flow. On average, $84.7 million of CBT wheat futures flowed into or out of commodity index investment each week. Compare this with the $789 million reported in Table X that flowed from the nearby futures to the second nearby futures over the roll period (about one week). And, compare the $134.1 million of CBT corn futures that flowed into or out of commodity index investment each week in the Granger-causality tests with the $1.2 billion that flowed from the nearby futures to the second nearby futures over the roll period. While both the roll-period and Granger-causality tests refute the notion of that commodity index investment flows "causes" futures price changes, the roll-period tests remain the most compelling.

F. Analysis of Contemporaneous Relation Between Returns and Flows

With causality ruled out, we now turn to examining the contemporaneous relation between returns and flows using the CFTC's COT Supplemental report data. While examining the contemporaneous relation between variables cannot determine causality, it does help characterize the relation between futures returns and the demands of speculators and commodity index investors to shed some light on the subcommittee report claim that commodity index investing has led to a permanent increase in the level

Table XIII. Granger causality tests of commodity index investing and futures returns using weekly changes in long open interest of COT Supplemental reports during the period January 2006 through July 2009.

Long open interest from COT includes all open interest in any commodity index strategy on a weekly. Futures price data are from the CBT, KCBT, CME, CSC, and NYC.

		Flows to commodity index investment "Granger-cause" futures returns		Futures returns "Granger-cause" flows to commodity index investment	
Commodity futures	Ticker symbol	F-statistic	Probability	F-statistic	Probability
CBT Wheat	W	0.1701	0.844	0.5231	0.594
KCBT wheat	KW	0.1591	0.853	3.1552	0.045**
Corn	C	2.0958	0.126	2.0731	0.129
Soybeans	S	2.7465	0.067	2.4341	0.091
Soybean oil	BO	2.6072	0.077	0.5804	0.561
Cotton	CT	5.8921	0.003**	0.2688	0.765
Live hogs	LH	1.8891	0.154	0.3461	0.708
Live cattle	LC	1.2080	0.301	0.2827	0.754
Feeder cattle	FC	0.3767	0.687	0.2532	0.777
Cocoa	CC	1.8098	0.167	1.3481	0.262
Sugar	SB	0.1582	0.854	0.7935	0.454
Cotton	KC	0.3346	0.716	0.5083	0.602

**Significant at the 0.05 level.

Table XIV. Notional value of flows into commodity index investment based on weekly changes in open interest of commodity index traders during the period January 2006 through July 2009.

		Weekly commodity index investment	
Commodity futures	Ticker symbol	Average flow	Average absolute flow
CBT wheat	W	-4,724,614	84,709,738
KCBT wheat	KW	-403,232	21,840,000
Corn	C	-8,343,614	134,112,115
Soybeans	S	3,897,936	123,718,218
Soybean oil	BO	552,977	34,461,380
Cotton	CT	2,131,847	47,204,598
Live hogs	LH	1,162,131	43,650,751
Live cattle	LC	6,165,122	55,355,084
Feeder cattle	FC	613,472	11,258,944
Cocoa	CC	1,401	158,379
Sugar	SB	4,414,789	68,182,154
Cotton	KC	3,105,938	37,226,547
Average		714,513	55,156,492

of futures prices, and, through arbitrage between markets, asset prices. If the subcommittee report's conclusion is correct, futures returns should be positively correlated with commodity index inflows but independent of commodity index outflows. In investigating such a relation, however, it is imperative to recognize that returns may also be correlated with the demands of other market participants, particularly speculators. To test the subcommittee report conclusion, we therefore perform the regression:

$$R_t = \alpha_0 + \alpha_1 Flow_{Spec,t} + \alpha_2 Flow_{CIT,t} + \alpha_3 d_t + \alpha_4 d_t Flow_{Spec,t} + \alpha_5 d_t Flow_{CIT,t} + \varepsilon_t, \quad (6)$$

where R_t is the futures returns and $Flow_{Spec,t}$ and $Flow_{CIT,t}$ are the weekly net inflows of speculators and commodity index traders as designated by the CFTC's Supplemental report, respectively. If the inflows of speculators and commodity index traders are related to price increases and outflows are related to price reductions, the coefficients α_1 (for the flows of speculators) and α_2 (for the flows of commodity index investors) should be positive. But, these variables alone do not address the asymmetry in the relation. The subcommittee report concludes that it is only inflows by commodity index traders that matter. Outflows should have no effect on prices. To account for this asymmetry, we need to distinguish between commodity index inflows and outflows. We do this by using a dummy variable that takes on a value of 1 when $Flow_{CIT,t} < 0$ and is 0 otherwise. In the event that the relation is symmetric, the coefficient α_5 should be equal to 0, reflecting no asymmetry between inflows and outflows. In the event that commodity index trader inflows increase price but commodity index outflows do not, the coefficient α_5 should have a value approximately equal to $-\alpha_2$.

Table XV contains the results of the regression for each of the 12 commodities in our sample. A number of interesting results emerge. First, the only relation that shows up as being consistent is the relation between the net flows of speculators and futures returns. Its coefficient α_1 is positive and significant for all 12 commodities. The fact that the coefficient α_4 is generally insignificant means that the relation between speculator net flows and returns does not depend on the direction of trading by commodity index traders. Second, the coefficient α_2 varies in sign and is insignificant in all but two cases. This suggests that, after controlling for the effects of speculator demand, commodity index investor net flows have no relation to futures returns. Moreover, the fact that the coefficient α_5 is insignificant across commodities means that there is no asymmetry in the effect of commodity index investor demand and futures returns.

III. Wheat Futures Market

The subcommittee report claims that commodity index investing not only has elevated the level of commodity prices in general but also has caused basis convergence problems in the CBT's wheat market. The causality test results reported in the last section refute the former claim. The purpose of this section is to investigate the wheat convergence issue. The section has four parts. First, we correct two methodological flaws in the way the futures basis is measured in the subcommittee report. Not only is the cash price proxy used incorrect theoretically and biased downward empirically, but also the reported basis is inflated as a result of using non-delivery periods when the futures price should exceed the cash price. Nonetheless, after correcting for the methodological deficiencies, there is some evidence to suggest that the wheat futures price did not always converge in the 2006-2009 period, particularly in late 2008. Second, we examine the CBT's wheat convergence over a period of time much longer than that used in the subcommittee report and show that wheat has failed to converge in periods when the amount of commodity index investing is known to be negligible. Third, we examine the convergence behavior of the CBT's corn and soybean futures contracts over the same historical period and find that, while neither corn nor soybeans have as great of divergence as wheat (corn is close), grain commodity futures in general seem to experience convergence anomalies at the same points in time. Finally, and most importantly perhaps, we address the issue whether the failure of the wheat futures price to converge to the cash price has any meaningful economic consequences. We show that there is no evidence to suggest that the CBT's wheat futures has become a less effective hedging tool.

A. Basis Measurement

The "futures basis" or, simply, "the basis" is defined here as the futures price less the price of the underlying cash commodity. In a properly-functioning market with rational investors, the basis should converge to zero as the futures contract approaches expiration. The reason is simple. The futures contract is a binding agreement to deliver the underlying commodity at the futures expiration date at the futures price. If the futures price is above the cash price at expiration, a risk-free profit equal to the difference between the futures and cash price can be earned by buying the cash commodity, selling the futures, and then delivering the commodity against its futures contract. If, on the other hand, the futures price is below the cash price, a risk-free profit equal to the difference between the cash price and the futures price can be earned by buying the futures, selling a forward

Table XV. Regressions of weekly futures returns on speculator and commodity index trader flows during the period January 2006 through July 2009.

Regressions are performed by commodity using 183 time-series return observations. Regression specification is:

$$R_t = \alpha_0 + \alpha_1 Flow_{Spec,t} + \alpha_2 Flow_{CIT,t} + \alpha_3 d_t + \alpha_4 d_t Flow_{Spec,t} + \alpha_5 d_t Flow_{CIT,t} + \varepsilon_t \quad (6)$$

where R_t is the futures returns and $Flow_{Spec,t}$ and $Flow_{CIT,t}$ are the weekly net inflows of speculators and commodity index traders as designated by the CFTC's Supplemental report, respectively. The dummy variable, d_t has a value of 1 when $Flow_{CIT,t} < 0$ and is 0 otherwise.

Ticker symbol	α_0	α_1	α_2	α_3	α_4	α_5	Adj. R^2
W	0.005071	0.000227**	0.000095	-0.002073	0.00002	0.000078	0.3161
KW	0.009945	0.000438**	-0.000071	-0.005979	-0.00012	0.000615	0.2228
C	0.015031**	0.000088**	-0.000071	-0.016562	0.000069**	0.000115	0.4136
S	-0.000471	0.000066**	0.000120**	0.008761	0.000001	0.000050	0.4494
BO	0.013171**	0.000171**	-0.000053	-0.026055**	0.000024	-0.000103	0.3043
CT	0.008555	0.000113**	-0.000015	-0.026466**	-0.000010	-0.000164	0.2725
LH	0.000419	0.000157**	0.000054	0.012021	0.000017	0.000271	0.0996
LC	-0.000022	0.000052**	0.000018	0.004957	-0.000007	0.000100	0.1716
FC	-0.001975	0.000131**	0.000072	0.004513	-0.000028	0.000039	0.0818
CC	0.006443	0.027634**	0.054791	-0.001315	-0.005591	0.059701	0.2631
SB	-0.003738	0.000089**	0.000028	0.016122	0.000053	0.000059	0.2330
KC	0.000818	0.000147**	0.000147**	-0.004099	-0.000011	-0.000053	0.5782

**Significant at the 0.05 level.

contract to sell the cash commodity, and taking delivery on the futures contract to meet its forward obligation. The absence of "free-money" opportunities ensures prices converge.

That is not to say, however, that the futures price must equal the cash price before expiration. Early in its life, the futures price can be thought of as the expected cash price at a future point in time. Since the cash market conditions in the future can differ from present conditions, the futures price may be quite different from the current cash price. As time passes and the futures contract nears its expiration date, the link between the futures price and the cash price becomes stronger as market participants begin to actively arbitrage between the futures and the underlying cash commodity.

The subcommittee report analyzes the basis convergence of the CBT's wheat futures contract and finds that, in recent years, the basis does not converge and that the futures price expires *above* the underlying cash price. At first blush, this finding flies against reason in that costless arbitrage should generate a risk-free profit – sell the futures, buy the cash commodity, and then deliver the commodity against its futures contract. Upon closer examination of the subcommittee report's methodology for computing the basis, it becomes obvious that the failure to converge is driven, at least in part, by a) using an inappropriate cash price and b) measuring the basis at times other than the delivery period when the futures price should exceed the cash price.

1. Appropriateness of Cash Price

The CBT's wheat futures contract calls for the delivery of US No. 2 Soft Red Wheat at one of a number of delivery locations including Chicago, Burns Harbor Indiana, Ohio river, Northwest Ohio (at a discount of 20 cents), and Mississippi River (at a premium of 20 cents).[19] The price of the same grade of wheat at the different locations will

[19]See CBOT Rules and Regulations, Chapter 14. http://www.cbot.com/cbot/pub/page/0,3181,931,00.html

vary depending on local supply and demand conditions. Costless arbitrage governs the range of prices, however. If the cash price of wheat in Chicago is $3 a bushel and the cash price of the same grade of wheat in Toledo is $2.50, arbitragers will buy the wheat in Toledo, ship it to Chicago, and sell it at $3, thereby earning an arbitrage profit of $.50. The transportation cost of shipping the wheat from Toledo to Chicago would have to be factored in. Assuming that transportation costs are $.10 a bushel, an arbitrage profit of $.40 remains possible. Arbitrage activity will continue until the Chicago and Toledo wheat prices deviate by no more than the transportation cost.

The subcommittee report attempts to circumvent the problem of identifying the appropriate cash price of the deliverable grade of wheat by using an index price of US No. 2 Soft Red Wheat (SRWI) disseminated by Minneapolis Grain Exchange (MGEX). To understand why the SRWI is not an appropriate measure for the price of the cash commodity underlying the CBT's wheat futures contract, we need to understand how the SRWI is computed.

The SRWI is one of seven of grain cash price indexes created by the MGEX to serve as the underlying asset of cash-settled futures and options contracts. The seven daily spot price indexes for wheat, corn, and soybeans are:

Index	Symbol
National corn index	NCI
National soybean index	NSI
Hard red winter wheat index	HRWI
Soft red winter wheat index	SRWI
Hard red spring wheat index	HRSI
Durum wheat index	DWI
Soft white wheat index	WWI

Each spot index is calculated daily and is the simple arithmetic average of posted elevator bids. The SRWI, for example, currently includes more than 600 bid price quotes for US No. 2 Soft Red Wheat collected from elevators in 20 different states. Table XVI contains the percent of the total number of elevators accounted for by each state as of July 8, 2008. Ohio and Illinois are highest, with 27.3% and 26.1% of total, respectively. Indiana, Missouri, Michigan and Wisconsin also have shares that are 5% or higher. Among these 600 cash prices are only a handful that represent locations specified for delivery on the CBT's wheat futures contract. Of the prices at the different delivery locations, the appropriate one is the lowest, after accounting for transportation costs. The difference between that price and the SRWI can be significant and unpredictable, as we will demonstrate shortly.

To gauge the size and direction of the error resulting from the use of the SRWI in the subcommittee report, we collect daily cash prices for two delivery locations specified in the CBT's wheat futures contract—West Chicago Terminal Elevators and West Toledo Terminal Mills—and compare them with the daily levels of the SRWI. The cash prices were obtained from the United States Department of Agriculture (USDA). Figure 12 plots the difference between the Chicago cash price and the SRWI as well as the Toledo cash price and the SRWI during the period January 3, 2000 through July 15, 2009.[20] The price differences are quite remarkable. First, both the Chicago and Toledo price differences reveal that the SRWI is a downward biased estimate of the cash price of the wheat deliverable on the CBT's contract. In general, the price difference are greater than 0, indicating that the SRWI is too low and will give the appearance that there is no convergence when there, in fact, may be. Second, there is considerable variation in the price differences through time. Naturally, this variation obfuscates the meaning of the convergence behavior documented in the subcommittee report. Since the SRWI is neither a tradable commodity nor a commodity deliverable on the CBT's wheat futures contract, it should not be used as a cash market proxy for a deliverable grade of wheat.

Table XVII provides more detail regarding the price differences through time. The results show that over the period January 3, 2000 through July 15, 2009, the cash price of deliverable cash commodities, that is, Chicago wheat and Toledo wheat, are 16.5 cents and 14.5 cents higher than the SRWI, respectively.[21] Not surprisingly, the price differences are not uniformly higher for Chicago wheat versus Toledo wheat. While Chicago wheat tends to be higher, Toledo wheat is higher in 2004 and 2005 as well as 2007 and 2008. In these years, Chicago wheat was cheaper to deliver than Toledo wheat ignoring transportation costs. Nevertheless, the price differences are uniformly positive across years, indicating that the use of the SRWI as a cash market proxy will overstate the size of the futures basis. It is hardly surprising, therefore, that the subcommittee report, which uses the SRWI as a proxy for cash wheat, finds "... consistently elevated futures prices relative to the cash market." In addition, the subcommittee report finds that, "... since 2006, the difference between Chicago wheat futures prices and cash prices has steadily increased." (p. 114). This, too, is hardly surprising considering that the divergence between the cash prices of the deliverable commodities and the SRWI has increased in recent years.

[20] The starting date was determined by the availability of historical data for the SRWI.

[21] Part of the difference may be attributable to the fact that SRWI is based on bid prices rather than trade prices.

Table XVI. Percent of total number of elevators surveyed by state in the calculation of the MGEX's Soft Red Wheat Index (SRWI) as of July 8, 2008.

Data are from MGEX web link, http://www.mgex.com/documents SRWImap071608.pdf

No.	State	Percent of total	No. of elevators
1	Ohio	27.3%	156
2	Illinois	26.1%	149
3	Indiana	12.4%	71
4	Missouri	9.8%	56
5	Michigan	5.8%	33
6	Wisconsin	5.6%	32
7	Kentucky	3.5%	20
8	Arkansas	2.3%	13
9	Louisiana	1.4%	8
10	Georgia	1.4%	8
11	Tennessee	1.1%	6
12	Nine other states	3.3%	19

Figure 12. Daily price difference between Chicago wheat cash price and the SRWI and the Toledo wheat cash price and the SRWI during the period January 3, 2000 through July 15, 2009.

Data are from MGEX website and USDA.

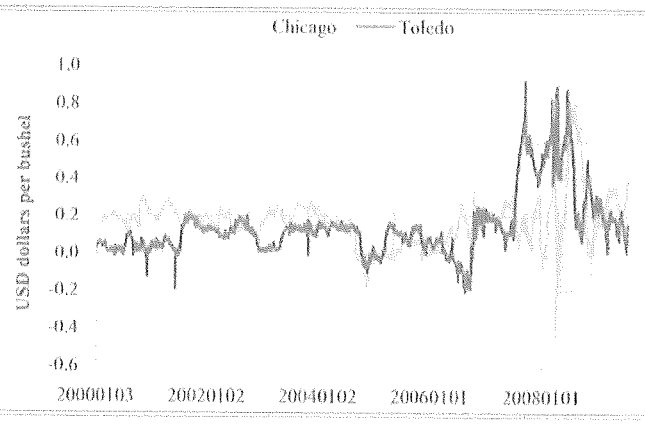


Table XVII. Average daily cash prices and cash price differences for Chicago wheat, Toledo wheat, and the SRWI during the period January 3, 2000 through July 15, 2009.

Data are from MGEX website and USDA.

					Price differences	
Year	No. of days	Chicago cash price	Toledo cash price	SRWI level	Chicago less SRWI	Toledo less SRWI
2000-2009	2,382	3.8299	3.8097	3.6645	0.1654	0.1452
2000	251	2.3168	2.1596	2.1278	0.1889	0.0317
2001	248	2.5823	2.4778	2.3863	0.1960	0.0916
2002	250	3.2124	3.1808	3.0657	0.1467	0.1151
2003	250	3.3991	3.2732	3.1814	0.2177	0.0918
2004	249	3.3594	3.3911	3.2957	0.0637	0.0954
2005	251	3.0124	3.0701	2.9911	0.0213	0.0790
2006	250	3.5835	3.4663	3.4504	0.1331	0.0159
2007	249	5.8495	6.0032	5.6707	0.1789	0.3326
2008	250	6.7493	6.9058	6.4612	0.2881	0.4446
2009	134	4.5954	4.4923	4.3281	0.2673	0.1641

Assuming the purpose is to gauge actual basis convergence, the prices of tradable, deliverable cash commodities must be used.[22]

2. Timing of Measurement

Aside from using an incorrect proxy for the price of deliverable wheat, there is another issue that inflates the level of the basis reported in the subcommittee report. Specifically, in the subcommittee report, convergence is measured on a daily basis throughout the calendar year by subtracting the cash price from the nearby futures price.[23] For most days during the year, however, the nearby futures price will lie above the cash price due to the carry costs of the underlying asset. Only during the delivery period (i.e., the first two weeks of the contract month) should the futures price equal the cash price.

To clarify this point, recall that the CBT's wheat futures contract has only five contract months in a given year—March, May, July, September, and December. This means that we are allowed only five short opportunities to measure convergence each year—during the delivery periods (i.e., the first two weeks) of the March, May, July, September and December futures contracts. On all other days during the year, the difference between the nearby futures contract and the cash price (i.e., the basis) should be different from 0. Since the analysis in the subcommittee report uses all days during the year, we should expect to see positive basis.

To examine the convergence issue, we compute the average daily basis for the CBT's wheat futures contract for each contract month during the sample period January 2000 through July 2009. Note the delivery period for the wheat futures contract begins the first business day of the contract month, and the last day of trading for the contract is the business day before the 15th calendar day of the contract month, so the average basis is an average across about 10 days. Since we do not know the cheapest-to-deliver location for each contract expiration, we use the cash price of No. 2 Soft Red Winter Wheat deliverable in Chicago. The results are displayed in Figure 13.

Our results are more comparable to Irwin, Garcia, Good, and Kunda (2009), who also use a deliverable grade of wheat to perform the basis computation. In place of taking an average of the basis over the delivery period, they use the basis on the first delivery date.

Figure 13 is directly comparable to Figure 26 on page 116 of the subcommittee report. The critical differences are that we are using the cash prices of the commodities that can actually be delivered on the CBT's wheat futures contract and only intervals of time when the futures price should converge to the cash price. As expected, the basis shown in Figure 13 is lower than that shown in the subcommittee report as a result of the downward bias of the cash proxy (i.e., the SRWI) discussed earlier and the inflated basis during non-delivery periods. Where the basis spiked at $2.25 per bushel in 2008 in the subcommittee report, our results show a level closer to $1.50. Our results are more comparable to Irwin, Garcia, Good, and Kunda (2009), who also use a deliverable grade of wheat to perform the basis computation. In place of taking an average of the basis over the delivery period, they use the basis on the first delivery date. And, in place of using Chicago wheat as the cash price, they use the price of wheat deliverable in the Toledo area. In summary, wheat futures prices do not appear to have converged in 2008, although the degree of divergence is not nearly as exaggerated as it appears in the subcommittee report.

B. History of Convergence

An inference drawn in the subcommittee report is that the lack of convergence in the wheat market in the 2006-2009 period, particularly in late 2008, is driven by an increase in commodity index investing. While we documented no increase in commodity index investing of the CBT's wheat futures contract during the period, one could argue that the most dramatic increase in commodity index investing took place just prior to 2006 and we are only seeing its effects registered now. A simple way of addressing this issue is to

[22] Indeed, the fact that the SRWI is not tradable is likely the reason that the cash-settled wheat futures markets launched by the MGEX failed. In principle, cash-settled contracts should be more successful than delivery contracts like the CBT's wheat futures. Costs of delivery (e.g., transportation costs) are avoided since the futures contract is simply marked-to-market at the cash index level at expiration. But, history has shown that cash-settled futures thrive only where some set of market participants can actively trade the underlying index and arbitrage between the futures and cash markets. Indeed, the idea of program-trading of the stocks underlying the S&P 500 index emanated from the desire to arbitrage between the markets. In the case of the SRWI, the underlying commodity basket is not practically tradable. Buying or selling one dollar of wheat in 600 delivery locations is hardly practical, even for the biggest grain merchants in the marketplace. Without active arbitrage between the markets, there is no assurance that the cash-settled futures is an effective hedging vehicle, and, without the presence of hedgers in the marketplace, futures contract markets die on the vine.

[23] See subcommittee report (2009).

Figure 13. Absolute basis between CBT's wheat futures contract and the cash price of wheat deliverable in Chicago during the period January 3, 2000 through July 15, 2009.

Futures data are from CME and cash data are from USDA. Average basis is computed over the daily levels observed during the contract delivery period.

examine basis behavior over a longer history. In Figure 14, we examine the basis behavior of wheat during delivery periods for all contracts traded during January 1992 through July 2009. Because the dollar price of wheat varied dramatically over the sample period, we measure basis relative to the futures price on the last day of trading in order to gauge the levels on a common footing. Because we do not know for certain which delivery location is cheapest-to-deliver, we use two cash prices of wheat—Chicago and Toledo.

Focusing in on Chicago wheat, note the following. First, the relative basis is fairly erratic throughout the sample period. From 1992 through 1998, the basis at expiration bounces between 0% and 10%. It then proceeds to increase, reaching a maximum level of 22.6% for the September 1999 contract delivery period. From that point, the relative basis at contract expiration falls back down and hovers at a level just above 0%. Subsequently, it rises and spikes at 16.9% for the September 2006 contract and 21.6% for the September 2008 contract. Based on the figure, it is fair to say that convergence has been an issue in the wheat market dating back at least to 1992. Generally, the level of basis stays within the 0-10% range; however, periodic spikes for the September contracts are noteworthy. Given that commodity index investing had a relatively small presence in the marketplace before 2004 and virtually no presence in the marketplace in the early 1990s, commodity index investing cannot be the cause of the basis instability noted throughout the period.

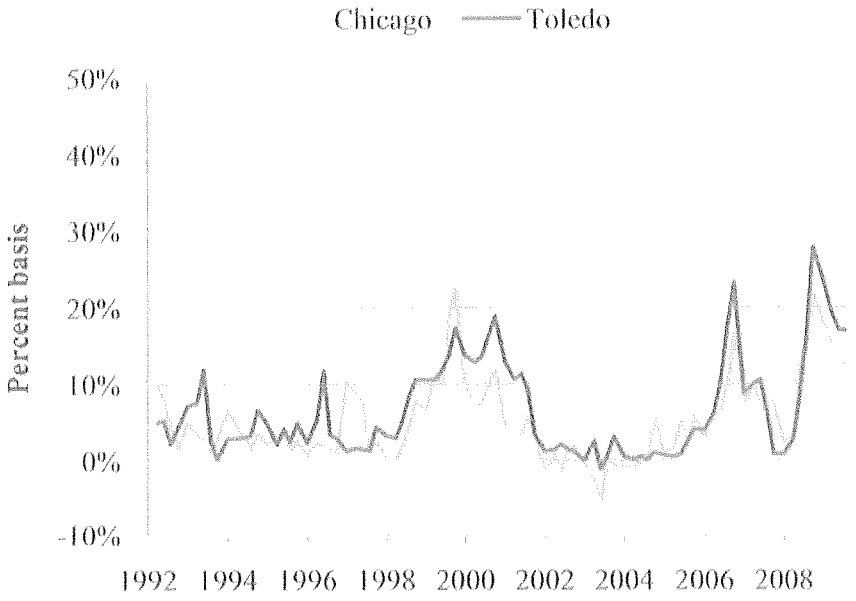
Figure 14 is also useful in demonstrating the concept of cheapest to deliver. The average basis during the delivery period varies differently through time for Chicago and Toledo wheat. In some months, Chicago wheat has a basis closer to 0, while, in other months, Toledo does. The cheapest to deliver is the delivery location whose basis is closest to 0. So, where the basis spikes up for the September 2006 and September 2008 contract expirations, it is of no relevance to assessing convergence. Convergence is only relevant for the cheapest to deliver commodity, and, in both of these months, Chicago wheat is cheaper. In addition, there is no assurance that Chicago wheat is cheapest. Delivery at a number of other locations is possible. The Chicago and Toledo cash prices were chosen because they are frequently the cheapest to deliver locations.

C. Inter-commodity Comparisons

Several other agricultural commodities are included in the popular commodity indexes like the S&P-GSCI and DJ-UBSCI. The CBT's corn futures, for example, has weights of 3.55% and 5.72% in the two indexes, respectively, while the

Figure 14. Relative basis between CBT's wheat futures contract and Chicago and Toledo wheat cash prices during the period January 1992 through July 2009. Futures data are from CBT and cash prices are from USDA.

Average basis is computed over the daily levels observed during the contract delivery period. Futures price for computing relative basis is the settlement futures price on the last day of trading.



CBT's wheat futures has weights of 3.90% and 4.80%. To gauge whether the same type of basis behavior has occurred for corn as for wheat, we examine basis convergence for all contract maturities from January 1992 through July 2009. The CBT's corn futures contract calls for delivery in Chicago, Burns Harbor Indiana, Lockport Seneca (at a premium of 2 cents), Ottawa-Chillicothe (at a premium of 2.5 cents), and Peoria-Pekin (at a premium of 3 cents). Since we do not know the cheapest-to-deliver location through history, we choose three cash prices in and around the Chicago area—Chicago, Illinois River North of Peoria, and Illinois River South of Peoria.

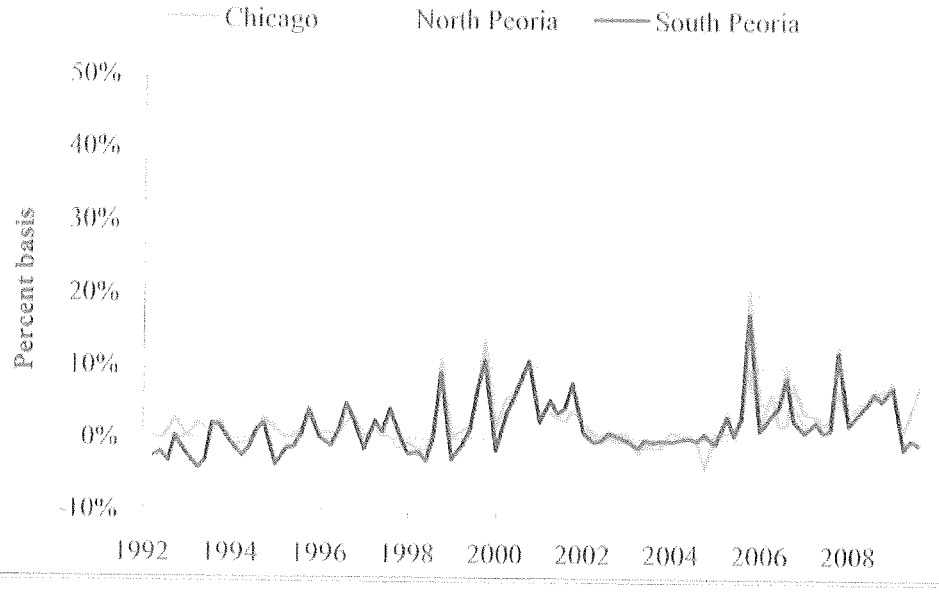
Figure 15 shows the relative basis for the CBT's corn futures in the delivery periods from January 1992 through July 2009. The observed basis behavior for corn is different in at least two ways from that of wheat—the cash prices at the delivery locations are very similar, as indicated by the fact the three lines are on top of each other in many contract months, and the range of oscillations is lower, with most contract months falling in the 0-10% range. But, in other ways, they remain similar. They do oscillate from delivery month to delivery month, and the degree of variation in the oscillations changes in similar ways through time, with modest variation occurring in 1992 through 1998, high variation occurring in 1999 through 2001, low variation in 2002 through 2005, and high variation again in 2006 through 2009. While convergence appears to be less of an issue for corn than for wheat, it also appears that these two agricultural markets are driven by similar market factors and the relative basis behavior is not entirely commodity specific.

The CBT's soybean futures is another agricultural commodity typically included in diversified commodity indexes. Its weights are 2.64% and 7.60% in the S&P-GSCI and DJ-UBSCI indexes, respectively. The CBT's soybean futures contract calls for delivery in Chicago, Burns Harbor Indiana, Lockport Seneca (at a premium of 2 cents), Ottawa-Chillicothe (at a premium of 2.5 cents), Peoria-Pekin (at a premium of 3 cents), Havana-Grafton (at a premium of 3.5 cents), and St Louis and Alton (at a premium of 6 cents).

To gauge whether the basis behavior of soybeans is different from that of wheat and corn, we examine basis convergence for all soybean futures contract expirations during the period January 1992 through July 2009. Three cash prices are again used, with delivery locations in

Figure 15. Relative basis between CBT's corn futures contract and the cash prices of corn deliverable in (a) Chicago, (b) Illinois River North of Peoria, and (c) Illinois River South of Peoria during the period January 3, 2000 through July 15, 2009.

Futures data are from CBT and cash data are from USDA. Average basis is computed over the daily levels observed during the contract delivery period. Futures price for computing relative basis is the settlement futures price on the last day of trading.



Chicago, Illinois River North of Peoria, and Illinois River South of Peoria. Figure 16 shows the results. The soybean basis behavior shows greater convergence than both wheat and corn. The relative basis hovers just above 0 through most of the period. Again, the behavior is a little more erratic in 1999 through 2001 and in 2006 through 2009, suggesting a market-wide effect for grain commodities in general.[34]

D. Economic Consequences

Up to this point, we have focused in on the issue of convergence in the wheat futures market, and, to be sure, there are instances in time, both before and after the introduction of commodity index investment, that the futures price exceeded the cash price of the deliverable commodity during the delivery period. But, the importance of the convergence issues presupposes that failure to converge has dire economic consequences. The subcommittee report certainly suggests that there are.

"The increasing gap between the futures and cash prices (basis), together with the failure of convergence, have *seriously impaired* (emphasis added) the ability of farmers, grain elevators, grain merchants, grain processors, and others in the agriculture industry to use the Chicago wheat futures market to manage and reduce the price risks arising from their operations in the wheat market." (See subcommittee report 2009, p. 113).

But, this claim is patently false. The fact of the matter is that convergence is of limited importance considering that most of these risk managers unwind their futures positions before the delivery period. The important issue is whether or not there is evidence to indicate that the Chicago wheat futures has become a less effective hedging vehicle.

To begin our assessment of the economic consequences of Chicago wheat's failure to converge, we turn to the daily open interest of the CBT's wheat futures contracts during the period January 1992 through July 2009. For each contract month during this period, we identify the maximum daily open interest during the contract's life and the open interest on the first notice day of the contract (i.e., the last business day in the month preceding the delivery month. In Figure 17, we plot these values. The results are quite revealing. While

[34]Recall that in Section II we showed the same seasonal behavior for the CBT's oats futures contract, and oats in not included in commodity index investing programs.

Figure 16. Relative basis between CBT's soybean futures contract and the cash prices of soybeans deliverable in (a) Chicago, (b) Illinois River North of Peoria, and (c) Illinois River South of Peoria during the period January 3, 2000 through July 15, 2009.

Futures data are from CME and cash data are from USDA. Average basis is computed over the daily levels observed during the contract delivery period. Futures price for computing relative basis is the settlement futures price on the last day of trading.

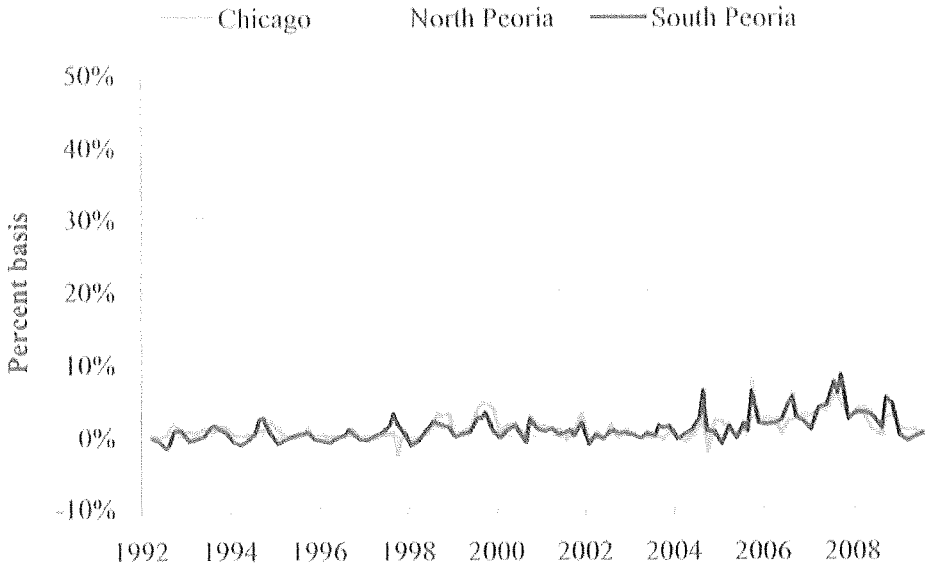
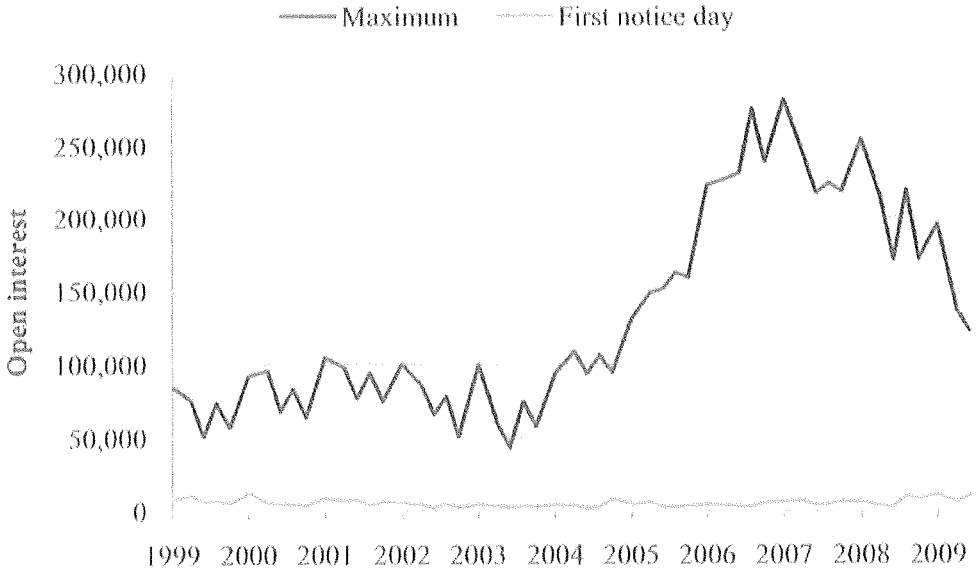


Figure 17. Maximum open interest and open interest on first notice day for CBT's wheat futures contracts during the period January 1992 through July 2009.

Futures data are from CBT.



the maximum levels of open interest were high in 2006 and 2007, at least relative to the levels observed before 2005, the open interest on the first notice day has remained relatively constant through time. Table XVIII contains the average open interest on the first notice day across contract months for the CBT's wheat futures contract as well as the CBT's corn and soybean futures contracts. As the table shows, the average number of futures contracts carried into the delivery month was 5,284 during the sub-period 1999-2004 and 5,583 in 2005-2009. These are small numbers, at least in a relative sense. The average ratio of open interest on the first notice day to the maximum open interest over the contract's life over the period January 2005 through July 2009 is only 2.9%. This means that 97.1% of risk managers (e.g., farmers, grain elevators, grain merchants, grain processors, and others in the agriculture industry) have unwound their hedge positions before the delivery month.[25] In other words, for the vast majority of wheat price risk managers, the issue of convergence is moot.

What is relevant to the risk manager is the effectiveness of the CBT's wheat futures at hedging commodity price risk over his/her hedging horizon. In practice, hedging effectiveness is measured by the adjusted R-squared from a regression of cash commodity returns on futures returns.[26] The adjusted R-squared has a range from 0 to 1. A value near 0 indicates that the futures is an ineffective hedging tool, and a value near 1 indicates that it is a very effective tool.

To assess whether the CBT's wheat futures contract has become a less effective hedging vehicle in recent times, as is suggested by the subcommittee report, we examine the returns of cash wheat and wheat futures over all contract expirations during the period January 2000 through July 2009. To proxy for the cash price of wheat, we use the daily levels of the SRW1 from the MGEX. The hedge horizon is set at 126 business days (about 6 months), and the hedge period ends on the first notice day of the futures contract month. The futures price data are from the CBT. For each futures contract expiration during the sample period, we regress cash returns on futures returns and record the adjusted R-squared. Table XIX summarizes the results. The table entries are the average adjusted R-squared values of the contract months in each year. As the table shows, the CBT's wheat futures contract has been a highly effective hedging instrument throughout the 10-year period. For the sub-period 2006-2009, the adjusted R-squared is 0.949, which means that 94.9% of cash commodity price risk can be eliminated using the wheat futures contract.

[25]Of course, 100% of commodity index investors closed their positions weeks before the delivery month.

[26]See Whaley (2006).

IV. Summary of Main Conclusions

The subcommittee report concludes that excessive speculation by commodity index investors has caused unwarranted increases in the price of wheat futures and has seriously impaired the contract's effectiveness at being an effective risk management tool. This study questions the legitimacy of this conclusion and reaches three main conclusions.

1) **Commodity index investment is not speculation.**

Commodity index investment is passive, fully-collateralized, long-only investment by an institution or individual and is no different in principle from a stock index or bond index portfolio. Its fundamental contribution to investment management is in providing an effective diversification tool.

2) **Commodity index rolls have little futures price impact, and inflows and outflows from commodity index investment do not cause futures prices to change.**

The price of a commodity reflects the cost of supplying that commodity and the demand for it by consumers. Changes in the cost of production or in demand change the price. The futures price reflects the spot price expected in the future and hence reflects the supply and demand anticipated for the commodity. For commodities that are stored, arbitrage assures that the spot and futures price are linked. We conduct six analyses to determine whether investment in commodity futures, sometimes in large amounts, diverts futures prices from their fundamental value. The first argues that, if index traders were the dominant force in the commodity futures market, the prices of all futures contracts in the index would rise or fall together. We show that the correlation in futures returns is neither high nor uniform. In the second, we show that commodities not in an index are correlated with commodities in the index approximately to the same degree as commodities in the index are correlated with each other, which suggests that fundamental forces, not index investing, is the source of the correlation. Third, commodity prices rose in 2006 and 2007. If the increase was due to index investing, one would not expect a similar rise for commodities not in an index. The prices of coal, cobalt and rhodium—commodities not in an index—also rose in price, however, which suggests the price rise cannot be the result of commodity index investing. Fourth, commodity index investors that mimic the S&P-GSCI and DJ-UBSCI roll out of the nearby contract and into the next contract according to a known schedule. Given the hundreds of millions of dollars in futures trades being consummated at this time, this would be the most likely time to see price impact, both in the sale

Table XVIII. Average open interest of first notice day relative to maximum open interest over contract life and average open interest on first notice day for selected agricultural futures contracts during the period January 1999 through July 2009.

Futures data are from the CBT.

Panel A. Open interest on first notice day			
Subperiod	Wheat	Corn	Soybean
1999-2004	5,284	22,611	11,299
2005-2009	5,583	26,638	12,591
Panel B. Open interest on first notice day relative to maximum open interest			
Subperiod	Wheat	Corn	Soybean
1999-2004	0.0667	0.1109	0.1581
2005-2009	0.0293	0.0557	0.1014

Table XIX. Average adjusted R-squared level of regression of daily cash wheat returns on daily wheat futures returns by contract month during the period January 2000 through July 2009.

Cash returns are calculated from SRWI levels and were obtained from the MGEX website. Futures returns are calculated from CBT prices. Return regressions are for the last 126 business days before and including the contract's first notice day.

Subperiod	Adjusted R-squared
1999-2004	0.943
2005-2009	0.949

of the nearby futures and the purchase of the second nearby. The positive, but economically insignificant, price effects observed suggest that the futures markets are deep and fully capable of absorbing commodity index investment rolls for most commodity futures markets. A separate analysis for crude oil futures—the commodity futures with the single largest notional value in the indexes (but not rolled in the same way within the indexes)—shows a positive and significant return differential. Fifth, we analyze in a Granger causality framework the relation between investment flows of index traders as reported in the Supplement to the COT reports and subsequent price changes. There is no evidence that investment flows Granger-cause price changes or that price changes Granger-cause flows. Sixth, the Granger causality tests examine weekly lag effects, which may be too coarse a measure to see an impact. We also look at a contemporaneous relation between commodity futures returns and flows under the assumption that inflows have a different price effect than outflows. We find no indication that commodity index traders affect prices in this framework. Other traders, classified as speculators, do have an impact.

3) **Failure of the wheat futures price to converge to the cash price at the contract's expiration has not undermined the futures contract's effectiveness as a risk management tool.**

The subcommittee report concludes that commodity index investing is a major cause in the failure of the CBT's wheat futures price to converge in the period 2006-2009, with the futures price being particularly elevated in late 2008. What is surprising about this conclusion is that commodity index investing in wheat was actually falling, not rising, in 2008. To understand the CBT's wheat price convergence more fully, we use a period of time much longer than that used in the subcommittee report and show that wheat has failed to converge in periods when the amount of commodity index investing is known to be negligible. We also examine the convergence behavior of the CBT's corn and soybean

futures contracts over the same historical period and find that, while neither corn nor soybeans have had as great of divergence as wheat, grain commodity futures in general seem to experience convergence anomalies at the same points in time. Finally, we address the issue whether the failure of the wheat futures price to converge to the cash price has any meaningful economic consequences. We find none. For convergence to be an issue, significant numbers of futures contracts must be carried into the delivery month. In the period 2005-2009, only about 5,000 contracts remained open on the first notice day of the delivery month, less than 3% of the maximum open interest that the contract realized during its life. In other words, 97% of the risk managers who had been using the wheat futures to hedge have disposed of their positions before convergence becomes an issue. The cash price for delivering this small amount is subject to the vagaries of the delivery mechanism and the option of the short to choose the grade, location, and exact time of delivery. The apparent failure to converge does not reduce the effectiveness of the CBT's wheat futures contract as a risk management tool, however, for we show that futures returns are highly correlated with the returns of a typical grade of wheat.■

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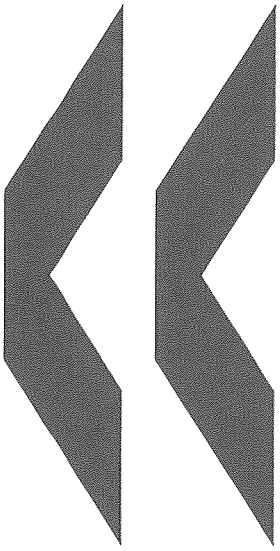

OECD Food, Agriculture and Fisheries Working Papers No. 27

The Impact of Index and Swap Funds on Commodity Futures Markets

PRELIMINARY RESULTS

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*University of Illinois, United States

Executive Summary

The report was prepared for the OECD by Professors Scott Irwin and Dwight Sanders. It represents a preliminary study which aims to clarify the role of index and swap funds in agricultural and energy commodity futures markets. The full report including the econometric analysis is available in the Annex to this report.

While the increased participation of index fund investments in commodity markets represents a significant structural change, this has not generated increased price volatility, implied or realised, in agricultural futures markets. Based on new data and empirical analysis, the study finds that index funds did *not* cause a bubble in commodity futures prices. There is no statistically significant relationship indicating that changes in index and swap fund positions have increased market volatility. The evidence presented here is strongest for the agricultural futures markets because the data on index trader positions are measured with reasonable accuracy. The evidence is not as strong in the two energy markets studied here because of considerable uncertainty about the degree to which the available data actually reflect index trader positions in these markets.

An unexpected finding was a negative relationship between index and swap fund positions and market volatility. That is, there is some evidence that increases in index trader positions are followed by lower market volatility. This result must be interpreted with considerable caution. The possibility still exists that trader positions are correlated with some third variable that is actually causing market volatility to decline. Nonetheless, this finding is contrary to popular notions about the market impact of index funds, but is not so surprising in light of the traditional problem in commodity futures markets of the lack of sufficient liquidity to meet hedging needs and to transfer risk.

The empirical evidence presented in this preliminary study does not appear at present to warrant extensive changes in the regulation of index funds participation in agricultural commodity markets; any such changes require careful consideration so as to avoid unintended negative impacts. For example, limiting the participation of index fund investors could unintentionally deprive commodity futures markets of an important source of liquidity and risk-absorption capacity at times when both are in high demand.

Lack of convergence between spot and futures prices in certain markets, however, does raise a number of issues about the functioning of these markets and possible role of index funds. Further research is needed to understand better these recent structural changes in futures marks and how they may impact on the dynamics of price formation. But at this time, the weight of evidence clearly suggests that increased index fund activity in 2006-08 did *not* cause a bubble in commodity futures prices.

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THE IMPACT OF INDEX AND SWAP FUNDS ON COMMODITY FUTURES MARKETS: PRELIMINARY RESULTS

1. Introduction

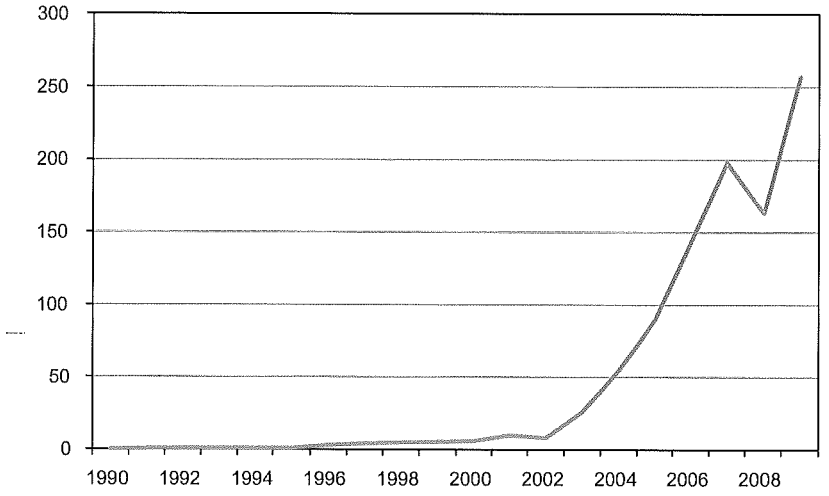
1. The financial industry has developed new products that allow institutions and individuals to invest in commodities through long-only index funds, over-the-counter (OTC) swap agreements, exchange traded funds, and other structured products.[1] Box 1 provides key definitions used in the discussion; see the glossary for a complete set of definitions. Regardless of form, these instruments have a common goal: to provide investors with buy-side exposure to returns from a particular index of commodity prices. The S&P GSCI Index™ (Standard's and Poor's Goldman Sachs Commodity Index) is one of the most widely tracked indexes and is generally considered an industry benchmark. It is computed as a production-weighted average of the prices from 24 commodity futures markets.

2. Several influential studies in recent years purport that investors can capture substantial risk premiums and reduce portfolio risk through relatively modest investment in long-only commodity index funds. Combined with the availability of deep and liquid exchange-traded futures contracts, this evidence fuelled a dramatic surge in index fund investment. Some describe this surge and its attendant impacts as the "financialization" of commodity futures markets. Given the size and scope of commodity index funds, it should probably not come as a surprise that a world-wide debate has ensued about their role in commodity markets. The debate has important ramifications from a policy and regulatory perspective as well as practical implications for the efficient pricing of commodity products.

3. There are a few indisputable facts about the behaviour of commodity futures markets over 2006-08, the period associated with the most controversy regarding the impact of money inflows from commodity index funds. First, inflows into long-only commodity index funds did increase rather substantially throughout 2006-08 (see Figure 1). According to the most widely-quoted industry source (Barclays) index fund investment increased from USD 90 billion at the beginning of 2006 to a peak of just under USD 200 billion at the end of 2007. Second, commodity prices have also increased rather dramatically - 71% as measured by the Commodity Research Bureau index - from January 2006 through June of 2008 (see Figure 2). Third, prices declined almost equally dramatically from June 2008 through early 2009 (see Figure 2). These facts are clear and not in dispute. It's the interpretation of the interaction among these facts that is so controversial.

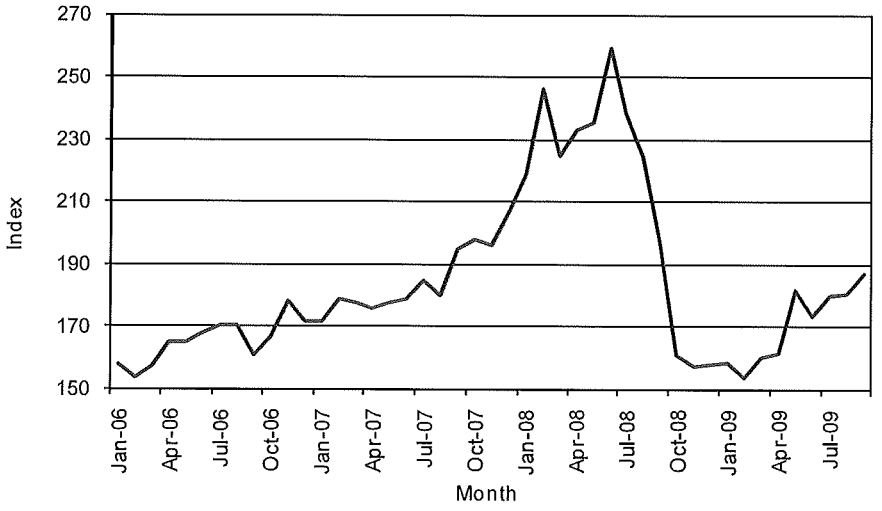
[1] In the remainder of this report, the term "commodity index fund" or "index fund" is used generically to refer to all of the varied long-only commodity investment instruments.

Figure 1. Commodity index fund investment (year end), 1990 – 2009



Source: Barclays

Figure 2. CRB Commodity index, January 2006 - September 2009



4. On one side, some hedge fund managers, commodity end-users, and policy-makers assert that speculative buying by index funds on such a wide scale created a "bubble," with the result that commodity futures prices far exceeded fundamental values during the boom. This view has led to new regulatory initiatives to limit speculative positions in commodity futures markets. On the other side, a number of economists have expressed scepticism about the bubble argument. These economists argue that commodity markets were driven by fundamental factors that pushed prices higher. For example, the main factors cited as driving the price of crude oil include strong demand from China, India, and other developing nations, a levelling out of crude oil production, a decrease in the responsiveness of consumers to price increases, and U.S. monetary policy. In the grain markets, the diversion of row crops to biofuel production and weather-

related production shortfalls are cited, as well as demand growth from developing nations and U.S. monetary policy.

Box 1. Key definitions

Speculator: In commodity futures, a trader who does not hedge, but who trades with the objective of achieving profits through the successful anticipation of price movements

Hedger: A trader who enters into positions in a futures market opposite to positions held in the cash market to minimize the risk of financial loss from an adverse price change; or who purchases or sells futures as a temporary substitute for a cash transaction that will occur later. One can hedge either a long cash market position (e.g., one owns the cash commodity) or a short cash market position (e.g., one plans on buying the cash commodity in the future).

Swap: In general, the exchange of one asset or liability for a similar asset or liability for the purpose of lengthening or shortening maturities, or otherwise shifting risks. This may entail selling one securities issue and buying another in foreign currency; it may entail buying a currency on the spot market and simultaneously selling it forward. Swaps also may involve exchanging income flows; for example, exchanging the fixed rate coupon stream of a bond for a variable rate payment stream, or vice versa, while not swapping the principal component of the bond. Swaps are generally traded over-the-counter.

Swap Dealer (AS): An entity such as a bank or investment bank that markets swaps to end users. Swap dealers often hedge their swap positions in futures markets.

Commodity Index Funds: Financial product whose value is based on an index of commodity futures prices.

Over-the-Counter (OTC): The trading of commodities, contracts, or other instruments not listed on any exchange. OTC transactions can occur electronically or over the telephone.

Speculative Bubble: A rapid run-up in prices caused by excessive buying that is unrelated to any of the basic, underlying factors affecting the supply or demand for a commodity or other asset. Speculative bubbles are usually associated with a "bandwagon" effect in which speculators rush to buy the commodity (in the case of futures, "to take positions") before the price trend ends, and an even greater rush to sell the commodity (unwind positions) when prices reverse.

Long: (1) One who has bought a futures contract to establish a market position; (2) a market position that obligates the holder to take delivery; (3) one who owns an inventory of commodities.

Long Hedge: Hedging transaction in which futures contracts are bought to protect against possible increases in the cost of commodities.

Short: (1) The selling side of an open futures contract; (2) a trader whose net position in the futures market shows an excess of open sales over open purchases. See Long.

Short Hedge: Selling futures contracts to protect against possible decreased prices of commodities.

Open Interest: The total number of futures contracts long or short in a delivery month or market that has been entered into and not yet liquidated by an offsetting transaction or fulfilled by delivery.

Excessive Speculation: Amount of speculation beyond that which is necessary or normal relative to hedging needs, as measured by Working's T. A large part of technically excess speculation is economically necessary for a well functioning market. The ratio of the amount of speculation to hedging needs must thus be greater than 1 for futures markets to have sufficient liquidity to fulfill their economic role. For Working's T-values of 1.15 or less markets are considered to have insufficient liquidity though there is an excess of speculation, technically speaking.

5. Even though almost two years have passed since the 2008 peak in commodity prices, the controversy surrounding index funds continues unabated. We contend that a detailed and dispassionate synthesis of the arguments and latest research will be of great utility to market observers and policymakers

given the strident nature of the debate. Policy makers need to have a full picture of the current state of scientific knowledge on the impact of commodity index funds before imposing costly new regulations. In this paper, we provide an overview of the arguments concerning the impact of index funds in commodity futures markets as well as an assessment of the latest research on the subject. We also summarise some new empirical evidence on the market impact of commodity index funds.

2. It was a Bubble

6. Masters (2008) has interwoven investment and price data to create the most widely-cited bubble argument, painting the activity of index funds as akin to the infamous Hunt brothers' cornering of the silver market. He blames the rapid increase in overall commodity prices from 2006-08 on institutional investors' embrace of commodities as an investable asset class. As noted in the introduction, it is clear that considerable dollars flowed into commodity index funds over this time period. However, the evidence provided by Masters is limited to anecdotes and the temporal correlation between money flows and prices. Masters and White (2008) recommend specific regulatory steps to address the alleged problems created by index fund investment in commodity futures markets, including the re-establishment of speculative position limits for all speculators in all commodity futures markets and the elimination or severe restriction of index speculation.

7. A similar position was taken by the U.S. Senate Permanent Subcommittee on Investigations in its examination of the performance of the Chicago Board of Trade's (CBOT) wheat futures contract (USS/PSI, 2009, p. 2):

> "This Report finds that there is significant and persuasive evidence to conclude that these commodity index traders, in the aggregate, were one of the major causes of "unwarranted changes"—here, increases—in the price of wheat futures contracts relative to the price of wheat in the cash market. The resulting unusual, persistent and large disparities between wheat futures and cash prices impaired the ability of participants in the grain market to use the futures market to price their crops and hedge their price risks over time, and therefore constituted an undue burden on interstate commerce. Accordingly, the Report finds that the activities of commodity index traders, in the aggregate, constituted "excessive speculation" in the wheat market under the Commodity Exchange Act."

8. Based on these findings, the Subcommittee recommended: 1) phasing out of existing position limit waivers for index traders in wheat, 2) if necessary, imposition of additional restrictions on index traders, such as a position limit of 5 000 contracts per trader, 3) investigation of index trading in other agricultural markets, and 4) strengthening of data collection on index trading in non-agricultural markets.

9. One of the limitations of the bubble argument made by Masters and others is that the link between money inflows from index funds and commodity futures prices is not well developed. This allows critics to assert that bubble proponents make the classical statistical mistake of confusing correlation with causation. In other words, simply observing that large investments have flowed into the long side of commodity futures markets at the same time that prices have risen substantially does not necessarily prove anything without a logical and causal link between the two. One attempt to establish this linkage is found in Petzel's (2009, pp. 8-9) testimony at a CFTC hearing on position limits in energy futures markets:

> "Seasoned observers of commodity markets know that as non-commercial 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."

10. In essence, Petzel argues that unleveraged futures positions of index funds are effectively synthetic long positions in physical commodities, and hence represent new demand. If the magnitude of index fund demand is large enough relative to physically-constrained supplies in the short-run, prices and price volatility can increase sharply. The bottom-line is that the size of index fund investment is "too big" for the current size of commodity futures markets.

11. Hamilton (2009) provides a more formal theoretical treatment of the issues. He begins by noting that the key challenge is reconciling a speculative bubble in crude oil prices with changes in the physical quantities of crude oil. A standard argument is that a price bubble will inevitably lead to a rise in inventories as the quantity supplied at the "bubble price" exceeds the quantity demanded. Hamilton's theoretical model shows the conditions that must occur for index fund speculation to lead to a bubble in a storable commodity market such as crude oil. First, index fund positions in the futures market must have a positive relationship to the level of futures prices. Otherwise there is no mechanism for the flow of index fund investment to initiate the bubble that starts in the futures market. Second, the elasticity of demand for the commodity (or the final product, gasoline in the case of crude oil) must be zero or very close to zero. This allows the bubble-related increase in the futures price to be fully passed on to consumers. Third, inventories of the commodity must not increase. These conditions provide an important theoretical framework on which to base empirical tests for the potential of price bubbles in storable commodity futures prices.

3. It was not a Bubble

12. A number of economists have expressed scepticism about the bubble argument. These economists cite several contrary facts and argue that commodity markets were driven by fundamental factors that pushed prices higher. Irwin, Sanders, and Merrin (2009) present a useful summary of the counter arguments made by these economists. Specifically, they note three logical inconsistencies in the arguments made by bubble proponents as well as five instances where the bubble story is not consistent with observed facts. Here, we review these points as well as some additional arguments made by both pro- and anti-bubble proponents in response.

13. The first possible logical inconsistency within the bubble argument is equating money inflows to commodity futures markets with demand. With equally informed market participants, there is no limit to the number of futures contracts that can be created at a given price level. Index fund buying in this situation is no more "new demand" than the corresponding selling is "new supply". Combined with the observation that commodity futures markets are zero-sum games, this implies that money flows in and of themselves do not necessarily impact prices. Prices will only change if new information emerges that causes market participants to revise their estimates of physical supply and/or demand.

14. What happens when market participants are not equally informed? When this is the case, it is rational for participants to condition demands on both their own information and information about other participants' demands that can be inferred ("inverted") from the futures price. The trades of uninformed participants can impact prices in this more realistic model if informed traders mistakenly believe that trades by uninformed participants reflect valuable information. Hence, it is possible that other traders in commodity futures markets interpreted the large order flow of index funds on the long side of the market as a reflection of valuable private information about commodity price prospects, which would have had the

effect of driving prices higher as these traders revised their own demands upward. Of course, this would have required a large number of sophisticated and experienced traders in commodity futures markets to reach a conclusion that index fund investors possessed valuable information that they themselves did not possess.

15. The second possible logical inconsistency is to argue that index fund investors artificially raised both futures and cash commodity prices when they only participated in futures markets. Futures contracts are financial transactions that only rarely involve the actual delivery of physical commodities. In order to impact the equilibrium price of commodities in the cash market, index investors would have to take delivery and/or buy quantities in the cash market and hold these inventories off the market. Index investors are purely involved in a financial transaction using futures markets; they do not engage in the purchase or hoarding of the cash commodity and any causal linkages between their futures market activity and cash prices is unclear at best. Hence, it is wrong to draw a parallel between index fund positions and past efforts to "corner" commodity markets, such as the Hunt brothers' effort to manipulate the silver market in 1979-80.

16. A third possible logical inconsistency is a blanket categorization of speculators, in particular, index funds, as wrongdoers and hedgers as victims of their actions. In reality, the "bad guy" is not so easily identified since hedgers sometimes speculate and some speculators also hedge. For example, large commercial firms may have valuable information gleaned from their far-flung cash market operations and trade based on that information. The following passage from a recent article on Cargill, Inc. (Davis, 2009) nicely illustrates the point:

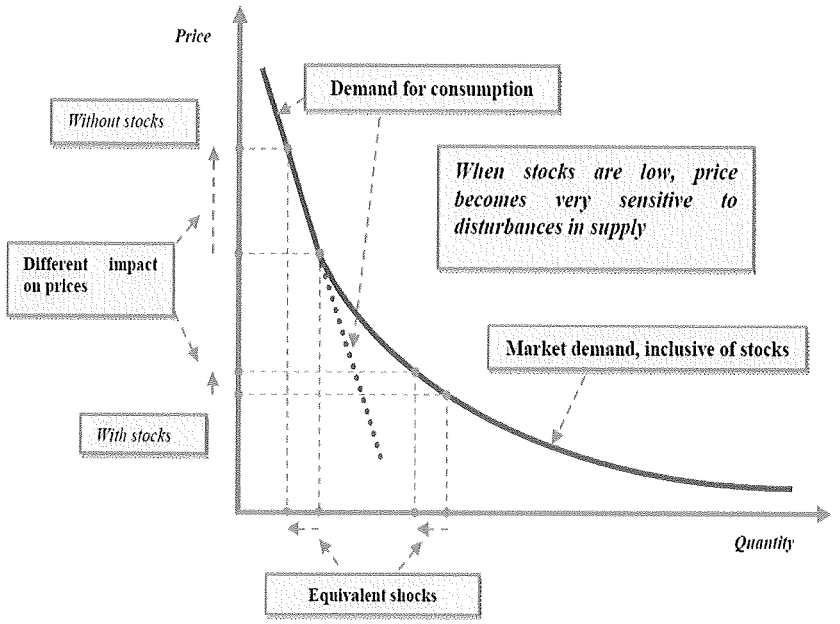
> Wearing multiple hats gives Cargill an unusually detailed view of the industries it bets on, as well as the ability to trade on its knowledge in ways few others can match. Cargill freely acknowledges it strives to profit from that information. "When we do a good job of assimilating all those seemingly unrelated facts," says Greg Page, Cargill's chief executive, in a rare interview, "it provides us an opportunity to make money...without necessarily having to make directional trades, *i.e.,* outguess the weather, outguess individual governments."

17. The implication is that the interplay between varied market participants is more complex than a standard textbook description of pure risk-avoiding hedgers and pure risk-seeking speculators. The reality is that market dynamics are ever changing and it can be difficult to understand the motivations and market implications of trading, especially in real-time.

18. In addition to the logical inconsistencies, there are several ways the bubble story is not consistent with the observed facts. First, as Krugman (2008) asserts, if a bubble raises the market price of a storable commodity above the true equilibrium price, then stocks of that commodity should increase (much like a government imposed price floor can create a surplus). Stocks were declining, not building, in most commodity markets over 2006-08, which is inconsistent with the depiction of a price bubble in these markets.

19. Second, the relationship between prices and inventories for storable commodities is highly convex. Figure 3, drawn from Wright (2009), illustrates this point. Note that a given reduction in quantity due a to supply and/or demand shock will have a much larger impact on price when starting with a low quantity (inventories) compared to when starting with a high quantity. It also implies that relatively minor reductions in quantity can result in very large increases in price when the market supply/demand balance is especially tight. Smith (2009) argues that it is plausible that a series of seemingly small supply disruptions in the spring and summer of 2008 could explain the large increase in crude oil prices during this time period in view of the extreme convexity of the pricing function for crude oil in the short-run.

Figure 3. Hypothetical example of a convex pricing function for a storable commodity



20. Third, theoretical models that show uninformed or noise traders impacting market prices rely on the unpredictable trading patterns of these traders to make arbitrage risky. Because the arbitrage - needed to drive prices to fundamental value - is not riskless, noise traders can drive a wedge between market prices and fundamental values. Importantly, index fund buying is very predictable. That is, index funds widely publish their portfolio (market) weights and roll-over periods. Thus, it seems highly unlikely that other large and rational traders would hesitate to trade against an index fund if they were driving prices away from fundamental values.

21. Fourth, if index fund buying drove commodity prices higher then markets without index fund investment should not have seen prices advance. Again, the observed facts are inconsistent with this notion. Irwin, Sanders, Merrin (2009) show that markets without index fund participation (fluid milk and rice futures) and commodities without futures markets (apples and edible beans) also showed price increases over the 2006-2008 period. Stoll and Whaley (2009) report that returns for Chicago Board of Trade (CBOT) wheat, Kansas City Board of Trade (KCBOT) wheat, and Minneapolis Grain Exchange (MGEX) wheat are all highly positively correlated over 2006-09, yet only CBOT wheat is used heavily by index investors. In a similar fashion, Commodity Exchange (COMEX) gold, COMEX silver, New York Mercantile (NYMEX) palladium, and NYMEX platinum futures prices are highly correlated over the same time period but only gold and silver are included in popular commodity indexes. Headey and Fan (2008) cite the rapid increases in the prices for "non-financialized" commodities such as rubber, onions, and iron ore as evidence that rapid price inflation occurred in commodities without futures markets. While certainly instructive, the limits of these kinds of comparisons also need to be kept in mind. Bubble proponents have pointed out that commodity markets selected for the development of futures contracts may be naturally more volatile than those commodities without futures markets.

22. Fifth, speculation was not excessive when correctly compared to hedging demands. The statistics on long-only index fund trading reported in the media and discussed at hearings tend to view speculation in a vacuum - focusing on absolute position size and activity. Working (1960) argued that speculation must be gauged relative to hedging needs. In particular, speculation can only be considered 'excessive' relative to the level of hedging activity in the market. Utilizing Working's speculative "T-index", Sanders, Irwin, and Merrin (2010) demonstrate that the level of speculation in nine agricultural futures markets from 2006-08 (adjusting for index fund positions) was not excessive. Indeed, the levels of speculation in all markets examined were within the realm of historical norms. Across most markets, the rise in index buying was more than offset by commercial (hedger) selling. Buyuksahin and Harris (2009) use daily data from the CFTC's internal large trader database to show that Working's T-index in the crude oil futures market increased in parallel with crude oil prices over 2004-09 but the peak of the index was still well within historical norms. Till (2009) reports similar results for crude oil, heating oil, and gasoline futures over 2006-2009 using recently available data in the CFTC's *Disaggregated Commitments of Traders* report.

23. The sixth observable fact revolves around the impact of index funds across markets. A priori, there is no reason to expect index funds to have a differential impact across markets given similar position sizes. That is, if index funds can inflate prices, they should have a uniform impact across markets for the same relative position size. It is therefore difficult to rationalize why index fund speculation would impact one market but not another. Further, one would expect markets with the highest concentration of index fund positions to show the largest price increases. Irwin, Sanders, and Merrin (2009) find just the opposite when comparing grain and livestock futures markets. The highest concentration of index fund positions was often in livestock markets, which had smallest price increases through the spring of 2008. This is difficult to reconcile with the assertion that index buying represents demand.

4. Evidence to date

24. Not surprisingly, a flurry of studies has been completed recently in an attempt to sort out which side of the debate is correct. Some studies find evidence that commodity index funds have impacted commodity futures prices (Gilbert, 2009; Einloth, 2009; Tang and Xiong, 2010). Results in these studies negate the argument that *no* evidence exists of a relationship between index fund trading and movements in commodity futures prices. However, the evidence is weak because the data and methods used in most of these studies are subject to a number of important criticisms. Hamilton's (2009) study, while not definitive in terms of empirics, is the most important of this group because his theoretical model shows the conditions that must occur for index fund speculation to lead to bubble impacts in a storable commodity market such as crude oil.

25. A number of studies find little evidence of a relationship between index fund positions and movements in commodity futures prices (Stoll and Whaley, 2009; Buyuksahin and Harris, 2009; Sanders and Irwin, 2010a, 2010b; Aulerich, Irwin, and Garcia, 2010). This constitutes a rejection of the first theoretical requirement for speculative impacts. The most recent evidence in crude oil markets (Kilian and Murphy, 2010) also indicates a rejection of the second theoretical requirement for speculative impacts - a zero or near zero price elasticity of demand. In sum, the weight of the evidence at this point in time clearly tilts in favor of the argument that index funds did not cause a bubble in commodity futures prices.[2]

26. There is still a need for further research on the market impact of commodity index funds. The first reason is that direct tests of the relationship between index fund positions and price movements in energy futures markets have been hampered by the lack of publically-available data on positions of index funds in these markets. The second reason is ongoing concerns about the power of time-series statistical

[2] Annex I of this paper contains detailed reviews of the studies cited in this section. See also Irwin and Sanders (2010).

tests used in the studies that fail to find evidence of a relationship between index fund positions and movements in commodity futures prices. The time-series tests may lack statistical power to reject the null hypothesis because the dependent variable - the change in futures price - is extremely volatile. In the empirical analysis summarized in the following section, we attempt to address both of these deficiencies.

5. New evidence

27. Our empirical analysis relies on two related data sets compiled by the U.S. Commodity Futures Trading Commission (CFTC). The CFTC has long provided the breakdown of each Tuesday's open interest for U.S. markets in the *Commitments of Traders* (COT) report. Open interest for a given market is aggregated across all contract expiration months in the weekly report. The traditional COT categories include: commercials (hedgers), non-commercials (speculators), and non-reporting (all traders with position sizes below the reporting level).

28. Starting in 2007 - in response to complaints by traditional traders about the rapid increase in long-only index money flowing into the market - the CFTC began releasing the weekly *Supplemental Commodity Index Traders* (CIT) reports, which break out the positions of index traders for 12 agricultural markets. According to the CFTC, the index trader positions reflect both pension funds that would have previously been classified as non-commercials as well as swap dealers who would have previously been classified as commercials hedging OTC transactions involving commodity indices. The *CIT* data are generally considered the best glimpse of index trader activity in the 12 agricultural markets covered by the report.

29. While the *CIT* data represent an improvement over the traditional *COT* data, concerns were expressed almost immediately that the data did not extend to other markets, particularly energy and metals futures. In response to requests for more information about the composition of open interest in a broader set of markets, the CFTC began publishing the weekly *Disaggregated Commitments of Traders* (DCOT) report in September 2009 and ultimately provided historical data back to June of 2006. The *DCOT* data are available for the same 12 agricultural markets covered by the *CIT* report plus a number of energy and metal futures markets. Like the *CIT* report, the positions in the *DCOT* report represent the combined futures and delta-adjusted options positions aggregated across all contracts for a particular market. Reporting traders are classified into four categories: swap dealers, managed money, processors and merchants, and other reporting traders.

30. An important question, especially for the energy futures markets, is the degree to which the *DCOT* swap dealers category represents index fund positions. One can infer from comparisons found in the CFTC's September 2008 report on swap dealer positions (CFTC, 2008) that *DCOT* swap dealer positions in agricultural futures markets correspond reasonably closely to index trader positions. Since swap dealers operating in agricultural markets conduct a limited amount of non-index long or short swap transactions there is little error in attributing the net long position of swap dealers in these markets to index funds. However, swap dealers in energy futures markets conduct a substantial amount of non-index swap transactions on both the long and short side of the market, which creates uncertainty about how well the net long position of swap dealers in energy markets represent index fund positions.[3] For example, the CFTC estimates that only 41% of long swap dealer positions in crude oil futures on three dates in 2007 and 2008 were linked to long-only index fund positions (CFTC, 2008). Despite this limitation, swap dealers are used in the present study as the best available proxy for index positions in the energy futures markets.

31. The *CIT* data are available weekly from January 3, 2006 through December 29, 2009 and the *DCOT* data are available at the same frequency starting on June 13, 2006. To facilitate the comparison of

[3] This was precisely the reason that the CFTC excluded energy futures markets from the *CIT* report.

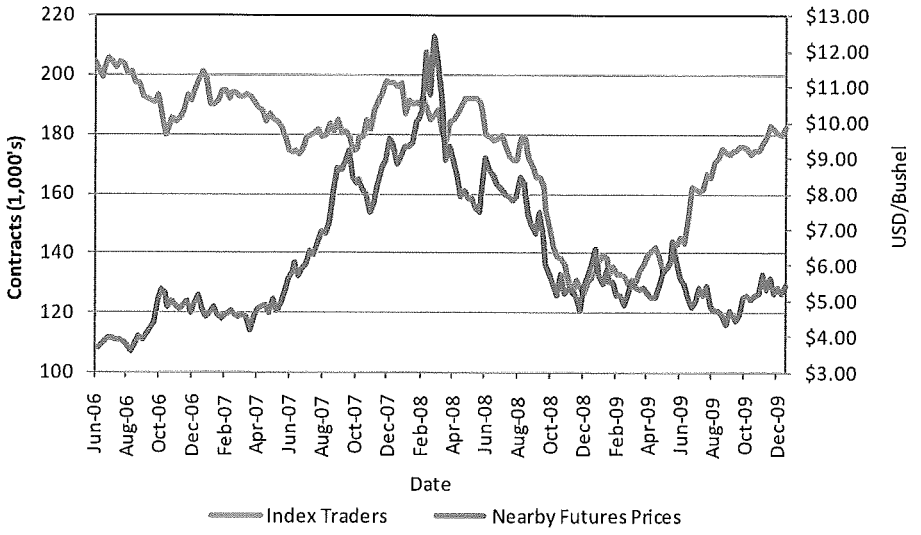
the data sets and results, a common sample starting on June 13, 2006 containing 186 weekly observations through December 29, 2009 was used in all empirical work.

32. Index trader positions are collected for the 12 *CIT* agricultural markets: Chicago Board of Trade (CBOT) corn, CBOT soybeans, CBOT soybean oil, CBOT wheat, Kansas City Board of Trade (KCBOT) wheat, New York Board of Trade (NYBOT) cotton, Chicago Mercantile Exchange (CME) live cattle, CME feeder cattle, CME lean hogs, NYBOT coffee, NYBOT sugar, and NYBOT cocoa. Corresponding *DCOT* data are collected for these 12 *CIT* markets along with the *DCOT* data for New York Mercantile Exchange (NYMEX) crude oil and natural gas. The focus in the *DCOT* data will be on swap dealer positions because of their potential link to index fund positions.

33. For the above markets, weekly futures returns (price changes) are calculated using nearby futures contracts, appropriately adjusting for contract roll-overs. In order to test for index trader impact on market variability, two measures of volatility are computed: implied volatility from the options markets and realized volatility as measured by Parkinson's (1980) extreme value estimator. It is important to establish whether or not index trader positions impact these market characteristics (returns, implied volatility, and realized volatility). Here, causal linkages are directly tested using Granger causality tests.

34. A simple graphical analysis of index trader positions and market prices can be misleading. As shown in Figure 4 for CBOT wheat, there are periods of time - such as mid-2007 through late 2008 - where there appears to be a close correspondence between index trader positions and price levels. Conversely, there are periods, such as most of 2009, where any relationship seems remote at best. This type of graphical inspection is commonly presented as establishing an "obvious" link between index positions and prices. However, it is fraught with statistical complications and begs for a more rigorous test of the linkages, if any.

Figure 4. Index trader net long positions in CBOT wheat and nearby futures prices, June 2006-December 2009

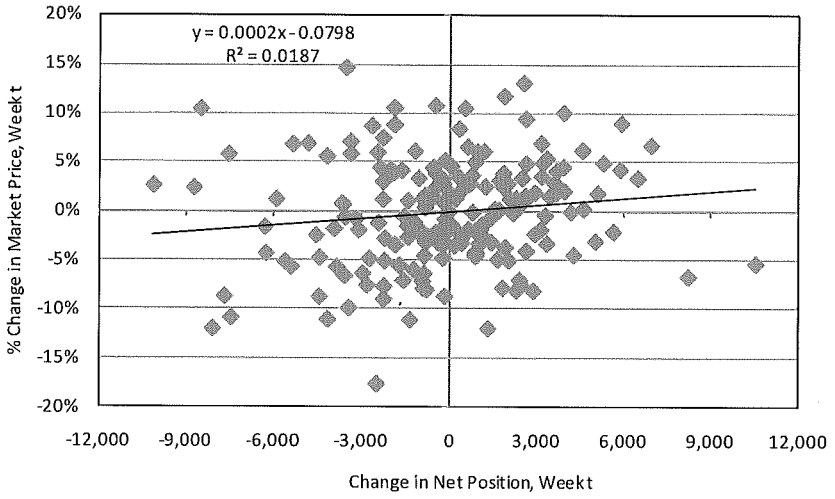


35. Granger causality is a standard statistical technique for determining whether one time series is useful in forecasting another. It is important to bear in mind that the term causality is used in a statistical sense, and not in a philosophical one of structural causation. More precisely a variable A is said to Granger cause B if knowing the time paths of B and A together improve the forecast of B based on its own time

path, thus providing a measure of incremental predictability. In our case the time series of interest are market measures of returns, implied volatility, and realized volatility, or variable B. The causal variables, or variable A, are measures of trader positions and speculation, including net long positions held by index funds, the percent of long positions held in each market by index funds, and Working's speculative index.

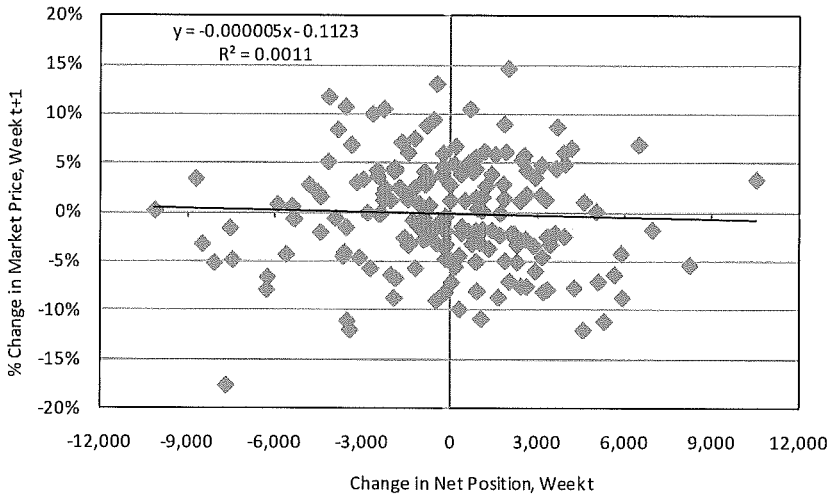
36. Simply put, Granger's test asks the question: Can past values of trader positions be used to predict either market returns or volatility? This is a much more demanding hurdle than simply looking for a contemporaneous correlation or association between variables. As shown in Figure 5, there is a positive contemporaneous association between changes in net positions held by index traders and price changes (returns) in the CBOT wheat market. The simple correlation coefficient is relatively low at 0.14; but, the relationship is statistically significant at the 10% level. However, the magnitude of the impact is quite low since a 3 000 contract increase in index traders' long position is associated with just a 0.6% increase in prices during the same week. More importantly, this contemporaneous analysis cannot distinguish between the increase in index traders' positions and other correlated shifts in fundamentals: correlation does not imply causation. Evidence of this point is found in Figure 6, which is the same as Figure 5 except there is a one week time lag between the change in index fund positions and the change in the futures price. As clearly shown in Figure 6, increases in net index fund positions are actually followed by small (statistically insignificant) declines in prices the subsequent week. In this example, there is no evidence that changes in index traders' net long positions lead to higher (or lower) market prices.

Figure 5. Contemporaneous relationship, CBOT wheat returns (price change) and index trader net long positions, June 2006-December 2009



Note: The slope of the regression line is positive and statistically different from zero at the 10% significance level. The simple correlation coefficient is 0.14.

Figure 6. Causal relationship, CBOT wheat returns (price change) and index trader net long positions, June 2006-December 2009



Note: The slope of the regression line is negative and not statistically different from zero at the 10% significance level. The simple correlation coefficient is -0.03.

37. More formal Granger causality tests are conducted for a number of combinations of causal variables (position measures) and market characteristics. A systems approach is used to test lead-lag dynamics. This improves the power of statistical tests by taking into account the contemporaneous correlation of model residuals across markets. The system test results are summarized in Table 1. The formal testing failed to find any reasonably consistent causal links between trader positions and returns. The only statistically significant finding was a negative relationship between positions and market volatility. That is, there is some consistent evidence that increases in index trader positions are followed by lower market volatility. Even these results for market volatility must be interpreted with caution. The possibility still exists that trader positions are correlated with some third variable that is actually causing market volatility to decline.

Table 1. Causal relationships estimated for market system, June 2006 - December 2009

	Causal Variable		
	Net Long Position in Contracts	**Percent of Long Positions**	**Working's Speculative Index**
Panel A: Index Traders			
Returns	No (negative)	No (positive)	NA
Implied Volatility	No (negative)	Yes (negative)	No (positive)
Realized Volatility	Yes (negative)	No (positive)	No (positive)
Panel B: Swap Dealers			
Returns	No (positive)	No (positive)	NA
Implied Volatility	No (negative)	Yes (negative)	NA
Realized Volatility	Yes (negative)	No (positive)	NA

Notes: A "Yes" indicates a statistically significant (5% level) causal relationship running from the causal variables (column headings) to the market factors (row headings) for the overall system test. A "No" indicates that no relationship was found. The direction of the causal relationship is indicated by "positive" or "negative" in parenthesis, regardless of whether the impact was statistically significant or not.

38. A simple statistical description of data on net positions of index traders and swap dealers is shown in Table 2, while Table 3 provides information on the total open interest contracts held by different players. The main characteristics of these data can be summarized as follows:

- The overlap between index trader positions (CIT data set) and those held by swap dealers (DCOT data set) is quite large for the traditional grain and livestock markets. It appears to be a somewhat weaker correspondence for the coffee, sugar, and cocoa markets. It is clear that the swap dealer positions for the energy markets contain many traders other than index funds. Swap dealer positions are at best an imperfect proxy for index fund positions in the energy markets.

- This is clearly seen in Table 2, which shows the net position (in contracts) held by index traders (Panel A) and swap dealers (Panel B) over the sample period. In Panel A, the minimum net long position held by index traders is never negative (short); whereas, in Panel B the minimum net long position for sugar, cocoa, crude oil, and natural gas is negative. In these markets, swap dealers clearly hold positions other than those representing long-only index investments.

Table 2. Summary statistics, net long positions held by index traders and swap dealers (# of contracts) June 2006-December 2009

Panel A: Index Traders

Market	Mean	Maximum	Minimum	St. Dev.
Corn	354 043	452 568	223 985	64 877
Soybeans	140 651	198 707	89 731	26 004
Soybean Oil	66 011	77 752	36 630	10 192
CBOT Wheat	174 677	205 585	126 545	21 769
KCBOT Wheat	28 654	46 527	16 293	6 011
Cotton	84 985	122 555	57 841	15 209
Live Cattle	110 006	156 752	80 276	20 632
Feeder Cattle	7 479	10 889	4 972	1 456
Lean Hogs	80 616	127 379	46 004	18 538
Coffee	44 451	67 021	30 572	9 697
Sugar	231 756	392 740	135 745	74 836
Cocoa	18 910	31 883	5 117	5 830

Panel B: Swap Dealers

Market	Mean	Maximum	Minimum	St. Dev.
Corn	313 172	430 100	163 606	77 941
Soybeans	121 557	193 888	73 898	27 892
Soybean Oil	61 453	89 502	27 442	16 234
CBOT Wheat	142 550	189 217	91 681	25 373
KCBOT Wheat	22 073	33 863	9 952	6 906
Cotton	72 092	118 380	42 637	16 797
Live Cattle	88 844	128 967	65 368	16 351
Feeder Cattle	4 161	6 723	1 730	1 194
Lean Hogs	69 149	114 377	36 326	16 858
Coffee	37 179	56 959	21 667	8 718
Sugar	132 099	271 255	-32 149	81 371
Cocoa	8 380	16 474	-5 103	4 763
Crude Oil	40 912	106 176	-10 534	27 504
Natural Gas	49 018	253 500	-67 553	78 063

Note: Net positions are simply calculated as long positions - short positions.

- Index fund and swap dealer positions are large. In an absolute sense, the largest average position sizes held in nearly every market is by long index funds or swap dealers. In some markets, such as CBOT wheat, the average position size for these traders is in excess of the speculative position limits. In a relative sense, index and swap dealer positions can also be quite large. Index traders often hold as much as 40% of the long positions in a market and the swap dealer category frequently holds over 30% of the long positions in a given market.

- Despite the large average position size, the total size of index funds within a given market is not overwhelming. Table 3 shows the percent of the market that is comprised of each trader category in the *CIT* (Panel A) and *DCOT* (Panel B) data.[4] In each market, the largest participant is a category other than index funds or swap dealers. In fact, in the *CIT* categories, index traders are the smallest category in 4 of the 12 markets and the second smallest in the other 8 markets. The exception is swap dealers in the crude oil market who account for 37% of the open interest. Again, this inconsistency indicates that the link

[4] The denominator in these calculations is the sum of total long and short open interest, or two times either the long or short total open interest.

between swap dealer positions and index traders may be weak in the energy markets.

Table 3. Percent of total open interest held by CIT and DCOT categories, June 2006-December 2009

Panel A: *CIT* Categories

Market	Non-Commercial	Commercial	Index	Non-Reporting
Corn	39%	35%	13%	14%
Soybeans	40%	33%	14%	14%
Soybean Oil	35%	44%	12%	8%
CBOT Wheat	41%	26%	23%	10%
KCBOT Wheat	28%	39%	12%	20%
Cotton	39%	38%	17%	6%
Live Cattle	38%	28%	20%	14%
Feeder Cattle	38%	17%	14%	31%
Lean Hogs	39%	25%	21%	14%
Coffee	43%	39%	13%	5%
Sugar	31%	44%	17%	8%
Cocoa	33%	54%	7%	6%

Panel B: DCOT Categories

Market	Managed Money	Producers & Merchants	Swap Dealers	Other Reporting	Non-Reporting
Corn	16%	32%	13%	25%	14%
Soybeans	19%	31%	13%	23%	14%
Soybean Oil	17%	42%	14%	18%	8%
CBOT Wheat	22%	23%	22%	22%	10%
KCBOT Wheat	19%	38%	10%	13%	20%
Cotton	16%	35%	18%	25%	%
Live Cattle	25%	27%	18%	16%	14%
Feeder Cattle	23%	17%	9%	20%	31%
Lean Hogs	23%	25%	19%	19%	14%
Coffee	20%	37%	14%	25%	5%
Sugar	16%	39%	19%	18%	8%
Cocoa	26%	48%	12%	9%	6%
Crude Oil	18%	18%	37%	23%	3%
Natural Gas	43%	12%	28%	11%	5%

39. The empirical results of the analysis are shown in Tables 4 through 7 and can be summarised by following general findings and representative results.

- There is no convincing evidence that positions held by index traders or swap dealers impact market returns. Except for a few instances in individual markets, Granger-style causality tests fail to reject the null hypothesis that that trader positions do not lead market returns.

- The full results for testing if CIT index traders lead market returns are shown in Table 4. In the individual markets, the null hypothesis of no causality can be rejected in cotton and corn at the 5% level (with 95% confidence). This is shown by the p-values for the null hypothesis that $\beta_j=0$, $\forall j$. Importantly, however, the directional impact for corn is negative while it is positive for cotton. This makes very little sense in the context of the current debate. Not surprisingly, the system-wide impact, which takes into account the opposing directional findings across markets, is negative (-0.4010) and indistinguishable from zero.

Table 4. Granger causality test results for CIT net positions do not lead returns, June 2006-December 2009

$$R_{t,k} = \alpha_k + \sum_{i=1}^{m} \gamma_{i,k} R_{t-i,k} + \sum_{j=1}^{n} \beta_{j,k} \Delta NET_{t-j,k} + \varepsilon_{t,k} \text{ for each market, } k, \text{ and time, } t.$$

Market, k	m,n	p-value β_j=0, ∀j	Estimate $\sum \beta_j$	p-value $\sum \beta_j$=0
Corn	1,1	0.0002	-0.1210	
Soybeans	1,1	0.4206	-0.0444	
Soybean Oil	1,1	0.2922	0.0874	
CBOT Wheat	1,1	0.3629	0.0319	
KCBOT Wheat	1,1	0.1261	-0.1460	
Cotton	1,1	0.0018	0.3590	
Live Cattle	2,2	0.1812	0.0008	0.9861
Feeder Cattle	2,1	0.1300	-0.3730	
Lean Hogs	1,1	0.2078	-0.1320	
Coffee	1,1	0.3348	-0.1730	
Sugar	1,1	0.2647	-0.0520	
Cocoa	1,1	0.4591	0.1610	
		p-value $\beta_{j,k}$=0, ∀j,k	Estimate $\sum\sum \beta_{j,k}$	p-value $\sum\sum \beta_{j,k}$=0
System		0.0001	-0.4010	0.3836

Note: $\sum \beta_j$ values are taken to the 10^6 power.

Technical Note: The models are estimated across the *K* markets as an SUR system. Wald tests could not reject the following cross-market coefficient restrictions: $\alpha_1 = \alpha_2 = ... = \alpha_K$; $\gamma_{1,1} = \gamma_{1,2} = ... = \gamma_{1,K}$; and $\gamma_{2,1} = \gamma_{2,2} = ... = \gamma_{2,K}$ for all *K* markets. These restrictions are imposed on the system and the common coefficients are estimated as a single pooled parameter across all *K* markets.

- Larger long positions by index traders and swap dealers lead to lower market volatility in a Granger sense. There is a consistent tendency across a number of position and volatility measures to reject the null hypothesis that index trader positions do not lead market volatility. The direction of the impact is routinely negative. 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. Still, this result is contrary to popular notions about index traders increasing market volatility.

- These general conclusions apply to both the volatility implied in the options markets and realized volatility. As a representative example, consider the Granger causality test of the null hypothesis that *DCOT* swap dealers' net positions do not lead realised market volatility. The system estimation results are presented in Table 5. The null hypothesis is rejected at the 5% level in soybeans and cocoa. In both of these markets, the directional impact is negative: increases in net long positions held by swap dealers predict lower market volatility in the subsequent week. More convincing than the individual market results, the system results show that the aggregate directional impact is statistically negative (-36.1) with nearly 99% confidence (1 - 0.0131).

Table 5. Granger causality test results for DCOT swap dealer net positions do not lead realized volatility, June 2006-December 2009

$$RV_{t,k} = \alpha_k + \sum_{i=1}^{m} \gamma_{i,k} RV_{t-i,k} + \sum_{j=1}^{n} \beta_{j,k} \Delta NET_{t-j,k} + \varepsilon_{t,k} \text{ for each market, } k, \text{ and time, } t.$$

Market	*m,n*	*p*-value β_j=0, ∀j	Estimate $\sum \beta_j$	*p*-value $\sum \beta_j$=0
Corn	2,1	0.8258	0.2000	
Soybeans	4,1	0.0242	-3.3700	
Soybean Oil	2,1	0.5347	-0.9500	
CBOT Wheat	2,1	0.6975	0.4370	
KCBOT Wheat	3,1	0.1308	-5.5000	
Cotton	3,1	0.9358	0.2340	
Live Cattle	3,1	0.0600	-2.4600	
Feeder Cattle	3,1	0.5317	-5.8200	
Lean Hogs	3,1	0.1531	3.7900	
Coffee	1,2	0.1568	-11.8200	0.0581
Sugar	3,1	0.8018	-0.3200	
Cocoa	4,1	0.0420	-12.0300	
Crude Oil	3,1	0.0889	1.0500	
Natural Gas	1,1	0.5975	0.4610	
		p-value $\beta_{j,k}$=0, ∀*j,k*	Estimate $\sum\sum \beta_{j,k}$	*p*-value $\sum\sum \beta_{j,k}$=0
System		0.0408	-36.1000	0.0131

Note: $\sum \beta_j$ values are taken to the 10^5 power.

Technical Note: The models are estimated across the *K* markets as an SUR system. Wald tests could not reject the following cross-market coefficient restrictions: $\gamma_{3,1} = \gamma_{3,2} = \ldots = \gamma_{23,K}$ for all *K* markets. These restrictions are imposed on the system and the common coefficients are estimated as a single pooled parameter across all *K* markets.

- Excessive speculation - as measured by Working's T-index - is associated with greater subsequent variability in a few markets. These results conflict with negative relationships found between index trader positions and market volatility. The contrasting results suggests that excessive speculation is broader than just index fund activity and may be better measured with Working's T-index, which measures excessive speculation relative to hedging demands.

- Table 6 shows the summary statistics for Working's T-index adjusted for index trader positions. For example, the average T-index for corn is 1.15 - indicating speculation in the corn market is 15% greater than that needed to meet hedging needs. Historically, this would have been considered a potentially inadequate amount of speculation to efficiently meet hedging demands and facilitate the transfer of risk. Notably, some of the markets with high T-values (livestock and CBOT wheat) are also those markets with a relatively high portion of index traders (see Table 3, Panel A). Still, even in these markets, the maximums are not beyond those recorded by prior researchers, the average values are near historic norms, and the minimums could be considered inadequate.

Table 6. Summary statistics, working's speculative T-Index, adjusted for index trader positions, June 2006-December 2009

Market	Mean	Maximum	Minimum	St. Dev.
Corn	1.15	1.34	1.07	0.06
Soybeans	1.17	1.53	1.09	0.09
Soybean Oil	1.12	1.36	1.04	0.07
CBOT Wheat	1.44	1.87	1.19	0.16
KCBOT Wheat	1.18	1.34	1.08	0.06
Cotton	1.16	1.48	1.03	0.11
Live Cattle	1.33	1.50	1.15	0.07
Feeder Cattle	1.86	3.28	1.32	0.38
Lean Hogs	1.43	2.01	1.17	0.19
Coffee	1.17	1.41	1.04	0.08
Sugar	1.15	1.26	1.06	0.04
Cocoa	1.14	1.28	1.06	0.05

Technical Note: Working's speculative "T" index is easily calculated using the traditional COT trader categories:

$T = 1 + SS / (HL + HS)$ if $(HS \geq HL)$

or

$T = 1 + SL / (HL + HS)$ if $(HL > HS)$

where open interest held by speculators (non-commercials) and hedgers (commercials) is denoted as follows: SS = Speculation, Short; SL = Speculation, Long; HL = Hedging, Long; and HS = Hedging, Short.

- Working's T-index is silent on the direction of speculation (long versus short). Instead, the amount of speculation is gauged relative to what is needed to balance hedging positions. Because it is directionless Working's T-index is only tested as a causal variable for market volatility. Table 7 shows the results for testing if the T-index Granger causes realized market volatility. Granger causality is found in 4 markets at the 95% confidence level. In all 4 markets, the directional impact is positive - higher levels of excessive speculation as measured by Working's T are followed by greater realized market volatility. For example, if the speculative index in lean hogs increases by 0.10, then actual volatility the following week increases by 1.18%. These individual market results are notable in comparison to the negative directional impacts found when simply measuring speculation with net index fund positions (Table 5). Still, the impact is not pervasive across markets as no system impact is found at even a modest confidence level.

Table 7. Granger causality test results for T-Index does not lead realized volatility, June 2006-December 2009

$$RV_{t,k} = \alpha_k + \sum_{i=1}^{m} \gamma_{i,k} RV_{t-i,k} + \sum_{j=1}^{n} \beta_{j,k} TIndex_{t-j,k} + \varepsilon_{t,k} \quad \text{for each market, } k, \text{ and time, } t.$$

Market	m,n	*p*-value β_j=0, ∀j	Estimate $\sum \beta_j$	*p*-value $\sum \beta_j$=0
Corn	1,1	0.0470	24.8261	
Soybeans	4,1	0.6982	-2.5196	
Soybean Oil	2,1	0.7590	2.3205	
CBOT Wheat	2,1	0.5745	-1.7284	
KCBOT Wheat	3,1	0.7993	-1.8937	
Cotton	3,1	0.4823	-4.7687	
Live Cattle	3,1	0.3602	3.2854	
Feeder Cattle	3,1	0.0208	1.8090	
Lean Hogs	3,1	0.0003	11.7991	
Coffee	1,1	0.6234	-4.0321	
Sugar	4,1	0.2101	-30.5000	
Cocoa	4,1	0.0308	34.0968	
		p-value $\beta_{j,k}$=0, ∀j,k	Estimate $\sum\sum \beta_{j,k}$	*p*-value $\sum\sum \beta_{j,k}$=0
System		0.0028	32.6945	0.3844

Technical Note: The models are estimated across the *K* markets as an SUR system. Wald tests could not reject the following cross-market coefficient restrictions: $\gamma_{2,1}=\gamma_{2,2}=...=\gamma_{2,K}$; $\gamma_{3,1}=\gamma_{3,2}=...=\gamma_{3,K}$ for all *K* markets. These restrictions are imposed on the system and the common coefficients are estimated as a single pooled parameter across all *K* markets.

40. In sum, our results tilt the weight of the evidence even further in favour of the argument that index funds did *not* cause a bubble in commodity futures prices.[5] The evidence in our study is strongest for the agricultural futures markets because the data on index trader positions are measured with reasonable accuracy. The evidence is not as strong in the two energy markets studied because of considerable uncertainty about the degree to which the available data actually reflect index trader positions in these markets. Perhaps the most surprising result is the consistent tendency for increasing index fund positions to be associated with *declining* volatility. Caution must be exercised in interpreting this finding as a third factor common to all markets may be in fact be generating the decline in volatility. Nonetheless, this result is contrary to popular notions about the market impact of index funds, but is not so surprising in light of the traditional problem in commodity futures markets of the *inadequacy* of speculation (see Sanders, Irwin, and Merrin, 2010). These results imply that more research in this area is needed to understand the present role of speculation in futures markets.

6. Policy Conclusions

41. The empirical evidence presented in this preliminary study does not appear at present to warrant extensive changes in the regulation of index funds participation in agricultural commodity markets; any such changes require careful consideration so as to avoid unintended negative impacts. For example, limiting the participation of index fund investors could unintentionally deprive commodity futures markets of an important source of liquidity and risk-absorption capacity at times when both are in high demand.

[5] Annex I of this paper contains a detailed presentation of all statistical test results. See also Irwin and Sanders (2010).

This could make commodity futures markets less efficient mechanisms for transferring risk from parties who do not want to bear it to those that do, creating added costs that ultimately are passed back to producers in the form of lower prices and to consumers as higher prices.

42. These conclusions do not imply that commodity futures markets have functioned flawlessly during the last several years. In particular, the lack of consistently acceptable convergence performance for CBOT corn, soybean, and wheat contracts since late 2005 has been widely discussed (e.g., Henriques, 2008). The failure of cash and futures prices to convergence at contract expiration has existed for extended and varied periods. Performance has been consistently weakest in wheat, with delivery location basis at times exceeding one dollar per bushel, a level of disconnect between cash and futures not previously experienced in grain futures markets. The possible role of index funds in contributing to convergence problems has also been widely discussed (USS/PSI, 2009). Further research is needed to better understand the impact of index fund trading on this aspect of commodity market performance as well as the fundamental role of speculation in these markets.

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GLOSSARY OF TERMS[6]

Arbitrage: A strategy involving the simultaneous purchase and sale of identical or equivalent commodity futures contracts or other instruments across two or more markets in order to benefit from a discrepancy in their price relationship. In a theoretical efficient market, there is a lack of opportunity for profitable arbitrage.

Back Months: Futures delivery months other than the spot or front month (also called deferred months).

Bear: One who expects a decline in prices. The opposite of a bull. A news item is considered bearish if it is expected to result in lower prices.

Bear Market: A market in which prices generally are declining over a period of months or years. The opposite of bull market.

Board of Trade: Any organized exchange or other trading facility for the trading of futures and/or option contracts.

Bull: One who expects a rise in prices. The opposite of bear. A news item is considered bullish if it is expected to result in higher prices.

Bull Market: A market in which prices generally are rising over a period of months or years. Opposite of bear market.

Buyer: A market participant who takes a long futures position or buys an option. An option buyer is also called a taker, holder, or owner.

Cash Commodity: The physical or actual commodity as distinguished from the futures contract, sometimes called spot commodity or actuals.

Cash Price: The price in the marketplace for actual cash or spot commodities to be delivered via customary market channels.

CFTC Form 40: The form used by large traders to report their futures and option positions and the purposes of those positions.

Closing Price: The price recorded during trading that takes place in the final period of a trading session's activity that is officially designated as the "close."

Commercial: An entity involved in the production, processing, or merchandising of a commodity.

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6 The terms and definitions used in the glossary are taken primarily from the Commodity Futures Trading Commission's "A Guide to the Language of the Futures Industry" which can be accessed online at http://www.cftc.gov/ConsumerProtection/EducationCenter/CFTCGlossary/index.htm.

Commitments of Traders Report (COT): A weekly report from the CFTC providing a breakdown of each Tuesday's open interest for markets in which 20 or more traders hold positions equal to or above the reporting levels established by the CFTC. Open interest is broken down by aggregate commercial, non-commercial, and non-reportable holdings.

Commodity Futures Trading Commission (CFTC): The Federal regulatory agency established by the Commodity Futures Trading Act of 1974 to administer the Commodity Exchange Act.

Commodity Index: An index of a specified set of (physical) commodity prices or commodity futures prices.

Commodity Index Fund: An investment fund that enters into futures or commodity swap positions for the purpose of replicating the return of an index of commodity prices or commodity futures prices.

Commodity Index Swap: A swap whose cash flows are intended to replicate a commodity index.

Commodity Index Trader: An entity that conducts futures trades on behalf of a commodity index fund or to hedge commodity index swap positions.

Commodity-Linked Bond: A bond in which payment to the investor is dependent to a certain extent on the price level of a commodity, such as crude oil, gold, or silver, at maturity.

Commodity Pool: An investment trust, syndicate, or similar form of enterprise operated for the purpose of trading commodity futures or option contracts. Typically thought of as an enterprise engaged in the business of investing the collective or "pooled" funds of multiple participants in trading commodity futures or options, where participants share in profits and losses on a pro rata basis.

Commodity Pool Operator (CPO): A person engaged in a business similar to an investment trust or a syndicate and who solicits or accepts funds, securities, or property for the purpose of trading commodity futures contracts or commodity options. The commodity pool operator either itself makes trading decisions on behalf of the pool or engages a commodity trading advisor to do so.

Commodity Trading Advisor (CTA): A person who, for pay, regularly engages in the business of advising others as to the value of commodity futures or options or the advisability of trading in commodity futures or options, or issues analyses or reports concerning commodity futures or options.

Commodity Swap: A swap in which the payout to at least one counterparty is based on the price of a commodity or the level of a commodity index.

Corner: (1) Securing such relative control of a commodity that its price can be manipulated, that is, can be controlled by the creator of the corner; or (2) in the extreme situation, obtaining contracts requiring the delivery of more commodities than are available for delivery.

Counterparty: The opposite party in a bilateral agreement, contract, or transaction, such as a swap.

Delivery: The tender and receipt of the actual commodity, the cash value of the commodity, or of a delivery instrument covering the commodity (e.g., warehouse receipts or shipping

Disaggregated Commitments of Traders Report (DCOT): A weekly report from the CFTC providing a breakdown of each Tuesday's open interest for markets in which 20 or more traders hold positions equal to or above the reporting levels established by the CFTC. Open interest is broken down by

managed money, swap dealers, producers and merchants, other reporting traders, and non-reporting traders.

Efficient Market: In economic theory, an efficient market is one in which market prices adjust rapidly to reflect new information. The degree to which the market is efficient depends on the quality of information reflected in market prices. In an efficient market, profitable arbitrage opportunities do not exist and traders cannot expect to consistently outperform the market unless they have lower-cost access to information that is reflected in market prices or unless they have access to information before it is reflected in market prices.

Exchange Traded Fund (ETF): An investment vehicle holding a commodity or other asset that issues shares that are traded like a stock on a securities exchange.

Front Month: The spot or nearby delivery month, the nearest traded contract month.

Fund of Funds: A commodity pool that invests in other commodity pools rather than directly in futures and options contracts.

Futures Commission Merchant (FCM): Individuals, associations, partnerships, corporations, and trusts that solicit or accept orders for the purchase or sale of any commodity for future delivery on or subject to the rules of any exchange and that accept payment from or extend credit to those whose orders are accepted.

Futures Contract: An agreement to purchase or sell a commodity for delivery in the future: (1) at a price that is determined at initiation of the contract; (2) that obligates each party to the contract to fulfill the contract at the specified price; (3) that is used to assume or shift price risk; and (4) that may be satisfied by delivery or offset.

Futures-equivalent: A term frequently used with reference to speculative position limits for options on futures contracts. The futures-equivalent of an option position is the number of options multiplied by the previous day's risk factor or delta for the option series. For example, ten deep out-of-money options with a delta of 0.20 would be considered two futures-equivalent contracts. The delta or risk factor used for this purpose is the same as that used in delta-based margining and risk analysis systems.

Futures Option: An option on a futures contract.

Futures Price: (1) Commonly held to mean the price of a commodity for future delivery that is traded on a futures exchange; (2) the price of any futures contract.

Hedge Exemption: An exemption from speculative position limits for bona fide hedgers and certain other persons who meet the requirements of exchange and CFTC rules.

Hedge Fund: A private investment fund or pool that trades and invests in various assets such as securities, commodities, currency, and derivatives on behalf of its clients, typically wealthy individuals. Some commodity pool operators operate hedge funds.

Hedger: A trader who enters into positions in a futures market opposite to positions held in the cash market to minimize the risk of financial loss from an adverse price change; or who purchases or sells futures as a temporary substitute for a cash transaction that will occur later. One can hedge either a long cash market position (e.g., one owns the cash commodity) or a short cash market position (e.g., one plans on buying the cash commodity in the future).

Historical Volatility: A statistical measure (specifically, the annualized standard deviation) of the volatility of a futures contract, security, or other instrument over a specified number of past trading days.

Implied Volatility: The volatility of a futures contract, security, or other instrument as implied by the prices of an option on that instrument, calculated using an option pricing model.

Large Traders: A large trader is one who holds or controls a position in any one future or in any one option expiration series of a commodity on any one exchange equaling or exceeding the exchange or CFTC-specified reporting level.

Long: (1) One who has bought a futures contract to establish a market position; (2) a market position that obligates the holder to take delivery; (3) one who owns an inventory of commodities.

Long Hedge: Hedging transaction in which futures contracts are bought to protect against possible increases in the cost of commodities.

Managed Money Traders (MMTs): Futures market participants who engage in futures trades on behalf of investment funds or clients. While MMTs are commonly equated with **hedge funds**, they may include **Commodity Pool Operators** and other managed accounts as well as hedge funds. While CFTC Form 40 does not provide a place to declare oneself a Managed Money Trader, a large trader can declare itself a "Hedge Fund (H)" or "Managed Accounts and Commodity Pools."

Manipulation: Any planned operation, transaction, or practice that causes or maintains an artificial price. Specific types include corners and squeezes as well as unusually large purchases or sales of a commodity or security in a short period of time in order to distort prices, and putting out false information in order to distort prices.

Nearby Delivery Month: The month of the futures contract closest to maturity; the front month or lead month.

Offset: Liquidating a purchase of futures contracts through the sale of an equal number of contracts of the same delivery month, or liquidating a short sale of futures through the purchase of an equal number of contracts of the same delivery month.

Open Interest: The total number of futures contracts long or short in a delivery month or market that has been entered into and not yet liquidated by an offsetting transaction or fulfilled by delivery.

Option: A contract that gives the buyer the right, but not the obligation, to buy or sell a specified quantity of a commodity or other instrument at a specific price within a specified period of time, regardless of the market price of that instrument. Also see Put and Call.

Over-the-Counter (OTC): The trading of commodities, contracts, or other instruments not listed on any exchange. OTC transactions can occur electronically or over the telephone. Also referred to as Off-Exchange.

Physical Delivery: A provision in a futures contract or other derivative for delivery of the actual commodity to satisfy the contract.

Position: An interest in the market, either long or short, in the form of one or more open contracts.

Price Discovery: The process of determining the price level for a commodity based on supply and demand conditions. Price discovery may occur in a futures market or cash market.

Reporting Level: Sizes of positions set by the exchanges and/or the CFTC at or above which commodity traders or brokers who carry these accounts must make daily reports about the size of the position by commodity, by delivery month, and whether the position is controlled by a commercial or non-commercial trader.

Rolling Futures Positions: The lifting a near futures position and re-establishing it in a more deferred delivery month.

Short: (1) The selling side of an open futures contract; (2) a trader whose net position in the futures market shows an excess of open sales over open purchases. See Long.

Short Hedge: Selling futures contracts to protect against possible decreased prices of commodities.

Small Traders: Traders who hold or control positions in futures or options that are below the reporting level specified by the exchange or the CFTC.

Speculative Bubble: A rapid run-up in prices caused by excessive buying that is unrelated to any of the basic, underlying factors affecting the supply or demand for a commodity or other asset. Speculative bubbles are usually associated with a "bandwagon" effect in which speculators rush to buy the commodity (in the case of futures, "to take positions") before the price trend ends, and an even greater rush to sell the commodity (unwind positions) when prices reverse.

Speculative Position Limit: The maximum position, either net long or net short, in one commodity future (or option) or in all futures (or options) of one commodity combined that may be held or controlled by one person (other than a person eligible for a hedge exemption) as prescribed by an exchange and/or by the CFTC.

Speculator: In commodity futures, a trader who does not hedge, but who trades with the objective of achieving profits through the successful anticipation of price movements.

Spread: The purchase of one futures delivery month against the sale of another futures delivery month of the same commodity; the purchase of one delivery month of one commodity against the sale of that same delivery month of a different commodity; or the purchase of one commodity in one market against the sale of the commodity in another market, to take advantage of a profit from a change in price relationships. The term spread is also used to refer to the difference between the price of a futures month and the price of another month of the same commodity. A spread can also apply to options.

Squeeze: A market situation in which the lack of supplies tends to force shorts to cover their positions by offset at higher prices.

Supplemental Commodity Index Traders (CIT): A weekly report from the CFTC providing a breakdown of each Tuesday's open interest for markets in which 20 or more traders hold positions equal to or above the reporting levels established by the CFTC. Open interest is broken down by commercial, non-commercial, index traders, and non-reportable holdings.

Swap: In general, the exchange of one asset or liability for a similar asset or liability for the purpose of lengthening or shortening maturities, or otherwise shifting risks. This may entail selling one securities issue and buying another in foreign currency; it may entail buying a currency on the spot

market and simultaneously selling it forward. Swaps also may involve exchanging income flows; for example, exchanging the fixed rate coupon stream of a bond for a variable rate payment stream, or vice versa, while not swapping the principal component of the bond. Swaps are generally traded over-the-counter.

Swap Dealer (AS): An entity such as a bank or investment bank that markets swaps to end users. Swap dealers often hedge their swap positions in futures markets. Alternatively, an entity that declares itself a "Swap/Derivatives Dealer" on CFTC Form 40.

Underlying Commodity: The cash commodity underlying a futures contract. Also, the commodity or futures contract on which a commodity option is based, and which must be accepted or delivered if the option is exercised.

Volatility: A statistical measurement (the annualized standard deviation of returns) of the rate of price change of a futures contract, security, or other instrument underlying an option. See Historical Volatility, Implied Volatility.

Volume: The number of contracts traded during a specified period of time. It is most commonly quoted as the number of contracts traded, but for some physical commodities may be quoted as the total of physical units, such as bales, bushels, or barrels.