Richard B. Hirst
Senior Vice President & General Counsel

March 28, 2011

FILED ELECTRONICALLY

David A. Stawick
Secretary
Commodity Futures Trading Commission
1155 21st Street, N.W.
Washington, D.C. 20581

Re: "Position Limits for Derivatives," 76 *Fed. Reg.* 4752 (Jan. 26, 2011) RIN: 3038-AD15 and AD16

Dear Mr. Stawick:

Delta Air Lines, Inc. ("Delta") appreciates the opportunity to comment on the Commodity Futures Trading Commission's ("Commission") proposed rules, "Position Limits for Derivatives," 76 *Fed. Reg.* 4752 (Jan. 26, 2011) ("Proposal"). Section 737 of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 ("Dodd-Frank Act"),[1] amended the Commodity Exchange Act, 7 U.S.C. §1 *et seq.* ("Act") to require that the Commission set and enforce speculative position limits on exempt and agricultural commodities. The Dodd-Frank Act makes the most significant changes to the provisions governing the Commission's authority to promulgate and enforce speculative position limits since they were first enacted in 1936. The proposed rules are the first step in implementing this Congressional mandate. The rules that the Commission adopts implementing these provisions will have a significant effect on whether the futures and over-the-counter ("OTC") markets in energy products operate primarily as a venue for speculation, damaging their public utility as a venue for price discovery and for commercial enterprises to hedge their business risks.

Delta Air Lines, Inc.

Delta is the world's largest airline both in terms of passenger traffic and fleet size. Delta's business has been, and continues to be, dramatically impacted by volatility in the oil markets. Delta consumes approximately four billion gallons of jet fuel annually. Jet fuel accounts for 40% or more of Delta's costs. The oil price bubble of 2007-20008 cost Delta approximately $8 billion and caused a 10 percent reduction in Delta's capacity and the elimination of nearly 10,000 jobs.[2] The effects of the current run-up in oil prices are equally dramatic. Every $1 per barrel rise

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[1] Dodd-Frank Wall Street Reform and Consumer Protection Act, Public Law No. 111–203, 124 Stat. 1376 (2010).

[2] *See* the comment letter submitted by Delta Air Lines Inc. in response to the Commission's notice of proposed rulemaking entitled, "Federal Speculative Position Limits for Referenced Energy Contracts and Associated Regulations; Proposed Rule," 75 Fed. Reg. 4144 (January 26, 2010)("2010 Proposal"). The 2010 Proposal was

in the price of oil equals about $100M increase in Delta's annualized cost. In addition to affecting the cash price of jet fuel, the increased volatility in the market directly and dramatically increases Delta's cost of hedging its price exposure, precisely when such protection is most needed.[3]

The cash price of oil has become increasingly disconnected from supply and demand for the underlying commodity, as the result of the growing volume of speculation in the futures markets, with the result that current oil prices are significantly higher than the marginal cost of production. As discussed below, it is commonly recognized that the unprecedented rise and collapse in oil prices during 2007-2008 was the result of a speculative bubble. The oil markets are today still characterized by higher volatility and by a greater volume of speculation than prior to the 2007-2008 speculative bubble and price levels are disconnected from fundamental supply and demand factors. As noted above, these artificial price levels have significantly increased Delta's fuel costs, hedging costs and overall business risk, reducing Delta's ability to make capital investments, to expand its business, and to create jobs.

I. The Position Limits as Proposed by the Commission Will Have No Effect on Curbing Speculation in the Energy Markets

The Commission is proposing to adopt the same open-interest formula for setting non-spot position limits that it proposed in 2010.[4] The open interest formula that was proposed in 2010 and again in this Proposal results in levels that are so high that they will have no effect on the volume of speculation or oil price volatility.

The formula that the Commission is proposing for setting speculative position limits when applied to futures contracts in 2010 would have resulted in the all-months combined speculative position limit in crude oil futures being 98,000 contracts.

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subsequently withdrawn in light of enactment of the Dodd-Frank Act. "Federal Speculative Position Limits for Referenced Energy Contracts and Associated Regulations," 75 Fed. Reg. 50950 (August 18, 2010).

[3] It is critical to note that the increased volatility and price levels of oil have a two-fold effect on Delta. First, the cost of the fuel itself is at inflated prices not supported by fundamental factors of supply and demand. Equally important, however, the cost of hedging that price risk increases dramatically as a result of the increased volatility and price levels. This is illustrated by the appended chart (Attachment 1) showing Delta's increased cost of hedging using options. As illustrated in the attached chart, the December 2008 crude price was $44.60/bbl. The calculated option price was $3.24/bbl or 7% of the underlying commodity based on a volatility of 105%. In comparison, the December 2004 crude price was $43.45/bbl and the option price was $1.43/bbl or 3% of the underlying. The biggest difference is that the implied volatility in 2004 was 48%. This graph indicates that during the time of increased volatility (e.g. Jan 08 – Jul 09), when hedging is most critical, option prices are much higher relative to the underlying commodity.

[4] Although the Commission is now only proposing to adopt the formula and not the actual limits, the 2010 Proposal (which used the same formula) is instructive in providing an insight into the size of the positions which will be permitted under this formula. The 2010 proposed rules did not address limits for OTC swaps. Authority to do so was included in the Dodd-Frank Act, which was enacted after the 2010 rules were proposed.

- This level is approximately five times the NYMEX all-months position accountability level for crude oil of 20,000 contracts.[5]

- This level is 50% higher than all-month speculative position limit for crude oil recommended by the Chicago Mercantile Exchange.[6]

- The Commission staff itself estimated that an all-months level of 98,000 contracts would have affected a maximum of three traders in the NYMEX oil futures market.[7]

- Commission staff estimated that speculative position limits set using this formula would have affected only ten traders in *all* energy contracts during the period January 1, 2008 to December 31, 2009.[8]

The open interest formula when applied to both futures and swap contracts as it would be under the Proposal yields an even higher speculative position limit. The Commission provided an illustrative calculation of the limit using available data on NYMEX futures contracts and swap transactions cleared by NYMEX. The estimated position limit using this data is 108,000.[9] The Commission did not provide any information, as it did in connection with its 2010 Proposal, of how many, if any, traders, would have been affected by these limits. Once more complete swap data is available, the speculative position limit would be even greater than 108,000 contracts.

These facts clearly reveal that the proposed open interest formula yields limits that are ineffective. The Commission derives these very high speculative position limits based upon a traditional market manipulation analysis.[10] However, curbing the market power of a single trader does not address excessive speculative activity that in the aggregate may have an unwarranted effect on prices. Stanford University economist Kenneth Singleton, in a ground-breaking econometric study, concluded that there is substantial evidence that investment flows into oil

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[5] In June, 2001, NYMEX certified amendments to the Commission replacing its speculative position limit in crude oil which was 20,000 contracts all-months or any single month with position accountability rules set at the same level. Subsequently, in 2007, NYMEX reduced the single month limit in crude oil contracts to 10,000. *See* CFTC Hearing (statement of Dan M. Berkovitz, General Counsel, at p. 7).
[6] The Chicago Mercantile Exchange in a concept release recommended that the Commission propose an all-months speculative position limit of 65,000 contracts. *See* 2010 Proposal, *supra* at 4162. It is striking that the self-regulatory organization on which oil futures contracts are traded recommended a limit lower than that which the Commission proposed. This alone should act as a warning to the Commission that its proposal should be reconsidered.
[7] CFTC Hearing, *supra* (statement of Steve Sherrod, Acting Director of Surveillance at p. 7).
[8] *Id.*
[9] http://www.cftc.gov/ucm/groups/public/@swaps/documents/file/poslimitstable-a.pdf.
[10] The Proposal is clearly focused on setting speculative position limits to deter possible manipulations, which is reflected in the use of deliverable supply to calculate a restrictive spot month limit level, but permitting very expansive back-month limits. This design may work well in deterring market manipulation, particularly with respect to the agricultural markets for which this model was developed initially by the Commission. As the Commission has stated, "position limits based on a percentage of open may help prevent any single speculative trader from acquiring excessive market power." See Proposal at 4759.

futures, particularly by index investors and hedge funds, affected futures prices, even after controlling for many of the other economic factors that researchers have argued affect oil prices.[11] Professor Singleton observed that trading by many individual investors pursuing their own rational investing decisions can nevertheless impose serious costs on society. Professor Singleton found that errors by investors in index funds and other speculators may be immaterial to the individual trader but materially detrimental to the welfare of society as a whole. Thus, the Commission's position limits must address the overall level of speculation in the futures market, not just the risk that an individual speculator may manipulate the market.

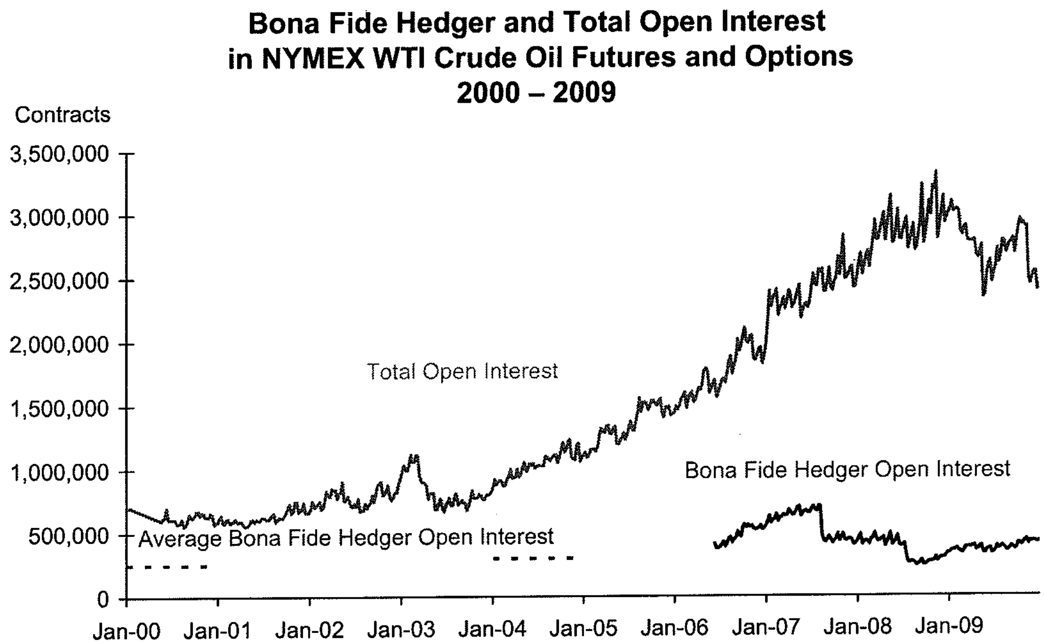
The Commission's proposal fails to address the fact that the absolute size of the positions permitted under the open interest formula has become so large that very few, if any, traders are actually affected by the limit. As discussed above, under the 2010 Proposal, only ten traders would have been affected by the proposed limits for all energy products. The formula used by the Commission, 10% of the first 25,000 contracts of open interest and 2.5% of open interest thereafter, was first introduced in 1992,[12] and the Commission has failed to update it in light of the vast expansion of open interest in the markets since then, leading to the Proposal's enormously high limits that will have no effect.

The Commission's formula will actually produce higher, less restrictive position limits as the volume of speculation increases

After the experience of the oil bubble of 2007-2008, one would expect the Commission to propose a formula for position limits which would reduce the amount of speculation in the market from the 2007-2008 level. Instead, the proposed formula actually produces higher position limits as the volume of speculation increases because under the formula position limits are based on a percentage of open interest, and open interest increases as speculation increases. Since there is more speculation in the market today than in 2008, the Commission's formula would actually produce higher limits today than it would have in 2008, had it been in effect then. The Commission's formula creates a feedback loop that does nothing to restrain, but rather permits, ever-increasing speculative activity.

The following chart illustrates the growth of overall open interest and the lack of comparable growth of trading by hedgers:

[11] Kenneth J. Singleton, "Investor Flows and the 2008 Boom/Bust in Oil Prices" (2011), *available at* http://ssrn.com/abstract=1793449 ("Singleton Study"). A copy of Professor Singleton's paper is appended as Attachment 2.
[12] "Revision of Federal Speculative Position Limits," 57 Fed. Reg. 12766, 12770 (April 13, 1992).



Note: Total open interest data are from weekly Commission COT reports. Bona fide hedger open interest data are from Buyuksahin 2008 and Commission disaggregated COT reports.

As a consequence of these two trends, the ratio of hedgers to speculators as a total percent of open interest reversed over the course of the period of 2000 to 2009. In short, hedgers at the beginning of the period comprised approximately 60% of total open interest, but shrank to approximately 40% of open interest in 2009. This disproportionate increase in speculative trading between 2000 and 2009 was not necessary to ensure market liquidity for bona fide hedgers or continued price discovery.

By calculating the proposed limits based on total interest with no adjustment for the changes in relative speculative trading versus hedging transactions as a historical norm compared to today's markets, the effect of the proposed limits is to legitimize and to endorse today's inflated levels of speculative activity in the market. Delta, in comments to the Commission, has suggested an alterative methodology based on the historical ratio of hedging to speculative activity that would set speculative position limits at levels that would constrain excessive speculation.[13]

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[13] See "Advance Comment on Speculative Position Limits of Delta Air Lines, Inc," at: http://www.cftc.gov/ucm/groups/public/@swaps/documents/dfsubmission/dfsubmission26_121310-1.pdf.

Delta has proposed an alternative methodology for setting speculative position limits based upon the growth in hedging transactions relative to total open interest. Its methodology is aimed at maintaining the historical relationship of 60% hedging activity to 40% speculative activity which prevailed during the period of 2000-2003, when the markets were operating in an orderly fashion and prior to the recent influx of speculative traders. The methodology achieves this goal by calculating a Speculative Open Interest Target that would be used in determining the single month and all-months combined speculative position limit that applies to individual traders. Under

Finally, the Commission has not made any proposal to address the issue of the effect of passive, long-only traders in the market. Any effective speculative limit framework must address this issue. In recent years, index traders have grown rapidly in both absolute and relative terms. It is of paramount importance that the Commission address this issue in light of that growth, the Commission's finding in 1981 that the markets' capacity to absorb speculative interest is not unlimited, and the danger that the rapidly growing presence and activities of index traders is impairing the functioning of the market. Futures market regulation is based upon the ability of the markets and their participants to provide public benefits in the form of hedging and price basing opportunities. Passive, long-only traders, unlike typical speculators that trade on the basis of a view of market direction--whether informed by market fundamentals or technical analysis--do not contribute to the aggregation of market information. Moreover, the market behavior of index traders is unlike that of any other trader and their uniform presence affects the market, creating conditions for market congestion, particularly during roll periods. As the Commission has concluded, the capacity of a market to absorb the establishment and liquidation of large speculative positions in an orderly manner is not unlimited.[14]

II. It is beyond debate that speculative activity affects prices in the futures markets

Excessive speculation is having a two-pronged effect on the market; the first is reflected in increased volatility characterized by acute price run-ups and the second is to apply sustained, long-term upward pressure on prices.

A. Excessive Speculation Results in Acute Price Swings in the Futures and Commodities Markets

Speculation in the futures markets has been widely acknowledged as a primary cause of the 2008 spike and subsequent rapid collapse of oil prices.[15] In recent months, another rapid rise in futures prices decoupled from the fundamentals of the underlying markets has occurred. As of early March, it was estimated that large financial firms had nearly twice as many long contracts on oil as they did during 2008.[16] Speculators again appear to be poised to create a bubble in the oil market driven by financial speculation and unwarranted concern on the part of investors, rather than industry fundamentals. Many economists,[17] investment bankers (including Goldman

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Delta's proposal, the limits themselves would operate as they do today. Based on these results, Delta calculated that the all months combined limit should be set at 5,000 contracts.

[14] "Establishment of Speculative Position Limits," 46 *Fed. Reg.* 50939, 50940 (Oct. 16, 1981) ("1981 Notice").

[15] For example, In June 2008 testimony before the U.S. Senate Commerce Committee, George Soros voiced his opinion that a fundamentally understandable long-term trend of increasing oil prices had turned into a speculative bubble because commodities had "become an asset class for institutional investors" that were "increasing allocations to that asset class by following an index buying strategy." Testimony before the U.S. Senate Commerce Committee Oversight Hearing on FTC Advanced Rulemaking on Oil Market Manipulation, June 3, 2008 (Testimony of George Soros).

[16] Colin Barr, "Speculators double down on oil," CNNMoney.com (Mar. 7, 2011), *available at* http://finance.fortune.cnn.com/2011/03/07/speculators-double-down-on-oil.

[17] *See*, Singleton Study, *supra*. *See also*, Mohsin S. Kahn, "The 2008 Oil Price 'Bubble,'" Peterson Institute for International Economics, Number PB09-19 (Aug. 2009), *available at* http://www.piie.com/publications/pb/pb09-

Sachs),[18] traders (including George Soros),[19] analysts,[20] and representatives of the major oil producing states[21] agree that increased speculation had caused prices to rise beyond what is dictated by supply and demand. Last year, economists from the World Bank and the European Commission also concluded that "index fund activity…played a key role during the 2008 price spike."[22] After a second run-up in prices occurred in 2009, even Nobel Laureate Paul Krugman, who had been skeptical of the role speculation played in the 2008 bubble, stated that in 2009, he could not avoid the conclusion that "speculation has been driving prices up."[23] Speculators again appear to be creating a bubble in the oil market.[24]

B. *The Effects of Passive Long Traders*

In addition to contributing to the overall level of speculation and its effect on volatility and price spikes in the futures markets, passive, long-only speculators also can push prices generally higher than market fundamentals would otherwise support. The recent influx of passive, long-only investors has expanded the number of buyers in the market. These buyers are relatively price insensitive because they are buying as a long-term investment strategy. These institutional investors increase buying pressure, leading sellers to raise their asking price for the commodity to compete with the higher prices coming from the futures market demand. Passive,

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19.pdf. (while fundamentals played some role in the trend of increasing oil prices, "speculation drove an oil price bubble in the first half of 2008.")

[18] Goldman Sachs, a proponent of the view that oil prices are primarily determined by fundamentals, concedes that speculation played a significant role in the 2008 price bubble, stating in a research publication that "speculators also contributed to the extreme price movements over the last two years. For example, new data suggests that speculators increased the price of oil by $9.50/bbl on average during the 2008 run-up." *See* "Commodity Prices and Volatility: Old Answers to New Questions, Global Economics Paper No: 194," Goldman Sachs Global Economics, Commodities and Strategy Research (March 20, 2010) at page 7.

[19] *See* Testimony of George Soros, *supra* n. 15.

[20] A survey conducted last year polled more than 40 traders and analysts at large banks, oil companies and trading houses and 73 percent said that increased speculation had caused prices to rise beyond what is dictated by supply and demand. See David Sheppard, "Financial speculation seen boosting oil price," Reuters (Apr. 27, 2010), *available at* http://www.reuters.com/article/2010/04/27/us-oil-speculation-survey-idUSTRE63Q1FJ20100427.

[21] Ali bin Ibrahim Al-Naini, the Minister of Petroleum, and Mineral Resources for the Kingdom of Saudi Arabia has pointed out that, as oil prices rose over 125% between mid-2007 and mid-2008, global supplies were growing more rapidly than global demand. *See*, Michael Greenberger, "The Relationship of Unregulated Excessive Speculation to Oil Market Price Volatility," Prepared for the International Energy Forum, p. 2 (2010), *available at* http://www.michaelgreenberger.com/files/IEF-Greenberger-AppendixVII.pdf., quoting Ali bin Ibrahim Al-Naini, Minister of Petroleum & Mineral Res., Speech at the 2008 Jeddah Energy Meeting (Jun. 22, 2008). The Minister concluded that industry fundamentals could not explain the high prices experienced in the summer of 2008 or the increase in volatility affecting the market.

[22] John Baffes and Tassos Haniotis, "Placing the 2006/08 Commodity Price Boom into Perspective," The World Bank Development Prospects Group, p. 9 (Jul. 2010), *available at* http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2010/07/21/000158349_20100721110120/Rendered/PDF/WPS5371.pdf.

[23] Paul Krugman, "Oil speculation," NYTimes.com (Jul. 8, 2009), *available at* http://krugman.blogs.nytimes.com/2009/07/08/oil-speculation.

[24] Mr. Al Naimi noted recently that, despite the current unrest in Libya, the oil market continues to be well supplied and Saudi Arabia stands ready to act if there is any disruption in production. Adam Schreck, "Saudis say shortage not behind oil price jump," Associated Press (Mar. 3, 2011).

long-only investors have transformed the market by introducing a pool of investors making monthly allocations to buying futures contracts, regardless of price. This has the effect of making sellers into the market less aggressive, and introduces upward pressure on prices.

The effect on the market from a number of traders pursing the same strategy can be substantial. In his newly released study, Professor Kenneth Singleton reviewed the literature and conducted his own empirical analysis which demonstrates that investment flows into oil futures, particularly by index investors and hedge funds, affect futures prices.[25] Professor Singleton found this effect to be true even after controlling for many of the other economic factors that researchers have heretofore argued affect oil prices.

Trading by many individual investors pursuing their own rational investing decisions can nevertheless have serious costs to society. Professor Singleton concludes that "an implication of 'forecasting the forecasts' of others is that commodity prices can be more volatile and, from a social welfare perspective, society can be worse off *even though each investor participating in this guesswork is small.*" As Professor Singleton observes, "If index investors are just slightly too optimistic (in market rallies) or pessimistic (in market downturns) relative to the true state of the world then their errors, while inconsequential for their own welfare, may be material for society as a whole."[26] Professor Singleton finds that small errors in the behavior of investors in index funds may be immaterial to the individual investor but materially detrimental to the welfare of society as a whole.[27]

III. The cash price of oil, and thus the cash price of oil-based products such as jet fuel, is based on oil prices on the futures exchanges

Airlines, including Delta, purchase jet fuel under long-term contracts in which the price term is open and set on a daily basis using a price determined by a pricing service such as Platt's. In this regard, airlines are typical of large purchasers of oil and fuel. In the United States, Platt's determines the cash price of oil and oil-based products such as jet fuel at the close of every trading day. It does so by using futures prices on the NYMEX as benchmarks, and making marginal adjustments on the basis of trading activity in the physical market. Thus the starting point for, and the most important factor in, the cash price of jet fuel in the U.S. is oil futures prices on the NYMEX. To the extent that futures price levels and volatility are affected by the sheer volume of speculation, as is clearly the case, the cash price of jet fuel and other oil-based products, such as gasoline, will be determined by the guesses of speculators about what other speculators will do, rather than by the cost of production.

IV. The Commission has a Legal Obligation to Address Excessive Speculation

For over seventy-five years, the Commission has been instructed by Congress to fix speculative position limits to diminish, eliminate, or prevent the burden on interstate commerce

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[25] Singleton Study, *supra*, at 20.
[26] *Id.* at 26.
[27] *Id.*

of " excessive speculation in futures contracts traded on designated contract markets causing sudden or unreasonable fluctuations or unwarranted changes in the prices of such commodity."[28]

In fulfillment of this Congressional mandate, the Commission, over the years, has adopted Commission-set speculative position limits in agricultural commodities and has required exchanges to set speculative position limits or to adopt position accountability rules for all other commodities.[29] However, since 2008, Congress has twice significantly strengthened the Commission's authority, making clear that the Commission is mandated to set speculative position limits in order to curb excessive speculation in energy contracts and other commodities.

In response to recent alleged manipulations in the natural gas markets and unprecedented volatility in other energy markets, Congress, in the CFTC Reauthorization Act of 2008 ("Reauthorization Act"), took the first recent step to reinvigorate the utility of speculative position limits as a tool in curbing the significant harm caused by excessive speculation. That statute granted the Commission authority to apply speculative position limits to Significant Price Discovery Contracts traded on exempt commercial markets, a type of OTC swap.[30] By amending the Act, Congress clearly intended that the Commission set speculative position limits to curb excessive speculative activity.[31]

Despite this new Congressional directive, the Commission proposed to set speculative position limits using the same open interest formula which dates from 1992. And, despite Congress' clear intention that speculative position limits should also curb speculation, the Commission focused its speculative position limit rules on preventing market manipulation."[32]

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[28] *See* sections 3 and 4a of the Act. These findings were incorporated in the Act in 1936, and reiterated with the creation of the Commission. *See* S. Rep. No.93-1131, 93d Cong., 2d Sess., 18-19 (1974).

[29] In doing so, the Commission has noted that

> it is the Commission's view that this objective is enhanced by speculative position limits since it appears that the capacity of any contract market to absorb the establishment and liquidation of large speculative positions in an orderly manner is related to the relative size of such positions; i.e., the capacity of the market is not unlimited. 1981 Notice, *supra* at 50940.

[30] In fulfillment of the new responsibility for setting speculative position limits in energy contracts under the Reauthorization Act, the Commission proposed to amend speculative position limits for energy contracts in several ways. First, it would have required that contract markets and exempt commercial markets with respect to their Significant Price Discovery Contracts set speculative position limits rather than position accountability rules. Also, the Commission proposed both market-specific limits in addition to aggregate limits across markets. "Federal Speculative Position Limits for Referenced Contracts and Associated Regulations," 75 Fed. Reg. 4143, 4168 (Jan. 26, 2010) ("2010 Proposal").

[31] *See*, 154 CONG. REC. H7529 (July 30, 2008) (statement of Rep. Dingell) (stating that the amendment was introduced to "ratchet back the excessive speculation which has undermined the ability of the commodity markets to enable price discovery, while ensuring a means for legitimate hedgers, such as airlines, to lock in future prices as a way to protect their business from price volatility"). *See also*, 154 CONG. REC. H7522 (July 30, 2008) (statement of Rep. Peterson); 154 CONG. REC. H7523-24 (July 30, 2008) (statement of Rep. Stupak); 154 CONG. REC. S7122 (July 23, 2008) (statement of Sen. Lieberman); 154 CONG. REC. S7245 (July 24, 2008) (statement of Sen. Levin); 154 CONG. REC. S9494 (Sept. 25, 2008) (statement of Sen. Levin).

[32] The Commission explained that its formula based on open interest was an extension of the logic "limiting positions based on deliverable supply . . . since, for example, traders with sufficiently large positions can squeeze shorts and thereby distort the price of the deliverable commodity. 2010 Proposal at 4152.

Following close on the heels of the 2008 Reauthorization Act, and its dramatic expansion of the Commission's speculative position limit authority,[33] the Dodd-Frank Act made even more sweeping changes to ensure that speculative position limits would be applied by the Commission in a manner intended to limit excessive speculation in the energy markets. As amended by the Dodd-Frank Act, section 4a(3) of the Act for the first time provides specific guidance to the Commission on the factors that the Commission should apply in setting speculative position limits. Previously, section 4a simply provided that the Commission shall fix limits as the Commission "finds are necessary to diminish, eliminate, or prevent" the burden on interstate commerce caused by excessive speculation. The Dodd-Frank Act provides explicit guidance that the goals of speculative limits are broader than restraining the market power of the very largest speculative traders. As amended, section 4a(3) of the Act instructs that speculative position limits, to the maximum extent practicable, should achieve four goals:

1) diminish, eliminate or prevent excessive speculation;
2) deter market manipulation;
3) ensure liquidity for bona fide hedgers; and
4) ensure that price discovery is not interrupted.[34]

Congress's intent that the Commission set speculative position limits to diminish, eliminate or prevent excessive speculation, in addition to market manipulation, is clear from the statutory language. In this regard, Senator Leahy noted that the Dodd-Frank Act will "stop Wall Street traders from artificially driving up prices of heating oil, gasoline, diesel fuel, and other commodities through unchecked speculation."[35]

It is striking that Congress amended section 4a(3) of the Act to clearly articulate that deterring manipulation and diminishing excessive speculation are distinct goals of speculative position limits. The Proposal merely states that "the formula would yield high position limits that nonetheless would prevent a speculative trader from acquiring excessively large positions

[33] The 2008 Reauthorization Act expanded the Commission's speculative position limit authority to include Significant Price Discovery Contracts traded on exempt commercial markets and contracts traded on a Foreign Board of Trade which are economically linked to those of a U.S. market.

[34]Section 4a((3) provides that;
In establishing the limits required in paragraph (2), the Commission, as appropriate, shall set limits—
(A) on the number of positions that may be held by any person for the spot month, each other month, and the aggregate number of positions that may be held by any person for all months; and
(B) to the maximum extent practicable, in its discretion—
(i) to diminish, eliminate, or prevent excessive speculation as described under this section;
(ii) to deter and prevent market manipulation, squeezes, and corners;
(iii) to ensure sufficient market liquidity for bona fide hedgers; and
(iv) to ensure that the price discovery function of the underlying market is not disrupted.

[35] 156 CONG. REC. S5913 (July 15, 2010) (statement by Sen. Leahy). *See also*, 156 CONG. REC. S5919 (July 15, 2010) (statement by Sen. Lincoln; 157 CONG. REC. S1595 (Mar. 14, 2011) (statement by Sen. Nelson).

and thereby would help prevent excessive speculation and deter and prevent market manipulation, squeezes and corners."[36]

As discussed above, the proposed speculative position limits are so high as to be completely ineffective. Nor does the Commission propose to address the effect of passive, long-only traders in any way. Accordingly, the Proposal does not fulfill the Congressional directive that the Commission set speculative position limits to diminish, eliminate or prevent excessive speculation.

V. The Commission Should Propose an Effective Speculative Position Limit Regime

Delta, in an advance comment to the Proposal, suggested one methodology for setting speculative position limits that it believes will achieve all four goals of the Dodd-Frank Act.[37] However, there may be other means to achieve the Congressional mandate, including using an open interest formula which is based on a percentage of hedging activity rather than total open interest. Delta urges the Commission to adopt speculative position limits which will be a meaningful and effective constraint against excessive speculation in the markets.

Delta also urges the Commission as both an immediate interim step and longer term, to adopt a position accountability rule in place of the position visibility rule that the Commission has proposed. Position accountability regimes, which have been administered by the exchanges for many years, would give the Commission some basic enforcement tools to address excessively large speculative positions which, although below the proposed speculative position limits, nevertheless cause market problems. Position accountability rules could be an effective adjunct to an effective speculative position limit regime.

The Commission has not proposed any solution addressing the separate and very real problem of passive, long-only speculative traders. The Commission must do so to fulfill its mandate to curb the ill effects of excessive speculation.

Finally, Delta does not support the general deferral of acting on speculative position limits until the Commission is able to assemble optimal data, nor does it support setting speculative limits so high that they will have no effect whatsoever based on the lack of data for certain market segments. Delta believes that the Commission should instead strive to establish meaningful speculative position limits using sampling and other statistical techniques to make reasonable, working assumptions about positions in various market segments and refining the speculative limits based upon market experience and better data as it is developed.

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As noted in this letter, the speculative bubble in oil prices has concrete detrimental consequences for the real economy. Congress provided the Commission with enhanced

[36] *See* Proposal *at* 4755.
[37] *See* "Advance Comment on Speculative Position Limits," *supra* n. 13.

Respectfully submitted,

Delta Air Lines, Inc.
By:

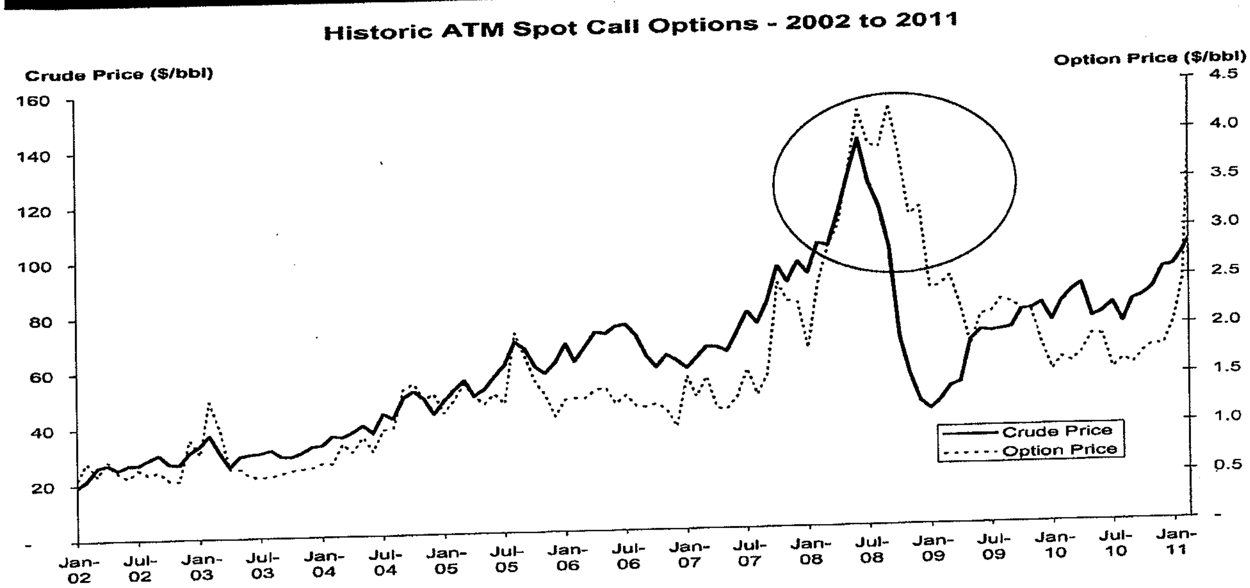
Richard B. Hirst,
Senior Vice President -General Counsel

Paul M. Architzel,
Counsel to Delta Air Lines, Inc.

cc: Chairman Gensler
Commissioner Dunn
Commissioner Chilton
Commissioner Sommers
Commissioner O'Malia
Daniel Berkovitz, General Counsel
Stephen Sherrod, Acting Director of Surveillance
Bruce Fekrat, DMO, Team Leader

ATTACHMENT 1

Movement of Option Prices & Crude Oil Over Time



- The purpose of this exercise was to determine how call option prices have moved over time with the price the underlying commodity.
- Call options give the buyer the right, but not the obligation, to purchase in the future the commodity at the predetermined strike price. For hedging, it is a cap on prices. This is a useful tool because it allows for participation with market prices as they move down, while protecting against rising prices. The cost of obtaining that protection is the premium (much like purchasing insurance).
- Historical option prices are not readily available. However, we do have access to implied volatilities from prior periods. Therefore, we can use option pricing models to recreate derivative prices. The formula for deriving the premium (i.e. Black-Scholes model) includes five factors; the underlying market price, the strike price (the cap level), implied volatility (measure of the riskiness of price movements), maturity date and risk free rates.
- In the above graph, the crude prices are ending spot prices for each month end from January 2002 through February 2011. The at-the-money option price (i.e. the strike price equals the market price) was derived for each contract using an option pricing model with implied volatilities.
- For instance, the December 2008 crude price was $44.60/bbl. The calculated option price was $3.24/bbl or 7% of the underlying commodity based on a volatility of 105%. In comparison, the December 2004 crude price was $43.45/bbl and the option price was $1.43/bbl or 3% of the underlying. The biggest difference is that the implied volatility in 2004 was 48%.
- This graph indicates that during the time of increased volatility (e.g. Jan 08 – Jul 09), when hedging is most critical, option prices are much higher relative to the underlying commodity.

ATTACHMENT 2

Investor Flows and the 2008 Boom/Bust in Oil Prices

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Abstract

This paper explores the impact of investor flows and financial market conditions on returns in crude-oil futures markets. I begin with a review of the economic mechanisms by which informational frictions and the associated speculative activity may induce prices to drift away from "fundamental" values and show increased volatility. This is followed by a discussion of the interplay between imperfect information about real economic activity, including supply, demand, and inventory accumulation, and speculative activity. Finally, I present new evidence that there was an economically and statistically significant effect of investor flows on futures prices, after controlling for returns in US and emerging-economy stock markets, a measure of the balance-sheet flexibility of large financial institutions, open interest, the futures/spot basis, and lagged returns on oil futures. The intermediate-term growth rates of index positions and managed-money spread positions had the largest impacts on futures prices.

1 Introduction

The dramatic rise and subsequent sharp decline in crude oil prices during 2008 has been a catalyst for extensive debate about the roles of speculative trading activity in price determination in energy markets.[1] Many attribute these swings to changes in fundamentals of supply and demand with the price effects and volatility actually moderated by the participation of non-user speculators and passive investors in oil futures markets and other energy-related derivatives.[2] At the same time there is mounting evidence that the "financialization" of commodity markets and the associated flows of funds into these markets from various categories of investors have had substantial impacts on the drifts and volatilities of commodity prices.[3] This paper builds upon the latter literature and undertakes an in depth analysis of the impact of investor flows and financial market conditions on returns in crude-oil futures markets.

The prototypical dynamic models referenced in discussions of the oil boom (e.g., Hamilton (2009a), Pirrong (2009)) have representative agent-types (producer, storage operator, commercial consumer, etc.) and simplified forms of demand/supply uncertainty. Moreover, these models, as well as the price-setting environment underlying Irwin and Sanders (2010)'s case against a role for speculative trading, do not allow for learning under imperfect information, heterogeneity of beliefs, and capital market and agency-related frictions that limit arbitrage activity. As such, they abstract entirely from the consequent rational motives for many categories of market participants to speculate in commodity markets based on their individual circumstances and views about fundamental economic factors.

Detailed information about the origins of most of the open interest in OTC commodity derivatives that could in principle shed light on the historical contributions of information- and learning-based speculative activity is not publicly available. However, indirect inferences suggest that traders' investment strategies did impact prices. Tang and Xiong (2009) show that, after 2004, agricultural commodities that are part of the GSCI and DJ-AIG indices became much more responsive to shocks to a world equity index, changes in the U.S. dollar exchange rate, and oil prices. These trends are stronger for those commodities that are part of a major index than for other commodities. Tang and Xiong attribute their findings to "spillover effects brought on by the increasing presence of index investors to individual commodities (page 17)." Using proprietary data from the Commodity Futures

[1]This debate is surely stimulated in part by the large costs that oil price booms and busts potentially impose on the real economy. See, for example, Hooker (1996), Rotemberg and Woodford (1996), Hamilton (2003), and the survey by Sauter and Awerbuch (2003).

[2]The conceptual arguments and empirical evidence favoring this view are summarized in a recent Organization of Economic Cooperation and Development report by Irwin and Sanders (2010).

[3]See, for example, Tang and Xiong (2009), Masters (2009), and Mou (2010).

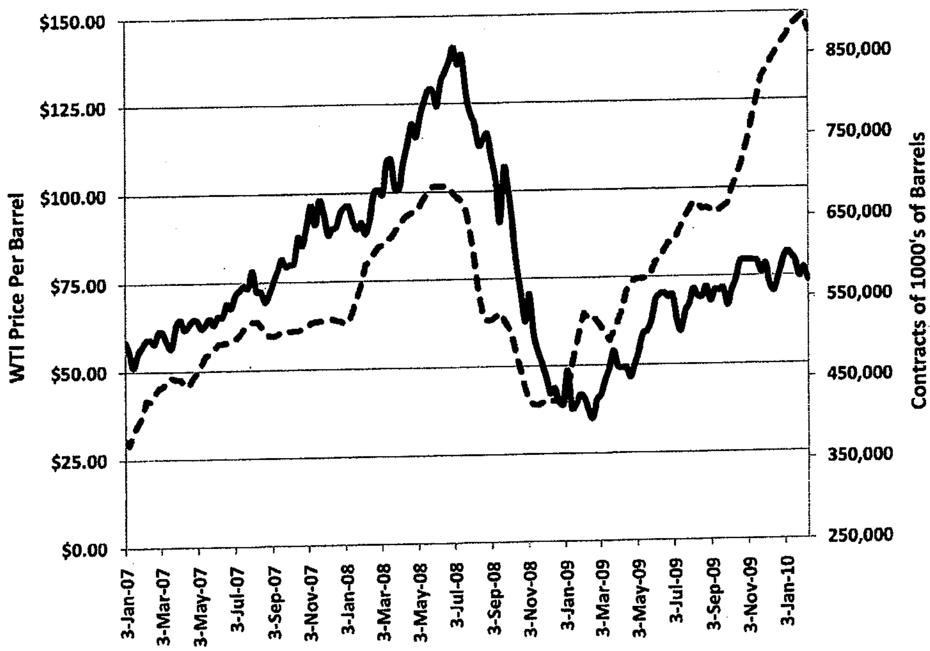

Figure 1: Commodity index long positions inferred from the CIT reports (dashed line, right sale) plotted against the front-month NYMEX WTI futures price (solid line, left scale).

Trading Commission (CFTC), Buyuksahin and Robe (2010a) link increased high-frequency correlations among equity and commodity returns to trading patterns of hedge funds. Less formally, Masters (2009) imputes flows into crude oil positions by index investors using the *CFTC*'s commodity index trader (*CIT*) reports. The imputed index long positions based on his methodology (Figure 1), displayed against the near-contract forward price of WTI crude oil, shows a strikingly high degree of comovement. Additionally, Mou (2010) documents substantial impacts on futures prices of the "roll strategies" employed by index funds, and finds a link between the implicit transactions cost born by index investors and the level of speculative capital deployed to "front run" these rolls.

To place these as well as my own empirical findings in an economic context, I begin in Section 2 with a review of the economic mechanisms by which informational frictions, and the associated speculative activity, may lead prices to drift away from "fundamental" values and induce higher market volatility. Section 3 discusses the interplay between imperfect information about real economic activity, including supply, demand, and inventory accumulation, and speculative activity. Section 4 presents new evidence that, even after controlling for many of the other conditioning variables in recent students of price behavior and risk premiums in oil futures markets, there were economically and statistically significant effects of investor flows on futures prices. Concluding remarks are presented in Section 5.

2 Speculation and Booms/Busts in Commodity Prices

As background to the subsequent empirical analysis of the impact of investor flows on futures prices I briefly review some of the potential consequences of heterogeneity of views, and associated speculative trading, on commodity prices. Absent near stock-out conditions in a commodity market, and (for simplicity) assuming a constant interest rate r, the current spot commodity price is related to a market participant's expected future price according to:[4]

$$S_t = \frac{1}{1+r} E_t^{\mathbb{Q}} \left[S_{t+1} \right] + S_t C_t, \tag{1}$$

where C_t denotes the convenience yield net of storage costs, and $E_t^{\mathbb{Q}}$ denotes the expectation under the risk-neutral pricing distribution conditional on date t information.

Much of the literature arguing for a "supply/demand" explanation of the oil price boom focuses on representative producers and refiners and arrives at the similar expression

$$S_t^* = \frac{1}{1+r} E_t^{\mathbb{P}} \left[S_{t+1}^* + G_{t+1} C_{t+1} \right], \tag{2}$$

where S_t^* denotes the price of crude oil S_t adjusted for storage costs, G_t is the price of refined gasoline, and $E_t^{\mathbb{P}}$ denotes the expectation of market participants under the distribution generating the historical data. The perfect-foresight model of Hamilton (2009a), for instance, leads to a special case of (2) without the expectation operator (since there is no uncertainty about future oil prices, inventory accumulations, or supply). The similarity between (1) and (2) arises in extant supply/demand models when market participants are assumed to be risk-neutral. If refiners and investors are risk averse, or if they face capital constraints that lead them to behave effectively as if they are risk averse, then (1) continues to hold but (2) is no longer valid. Accordingly, I henceforth focus on (1).

Implicit in (1) are the risk premiums that market participants demand when trading commodities in futures and spot markets. In an arbitrage-free setting the futures price today for delivery of a commodity τ periods in the future, F_t^{τ}, is equal to the expected future spot

[4]See, for example, equation (4) of Casassus and Collin-Dufresne (2005).

price: $E_t^{\mathbb{Q}}[S_{t+\tau}] = F_t^\tau$. Therefore,

$$F_t^\tau = E_t^{\mathbb{P}}[S_{t+\tau}] + \left(E_t^{\mathbb{Q}}[S_{t+\tau}] - E_t^{\mathbb{P}}[S_{t+\tau}]\right) \equiv E_t^{\mathbb{P}}[S_{t+\tau}] + RP_t^\tau, \tag{3}$$

where RP_t^τ is the *risk premium* associated with the economic forces that determine oil prices over the horizon τ. More generally, RP also captures the consequences of any limits to arbitrage, including financial market frictions that impinge on the flexibility of market participants to finance their commodity positions. Combining expressions (1) and (3) gives

$$S_t = \frac{1}{1+r} E_t^{\mathbb{P}}[S_{t+1}] + S_t \mathcal{C}_t + \frac{1}{1+r} RP_t^1. \tag{4}$$

An analogous expression holds for each investor who is participating in oil markets.

Expression (4) is not a structural relationship. Rather it summarizes the intertemporal trade-offs of a market participant who is unconstrained in trading in the spot and futures markets in circumstances where inventories are not near stock-out conditions. To sustain this expression in equilibrium, it is not necessary that participants in the spot and futures markets, or those refining or holding inventories of crude oil, be one and the same individual.[5] Nor must one assume that investors hold the same beliefs about future market conditions (i.e., that there is a representative investor).[6]

It follows that: (i) Spot prices are influenced not only by current oil market and macroeconomic conditions, but also by investors' expectations about future economic activity. (ii) Supply and demand pressures in the futures and commodity swap markets will in general affect prices in the spot market. Indeed, these relationships are fully consistent with price discovery taking place in either the futures, the cash, or the commodity swap markets, or in all three. (iii) Risk premiums will typically change over time as investors' willingness to bear risk changes. As I discuss in more depth below, the capacity of financial institutions to bear risk also changes over time, and this also may affect equilibrium futures and spot prices. (iv) Higher-order moments of prices and yields in financial markets also affect spot, futures, and swap prices through risk premiums and precautionary demands.

In addition these pricing relationships accommodate the possibility that investors hold different beliefs about the future course of economic events that impinge on commodity prices, and hence that there is not a representative investor in commodity markets. There is likely to

[5]In particular, the claim that "index fund investors ... only participated in futures markets... 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 of the market. (IS_{OECD}, page 8)" is not true in the economic environment considered here.

[6]The same observations apply to the trading in and pricing of commodity swap contracts.

be some disagreement among market participants about virtually every source of fundamental risk, including the future of global demands, the prospects for supply, future financing costs, etc. Saporta, Trott, and Tudela (2009) document large errors in forecasting demand for oil, typically on the side of under estimation of demand and mostly related to the non-OECD Asia and the Middle East regions. Additionally, they document substantial revisions to forecasts of market tightness, based on data reported by the U.S. Energy Information Administration (EIA), especially during 2007.[7] The International Energy Agency (IEA (2009)) points to substantial revisions to their monthly estimates of demands for the U.S. and, regarding non-OECD inventories, IEA (2008b) observes that "detailed inventory data [for China] continues to test observers' powers of deduction. As we have repeatedly stressed in this report, these data are key to any assessment of underlying demand trends... (page 15)" Sornette, Woodard, and Zhou (2008) document significant differences in the total world supplies for liquid fuels published by the IEA and the EIA, particularly from 2006 until 2008. The timeliness of non-OECD data is highly variable (IEA), and OPEC quotas and measured production levels are quite vague (Hamilton (2009b)).

Direct evidence on the extent of disagreement about future oil prices on the part of professional market participants comes from comparing the patterns in the cross-sectional standard deviations of the one-year ahead forecasts of oil prices by the professionals surveyed by Consensus Economics.[8] Larger values of this dispersion measure correspond to greater disagreement among the professional forecasters surveyed. Figure 2 shows a strong positive correlation between the degree of disagreement among forecasters and the level of the WTI oil price. This comovement is consistent with the positive relation between price drift and greater dispersion in investors beliefs found in theory and documented in equity markets.

How do heterogeneous beliefs get impounded into spot and futures commodity prices; and what are the potential implications for booms and busts in commodity prices? Virtually all classes of participants in commodity markets are, at one time or another, taking speculative positions.[9] Certainly in this category are the large financial institutions that make markets

[7]Market tightness is defined as total consumption (excluding stocks) minus the sum of non-OPEC and OPEC production. After comparing news about, and revisions in forecasts of, supply and demand for oil during 2008, these authors conclude that "Based on the news about the balance of demand and supply in 2008 ... it seems that one can justify neither the rise in prices in the first half of 2008, nor the fall in prices in the second half (page 222)."

[8]Consensus Economics surveys over thirty of (in their words) "the world's most prominent commodity forecasters" and asks for their forecasts of oil prices in the future. The series plotted in Figure 2 is the cross-forecaster standard deviation for each month of their reported forecasts. I am grateful to the IMF for providing this series, as reported in their *World Economic Forum.*

[9]The primary exception would be participants that hold futures or options positions that precisely offset their current spot exposures and who adjust their derivative positions frequently enough to rebalance as new exposures arrive and old exposures dissipate.

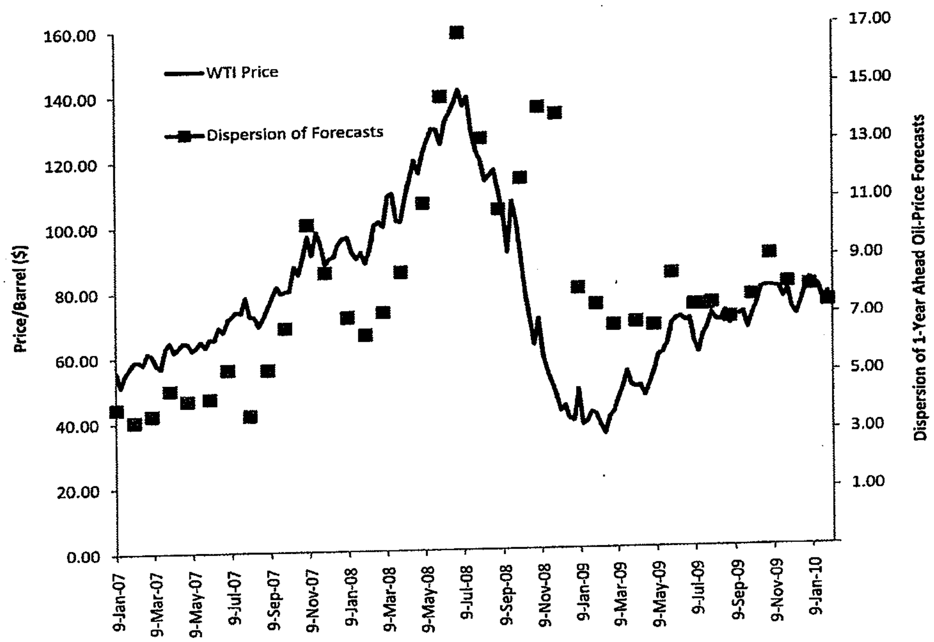

Figure 2: The front-month NYMEX WTI futures price (solid line, left scale) plotted against the cross-sectional dispersion of forecasts of oil prices one-year ahead by the professionals surveyed by Consensus Economics (squares, right scale).

in commodity-related instruments; refiners and others who hold sizable inventories; hedge funds and investment management companies; and commodity index investors.

How might this heterogeneity of beliefs impact oil prices? In a "rational expectations" equilibrium (*REE*) the source of different views across investors is private information. Investors share common priors and they do not disagree about public information. In contrast, in a "differences of opinion" equilibrium (*DOE*) investors can disagree even when their views are common knowledge. Accordingly, in a *DOE* investors can agree to disagree even when they share common information– they disagree about the interpretation of public information. Under a *REE* it is difficult to generate the volume of trade observed in commodity markets, because investors share common beliefs (see the "no-trade" theorems of Milgrom and Stokey (1982) and Tirole (1982)). In contrast in a *DOE*, because investors may disagree about the interpretation of public information, it is possible to generate rich patterns of comovement among asset returns, trading volume, and market price volatility (e.g., Cao and Ou-Yang (2009) and Banerjee and Kremer (2010)).

When market participants have different information sets, behavior in the spirit of Keynes' "beauty contest" may arise naturally. It is typically optimal for each participant to forecast the forecasts of others (Townsend (1983), Singleton (1987)). That is, participants will try to guess what other participants are thinking and to adjust their investment strategies accordingly. Within present value models that share many of the same intertemporal considerations involved in pricing commodities,[10] Xiong and Yan (2009) and Nimark (2009) show that groups of traders that hold different views will naturally engage in speculative activity with each other. Indeed, Allen, Morris, and Shin (2006) show that this heterogeneity leads investors to overweight public opinion and this, in turn, exacerbates volatility in financial markets.

In addition to excessive volatility, differences of opinion can give rise to drift in commodity prices and momentum-like trading in response to public announcements.[11] Conditional on past performance, there may be periods when commodity prices tend to drift in the same direction. Banerjee, Kaniel, and Kremer (2009) show that such price drift does not arise naturally in a *REE*, but it typically symptomatic of a *DOE* in which investors disagree about the interpretation of public information and in which they are uncertain about the views held by other investors. Both of these suppositions seem plausible in commodity markets.

Adam and Marcet (2010a), taking a complementary approach, show how boom and bust cycles in asset prices can result from Bayesian learning by investors. Investors in their model are "internally" rational in the sense of Adam and Marcet (2010b)– they make fully optimal dynamic decisions given their subjective beliefs about variables that impact prices and are beyond their control. However investors may not agree on how public information about fundamentals translate into a specific price level. Nor do investors know the utility weights that other investors assign to specific economic events. For both of these reasons internally rational investors try to infer from market prices information about fundamental economic variables and the end result is not a *REE*. They show that a model of stock price formation embodying these features produces boom/bust cycles in stock prices that match those experienced historically.

Three implications of this literature, particularly as they relate to the roles of speculation in commodity markets, warrant emphasis. First, it is not necessary for investors with heterogeneous beliefs to have private information in order for their actions to impact commodity prices. Rather, so long as they have differences of opinion about the interpretation of public information and find it useful to learn from past prices, then their actions can induce higher volatility, price drift, and booms and busts in prices. Second, the documented comovement among futures prices on commodities that are and are not in an index, or among spot prices

[10]These authors study bond marktes. As we have seen, analogous to the discounting in bond markets, commodity markets involve present values tied to financing cost, convenience yields, and storage costs.

[11]There is extensive empirical evidence that announcements of public information lead post-announcement drift and momentum in common stock markets; see, for instance, Zhang (2006) and Verardo (2009).

across markets with and without associated futures contracts, is not evidence against an important role for speculation underlying this comovement.[12] Participants in all commodity markets should find it optimal to condition on prices in other markets when drawing inferences about future spot prices, and this includes wholesalers and speculators.[13]

Third, the fact that investors are learning about both fundamentals and what other investors know or believe about future commodity prices may mean that the release of a seemingly small amount of new information about supply or demand has large effects on prices. Indeed, it is possible that prices change owing to changes in investors perceptions or risk appetite and absent the release of any new information.[14]

3 Demand/Supply, Inventories, and Speculation

Many of the arguments against a significant role for speculative trading in the recent boom/bust in oil prices highlight the historical linkages between supply/demand and inventory accumulation. Specifically, a widely held view is that speculative trading that distorts prices on the upside must be accompanied by increases in inventories.[15] This supposition has been used by both sides of the speculation/fundamentals debate. Some arguing for fundamentals have noted that we did not see large accumulations in inventories on the parts of refiners (e.g, Hamilton (2009a)), while others (e.g., U.S. Senate Permanent Subcommittee on Investigations (2006)) argue that the coincident increases in U.S. inventories and oil prices from 2004 to 2006 is evidence of speculative activity inducing higher spot prices. From Figure 3 it is seen that prior to 2003 there was a strong negative relationship between the price of oil and the amount of oil stored in the U.S. for commercial use (net of strategic petroleum reserves). This price/inventory relationship turned significantly positive from 2004 to 2007. It weakened in 2007 and turned negative, and then was weakly positive again during the first half of 2008.

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[12]It follows that the presence of heterogeneous beliefs and learning could invalidate both of the following claims in Irwin and Sanders (2010): (i) for index investors to have had a material affect on commodity prices "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 (page 8)." and (ii) "if index buying drove commodity prices higher then markets without index fund investment should not have seen prices advance (page 9)."

[13]The perception that there are links between flows into index funds and agricultural commodity prices is evident from Corkery and Cui (2010) who cite concerns about pension fund investments in commodities exacerbating fluctuation in food prices and, thereby, food shortages in poorer nations.

[14]Tang and Xiong (2009) conclude that "the price of an individual commodity is no longer simply determined by its supply and demand. Instead, prices are also determined by ... the risk appetite for financial assets, and investment behavior of diversified commodity index investors (page 30)."

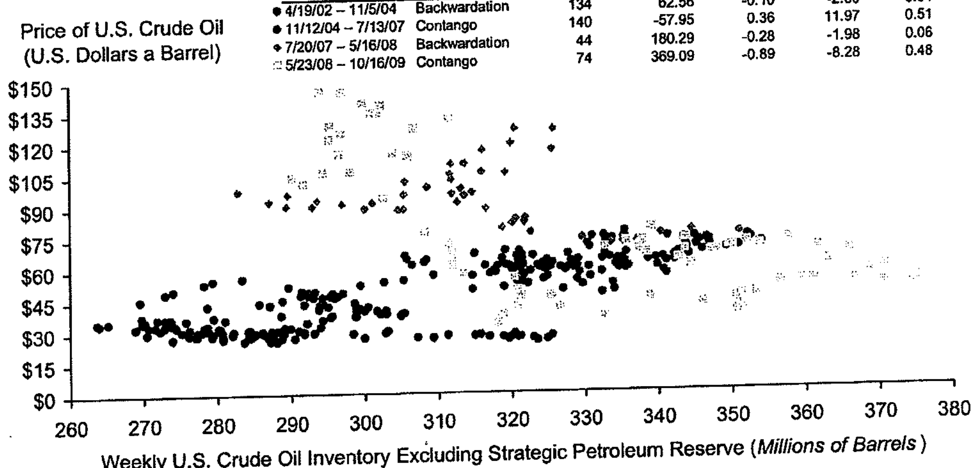
[15]For instance, the IEA expresses the view that "if speculators are driving spot oil prices, an imbalance in the form of higher stocks should be apparent (IEA (2008a))."

Crude Oil Spot Price vs. U.S. Stocks
4/19/02 – 10/16/09

Source: Energy Information Administration; *Bloomberg*

Regression Results of Spot Prices on Inventories

Time Period	Term Structure[1]	Number of Observations	Intercept	Coefficient	T Stat for Coefficient	Adjusted R Squared
4/19/02 – 11/5/04	Backwardation	134	62.56	-0.10	-2.60	0.04
11/12/04 – 7/13/07	Contango	140	-57.95	0.36	11.97	0.51
7/20/07 – 5/16/08	Backwardation	44	180.29	-0.28	-1.98	0.06
5/23/08 – 10/16/09	Contango	74	369.09	-0.89	-8.28	0.48



Note 1: Contango and Backwardation are defined using the spot price and the three-month futures price.

Figure 3: U.S. commercial inventories of crude oil plotted against the spot price of oil, for various recent subperiods.

Several caveats about the theoretically predicted price/inventory relationship and the historical evidence warrant emphasis. First, the price of oil is set in global markets, so it is potentially misleading to carry out a debate about inventory/price relationships by focusing on U.S. inventory levels alone. As I discussed above, during this period several major emerging economies where stockpiling crude oil in strategic reserves. These reserves are omitted from Figure 3 and, even if one wanted to include them, the inventory data for emerging economies has been much less reliable than for the G7.

Under the assumption that there is time-varying volatility (risk) related to either the demand or supply of oil, those with storage capacity may also have a precautionary demand for oil. An inherent feature of precautionary demand is that it increases with the degree of risk. In a model of rational market participants in which there is time-varying economic uncertainty about the future, but otherwise similar features to Hamilton's framework, Pirrong (2009) shows that there is not a stable relationship between inventories and prices and that a positive inventory-price relationship may arise as a consequence of increased demand- or supply-side uncertainty. Thus, there is not an unambiguously positive theoretical relationship between changes in prices and inventories, even absent accommodation of important roles in price setting of trading patterns induced by investor beliefs and learning.

Equally importantly, the impact of inventory adjustments on the volatility of prices depends critically on what one assumes about the nature of uncertainty about supply and demand. Many storage models (e.g., Deaton and Laroque (1996)) assume that, subsequent to a surprise change in inventories induced by a shock to demand, inventories revert to a long-run mean. It is this response pattern that led Verleger (2010), among others, to expect inventory adjustments to have a stabilizing effect on oil prices. However, these models of storage cannot simultaneously explain the high degree of persistence in oil prices and the high level of oil price volatility over the past 30 years (Dvir and Rogoff (2009)).

Arbitrageurs (those who store to make a profit from price changes) are confronted with two opposing implications of a positive income or demand shock. The price of oil increases and there is a drop in effective availability, both of which encourage a reduction in optimal storage. On the other hand, the persistent nature of aggregate demand means that both income and prices are expected to be higher in the future. Dvir and Rogoff (2009) show that when growth has a trend component, the expectation that prices will be higher in the future encourages an *increase* in inventories and this effect dominates the reduction in storage induced by the immediate post-shock increase in prices. On balance, storage (by arbitrageurs, refiners or consumers) may amplify the effects of demand shocks on prices.[16] Aguiar and Gopinath (2007) argue that shocks to growth contribute more to variability in output in emerging than in developed economies.

These observations, together with the inherent difficulty of accurately predicting future growth, suggest that there were (i) differences of opinion about future growth in emerging economies, and hence about demand for oil; (ii) market participants were, in part, drawing inferences from market prices about the "consensus" view about economic growth; and (iii) at least some subsets of participants were taking speculative (risky) positions in commodities and emerging market equities, or both, based on their views. The literature summarized in Section 2 shows that the resulting trading patterns could well have had destabilizing effects on prices. Optimal inventory management, through the channels just discussed, can potentially amplify the effects of differences of opinion and learning on commodity prices.

Figure 4 plots the level of non-strategic U.S. crude oil inventories against the spread between the futures prices for two- and four-month contracts ($M2 - M4$, inverted scale). Spreads that are above the zero line occur when the futures market is in contango, and spreads

[16] While this amplification mechanism has some characteristics of the precautionary demand studied by Pirrong, the economic mechanism underlying it is not driven by uncertainty about demand, but rather by expectations of rising prices.

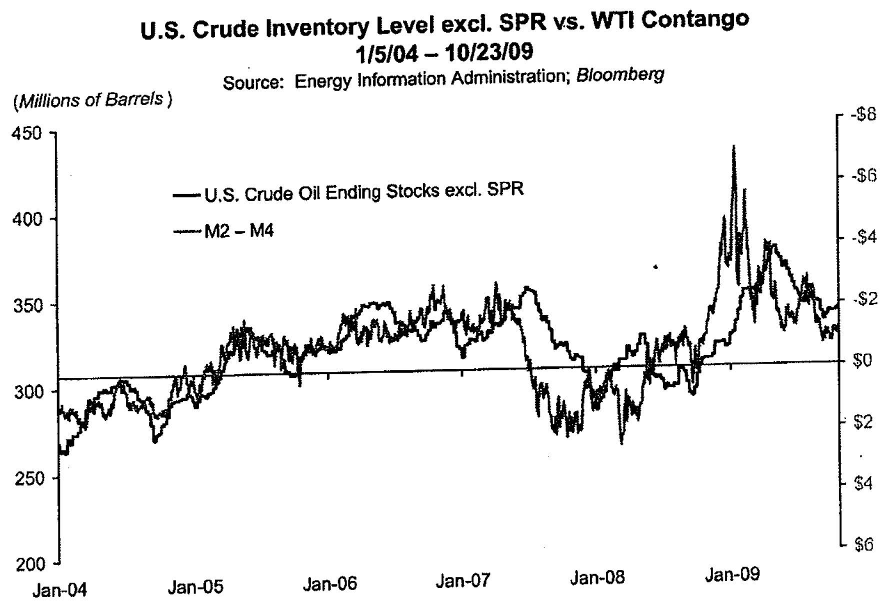


Figure 4: U.S. Commercial Inventories of Crude Oil Plotted Against the Spread Between Two-Month and Four-Month Futures Prices

below this line indicate backwardation. There is a clear tendency throughout the period of 2004 through 2009 for inventories to increase when the futures market is in contango.[17] The positive correlation between inventory levels and the futures basis is consistent with the modern theory of storage as developed by, for instance, Deaton and Laroque (1996) and Routledge, Seppi, and Spatt (2000). However their models embody the "leaning against the wind" view of inventory management and, hence, omit the possibility that expectations of higher prices in the future may encourage inventory accumulation in response to a price increase today. A notable feature of Figure 4 that seems consistent with the latter amplification effect, at least from 2007 onwards, is that steepening and flattening of the forward curve preceded changes in inventories: a steeper forward curve anticipated accumulations of inventories.

These theories of storage typically presume that market participants are risk neutral and, hence, there is no risk premium embedded in futures returns. Gorton, Hayashi, and Rouwenhorst (2007) extend the model of Deaton and Laroque (1996) to allow for risk averse speculators (maintaining mean reverting demand) and show that inventories are negatively related to expected excess returns in futures markets. They also establish a link between the futures basis and inventories. These authors and Hong and Yogo (2010), among others,

[17]These patterns are even stronger when inventory levels from Cushing or Padd2 are used.

present empirical evidence that a high basis (high $M2 - M4$ in Figure 4) predicts a high excess returns on futures positions, consistent with the theory of normal backwardation and compatible with the theory of storage. I revisit these correlations for the recent period of the oil boom as part of the following analysis of investor flows and oil prices.

4 Investor Flows and Oil Prices

Teasing out the relative contributions of the risks associated with fundamental factors in demand and supply through the channels encompassed in models such those of Hamilton (2009a) and Pirrong (2009) from the effects of price drift owing to learning and speculation based on differences of opinion will require much richer structural models than have heretofore been examined. In an attempt to provide some guidance to such endeavors, the remainder of this paper explores the historical correlations between differences of opinion, trader flows, and excess returns in oil markets, particularly for the 2008/09 boom and bust.

The comovement of the price of oil and the dispersion of forecasts of this price documented in Figure 2 suggests that professional participants in this market held different views and that these differences of opinion increased during this period. Of relevance to the subsequent discussion is whether this increase in dispersion coincided with increased dispersion in forecasts of world economic growth. Some evidence on this question is provided in Figure 5 which plots the ratio of the forecast dispersion for the price of oil to the corresponding dispersion of forecasts of growth for the world economy.[18] At least relative to the dispersion in opinions about world economic growth, there was something special about oil markets during 2008. Dispersion in views about economic growth did not rise substantially from its mid-2008 value until the spring of 2009 when the financial crisis was more pronounced.

4.1 What Is Known About Investor Flows and Commodity Prices?

A contentious issue related to the recent behavior of commodity prices is the degree to which growth in index investing– exposure to commodities through index-linked products– contributed to price volatility, a higher level of oil prices and greater disagreement among market participants about the future course of oil prices. Surely the entry of index investors as a new class of market participants affected the trading strategies of at least some other large investors. In particular, Buyuksahin et al. (2008) argue that prior to the early 2000's, the prices of long- and short-dated futures contracts behaved as if these contracts were traded

[18] For the purpose of these calculations the world is considered to be the G7 plus Brazil, China, India, Mexico, and Russia. I am grateful to the IMF for providing me with these dispersion measures.

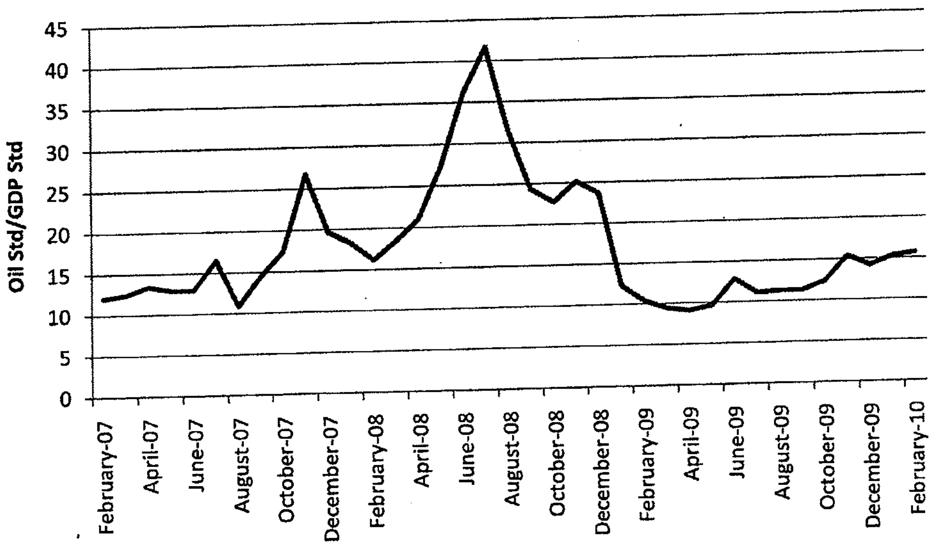


Figure 5: Ratio of the dispersions in forecasts for the price of oil and world economic growth (real GDP growth).

in segmented markets. They find that, since the middle of 2004, the prices of one- and two-year futures have been "cointegrated" with the nearby contract; that is, that all of these prices trend together. This closer integration of futures along the maturity spectrum was no doubt a consequence of several developments, including the increased trading activities of hedge funds engaged in spread trades (Buyuksahin et al. (2008)) and the incentives for index-fund managers to purchase longer-dated exposures through futures when the market is in contango. Very little is known publicly about the degree to which different groups of commodity investors were effectively trading against each other, either based on revealed positions of classes of investors, observed order flow, or by following momentum strategies.[19]

Many have characterized index traders as "passive investors."[20] As noted by Stoll and Whaley (2009), patterns similar to Figure 1 (in their case for agricultural commodities) reflect the fact that a portion of the imputed position of index traders in any given commodity is

[19]Some information about positions was available from the CFTC and mutual funds, or was observed (by traders) through financial institutions' own trading operations. There is extensive empirical evidence that order flow information in markets is a valuable input into the trading strategies of large financial institutions. See, for example, the evidence on currency markets in Evans and Lyons (2009).

[20]For instance, Stoll and Whaley (2009) express the view that commodity index investors "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 (Stoll and Whaley (2009), page 17)."

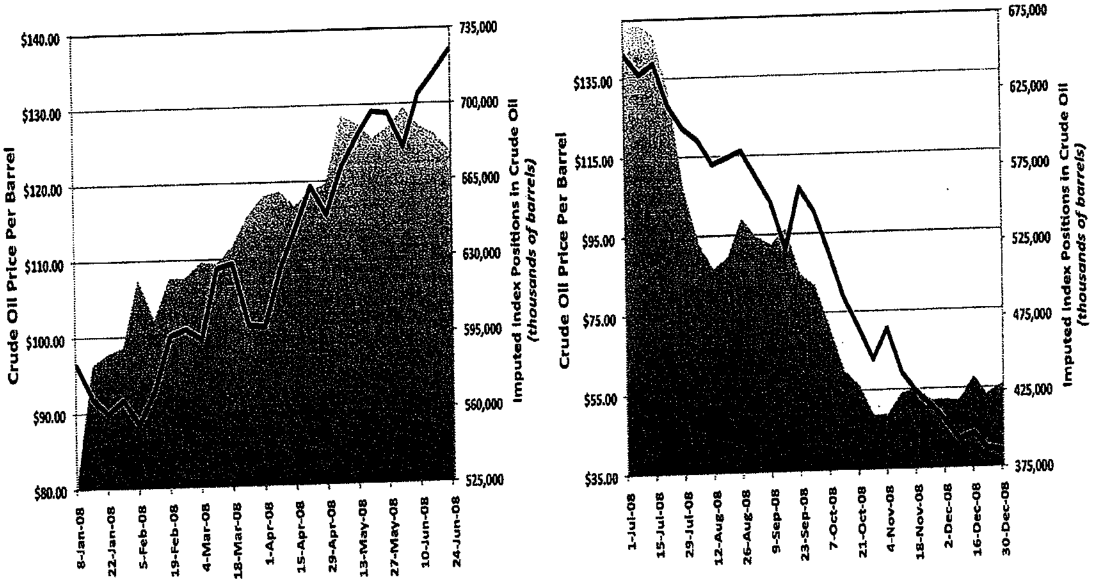


Figure 6: Crude oil prices (near futures contract) and imputed positions of index investors (barrels of oil) during the first (left) and second (right) halves of 2008.

driven by the movement in the underlying commodity price, as opposed to changes in the sizes of the positions of index traders. Nevertheless, overall position sizes did change. Even under the conservative estimates of position sizes by index investors in Stoll and Whaley, they doubled between 2006 and the middle of 2008, and then declined rapidly by nearly one half as of early 2009. Figure 6 overlays time paths of crude oil prices and the imputed positions of index investors in crude oil during the first and second halves of 2008. This data also shows a substantial increase and then decline in index positions, with medium-term patterns that closely track those of oil prices during the "boom and bust."

Moreover, the increased correlation between excess returns on commodities and global equity returns during 2004 - 2009 documented in Tang and Xiong (2009) and Buyuksahin and Robe (2010b) suggests that either index investors held positions in both asset classes until the global economy weakened, at which point many simultaneously unwound their long positions, or that different investors were engaged in correlated trading strategies induced by similarly optimistic views about emerging economies.

More generally, changes in aggregate positions reflect purchases by new investors and changes in existing positions of established investors. Even if the horizons of a majority of index investors are relatively long (weeks and months, not days), their positions are surely not immune to changes in their assessments of future economic growth, nor of their subjective assessments of the reliability of their forecasts.

Another, complementary issue that naturally arises in discussions of the impact of any given class of investors on commodity prices is whether large increases in desired long or short positions can impact prices in the futures and spot markets. In any market setting where there are limits to the amount of capital investors are willing to commit to an asset class– that is, where there are limits to arbitrage– the answer is generally yes. Price increases in responses to increased demands for long positions are typically necessary to induce other investors to commit more capital to taking the opposite side of these transactions. Acharya, Lochstoer, and Ramadorai (2009) and Etula (2010) document a significant connection between the risk-bearing capacity of broker-dealers and risk premiums in commodity markets.

Though index traders have received much of the negative publicity in discussions of the 2008 boom/bust in oil prices, it is of interest to examine the impacts of the trading activities of all large classes of investors on prices during this period. The CFTC is now making available position reports on four categories of traders, back to 2006: traditional commercial (commodity wholesalers, producers, etc.), managed money (e.g., hedge funds), commodity swap dealers, and "other." In addition, research staff at the CFTC have undertaken several studies of trader positions using internal proprietary data that has a much finer breakdown of market participants into categories of traders and is available daily.

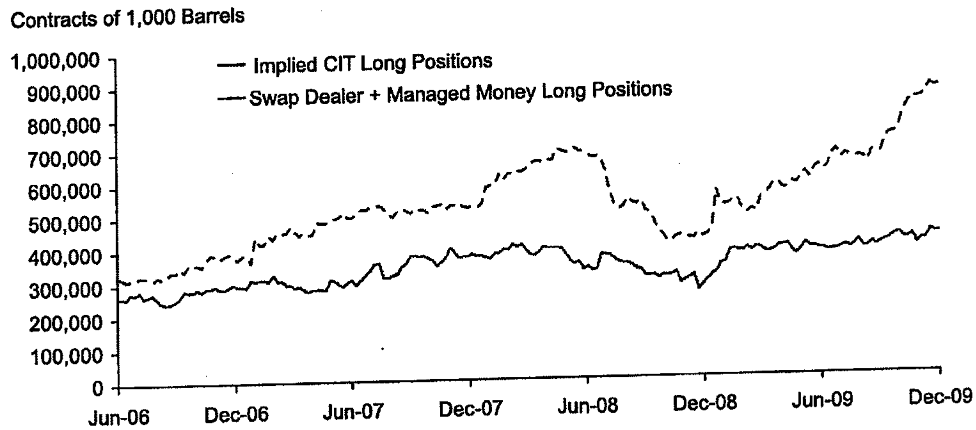
Overall, most of the evidence from this literature suggests that position changes in futures markets by managed money or commodity swap dealers either have weak or no (statistically significant) impact on prices and there is some evidence that hedging activity tends to stabilize prices (reduce price volatility).[21] However, knowing whether price changes lead or lag position changes over short horizons (a few days) is of limited value for assessing the price pressure effects of flows into commodity derivatives markets. Of more relevance is whether flows affect returns and risk premiums over weeks or months.[22] The imputed flows of funds into index positions displayed in Figure 1 suggests that such intermediate-term price-pressure effects may well have been present.

Prior to 2009 the Commitment of Traders Report (COT) only reported information for the broad categories of "commercial" and "non-commercial" traders. Figure 7 redisplays the imputed long positions of index investors from the CIT reports that is in Figure 1,[23] along with the "swap dealers and managed money" category from the COT report. The latter is the data often used in empirical studies of the impact of index investor flows on futures prices. Clearly these two series are very different, particularly from the fourth quarter of 2007

[21] See, for example, Boyd, Buyuksahin, Harris, and Haigh (2009), Buyuksahin and Robe (2009), Buyuksahin and Harris (2009), and Brunetti and Buyuksahin (2009).

[22] Similarly, evidence that any particular group of investors acquires positions after say a price decline does not contradict the view that this group is inducing systematic pressure for prices to move up or down.

[23] Implied CIT positions are calculated by dividing the imputed dollar amount of total index positions in NYMEX WTI crude oil futures by the value of a contract, calculated as the front-month futures contract price per barrel multiplied by 1000.



Source: Commodity Futures Trading Commission; Energy Information Administration; *Bloomberg*

Figure 7: CIT-imputed commodity index long positions plotted against the swap dealer and managed money positions as reported by the CFTC's Commitment of Traders report.

through the third quarter of 2008, and then again through the second half of 2009. This graph lends support to the view that the CFTC's COT data does not give a reliable picture of the overall demand for and supply of commodity risk exposure.[24]

Perhaps the most compelling evidence to date that index flows and "limits to arbitrage" have, together, had economically important effects on futures prices is provided by Mou (2010)'s analysis of excess returns around the dates of the rolls of the futures positions in the GSCI index. He shows that, by taking certain spread positions in commodity futures prior to the publicly known schedules for rolling the futures positions in commodity index funds, speculators made substantial profits effectively at the expense of index investors. The price-pressure effects were substantial, particularly for energy-related contracts. Moreover, the profitability of the trading strategies Mou examines were decreasing in the amount of arbitrage capital deployed in the futures markets and increasing in the proportion of futures positions attributable to index fund investments. A striking aspect of Mou's findings is that simple and low-cost trade strategies could have been used to arbitrage away the large profits

[24]There is an extensive literature examining links between net positions of hedgers and the forecastability of commodity returns– the "hedging pressure" hypothesis (Keynes (1930), Hicks (1939)). In two recent explorations of this issue Gorton, Hayashi, and Rouwenhorst (2007) find no support for the hedging pressure hypothesis, while Basu and Miffre (2010) argue that systematic hedging pressure is an important determinant of risk premiums. Both use the aggregated CFTC data on commercial and non-commercial traders in futures markets, a very course categorization that, as can be seen from Figure 7, is not reliably informative about the trading activities of such classes of investors as index investors or hedge funds.

from positioning ahead of the Goldman roll. Yet, while the profitability of such positions declined leading up to the boom of 2008, they remained positive suggesting that there were limits to the amount of speculative capital investors were willing to deploy.

4.2 New Evidence on the Impact of Trader Flows on Oil Prices

In the light of this conflicting evidence on the impact of trader positions on futures prices, I explored complementary statistical relationships using the imputed flows by index and managed-money investors. Specifically, I computed weekly time-series of excess returns from holding positions in futures at different maturity points along the yield curve. The maturities included were the 1, 3, 6, 9, 12, 15, 18, 21, and 24 month contracts, and the sample period was September 12, 2006 through January 12, 2010. Details of the excess return calculations are presented in the Appendix.

I included the following list of predictor variables for excess returns:

RSP1 and ***REM1***: the one-week returns on the S&P500 and the MSCI Emerging Asia indices, respectively. Inclusion of these returns controls for the possibility that investors were pursuing trading strategies in oil futures that conditioned on recent developments in global equity markets.

REPO1: the one-week change in overnight repo positions on Treasury bonds by primary dealers. Etula (2010) in the context of futures trading, and Adrian, Moench, and Shin (2010) more generally, argue that the balance sheets of financial institutions affect their willingness to commit capital to risky investments. This in turn implies that risk premiums may depend on the costs to these institutions of financing their trading activities. The growth in overnight repo positions is one indicator of balance-sheet flexibility.

IIP13: the thirteen-week change in the imputed positions of index investors in millions, computed using the same algorithm as in Masters (2009). In contrast to most of the extant literature, I focus on changes in index positions measured over three months (thirteen weeks) rather than over a few days or a week.[25]

MMSPD13: the thirteen-week change in managed-money spread positions in millions, as constructed by the CFTC. Erb and Harvey (2006) and Fuertes, Miffre, and Rallis (2008)

[25]The flows computed using the methodology in Masters (2009) is not without its limitations. However, for analyzing forecasts of changes in futures prices, it is not necessary that $IIP13$ be a perfect measure of the flow of funds into index positions. Some measurement errors seem inevitable. If the proportion of each index made up of any one agricultural product is small, mismeasurement is likely to be amplified through the scaling process. Further, valuation is done at the near-contract futures price (as was the case in Tang and Xiong (2009)), and this might not have been how index traders positioned the actual fund flows in oil markets. The evidence in Buyuksahin et al. (2008), based on proprietary CFTC data, suggests that the net positions of commodity swap dealers were primarily in short-dated futures contracts (three months or under).

document that simple spread trades based on the term structure of futures prices led to large historical returns. Spread positions were the largest component of open interest during my sample period (Buyuksahin et al. (2008)), and the disaggregated COT reports show that managed money accounts showed substantial growth in spread positions. Spread trades are not signed: trades that are long or short the long-dated futures are treated symmetrically.

OI13: the thirteen-week change in aggregate open interest in millions, as constructed by the CFTC. Hong and Yogo (2010) find that increases in open interest over an annual window predict monthly excess returns on futures. One explanation for this finding is that investors are learning about fundamental macroeconomic information from both past prices and open interest.[26] I account for this potential effect for weekly holding periods by conditioning on the three-month change in aggregate open interest in oil futures.

AVBAS1: the one-week change in average basis. Defining the basis at time t of a futures contract with maturity $T_i(t)$ to be[27]

$$B_i(t) = \left(\frac{F_t^{T_i}}{S_t}\right)^{1/(T_i(t)-t)} - 1, \tag{5}$$

as in Hong and Yogo (2010), then *AVBAS1* is the average of these values for maturities $i \in \{1, 3, 6, 9, 12, 15, 18, 21, 24\}$. In computing (5) I account for the time-varying maturity of the futures contracts. Hong and Yogo condition on their measure of basis to capture possible effects of hedging pressures on subsequent returns on futures positions. It is also a proxy for the net convenience yield in commodity markets.

Finally, I condition on the lagged value of the realized weekly excess return on oil futures positions. Stoll and Whaley (2009) find that, once lagged returns on futures positions are included in predictive regressions, there is no incremental predictive power for flows into commodity index investment. Similar points related to lagged open interest have been made by others. However, using data over a longer sample period and for a much broader set of commodities, Hong and Yogo (2010) find a very strong predictive relationship between current open interest and subsequent returns on futures positions. Moreover, when both open interest and lagged returns are included in predictive regressions, open interest drives out the forecasting power of returns.

I estimated the forecasting equations

$$ERmM_{t+1} = \mu_m + \Pi_m X_t + \Psi_m ERmM_t + \varepsilon_{m,t+1}, \tag{6}$$

[26] Consistent with this interpretation, Hong and Yogo (2010) find that open interest also has predictive content for future inflation and short-term bond yields.

[27] Note that this measure of the basis has the opposite sign of the basis in Figure 4.

Variable	RSP1	REM1	REPO1	IIP13	MMSPD13	OI13	AVBAS1
			Contemporaneous Predictors				
ER1M	0.35	0.40	0.10	0.21	0.16	0.12	-0.43
ER3M	0.43	0.48	0.08	0.24	0.19	0.15	-0.26
ER6M	0.45	0.50	0.06	0.25	0.17	0.15	-0.21
ER12M	0.44	0.51	0.04	0.25	0.15	0.14	-0.17
ER24M	0.41	0.48	0.04	0.25	0.12	0.13	-0.12
			Lagged Predictors				
ER1M	0.03	-0.17	-0.21	0.25	0.18	0.12	-0.25
ER3M	0.11	-0.10	-0.20	0.26	0.19	0.13	-0.32
ER6M	0.13	-0.09	-0.19	0.26	0.18	0.13	-0.30
ER12M	0.16	-0.10	-0.19	0.26	0.16	0.12	-0.24
ER24M	0.15	-0.11	-0.17	0.25	0.13	0.11	-0.18

Table 1: Correlations among the one-week excess returns on futures positions and the contemporaneous and lagged values of the predictor variables.

where $ERmM_t$ is the realized excess return for a one-week investment horizon on a futures position that expires in m months, X_t is the set of predictor variables, and the data were sampled at weekly intervals. The fitted values from these regressions are typically interpreted as expected excess returns or, equivalently, as risk premiums in futures markets. This is a natural interpretation when X_t represents information that was readily available to at least some market participants at the time the forecasts were formed. The variables $IIP13$ and $MMSPD13$ were constructed (by the CFTC) based on information at the time of the forecast. However this data was released by the CFTC starting in 2009 and, as such, was not readily available to market participants during my sample period. Therefore, a finding of economically important effects of these variables on $ERmM_{t+1}$ represents evidence of price pressure effects of flows by these investor classes on futures prices (controlling for other variables in X_t), but not necessarily evidence of market participants adjusting their risk premiums at the time in response to releases of information about these flows.

The correlations among the $ERmM$ and both contemporaneous and first-lagged values of the conditioning variables X are displayed in Table 1. All of the contemporaneous correlations between the excess returns and the predictor variables have signs that are consistent with previous findings in the literature. The correlations of the excess returns with emerging market stock returns ($REM1$) and the growth in repo positions by primary dealers ($REPO1$) change sign when these conditioning variables are lagged one period. Moreover, when investor flows are measured over periods of weeks, rather than days as in much of the literature, they have sizable correlations with excess returns. I elaborate on these findings below.

The correlations between changes in oil futures prices and both index and managed-money flows are positive. For the signed index positions, this is consistent with positive (momentum-type) price pressure effects. Notice also that the thirteen-week change in open interest is positively correlated with oil price changes. This finding is consistent with the strong positive correlation of these variables found by Hong and Yogo (2010) using monthly data over a much longer sample period. They interpret these correlations as indicative of open interest embodying information about future economic activity that investors find useful for predicting future commodity prices. Such a role of open interest would naturally arise in economic environments where investors learn from past prices and trading volumes as in the models discussed in Section 2. Supporting such an informational role, Hong and Yogo also find that open interest has predictive content for future bond returns and inflation in the U.S.

To explore these comovements more systematically and jointly, I estimated the parameters in (6) using linear least-squares projection. The null hypotheses are that the elements of Π are zero: excess returns on futures positions are not predictable by the variables in X_t, after conditioning on lagged information about excess returns. The economic theories of the dynamic properties of excess returns reviewed above allow for the possibility that other transformations of the conditioning information (more lags or nonlinear transformations) have incremental predictive content for excess returns. Accordingly, following Hansen (1982) and Hansen and Singleton (1982), robust standard errors are computed allowing for serial correlation and conditional heteroskedasticity in ε_{t+1}.[28] Estimates of Π along with their asymptotic "t-statistics" are displayed in Table 2.

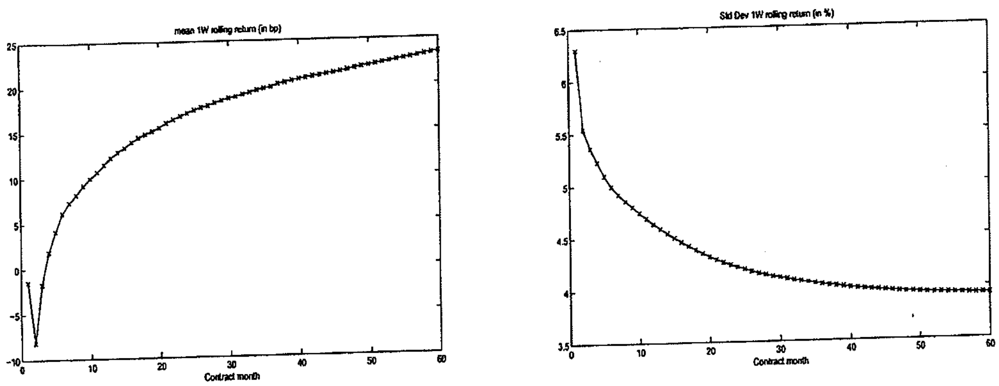
Note, first of all, that the adjusted R^2's in these projections provide compelling evidence that excess returns on futures positions in oil markets had a significant predictable component during this sample period. From Figure 8 it is seen that the volatilities of the excess returns decline, and the mean excess returns are increasing, in the contract month. Thus, the low adjusted R^2's for the longer maturity contracts imply that the predictor variables explain a smaller percentages of relatively less volatile, but larger on average, returns.

The coefficients on most of the conditioning variables and for most of the contract months are statistically different from zero at conventional significance levels. The two primary exceptions are the coefficients on the lagged returns (second to last column) and the growth in open interest ($OI13$). Interestingly, the coefficients on $OI13$ (partial correlations) switch sign and shrink in absolute value relative to the correlations in Table 1, and they are small relative to their estimated standard errors. After conditioning on the trading patterns of index investors and hedge funds, at least for the sample period around the 2008 boom/bust, open interest does not have significant predictive content for excess returns.

[28]Specifically, I use the Newey and West (1987) construction allowing for five lags.

Contract	RSP1	REM1	REPO1	IIP13	MMSPD13	OI13	AVBAS1	R_{Lag}	Adj R^2
1	0.332	-0.342	-0.201	0.272	0.357	-0.103	-4.165	-0.219	0.27
	(1.44)	(-2.44)	(-2.89)	(3.51)	(4.36)	(-2.17)	(-6.26)	(-2.05)	
3	0.361	-0.242	-0.170	0.218	0.284	-0.082	-3.661	-0.152	0.27
	(1.99)	(-2.02)	(-2.76)	(3.71)	(4.43)	(-1.87)	(-6.48)	(-2.10)	
6	0.391	-0.261	-0.150	0.197	0.245	-0.072	-3.022	-0.105	0.25
	(2.35)	(-2.27)	(-2.64)	(3.49)	(4.14)	(-1.74)	(-5.59)	(-1.62)	
9	0.424	-0.275	-0.142	0.187	0.222	-0.067	-2.551	-0.090	0.24
	(2.67)	(-2.46)	(-2.58)	(3.45)	(3.95)	(-1.73)	(-4.72)	(-1.40)	
12	0.437	-0.283	-0.133	0.179	0.202	-0.064	-2.141	-0.075	0.22
	(2.84)	(-2.60)	(-2.49)	(3.42)	(3.83)	(-1.73)	(-3.97)	(-1.14)	
18	0.430	-0.286	-0.119	0.166	0.174	-0.058	-1.657	-0.054	0.20
	(2.99)	(-2.79)	(-2.35)	(3.42)	(3.61)	(-1.72)	(-3.13)	(-0.75)	
24	0.412	-0.287	-0.107	0.157	0.159	-0.053	-1.329	-0.046	0.18
	(2.98)	(-2.87)	(-2.21)	(3.46)	(3.40)	(-1.67)	(-2.60)	(-0.59)	
36	0.378	-0.294	-0.093	0.145	0.144	-0.048	-0.981	-0.033	0.16
	(2.85)	(-2.99)	(-2.05)	(3.52)	(3.02)	(-1.60)	(-2.10)	(-0.40)	

Table 2: Estimates and robust test statistics for the futures excess return forecasting model.



(a) Sample Mean

(b) Sample Standard Deviation

Figure 8: Sample moments in basis points of the weekly excess returns on futures.

That intermediate-term changes in index positions largely drive out open interest as a predictor of changes in oil prices suggests that at least a portion of the predictive content of open interest found in previous studies was a consequence of it serving as a proxy for the information in index and hedge fund positions. Consistent with this interpretation is the sample correlation between $IIP13$ ($MMSPD13$) and $OI13$ of 0.56 (0.45). By conditioning on order flow, absent information about $IIP13$ and $MMSPR13$, market participants may well have captured a substantial part of the impact of index and manage-money flows on prices, and this would show up in required risk premiums in oil markets.

There does appear to be a small remaining negative effect of open interest on futures returns, particularly for the shortest maturity futures contracts. (The negative coefficients on $OI13$ decline monotonically with the maturity of the futures contract.) A plausible interpretation of these negative coefficients is that some market participants were taking contrarian positions based on the view that oil prices had over-reacted to new information. Some evidence that hedge funds played such a stabilizing role over very short horizons (much shorter than what I am considering) is provided in Brunetti and Buyuksahin (2009). For the intermediate term horizons investigated here, such (statistically weak) feedback effects are dominated by flows from index and managed-money accounts.

The coefficients on the lagged futures returns for the one- and three-month contracts are marginally significant, but for all other contracts they are statistically insignificant. Additionally, the absolute values of the estimates decline rapidly with the maturity of the futures contract. Thus, there is weak evidence of reversals in the prices of the short-dated futures contracts, after conditioning on the information in the other components of X_t. More generally, and importantly for interpreting the evidence regarding the boom and bust in oil prices, these findings suggest that the significant predictive content of the conditioning variables X_t is fully robust to inclusion of the lagged return (see also below). This stands in contrast to the results from focusing on returns and conditioning variables over daily intervals as, for instance, in Buyuksahin and Harris (2009) and Stoll and Whaley (2009).

The large positive correlation between returns on commodity futures positions and stocks in emerging economies reported in Table 1 is often noted in discussions of investor flows. An interesting aspect of both the correlations in Table 1 and the coefficients in Table 2 is that the lagged returns on emerging market equity positions are negatively correlated with futures returns. The negative (and statistically significant) partial correlation coefficients indicate that, after for controlling for all of the other components of X_t, an increase in $REM1$ predicts a decline in futures prices in the subsequent week. These findings suggest that positive news about emerging economies leads to *contemporaneous* changes in oil futures and emerging market equity prices in the same direction. However, $REM1$ predicts subsequent reversals in futures prices. Limits to capital market intermediation and the consequent slow commitment of capital to new OTC commodity derivatives positions is a plausible explanation for these reversals (see Duffie (2010) and the references therein). Spot and futures prices respond immediately to new information about emerging market growth, but broker-dealers take time to adjust their own inventory and OTC derivatives positions.

Similarly, the negative and statistically significant effects of $REPO1$ on excess returns are consistent with model of Etula (2010) in which risk limits and funding pressures faced by broker-dealers impact risk premiums in commodity markets. The OTC commodity derivatives market is substantially larger than the markets for exchange traded products and servicing the OTC markets requires a substantial commitment of capital by broker-dealers. As funding conditions improve– reflected here through an increase in the repo positions of primary dealers– the effective risk aversion of broker-dealers declines and, hence, so should the expected excess returns in commodity futures markets. This effect of funding liquidity on excess returns declines (in absolute value) with contract maturity, while remaining statistically significant.

Perhaps the most striking findings in Table 2 are the statistically significant predictive powers of changes in the index investor ($IIP13$) and managed money spread ($MMSPD13$) positions on excess returns in crude oil futures markets. Increases in flows into index funds over the preceding three months predict higher subsequent futures prices. These effects are significant for contracts of all maturities, and this is after controlling for lagged futures returns and all of the other conditioning variables in X_t. The flow variable $IIP13$ is capturing price pressures associated with intermediate-term persistent flows of funds into index positions.

Elaborating, assuming that futures returns and the predictor variables are covariance stationary, the null hypothesis that the coefficient on investor flows in projections of weekly returns on intermediate-term growth rates in these flows has the same economic content as the null hypothesis that short-term flows impact futures prices over intermediate-term horizons (Hodrick (1992), Singleton (2006)). Consistent with most prior studies, including weekly changes in index positions has little predictive content for the weekly excess returns. These observations suggest that, if present, the price drift in futures markets related to learning and speculative trade is manifested over return horizons of a few weeks or months. Correlations between futures prices and flow variables sampled at high frequency are likely to be dominated by noise that obscures the presence of this longer-horizon comovement.

There is also a significantly positive effect of flows into managed money spread positions on future oil prices. The weekly excess returns embody the roll returns once per month. Therefore, the predictive power of $MMSPD13$ might in part reflect the growth in spread trading by hedge funds in anticipation of the Goldman roll for index funds (Mou (2010)). Alternatively, Boyd, Buyuksahin, Harris, and Haigh (2010) present evidence of herding behavior by hedge funds during this sample period. Whatever the motives of the professionals categorized as "managed money" traders, their net effect on excess returns was positive: increases in spread positions were associated with future increases in oil contract prices. Ceterus paribus, the marginal effects of growth in index or managed-money positions on excess returns were comparable: the hypothesis that the matching coefficients in columns five and six of Table 2 are the same cannot be rejected for any of the contract months.

Finally, increases in the average basis ($AVBAS1$) are associated with declines in excess returns. The coefficients on $AVBAS1$ are both more negative and statistically significant for the short-maturity contracts. These statistically significant coefficients are in contrast to those in studies of earlier sample periods (e.g., Fama and French (1987)), and also to those in Hong and Yogo (2010) who examine monthly excess returns over the longer sample period 1987-2008. Additionally, $AVBAS1$ shows small bilateral correlations with the other conditioning variables. For instance, its correlations with $(REPO1, IIP13, MMSPD13, OI13)$ are $(-0.15, -0.05, -0.05, -0.08)$ so the weekly average basis represents distinct information about future returns. Hong and Yogo (2010) interpret a negative correlation between the basis and returns on futures positions as arising out of hedging activities of producers. However, this explanation appears to be based on the "leaning against the wind" view of hedging. Recall from Figure 4 that changes in the shape of the futures curve tended to anticipate changes in inventory positions during my sample period. Moreover, under plausible assumptions about the persistence in aggregate demand for oil, price increases today can lead to increases in inventories in anticipation of further price increases in the future.

An alternative possibility is that the trading strategies of investors– not necessarily producers– led futures prices to move more than spot prices in response to commodity-relevant news. These reactions were then partially reversed in the subsequent week. The impacts of $AVBAS1$ on excess returns decline (in absolute value) with contract maturity, indicating that reversals were largest for the shorter maturity contracts. An interesting question for future research is the relationship during this boom/bust period between the convenience yields on futures contracts and excess returns.

4.3 Robustness of Excess Return Projections to the Inclusion of Other Conditioning Information

The reported findings are robust to inclusion of several other conditioning variables. Specifically, as noted above, the growth rates in flows into index and managed-money accounts over one-week intervals do not add significantly to the forecasts of excess returns.

In preliminary regressions I also included the one-week change in the Cushing, OK inventory of crude oil in millions, as reported on Bloomberg, to check the robustness of the results to the inclusion of inventory information. There is a statistically weak negative effect of inventory information on the excess return for the one-month contract. Beyond one month the coefficients are all small relative to their estimated standard errors.

Additionally, I estimated the predictive regressions with additional lags of excess returns included as predictor variables and the pattern of results in Table 2 remained qualitatively the same. The inclusion of past information about returns does materially affect the predictive content of the investor flow variables.

Finally, some argue that the trading patterns of index and managed-money investors are linked to speculation about global economic growth. A relevant question then is whether measures of global economic growth also had predictive power for excess returns on futures. As a proxy for aggregate demand, I follow Kilian (2009) and Pirrong (2009), as well as many oil-market practitioners, and use shipping rates, namely, the Baltic Exchange Dry Index (BEDI). The growth rate of the BEDI over the previous three months does explain an additional $2-3\%$ of the variation in excess returns, and its coefficients are marginally statistically significant. However, BEDI has very little effect on the explanatory power of the other predictors: they continue to explain most of the variation in futures returns.

5 Concluding Remarks

Investing while learning about economic fundamentals, both from public announcements and market prices, may well induce excessive price volatility and drift in commodity prices.

These phenomena are entirely absent, essentially by assumption, from the models of oil price determination that focus on representative suppliers, consumers, and hedgers. An implication of the presence of "forecasting the forecasts" of others is that commodity prices can be more volatile and, from a social welfare perspective, society can be worse off *even though each investor participating in this guesswork is small.* That is, social welfare may be reduced even though equilibrium prices do not depend directly on the degree to which any individual investor incorrectly measures fundamental economic variables.

The welfare costs of trading based on imperfect information are potentially amplified by the fact that the costs to individual investors of near-rational behavior – following slightly suboptimal investment or consumption plans– is negligible and yet this behavior might be quite costly for society as a whole (Lucas (1987) and Cochrane (1989)).[29] When investors make small correlated errors around their optimal investment policies, financial markets amplify these errors and generate volatility in securities prices that is unrelated to fundamental supply/demand information (Hassan and Mertens (2010)).

The particular economic mechanism through which social welfare is reduced in the model of Hassan and Mertens (2010) is that higher volatility in capital markets raises risk premiums and, as a consequence, the cost of capital to firms. This, in turn, affects firms' investment plans and impacts overall output in an economy. The same issues arise, for example, in an economy in which commercial users purchase commodities as intermediate inputs into production. Furthermore, such additional frictions as multi-period contracting over labor and physical capital will likely exacerbate the social costs of excessive volatility.

Much of the recent debate about "excessive" speculation in commodity markets has focused on the flows into index funds. I have found that these flows are positively correlated with *future* changes in commodity prices, and these findings complement the evidence in Tang and Xiong (2009) on the financialization of commodity markets. Assessing the social costs of these price-pressure effects requires additional economic structure. If index investors are just slightly too optimistic (in market rallies) or pessimistic (in market downturns) relative to the true state of the world then their errors, while inconsequential for their own welfare, may be material for society as a whole.[30]

[29]Such suboptimal plans may arise out of misinterpretations of public information say about future economic growth in developing countries, because of small costs to sorting through the complexity of global economic developments and their implications for commodity prices, or because of over-confidence about future economic growth as in Dumas, Kurshev, and Uppal (2006).

[30]Recent research by Qiu and Wang (2010) shows that when market participants have heterogeneous information, and so asset prices depend on the expectations of the expectations of others, prices tend to be more volatile and the overall welfare of society is lowered. Additionally, if index traders impart noise to market prices through their trading activities, then this could also reduce the efficiency with which futures and spot markets perform their roles in price discovery.

More broadly, it is the dynamic interactions of the trading activities of index investors, hedge funds, broker/dealers in commodity markets, and commercial hedgers that ultimately set prices in commodity spot and futures markets. Just as index investors are, in part, adjusting their positions based on their views about global supplies and demands, other market participants are doing likewise and they are positioning based on their views about what index and other classes of investors are doing. This may well explain the significant effects of hedge fund spread positions on excess returns in oil markets documented here.

Finally, much of the literature on commodity pricing abstracts from the impact of the extensive array of derivatives contracts in commodity markets (e.g., commodity swaps) on market-price dynamics. Adding derivatives markets will typically improve price discovery and mitigate some of the informational problems highlighted above. However enhanced price discovery is only one facet of the complex effects of imperfect information and incomplete financial markets on commodity price setting. In addition to their affects on price discovery, derivatives markets alter participants' access to hedging vehicles and, thereby, affect allocational efficiency. Society can be worse off when information is asymmetric and participants are not able to hedge against all of their business or income risks (Huang and Wang (1997)). A key step towards a better understanding of the effects of interactions among various market participants on price behavior is the collection and dissemination of more detailed information about the trading patterns in *OTC* commodity derivatives, as well as exchange traded futures.

Appendix: Construction of Excess Returns

Let $F_t^{T_i(t)}$ denote the futures contract with expiration $T_i(t)$. The futures-price-term-structure consists of points $F_t^{T_1(t)}, ..., F_t^{T_N(t)}$. Let $D(s) > s$ denote the first time after s that the generic futures curve switches contracts. Then, for all $i = 1, ..., N-1$, and all s,

$$T_{i+1}(D(s)-1) = T_i(D(s))$$

The excess rolling return in generic contract i, between s and t is given by

$$\begin{aligned}
&\frac{F_t^{T_i(t)}}{F_s^{T_i(s)}} - 1 && if \quad t < D(s) \\
&\frac{F_{D(s)-1}^{T_i(D(s)-1)}}{F_s^{T_i(s)}} \cdot \frac{F_t^{T_i(t)}}{F_{D(s)-1}^{T_{i+1}(D(s)-1)}} - 1 && if \quad D(s) \leq t < D^{(2)}(s) \\
&\frac{F_{D(s)-1}^{T_i(D(s)-1)}}{F_s^{T_i(s)}} \cdot \frac{F_{D^{(2)}(s)-1}^{T_i(D^{(2)}(s)-1)}}{F_{D(s)-1}^{T_{i+1}(D(s)-1)}} \cdot \frac{F_t^{T_i(t)}}{F_{D^{(2)}(s)-1}^{T_{i+1}(D^{(2)}(s)-1)}} - 1 && if \quad D^{(2)}(s) \leq t < D^{(3)}(s)
\end{aligned}$$

and so forth.

By construction these are the net returns from holding one long position in the generic i-month contract, liquidating the position the day before the generic curve 'moves the contracts one month down', and going long one unit in the following month $i+1$ (which the day after, by definition will be generic contract i). This strategy is followed from s until t.

The risk free rate does not enter these calculations. The rational is (following, for instance, Etula (2010)) that investing in a futures position, does not require an initial capital injection. In practice, however, the futures trading strategies are met with margin calls. For this reason Hong and Yogo (2010) consider a fully collateralized return of the form (say if $t < D(s)$)

$$\frac{F_t^{T_i(t)}}{F_s^{T_i(s)}} R_{s,t}^f$$

My calculations omit the multiplying factor $R_{s,t}^f$ from the construction of excess returns.

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