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Bubbles, Froth, and Facts:
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Practitioner's Abstract

The Masters Hypothesis is the assertion that large investment inflows into long-only commodity index funds pushed prices far above fundamental value. In particular, the architect of the hypothesis—Michael Masters—suggests that long-only index funds were the cause of a massive increase in commodity prices that culminated in mid-2008. Since that time, there has been a veritable explosion in empirical research on commodity market bubbles and the Masters Hypothesis. In this research we carefully dissect the typology of this literature with particular care given to the distinction between financialization impacts and actual bubble impacts. After carefully defining the characteristics of a Masters-like bubble, simple empirical tests are conducted on the 12 agricultural markets included in the CFTC's Supplemental Commitments of Traders data base. Price behavior consistent with the Masters Hypothesis is surprisingly difficult to find in the data. This is an important finding given the on-going policy debate and regulations proposed to limit speculative positions in these markets.

Key Words: Agricultural; Bubble; Commodity; Futures market; Index funds

"I firmly believe that the current record oil price in excess of $135 per barrel is inflated. I believe, based on supply and demand fundamentals, crude oil prices should not be above $60 per barrel…I cannot think of any reason that explains the run-up in crude oil price, beside excessive speculation" (Gheit, June 2008).

Introduction

The above congressional testimony made by Fadel Gheit—Managing Director and Senior Oil Analyst for Oppenheimer & Co. Inc.—represents the typical view that a price bubble occurred in commodity prices in 2007-2008. Mr. Gheit's assessment that crude oil prices were a whopping $75 per barrel or 125% above fundamental value is consistent with the bubble theory popularized by Michael Masters. In what is often referred to as the Masters Hypothesis (Irwin and Sanders, 2012), the wave of institutional money flowed into the futures markets through long-only index funds is asserted to have had a "massive impact on the futures markets that makes the Hunt Brothers pale in comparison" (Masters and White, 2009). Indeed, Mr. Masters (2008) testified that "that Institutional Investors are one of, if not the primary, factors affecting commodities prices today" and provides a colorful description of the size of institutional buying—"the current Wheat futures stockpile of Index Speculators is enough to supply every American citizen with all the bread, pasta and baked goods they can eat for the next two years!"

The preceding discussion highlights the central claim of the Masters Hypothesis—a wave of index fund investment caused irrational and gross mispricing across a wide range of commodities. This claim has driven related policy debates about re-regulating speculation in commodity futures markets (Irwin and Sanders, 2011). Unfortunately, there appears to be a considerable amount of confusion in the literature regarding this key point. Some researchers have connected index fund positions with a rational price effect related to increased market integration (e.g., Tang and Xiong, 2012) or changes in risk premiums (Hamilton and Wu, 2014, 2015) while others have estimated only small isolated market impacts (e.g., Gilbert and Pfuderer, 2014). This research has been mistakenly cited in some quarters as evidence in support of the Masters Hypothesis and used to support a call for additional market regulation (e.g., Tadesse, et al., 2014).

This paper makes two important contributions to the literature. The first is to carefully delineate the various empirical work related to index investment in commodity futures markets. We argue that the literature can be divided into two broad categories: i) tests of financialization impacts, and ii) tests of bubble impacts or the Masters Hypothesis. Importantly, support for financialization impacts does not imply support for the Masters Hypothesis. The second contribution is new empirical evidence that closely examines the correlations between traders' positions and market returns. The empirics are motivated by the observation that the egregious pricing errors under the Masters Hypothesis should be obvious in even the simplest tests. In other words, identification of a 25, 50, or 100% pricing error should be an econometric slam dunk.

This paper helps to shape the on-going policy debate and regulatory initiatives by better identifying the relevant research question and highlighting the pertinent results in the literature. Moreover, the presented empirics add to the already weighty evidence that the Masters Hypothesis has no legs.

Parsing the Literature

The literature on long-only index funds and the possible impact on commodity prices has increased dramatically in recent years. Indeed, there have been a number of review articles appear recently in the literature (Irwin and Sanders ,2011; Will et al. ,2012; Fattouh, Kilian, and Mahadeva, 2013; Irwin, 2013; and Cheng and Xiong, 2014). Here, we do not provide another such review. Instead, we present a typology for the research area using some select examples from the existing literature. The empirical literature can be broadly defined into tests for two types of market impacts: financialization impacts and price bubble impacts.

The emergence of long-only index funds (and commodity futures markets as an "asset class") represents just one of many structural changes that occurred during the "financialization" of commodity futures markets in the mid-2000's (Irwin and Sanders, 2012). While the investment performance of long-only commodity futures funds is debatable, the fact that these market participants rose from relative obscurity to be large market participants is not (Sanders and Irwin, 2012). Long-only index traders are neither hedgers nor speculators in the traditional sense. Their increased market participation—and the corresponding rise in exchange traded funds (ETFs), mutual funds, and other commodity-linked investment vehicles—may rightfully be viewed as an exogenous market shift that could result in rational market adjustments.

Potential financialization impacts would include increased market integration (e.g., Tang and Xiong, 2012) and changes in risk premiums (e.g., Hamilton and Wu, 2014, 2015). Likewise, impacts on calendar spreads during index roll periods are likely representative of rational sunshine trading effects (e.g., Bessembinder, et al., 2012). These impacts, while important, should not be misconstrued as evidence of massive pricing errors or price bubbles. Some studies also report limited evidence linking index positions to market volatility (e.g., Gilbert, 2010). Even these do not provide the direct evidence needed to support the Masters Hypothesis and are more likely capturing other factors associated with financialization impacts.

Tests for pricing impacts or market bubbles—which are evidence regarding the Masters Hypothesis—can include Granger causality tests (e.g., Stoll and Whaley, 2010), instrumental variable models (e.g., Gilbert and Pfuderer, 2014) as well as pure econometric tests for bubble-like price behavior (e.g., Etienne, Irwin, and Garcia, 2015). These tests are important in establishing either the existence of bubble-like price behavior or linkages between index positions and prices. Importantly, researchers must carefully evaluate their results in terms of both statistical and economic significance. Support for the Masters Hypothesis must include both a linkage between index investments and price movements as well as evidence of bubble-like price behavior or massive pricing errors. Minor price impacts in isolated examples or bubble-like price behavior not associated with index investors are generally not consistent evidence to support the Masters Hypothesis.

The basic typology for the empirical literature is diagramed in figure 1 with some examples from the literature. Essentially, empirical tests that find price impacts must clearly identify the nature of that impact. Is it a rational response to an exogenous position change? Or, it is it an irrational pricing error driven by long-only index funds? This mapping of the literature should provide guidance for policy-makers striving to understand the current research as well as a possible roadmap for future research.

As shown in figure 1, the actual evidence in favor of the Masters Hypothesis is scant. Of those studies, some (e.g., Singleton, 2014) have known shortcomings associated with their data (see Sanders and Irwin, 2013) and some identify very minor and isolated impacts (e.g. Gilbert and Pfuderer, 2014). Others (e.g., Tadesse et al., 2014) miss the mark entirely by focusing on cash (not futures) prices and using speculation measures that have no clear link to index investment.

In the following sections we focus specifically on the relevant policy question surrounding the Masters Hypothesis: Are large increases in index fund positions associated with massive overpricing in commodity futures markets? Here, we simplify the analysis and search for any direct evidence that might support this contention.

Data, Methods, and Results

Prior research has used a number of econometric techniques such as Granger causality (e.g., Stoll and Whaley, 2010) and instrumental variables (Gilbert and Pfuderer, 2014) in an attempt to identify linkages between long-only index positions and market behavior. Here, we appeal to Occam's razor and cut to the heart of the Masters Hypothesis— index fund buying causes massive over-valuation of prices. In this regard, the Masters Hypothesis is very clear; that is, the valuation errors in the marketplace are "massive" and they are directly caused by index trader positions.

In this simple interpretation, the Masters Hypothesis leads to three straight forward predictions: 1) large index positions should be associated with high price levels; 2) large and rapid increases in index positions should be accompanied by increases in prices; and 3) the prior two findings should be consistent across markets and time. Here, we examine the historical correlations that underlie most of the prior empirical studies and then examine some new evidence as it relates to these three predictions.

Position Data

Starting in 2007—in response to complaints by traditional traders about the rapid increase in long-only index money flowing into the markets—the Commodity Futures Trading Commission (CFTC) began reporting the positions held by index traders in 12 commodity futures markets in the Supplemental Commitments of Traders (SCOT) report. According to the CFTC, index trader positions reflect both pension funds that would have previously been classified as non-commercials (speculators) as well as swap dealers who would have previously been classified as commercials (hedgers). While the CFTC classification procedure still has some flaws associated with swap activity and internal netting of positions by firms, the SCOT have been shown to be representative of long-only index positions in the agricultural markets where over-the-counter swap activity is minimal (Sanders and Irwin, 2013).

The SCOT data are released each Friday in conjunction with the traditional COT report and show the combined futures and options positions as of Tuesday's market close. The weekly data are available for 12 agricultural markets. For 8 of the 12 markets (feeder cattle, soybean oil, cocoa, coffee, cotton, sugar, live cattle, and lean hogs) the data are from 2006-2014 for a total of 470 observations. Four of the markets (corn, soybeans, CBOT wheat, and KCBOT wheat) have data available from 2004-2014 for a total of 574 observations.[1]

Positions are reported as the number of long and short contracts held by index traders as of Tuesday's market settlement. To accurately capture the net buying or selling by index funds, the empirical analysis will focus on the net long positions:

(1) $$\text{Net Long}_t = \text{Long Open Interest}_t - \text{Short Open Interest}_t$$

The short open interest held by index investors is generally quite small and the net long positions is always positive in the SCOT data set.

The change in the net long position is simply calculated as the first difference of net long as defined in (1) and the percent change in the net long position is calculated as the log relative change from week t-1 to week t:

(2) $$\text{Percent Change in Net Long}_t = \ln\left(\frac{Net\ Long_t}{Net\ Long_{t-1}}\right) * 100$$

Finally, the relative size of the index fund position is measured as a percent of total open interest (futures and options combined).

[1] The CFTC collected these additional data for selected grain futures markets over 2004-2005 at the request of the U.S. Senate Permanent Subcommittee on Investigations and these data are used in the present analysis.

(3) $$\text{Percent of Open Interest}_t = \left(\frac{Index\ Trader\ Long\ Open\ Interest_t}{Total\ Market\ Open\ Interest_t}\right)$$

The three measures above are used in conjunction with futures data to analyze index trade positions in the context of the Masters Hypothesis.

Futures Data

To correspond with the release dates for the SCOT data, the Tuesday-to-Tuesday log-relative returns are collected for nearby futures contracts. Specifically, R_t, are calculated using nearby futures contracts adjusting appropriately for contract roll-overs as follows:

(4) $$R_t^1 = \ln\left(\frac{p_t^1}{p_{t-1}^1}\right) * 100$$

where, p_t^1 is the futures price of the first listed or nearest-to-expiration contract on each trading day. In order to avoid distortions associated with contract rollovers, p_t^1 in the log relative price return always reflects the same nearest-to-expiration contract as p_{t-1}^1. Roll-over dates for the 12 markets are set on the 15th of the month prior to the delivery month.

Rank Order Tests

The Masters Hypothesis clearly predicts that large index positions are associated with high prices that have been pushed above fundamental value. Market prices are noisy and it is notoriously difficult to define fundamental value. Still, as posited by Masters, very high prices over this sample are a direct result of index positions. If so, then there should be some connection between absolute price levels and the position size held by index funds.

To test this assertion we use a simple Spearman rank-order correlation coefficient. Specifically, the nearby futures prices for all 12 markets for the common sample from 2006-2014 are ranked from high to low by week. Long index positions as a percent of open interest on the corresponding Tuesday are also ranked from high to low. Then, the Spearman rank-order correlation coefficient is calculated between the rankings of prices and position size.

The calculated rank correlations are presented in table 1. Ten of the 12 rank-order correlations are statistically different from zero. Of those, 7 are negative and 3 are positive. So, if anything, over this sample larger index positions (as a percent of open interest) are associated with lower than average prices. This is not consistent with bubble-like price behavior under the Masters Hypothesis.

Correlations

Pearson correlation coefficients are calculated between the change in net long positions and market returns for the same week (contemporaneous correlation). The correlations are calculated separately for each year as well as the entire sample to give some feel for the consistency through time. The results are presented in table 2 where the shaded correlations are statistically different from zero at the 5% level using a two-tailed t-test.

As shown in table 2, nine of the 12 contemporaneous correlations calculated for the entire sample are statistically different from zero and positive. Some of the correlations are surprisingly large, such as cocoa at 0.30 while most are less than 0.20. Regardless, contemporaneous correlations clearly exist between changes in index positions and futures returns. This contemporaneous relationship is undoubtedly the driver behind some of the empirical results that find a market linkage between index funds and market prices (e.g., Gilbert and Pfuderer, 2014).

As is well-documented in the literature these linkages essentially disappear when time lags are introduced (Sanders and Irwin, 2011). As shown in table 3, the correlation between changes in index positions in week t and returns in the following week (t+1) are largely nonexistent. That is, only one of the correlations is statistically different from zero across the entire sample (corn) and it is negative. These correlations underlie the general lack of any causal linkages documented in prior empirical studies (e.g., Stoll and Whaley, 2010). Table 4 shows the correlations between market returns and changes in index positions the following week. Positive correlations in this table (feeder cattle, soybeans, and cocoa) are suggestive of some level of performance chasing or trend following by index investors. But, here again, the evidence is also very weak and sporadic.

Overall, the data suggest an almost purely contemporaneous correlation between changes in index positions and market returns. As suggested by Gilbert and Pfuderer (2014) causation may still exist between index positions and returns; however, it may be instantaneous in nature or only detectable over shorter time horizons. To date, the studies using shorter horizons—such as daily data—have also failed to find any causal linkages (Aulerich, Irwin, and Garcia, 2013; Sanders and Irwin, 2015). Yet, the possibility cannot be ruled out and a closer look at short horizons may be in order.

It is worth noting that the correlations in table 2 show very little consistency through time. For instance, soybean oil shows a statistically significant 0.14 correlation across the entire sample; yet, the statistically positive correlations are restricted to 2 years, 2007 and 2008.

A simple graphical analysis indicates that the years with statistically significant positive correlations do not conform to the notion of a Masters-style price bubble. The net long index positions held in soybean oil are plotted in figure 2 along with the nearby futures prices. The shaded years, 2007-2008, represent years with statistically significant positive correlations between nearby futures returns and changes in net long index positions (see table 2). What is very clear from figure 2 is how these years in no way resemble a price bubble as described by the Masters Hypothesis. Indeed, from January 2007 through June of 2008 the net long position held by index funds increased by a pedestrian 4% (or 2,788 contracts) while prices increased by 71%. Then, in the second half of 2008—in the midst of the financial crises—long only index positions fell by 27,170 contracts (61%) and prices fell by over 70%. Prices went up and then came down; index positions only came down. It is clear that the positive correlations in 2007-2008 are not consistent with the Masters Hypothesis. Indeed, a visual examination of figure 2 brings up another striking failure. In the first three months of 2010, the net long position in soybean oil increased a remarkable 39,626 contracts (+67%) and yet nearby futures prices actually fell by 3%.

As shown in figure 3, the Masters Hypothesis again fails miserably when trying to explain how the initial 6-fold increase in net long CBOT wheat positions from 2004 through early 2006 was accompanied by a cumulative return of -29% to nearby futures. It seems that if there were going to be a market impact from long only index investments, it would have been in this initial accumulation of positions. Note, in table 2, the statistically positive correlation for the CBOT wheat market is in 2011 at a fairly high 0.33. Figure 3 shows that this was a relatively tame year in the CBOT wheat market with both prices and net long index positions moving in a more or less sideways pattern—certainly not the type of event described by Masters.

Examining correlations at shorter time intervals might reveal some relationships that are not evident using weekly data. However, the SCOT data are only compiled for the public on a weekly Tuesday schedule. Still, some additional insight may be gained by examining the correlation between the change in net long positions from Tuesday-to-Tuesday and the surrounding daily market returns. For example, the change in net long positions from Tuesday-to-Tuesday may correlate with the market return on the very next day, Wednesday, even though it doesn't correlated strongly with the return for the entire following week.

The basic data setup is shown in table 5 along with the simple Pearson correlation coefficients. Essentially the weekly change in the index net long position is correlated with each individual day in the preceding, concurrent, and following week. Correlations in the concurrent week are essentially contemporaneous and should be reflective of those presented in table 2. Correlations in the prior week represent any tendency for returns to lead positions. That is, it is the correlation between each daily return this week and the change in index positions the following week. Then, the correlations on the right side of the table are the correlations between changes in net long positions and daily returns in the subsequent week. Correlations in that week would suggest that index positions lead returns.

Importantly, this disaggregation circumvents the market efficiency argument proposed by Gilbert and Pfuderer (2014). If traders react to the SCOT reports as though they are informative and prices adjust instantly, then no causal linkages can be found in the data (see also Grosche, 2014). The SCOT reports positions as of Tuesday but they are not released to the public until Friday (after the close). So, for Wednesday through Friday the data are essentially private. On those days, there could well be a market correlation that would not violate the notion of market efficiency.

The correlations shown in table 5 lead to a few clear conclusions. First, the positive contemporaneous correlations are quite evident in the middle panel and they are centered on the Thursday of the compilation week. Second, of the twelve markets, three show a positive correlation in the day prior (t-5) to the compilation week which may suggest some very minor tendency toward performance chasing consistent with table 4. Finally, there are just 2 positive correlation coefficients in the week following the SCOT compilation with one on Wednesday (t+1) and one on Friday (t+3). So, not even on the very next day (Wednesday) following the compilation of positions (Tuesday) is there any evidence of a causal linkage between the change in index positions and prices. On that Wednesday (t+1), the position data are not yet public, so if there were going to be an impact found using these data, it should show up as a correlation on that Wednesday. The average correlation on that Wednesday is actually negative in all but 2 markets.

To illustrate the pattern of the correlations across time, the correlations for soybeans are shown in the pre-crises (figure 4), crises (figure 5), and post crises periods (figure 6). Looking across all three subsamples a few common findings become clear. First, the lack of correlation in the week after the position change is consistent. In fact the correlation on the Wednesday after the position data are compiled is negative in each subsample. Second, the positive correlation with the returns in the prior week (performance chasing) is mostly evident during the crises period from July of 2008 through December of 2011. It is also during this crises period when the contemporaneous correlations are the strongest. Finally, during the post-crises period of 2012-2014 all of the correlations are diminished and much less consistent across days. These data at least suggest that any documented effects may well be highly sample sensitive especially in regards to the 2008-2011 financial crises.

Extreme Moves

Simple weekly correlations may not capture the essence of the Masters Hypothesis and the underlying policy concerns. That is, the real impact of unfettered index buying is likely to occur when there are extreme changes in positions. To isolate these impacts we examine the percent change in net long positions for each market over rolling 26-week intervals. Then, the three non-overlapping 26-week windows with the largest increase in fund positions is identified. The cumulative return to nearby futures over that same 26-week window is also calculated. The data are tabulated and presented in table 6.

Looking at table 6, the KCBOT wheat market had the three largest increases in net long index positions in the 26-weeks ending December 1, 2009, February 5, 2013, and July 26, 2005. The largest increase (December 1, 2009) was characterized by a 59.7% increase in net long index positions and a 24.6% cumulative decline in nearby futures prices. The second largest increase (26-weeks ending February 5, 2013) had a 53.9% increase in net long positions held by index traders while at the same time futures declined 15.2%. The largest 3 increases for each market and the corresponding futures returns are shown in the remainder of table 6.

In table 6, some of the markets—such as cocoa—show positive futures returns during these episodes. Others—such as wheat—show negative futures returns during these windows. Most markets show both. Of the 36 windows presented, 19 are positive and 17 are negative. The average 26-week increase in the position size is 50.5% and the average futures return is 1.4%. Just isolating the largest increase for each market, the average increase in position size is 64.8% and is accompanied by an *annualized* futures return of 2%. It is difficult to reconcile these rather modest changes in futures prices with the concept of a massive overvaluation under the Masters Hypothesis.

The parallel data are collected for the 3 largest decreases in index positions and presented in table 7. With the largest declines in index positions there is somewhat more consistency in terms of the corresponding futures returns. That is, the average 26-week decline in index positions is 45.7% and it is accompanied by a negative 2.2% average futures return. Of the 36 windows, 21 are negative and 15 are positive. A closer inspection reveals that 11 of the 12 markets have the largest decline in positions during the financial crises—that is, those windows ending between October 28, 2008 (KCBOT wheat) and March 17, 2009 (soybean oil). These 12 windows that correspond to the financial crises show an average decline in index positions of 90.8% and a negative futures return of 33.9%. Clearly, during that crises period there were many other things impacting financial asset values and trader activity. For the 24 non-crises windows the average index position declined by 31.8% but futures returns were a positive 13.6%. So, ignoring the crises-related declines, the relationship is negative. Including the crises-related declines the futures return associated with an average decline in net long index positions of 45.7% is still less than 4.5% annualized. Again, these are hardly the magnitudes associated with the gross mispricing predicted under the Masters Hypothesis.

Consistency

A Masters Hypothesis proponent could quickly latch onto the cocoa market as proof positive for the hypothesis. In table 1, cocoa shows a positive rank-order correlation between price levels and the size of the index position. Table 2 presents a reasonably consistent and statistically significant positive contemporaneous correlation across time for the cocoa market. The one instance of a single-day causal correlation is in the cocoa market (table 5). Likewise, the extreme increases in the net long index positions in the cocoa market are all associated with large increases in prices (table 6).

Perhaps index funds have had an impact on the cocoa market for some bizarre reason. Or, perhaps, there was something else unique occurring in cocoa such as the attempted market manipulation reported by the *New York Times* (Werdigier and Creswell, 2010). So, while it seems most unlikely for there to be an impact in a market such as cocoa—where arbitragers can easily trade the London-based contract against the U.S.-based contract—the data do support that possibility.

If it were viewed in isolation, the cocoa market data could be cited as evidence in support of the Masters Hypothesis. But, it should not be viewed in isolation. The Masters Hypothesis was not presented as a description of the cocoa market. Rather, it is presented as an explanation for massive price increases across all markets. Evidence to support the underlying notion of an index-driven price bubble must be consistent and pervasive across time and markets. While the results for cocoa are indeed curious and may warrant additional investigation, they are by no means a blanket endorsement of the Masters Hypothesis and certainly do not warrant calls for additional regulation of all futures markets.

Summary and Conclusions

Michael Masters (2008, 2009) is one of the most vocal critics of commodity index investments. Indeed, his name has become synonymous with the notion that index funds represent an artificial demand shift that pushes commodity prices away from their true fundamental value. The hallmarks of the aptly named Masters Hypothesis include large—100% or more—deviations from fundamental value and a direct link to index fund positions in futures markets (Irwin and Sanders, 2012).

The massive pricing errors implied by the Masters Hypothesis represent the crucial policy question. Unfortunately, some researchers and policy makers have taken empirical evidence of financialization impacts—that is, impacts on risk premiums, market integration, or price spreads—as evidence in support of the Masters Hypothesis and additional market regulation. This is a mistake. Here, we show a clear typology of the empirical tests involving index investment and market impacts. The vast majority of empirical evidence shows either no market impact or impacts consistent with rational market responses to the financialization of commodity futures markets.

The evidence in support of the Masters Hypothesis and bubble-like price behavior is actually quite weak within the existing literature. Moreover, using index positions from the SCOT report, we show that it is quite difficult to find any consistent support for the Masters Hypothesis. First, we confirm the well-established contemporaneous correlations between changes in the SCOT index positions and nearby futures returns. However, upon close inspection it is clear that many of the positive correlations stem from years that are far from bubble-like—that is, both the markets and index positions are essentially in a sideways pattern. Second, we show that in periods where there are extremely large changes in the size of index positions there generally are not correspondingly large changes in prices. Finally, rank-order correlations show a mostly negative relationship between the relative size of index positions and overall price levels. The Masters Hypothesis comes up short on its most basic market predictions.

Market regulation is expensive both in terms of administrative burden and market friction. Michael Masters (2008, 2009) sensationalized the market impact of index investors and led the chorus for additional market regulations. However, the weight of the evidence does not support even the most basic predictions stemming of the Masters Hypothesis; therefore, it should be discarded.

References

Acworth, W. "CFTC Examines Position Limits." *The Magazine of the Futures Industry*, September 2009a, pp. 24-26.

Acworth, W. "The Gensler Agenda." *The Magazine of the Futures Industry*, September 2009b, pp. 18-23.

Admati, A.R., and P, Pfleiderer. 1991. "Sunshine Trading and Financial Market Equilibrium." *Review of Financial Studies* 4(3): 443-481.

Aulerich, N. M., S.H. Irwin, and P. Garcia. 2013. "Bubbles, Food Prices, and Speculation: Evidence from the CFTC's Daily Large Trader Data Files." Working Paper No. 19065. National Bureau of Economics Research.

Bessembinder, H., A. Carrion, L. Tuttle, and K. Venkataraman. 2012. "Predatory or Sunshine Trading? Evidence from Crude Oil ETF Rolls." Working Paper, Univ of Utah.

B. Bahattin, and J. H. Harris. 2011. "Do Speculators Drive Crude Oil Futures Prices?" *Energy Journal* 32(2): 167-202.

Capelle-Blancard, G., and D. Coulibaly. 2011. "Index Trading and Agricultural Commodity Prices: A Panel Granger Causality Analysis." *Economie Internationale* 126 (2-3): 51-72.

Cheng, Ing-Haw, and Wei Xiong. 2014. "The Financialization of Commodity Markets." *Annual Review of Financial Economics* 6: 419-441.

Commodity Futures Trading Commission (CFTC). "CFTC Provides Notice of the Reopened Comment Period for its Rulemaking Proposals on Position Limits for Physical Commodity Derivatives and Aggregation." Press Release PR7126-15, February 24, 2015. (available online: http://www.cftc.gov/PressRoom/PressReleases/pr7126-15)

F. Bassam, L. Kilian, and L. Mahadeva. 2013. "The Role of Speculation in Oil Markets: What Have We Learned So Far?" *Energy Journal* 34(3): 7-33.

Gheit, F. "Testimony of Mr. Fadel Gheit Managing Director & Senior Oil Analyst Oppenheimer & Co. Inc. Before the Subcommittee on Oversight and Investigations Committee on Energy and Commerce." June 23, 2008. (Available at: http://democrats.energycommerce.house.gov/images/stories/Documents/Hearings/PDF/Testimony/OI/110-oi-hrg.062308.Gheit-testimony.pdf).

Gilbert, C. L. 2010. "Speculative Influences on Commodity Futures Prices 2006-2008." United Nations Conference on Trade and Development Discussion Paper No.197.

Gilbert, C.L. "Testing the Masters Volatility Hypothesis: Speculative Impacts on Agricultural Price Volatility." Paper prepared for the 123rd European Agricultural Economics Association Seminar, Dublin, 22-24, February 2012 (rev. 2013).

Gilbert, C. L., and S. Pfuderer. 2014. "The Role of Index Trading in Price Formation in the Grains and Oilseeds Markets." *Journal of Agricultural Economics*. 65:303-322.

Grosche, S-C. 2014. "What Does Granger Causality Prove? A Critical Examination of the Interpretation of Granger Causality Results on Price Effects of Index Trading in Agricultural Markets." *Journal of Agricultural Economics*. 65:279-302.

Hamilton, J.D., Wu, J.C., 2014. "Risk Premia in Crude Oil Futures Prices." *Journal of International Money and Finance*. 42, 9-37.

Hamilton, J.D., and J.C. Wu. 2015. Effects of Index-Fund Investing on Commodity Futures Prices. *International Economic Review* 56(1): 187-205.

Irwin, S. H. 2013. Commodity Index Investment and Food Prices: Does the "Masters Hypothesis" Explain Recent Price Spikes? *Agricultural Economics* 44(s1): 29-41.

Irwin, S.H., and D.R. Sanders. "Financialization and Structural Change in Commodity Futures Markets." *Journal of Agricultural and Applied Economics*. 44(2012):371-396.

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

Irwin, S. H., and D.R. Sanders. 2012. "Testing the Masters Hypothesis in Commodity Futures Markets." *Energy Economics* 34(1): 256-269.

Masters, M.W. "Testimony before the Committee on Homeland Security and Government Affairs, U.S. Senate." May 20, 2008. Available from URL: http://hsgac.senate.gov/public/_files/052008Masters.pdf [accessed 1 April 2009].

Masters, M.W., and A.K. White. "The Accidental Hunt Brothers: How Institutional Investors are Driving up Food and Energy Prices." 2008. Available from URL: http://accidentalhuntbrothers.com/ [accessed 1 April 2009].

Sanders, D.R. and S.H. Irwin. "A Reappraisal of Investing in Commodity Futures Markets." *Applied Economic Perspectives and Policy*. 34(2012):515-530.

Sanders, D.R. and S.H. Irwin. "New Evidence on the Impact of Index Funds in U.S. Grain Futures Markets." *Canadian Journal of Agricultural Economics*. 59(2011):519-532.

Sanders, D.R., and S.H. Irwin. 2011. "The Impact of Index Funds in Commodity Futures Markets: A Systems Approach." *Journal of Alternative Investments* 14(1): 40-49.

Sanders, D.R., and S.H. Irwin. 2013. "Measuring Index Investment in Commodity Futures Markets". *Energy Journal* 34(4): 105-127.

Sanders, D.R., and S.H. Irwin. 2015. "The 'Necessity' of New Position Limits in Agricultural Futures Markets: The Verdict from Daily Firm Level Position Data." Forthcoming, *Applied Economic Perspectives and Policy*.

Singleton, Kenneth J. 2014. "Investor Flows and the 2008 Boom/Bust in Oil Prices." *Management Science* 60(2): 300-318.

Stoll, H.R., and R. E.Whaley. 2010. "Commodity Index Investing and Commodity Futures Prices." *Journal of Applied Finance* 20 (1): 7-46.

Tadesse, G., B. Algieri, M. Kalkuhl, and J. von Braun. "Drivers and Triggers of International Food Price Spikes and Volatility." *Food Policy* 47(2014): 117-128.

Tang, K. and W. Xiong "Index Investment and Financialization of Commodities." *Financial Analysts Journal*, 68(2012):54-74.

Werdigier, J. and J. Creswell. "Investor manipulating cocoa market, critics say." New York Times, July 25, 2010. (available at: http://www.cleveland.com/world/index.ssf/2010/07/critics_say_london_investor_is.html)

Will, Matthias G, Sören Prehn, Ingo Pies, and Thomas Glauben. 2012. Is Financial Speculation with Agricultural Commodities Harmful or Helpful? A Literature Review of Current Empirical Research. Discussion Paper No. 2012-27. Martin Luther University, Halle, Wittenberg.

Table 1. Rank Correlation Test, Nearby Futures Price Levels and Index Position as a Percent of Open Interest, 2006-2014.

Market	Spearman Rank Correlation	p-value
KCBT Wheat	0.12	0.009
Feeder Cattle	-0.71	0.000
Soybean Oil	0.19	0.000
Corn	-0.27	0.000
Soybeans	-0.46	0.000
CBOT Wheat	-0.24	0.000
Cocoa	0.52	0.000
Coffee	0.02	0.729
Cotton	-0.56	0.000
Sugar	0.06	0.212
Live Cattle	-0.66	0.000
Lean Hogs	-0.70	0.000

Notes: The p-value is from a two-tailed t-test under the null that the correlation is zero.

Table 2. Contemporaneous Correlations, Change in SCOT Net Long Index Positions and Nearby Futures Returns

Year	KCBOT Wheat	Feeder Cattle	Soybean Oil	Corn	Soybeans	CBOT Wheat	Cocoa	Coffee	Cotton	Sugar	Live Cattle	Lean Hogs
2004	-0.2079			0.1612	0.2411	0.0252						
2005	0.0857			0.0246	0.1533	-0.2309						
2006	0.2764	-0.1855	-0.1195	0.1335	-0.2730	0.1885	-0.0087	-0.1338	-0.2616	-0.2308	-0.1221	0.1433
2007	0.0310	0.0505	0.4043	-0.0049	0.2820	0.0351	0.0480	0.0207	0.5493	0.0487	0.1830	-0.3160
2008	0.1530	0.0216	0.3138	0.4639	0.5625	0.2284	0.5225	0.4021	0.1929	0.1749	0.3150	0.1324
2009	0.3636	-0.0689	-0.0087	0.3041	0.4034	0.0423	0.2993	0.2327	0.2613	-0.0012	0.2698	0.0084
2010	0.3676	0.3094	0.1071	-0.2148	-0.0296	0.0889	0.4205	0.4634	0.0554	-0.1665	0.3570	0.0039
2011	0.1423	0.4972	0.2143	0.0605	0.5443	0.3324	0.3351	0.2097	0.0178	0.1370	0.2862	0.2548
2012	0.1602	0.2918	0.0355	-0.0560	0.0831	-0.2228	0.2238	0.2432	0.0419	-0.0758	0.3390	0.2480
2013	0.3344	-0.0052	-0.1965	0.3308	0.0334	-0.0938	0.3867	0.2834	0.2571	-0.0930	0.0826	0.2610
2014	0.0582	0.0528	0.1287	0.0449	0.2284	0.2062	0.0356	-0.2098	0.0391	-0.5024	-0.0233	0.1084
All Years	**0.1761**	**0.1258**	**0.1367**	**0.1208**	**0.2417**	**0.0813**	**0.3036**	**0.1644**	**0.1377**	**-0.0239**	**0.1959**	**0.0890**

Notes: Shaded correlations are statistically different from zero at the 5% level using a two-tailed t-test.

Table 3. Lagged Correlations, Change in SCOT Net Long Index Positions and Nearby Futures Returns the Following Week

Year	KCBOT Wheat	Feeder Cattle	Soybean Oil	Corn	Soybeans	CBOT Wheat	Cocoa	Coffee	Cotton	Sugar	Live Cattle	Lean Hogs
2004	0.0993			0.0088	0.1370	-0.0591						
2005	0.2005			0.1385	-0.2077	-0.1030						
2006	-0.0101	-0.2342	-0.1256	-0.0983	-0.2574	0.1169	0.0788	-0.1881	0.0174	-0.0341	-0.2912	-0.2587
2007	0.0702	0.0187	-0.0318	-0.3101	-0.0356	-0.0361	0.2588	0.1212	0.0118	0.0654	-0.1520	-0.1541
2008	0.0611	-0.1906	0.1937	0.0687	0.2367	0.0700	0.1968	0.1080	0.3645	0.0331	0.0462	-0.0282
2009	-0.1498	0.2012	0.1930	-0.2316	-0.0022	-0.2668	-0.1289	-0.2000	0.0928	-0.1110	0.0722	0.2847
2010	0.1460	-0.1216	-0.0356	-0.1468	0.0927	-0.2619	-0.2032	-0.1034	-0.1903	-0.1360	0.0234	-0.1274
2011	0.0791	-0.0354	-0.0936	-0.2048	-0.0976	-0.1270	-0.0877	-0.0511	-0.2925	-0.1496	-0.0872	0.2352
2012	0.0525	-0.0073	0.0865	-0.1991	-0.1771	0.0079	0.0304	0.1197	-0.0722	0.3066	-0.2664	-0.0632
2013	0.0659	0.0853	0.1689	-0.0149	-0.0748	-0.0488	-0.1151	-0.0856	0.0843	-0.1370	0.2058	0.4153
2014	-0.1619	0.1012	-0.1644	-0.1174	0.1612	-0.0600	-0.1115	-0.0862	-0.1900	-0.1009	0.0216	0.2226
All Years	**0.0321**	**-0.0343**	**0.0617**	**-0.0982**	**0.0157**	**-0.0598**	**0.0135**	**-0.0400**	**0.0196**	**-0.0477**	**-0.0334**	**0.0588**

Notes: Shaded correlations are statistically different from zero at the 5% level using a two-tailed t-test.

Table 4. Lagged Correlations, Change in SCOT Net Long Index Positions and Nearby Futures Returns the Prior Week

Year	KCBOT Wheat	Feeder Cattle	Soybean Oil	Corn	Soybeans	CBOT Wheat	Cocoa	Coffee	Cotton	Sugar	Live Cattle	Lean Hogs
2004	-0.1840			0.3638	0.3420	0.2044						
2005	-0.0210			0.1714	0.2144	-0.1091						
2006	0.2996	0.0837	-0.1316	-0.1366	-0.1169	-0.0895	0.0636	-0.0576	0.0301	-0.2581	-0.0618	-0.2317
2007	0.0667	-0.0970	-0.0726	0.0880	0.1338	-0.1043	-0.2184	-0.2423	-0.2120	-0.2160	0.1016	-0.1219
2008	0.3072	0.0719	0.0731	0.4511	0.2911	0.0672	0.2423	0.2802	0.2431	0.3439	0.2086	0.1832
2009	-0.1358	0.1227	-0.1787	0.0239	-0.0057	-0.2660	0.1360	-0.1802	-0.0579	-0.0454	0.0267	0.0113
2010	0.0120	0.3994	0.0712	-0.0894	-0.0145	-0.2903	0.0517	-0.0042	-0.1270	-0.2388	-0.0886	0.2987
2011	-0.1569	0.1014	0.1553	0.0909	0.2486	-0.0880	0.1529	0.0653	0.1131	-0.2247	0.1486	0.1464
2012	0.0291	0.0328	0.0656	-0.2708	-0.2019	-0.0824	0.1880	-0.1016	0.1471	-0.0073	0.1153	-0.0459
2013	-0.0128	0.3641	0.2782	-0.0797	0.1036	0.1960	0.1395	0.1879	0.1149	-0.1977	0.0494	0.3253
2014	-0.1597	0.0936	0.0072	-0.2108	0.1788	0.0111	0.1362	-0.3094	0.3340	0.0264	-0.2233	0.1843
All Years	**0.0172**	**0.1245**	**0.0499**	**0.0627**	**0.1168**	**-0.0570**	**0.1264**	**-0.0265**	**0.0902**	**-0.0579**	**0.0481**	**0.0722**

Notes: Shaded correlations are statistically different from zero at the 5% level using a two-tailed t-test.

Table 5. Correlations, Weekly Change in Net Long Positons and Daily Futures Returns, 2006-2014

	-----Prior Week-----					-----Same Week-----					-----Following Week-----				
						----SCOT Measures Tuesday-to-Tuesday Close----					-----SCOT Private-----			-----SCOT Public-----	
	-----Returns Lead Positions-----					-----Contemporaneous Correlations-----					-----Positions Lead Returns-----				
	Weds.	Thurs.	Fri.	Mon.	Tues.	Weds.	Thurs.	Fri.	Mon.	Tues.	Weds.	Thurs.	Fri.	Mon.	Tues.
Market	**t-9**	**t-8**	**t-7**	**t-6**	**t-5**	**t-4**	**t-3**	**t-2**	**t-1**	**t**	**t+1**	**t+2**	**t+3**	**t+4**	**t+5**
KCBT Wheat	-0.0077	0.0390	-0.0242	0.0123	0.0252	0.0801	0.1141	0.0698	0.1036	0.0690	-0.0108	-0.0439	0.0600	0.0139	0.0595
Feeder Cattle	0.0393	0.0408	-0.0057	0.0671	0.1511	0.1020	0.1328	0.0318	0.0510	0.0140	-0.0338	0.0163	0.0067	-0.0053	-0.1042
Soybean Oil	-0.0153	0.0707	-0.0359	0.0261	0.1037	0.0381	0.0956	0.0805	0.0096	0.1032	0.0176	0.0411	0.0410	-0.0014	0.0819
Corn	-0.0564	0.0677	0.0326	0.0563	0.0696	0.0023	0.0801	0.1691	0.0219	-0.0114	-0.0859	-0.0449	-0.0303	-0.0467	-0.0485
Soybeans	0.0196	0.0668	0.0240	0.0554	0.1066	0.1172	0.1454	0.1610	0.0806	0.0884	-0.0815	0.0407	0.1033	-0.0685	0.0546
CBOT Wheat	-0.0862	-0.0132	-0.0666	0.0264	0.0286	0.0500	0.1013	0.0366	-0.0083	0.0550	-0.0061	-0.0658	-0.0134	-0.0291	0.0159
Cocoa	0.0666	0.0431	-0.0104	0.0416	0.0483	0.1608	0.2529	0.1347	0.1046	0.0283	0.1183	0.0095	-0.0386	0.0401	-0.0929
Coffee	-0.0653	0.0187	-0.0485	0.0118	-0.0101	0.0120	0.1260	0.0907	0.0604	0.0605	-0.0904	0.0577	-0.0290	-0.0177	-0.0621
Cotton	-0.0079	0.0444	0.0818	0.0330	0.0298	0.1548	0.0605	0.0754	0.0469	0.0109	-0.0869	0.0012	0.0905	0.0534	-0.0548
Sugar	-0.0555	-0.0234	-0.0186	-0.0351	-0.0298	0.0006	0.0238	-0.0115	-0.0248	-0.0620	-0.0630	0.0438	0.0255	-0.1029	-0.0075
Live Cattle	0.0034	0.0524	0.0072	0.0132	0.0634	0.1039	0.2495	0.0704	0.0176	-0.0304	-0.0144	0.0073	-0.0001	-0.0115	-0.0777
Lean Hogs	0.0389	0.0327	0.0374	0.0158	0.0701	0.0908	0.1240	0.0412	-0.0113	-0.0062	-0.0504	0.0117	-0.0334	0.0857	0.0535
Average	**-0.0105**	**0.0366**	**-0.0022**	**0.0270**	**0.0547**	**0.0761**	**0.1255**	**0.0791**	**0.0377**	**0.0266**	**-0.0323**	**0.0062**	**0.0152**	**-0.0075**	**-0.0152**

Note: Shaded coefficients are statistically different from zero at the 5% level using a two-tailed t-test.

Table 6. Largest Percent Increases in Net Long Index Positions and Corresponding Futures Return.

	-------Largest Position Increases------				-------Largest Position Increases------		
Market	Ending Date	Position % Change	Futures Return	Market	Ending Date	Position % Change	Futures Return
KCBOT Wheat	12/1/09	59.7	-24.6	Cocoa	5/12/09	111.5	19.2
	2/5/13	53.9	-15.2		11/17/09	66.6	28.8
	7/26/05	38.0	3.5		2/26/08	53.9	36.9
Feeder Cattle	4/6/10	56.5	17.4	Coffee	11/17/09	47.4	3.2
	4/12/11	50.8	16.6		12/8/09	45.3	7.6
	4/24/07	26.8	6.9		1/22/13	39.8	-21.8
Soybean Oil	6/15/10	67.1	-6.9	Cotton	4/24/12	48.5	-7.7
	9/15/09	53.8	7.8		7/3/06	45.1	-14.6
	4/3/12	40.7	11.3		2/26/08	36.0	26.1
Corn	7/6/04	63.1	-5.1	Sugar	2/5/08	59.4	16.2
	5/17/05	61.6	-11.2		7/5/11	45.3	-3.2
	5/23/06	58.0	11.1		4/24/12	34.7	-17.3
Soybeans	5/10/05	97.6	20.4	Live Cattle	11/17/09	37.9	4.1
	9/1/09	42.6	24.7		5/16/06	33.4	-16.7
	4/4/06	40.9	-7.1		12/15/09	27.2	6.0
Wheat	2/15/05	80.1	-11.1	Lean Hogs	11/9/09	48.3	-13.2
	7/6/04	45.6	-20.5		6/3/08	36.5	7.1
	9/6/05	30.3	-16.4		4/4/06	34.0	-13.4
				Average		**50.5**	**1.4**
				No. Positive			**19**
				No. Negative			**17**

Table 7. Largest Percent Decreases in Net Long Index Positions and Corresponding Futures Return.

	-------Largest Position Decreases------				-------Largest Position Decreases------		
	Ending	**Position**	**Futures**		**Ending**	**Position**	**Futures**
Market	**Date**	**% Change**	**Return**	**Market**	**Date**	**% Change**	**Return**
KCBOT Wheat	10/28/08	-62.9	-45.2	Cocoa	11/18/08	-177.6	-23.7
	3/15/11	-44.8	-1.9		4/1/14	-49.4	11.3
	7/30/13	-36.6	-20.0		7/13/10	-26.9	-11.0
Feeder Cattle	11/4/08	-62.5	-9.7	Coffee	1/13/09	-62.8	-23.3
	1/10/12	-38.7	2.1		1/18/11	-32.5	38.1
	6/3/14	-35.6	16.9		6/3/14	-26.2	42.5
Soybean Oil	3/17/09	-65.4	-35.4	Cotton	2/15/11	-56.2	79.8
	10/4/11	-29.8	-21.0		1/13/09	-53.6	-46.3
	8/14/12	-23.0	-1.5		2/25/14	-29.4	1.9
Corn	11/11/08	-68.0	-52.1	Sugar	2/3/09	-76.6	-19.8
	2/6/07	-25.6	40.8		1/19/10	-34.8	48.2
	2/15/11	-27.5	45.0		1/4/11	-31.8	61.9
Soybeans	12/16/08	-65.5	-61.2	Live Cattle	1/27/09	-56.6	-27.4
	9/18/12	-42.0	22.8		1/17/12	-19.0	6.2
	4/19/11	-23.2	10.1		6/18/13	-16.9	-10.3
Wheat	11/25/08	-41.7	-34.7	Lean Hogs	2/10/09	-90.8	-28.1
	1/29/13	-28.1	-17.5		3/26/13	-33.7	-2.9
	12/24/13	-24.6	-15.6		1/28/14	-25.8	1.2
				Average		**-45.7**	**-2.2**
				No. Positive			**15**
				No. Negative			**21**

Figure 1. Typology of Empirical Tess for Market Impact of Index Investment

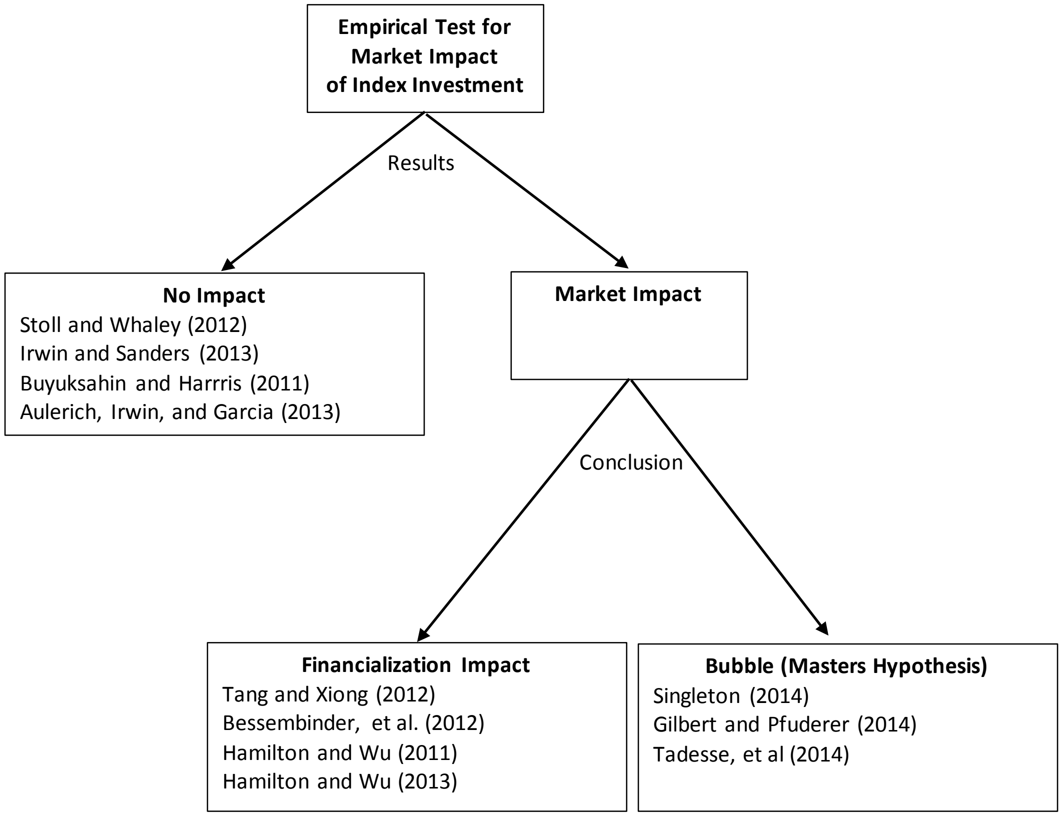
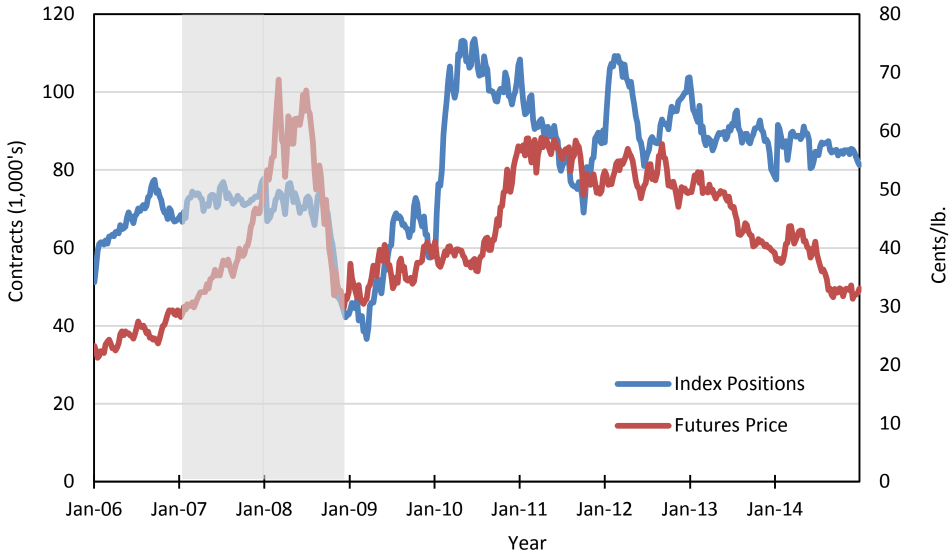


Figure 2. Soybean Oil, SCOT Net Long Index Positions and Nearby Futures Prices, 2006-2014.



Note: shaded areas represent years when the contemporaneous correlations between futures returns and changes in net long index positions are statistically positive.

Figure 3. CBOT Wheat, SCOT Net Long Index Positions and Nearby Futures Prices, 2004-2014

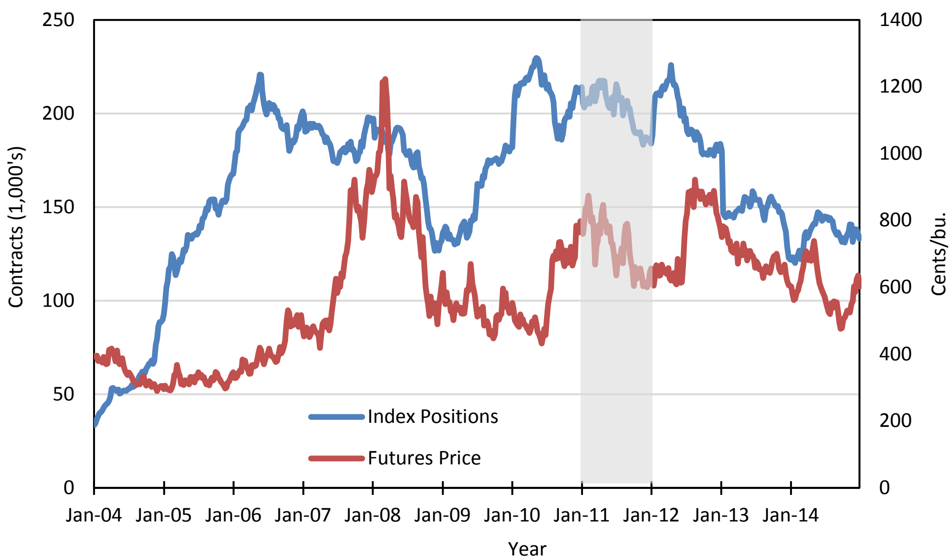


Figure 4. Correlations, Soybeans, Weekly Change in Net Long Index Positions and Daily Returns, January, 2006 – June, 2008.

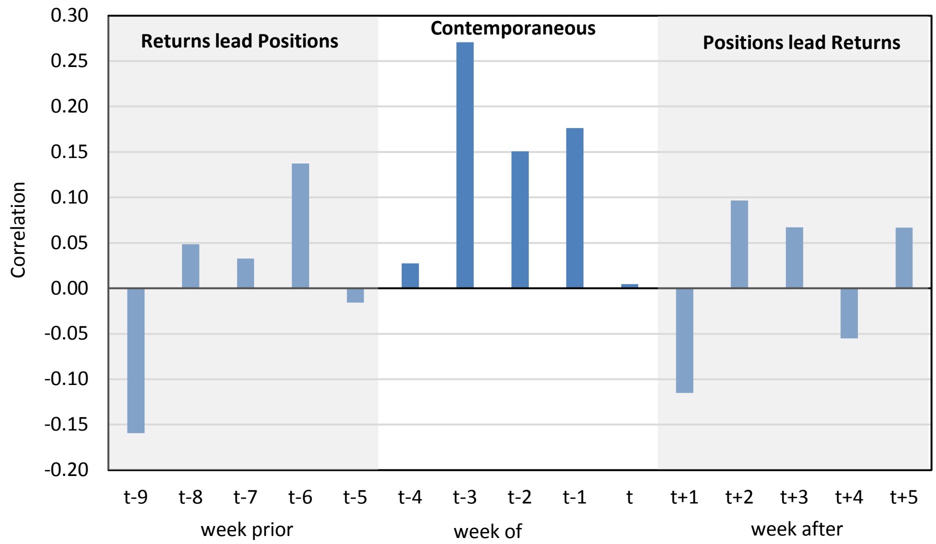


Figure 5. Correlations, Soybeans, Weekly Change in Net Long Index Positions and Daily Returns, July, 2009 – December, 2011.

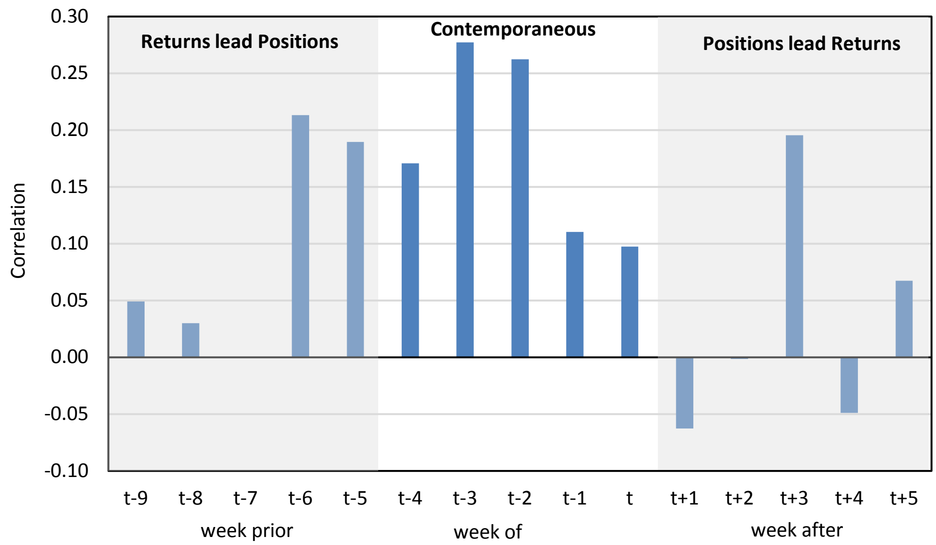


Figure 6. Correlations, Soybeans, Weekly Change in Net Long Index Positions and Daily Returns, January, 2012 – December, 2014.