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Commodity returns and their volatility in relation to speculation: A replication study[1]

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Abstract

Granger causality (GC) tests are widely used when it comes to empirically address the dynamic relationship between speculative activities and pricing on commodity markets. However, the sheer number of studies and their heterogeneity makes it extremely difficult – if not impossible – to compare their results and to derive meaningful conclusions. This is the main objective of this paper, which analyzes a consistent dataset with a homogeneous estimation approach. We analyze futures returns and volatilities of 28 commodities for three maturities, from January 2006 to March 2015, in relation to three speculation proxies. Overall, we find a larger number of significant GC effects for volatilities than for returns. The volatility effect is mostly negative, i.e. more speculation is followed by lower volatilities. This is particularly true if the Working index used as speculation proxy. The majority of destabilizing effects (positive relations) if any, is found in livestock. However, no such effects seem to be present in typical agricultural commodities. Mixed evidence is found for softs. Apart from statistical significance, the explained variance of returns and volatilities is below 8% and therefore economically small or at best moderate.

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1. Introduction

A considerable body of empirical tests has been performed over the past decade about the temporal relationship between measures of financial speculation and the prices, returns and volatilities of a wide range of commodity futures. These tests were mainly motivated by the public concern about the adverse impact of financial investors, notably the growth of index-related investing since the mid-2000s, on commodity prices. This "financialization" of commodity markets has been the subject of numerous theoretical and empirical studies. The (empirical) results are far from homogenous and not easy to summarize, although the number of studies that report economically or statistically significant effects represents a minority. Reviews of recent empirical research can be found in essentially all published papers and survey articles.[2]

A major obstacle in comparing and interpreting the results is their heterogeneity across the selection of commodities, analyzed time period, test methodology, speculation proxies, and the nature of price data (price levels, returns, volatilities). Part of these issues is common to all empirical testing in the field of finance, but two issues are specific to commodities: first and most important, the computation of feasible returns on futures positions is not as clear-cut as for traditional financial assets. It requires clear specification, which is often missing. Worse, in several (even published) studies, the nature of price data is not even described: spot or futures, price levels or returns, discrete observations or time averages?[3] Unfortunately, the documentation of data is fairly poor in many studies, which precludes a comparison of results on a priori grounds. Second, speculation proxies rely on statistical information (e.g. position data) which is sometimes ambiguous to relate to commonsense or consensus views about speculation. Therefore the robustness of empirical results with respect to various proxies seems essential.[4]

In order to control for the various effects which might affect the empirical results, this paper aims at providing a set of tests applied to a large set of commodities, using

- a common sample period
- a single test methodology (Granger causality tests and VAR variance decomposition)
- a unified sample of commodity futures returns (i.e. the same construction method of single commodity returns, not indices, and three maturities)

[2] A recent overview can be found in Lehecka (2015), or in many of the papers published in the special issue on "Understanding International Commodity Price Fluctuations" of the *Journal of International Money and Finance*, Volume 42 (April 2014). With respect to food commodities, they survey of Gilbert and Pfuderer (2014) is informative.

[3] It is worth mentioning that it is not uncommon in agricultural economics to work with price averages in empirical studies.

[4] We have summarized the main quantitative and qualitative insights of a review of some 100 (mostly published) research papers on speculation and commodity prices (levels, returns, volatilities and spillovers) covering the past decade in a separate working paper which is available upon request.

- a set of homogenous, direct speculation proxies from a single data source

Therefore, our contribution is not in applying new tests or using new data, but rather to make the empirical results from a set of standard tests comparable.

A study which is closely related to ours has recently been published by Lehecka (2015). The authors analyzes a comparable set of commodities over a similar time horizon, but analyses Granger causality of speculation with respect to futures price *levels*, not returns and their volatility.[5] The author analyses a whole battery of disaggregate hedging and speculation variables, and covers a comparable (although slightly smaller) range of commodities than our paper. He concludes from his results that hedging and speculative positions may not be helpful in explaining prices and puts a lot of emphasis on the observation that prices have predictive power for position changes. Hence, the focus of the two papers is fairly different.

The paper is structured as follows: In Section 2, we describe the data used in this study, the specification of the speculation measures, and the test methodology. Descriptive statistics of the speculation measures can be found in Section 3, and the empirical findings are discussed in Section 4. The main findings are summarized in Section 5.

2. Data and Methodology

The most common test in addressing the question of investors' speculative effects on commodity futures returns are bivariate Granger causality tests. We would like to emphasize here that these tests do not test causality in any epistemological sense, but rather assess the predictive power of one time series with respect to another. Thus, it is a test of temporal leadership of two series based on correlations at various lags. Standard GC tests require stationary data, which is widely supported by financial returns, and as to be shown also for the speculation proxies used.

Speculation measures (proxies)

We use three measures ("proxies") for speculation in this paper: The first is the standard Working T-index (WT) originally suggested by Working (1960) and has since then be used in numerous empirical studies; the second measure is simply the percentage of total, long and short, speculation in relation to total open interest (SOI), and the third measure is a measure called "speculation pressure" (SP).

The Working T-index (WT) relates un-necessary long or short speculation to the total amount of hedging. It can be therefore interpreted as a measure of *excess* speculation. The formula is given by

[5] We have analyzed speculation shocks to price level data using cointegration analysis and Gonzalo-Ng shock decomposition in a separate paper; see Haase, Seiler, and Zimmermann (2015).

$$WT = \begin{cases} 1 + \dfrac{SS}{HL + HS}, & HS \geq HL \\ 1 + \dfrac{SL}{HL + HS}, & HS < HL \end{cases}$$

where: SS (SL) denotes speculators short (long) and HL (HS) denotes hedgers long (short).

Intuitively: If there is short-hedging pressure in a commodity (short positions exceed long positions, as it is mostly the case for agricultural futures), there is an economic need for long speculation for balancing out the positions. Short speculation is therefore regarded as unnecessary or excessive and put in relation to total hedging in the WT index. In the case of long-hedging pressure, the WT index puts (unnecessary or excess) long speculation in relation to total hedging.

It should be noticed that the WT index must be interpreted as an upper bound on excessive speculation, as a purely technical measure without much economic content: The index could be erroneously interpreted in a static way, namely that commercials (hedgers) trade their positions among themselves and, at the end, transfer their net position to speculators. But this is not how markets actually work: speculators are counterparties during the entire process of commercial hedging and form an essential part in the matching of counterparties, without which the process of risk intermediation (from the mismatch of positions sizes, maturities and market timing) would not work and hence the market would not exist. [6]

The Working WT index is economically meaningful in the sense that it relates speculation to hedging. Sometimes, in the public discussion, it is the amount of speculation per se that is criticized. For this purpose, we use an alternative and much simpler measure, namely the percentage of total, long and short, speculation augmented by the noncommercial "spread" positions (SSP), in relation to total open interest (SOI), which for consistency reasons must be doubled:[7]

$$SOI = \frac{SL + SS + SSP}{2 \cdot TOI}$$

The measure is called "speculative open interest". It does not address the imbalance between long and short positions. To account for this, we use a third proxy, called net speculation pressure (SP), which represents the *net* long position of speculators divided by total speculation:[8]

[6] It is worth noting that this interpretation is reflected in Working's own wording: "Indeed, the speculative index itself is a direct measure of the amount of that "excess" [speculation]. But at least a large part of what may be called technically an "excess" of speculation is economically necessary." (Working 1960, p. 197).
[7] The arithmetic of position accounting can be found e.g. in Sanders, Boris, and Manfredo (2004).
[8] Similar measures have been used by Sanders, Boris, and Manfredo (2004), or Lehecka (2015).The term is borrowed from "net hedging pressure" (introduced by Cootner 1960) which is used to explain the Keynes-Hicks normal backwardation model of commodity term structure.

$$SP = \frac{(SL + SSP) - (SS + SSP)}{(SL + SSP) + (SS + SSP)} = \frac{SL - SS}{SL + SS + 2 \cdot SSP}$$

where each side of speculation are augmented by the noncommercial "spread" positions (they cancel out in the numerator).[9] In contrast to Working's WT-index, speculation is not related to hedging; it is a pure measure about speculators' net position in futures contracts.

Each of the two proxies measures a different aspect of speculation, and hence, they should be considered as complementary.

Speculation: COT and SCOT open interest data

Both proxies rely on an adequate measurement of speculation and hedging. As has become standard in the empirical literature, both measures are calculated using the weekly COT reports, and since 2007 the Supplemental Index Traders reports, released by the US Commodity Futures Trading Commission (CFTC).

COT report. It contains each Tuesday's open interest (number of outstanding contracts) for US exchanges on which 20 or more traders hold positions equal to or above the reporting levels established by the CFTC. Since March 14, 1995, the Futures-and-Options-Combined Report is released which provides an aggregation of futures market open interest and delta weighted option market open interest. The published open interest for each market is aggregated across all contract maturities in both reports. The weekly reports are released on Friday at 3:30 p.m. Eastern time.

The combined COT-report classifies the positions into Commercials, Non-commercials, and None-Reporting. For each group, the respective number of long and short contracts is reported separately, and the aggregate of long and short positions adds up to the market's total open interest. Following common practice in the empirical literature, "Commercials" are considered as hedgers whereas "Noncommercials" are classified as speculators. However, the group of "Nonreporting" traders cannot be easily classified as hedgers or speculators without strong assumptions. Sanders, Irwin, and Merrin (2010) point out that the speculation index is not particularly sensitive to the assignment of the non-reporting traders. For that reason, this group is omitted in computing our speculation measures.

SCOT report: Since January 5, 2007, the CFTC publishes a supplemental COT report (SCOT[10]) which releases the positions of *Index Traders* separately from the Noncommercial and Commercial positions; the non-reportable positions are not affected. The data are calculated back to January 3, 2006.

[9] Spreading includes simultaneous long and short futures and options positions in the same underlying commodity by non-commercial traders (in our classification: speculators).
[10] Sometimes, the report is also referred as CIT (Commodity Index Trader) report in the literature.

The SCOT Index Traders category includes positions from COT's Commercial *and* Noncommercial traders:

- COT Commercials include Swap Dealers (SWD), which are classified as either index- or nonindex traders. The index-related SWD are reclassified into the new category in the SCOT report. It has been argued[11] that their hedging activity in the futures markets mostly originates from index-related OTC index products (offered by banks and brokers to financial investors) and as such does not represent classical hedging from positions in the physical commodity market.

- COT Noncommercials include Money Managers (MM), which are classified as either index- or nonindex managers. The index-related MM are reclassified into the new category in the SCOT report. It has been argued that MM with index positions in commodities have different investment objectives than traditional "speculative" MM in commodity futures: they take long-only positions without directional bets and without leverage; see Stoll and Whaley 2011 forward strong arguments in this direction.

Thus, there are arguments in favor and against including the two categories of Index Traders in measuring "speculation". Since we prefer our proxies to be biased towards "too much" speculation[12], *both* categories, i.e. *all* Index Traders according to the SCOT reports, are considered as "speculation" and therefore added to the Noncommercial category in our speculation proxies.

Summing up, long and short "speculation" (SS, SL) in our WT- and SP-measures includes the sum of Noncommercial and *all* Index Trader positions when using the SCOT data. Compared to the COT-classification, it is the group of *index-related SWD* which makes the difference: they are eliminated from the hedgers and added to the speculators.[13]

Thus, we use two proxies of speculation (WT and SP) applied to two hedger/speculator classifications (based on COT- and SCOT-reports).

Commodity futures contracts

We have selected all 28 commodities on which futures are traded in the time period from January 2006 to March 2015 and for which COT position data are reported. The SCOT data are available only for a subset of 12 commodities which are included in standard commodity indices. Our sample length is determined by the availability of the SCOT data. Although the

[11] CFTC (2006): Commission Actions in Response to the "Comprehensive Review of the Commitments of Traders Reporting Program" (June 21, 2006)

[12] If we would not report significant effects in our empirical tests, one objective might be that we understate the effective amount of speculation.

[13] The index-related MM are speculators in the COT- as well as in our SCOT-based classification.

combined COT-position data are available since 1995, we use a *common* sample period for the COT- and SCOT-based speculation measures for the purpose of comparison.

We use three contract maturities, namely 3 months, 6 months, and 12 months (specifically, the maximum number of days to maturity are 52, 183, and 365). However, from our preselected 28 commodities, due to liquidity constraints and data limitations, we exclude three energy commodities from our analysis (DL, EN, and XB). Hence, our final sample includes 25 commodities for the COT data, and a subset of 12 commodities for the SCOT data, which three maturities each.

Commodity futures prices and returns

Futures price series are constructed by applying the rollover procedure which is familiar in the empirical commodity literature. The contracts are rolled into the next available maturity in the month where the shortest contract expires; a fixed business day is selected for the rollover. The roll schedule applied to each commodity is displayed in **Table APP1** in the Appendix. Using Wheat as an example, the contract is rolled on the 12th business day of February, where the expiration month switches from March to May. On the 12th business day of April, the expiration month switches from May to July. This expiration applies until the 12th business day in June, where the expiration month switches to September, and so on.

All prices are denoted in U.S. dollars and were downloaded from Thomson Reuters Datastream. In order to match returns with the weekly position data available from the CFTC commitment of traders (COT) reports used for our speculation proxies, we compute weekly Tuesday-to-Tuesday log returns.

Granger causality (GC) tests

We apply standard Granger causality tests to weekly return and position data, and respectively, weekly return variances and position data. Returns are measured as log changes of Tuesday closing prices, and weekly variances are proxied by quadratic log returns.[14]

The timing of the variables needs some explanation; it is surprising that this crucial topic is mostly not addressed in empirical studies.[15] The weekly published COT- (and SCOT-) reports contain the position data on Tuesday, but they are not released until Friday. Depending on how well and quick information is processed in commodity markets, the release may have an impact on prices. If there is an information (aggregation) effect, the Tuesday-positions in *t*

[14] This is justified if the measurement interval is „small“ and the expected return is close to zero. Since in general the variability of commodity returns seems to dominate expectations (risk premiums), this procedure seems adequate to us even if a week is not strictly a “small” time interval.

[15] A notable exception is Sanders, Boris, and Manfredo (2004); the study reveals that the timing of the COT data and returns has some impact on empirical findings.

(released a few days later) would have predictive power for the weekly futures return from *t* to *t+1*, but this effect is unrelated to the economic causation of speculative positions on subsequent returns and volatility. In this case, in order to stay conservative towards finding causal effects running from positions to returns and volatilities, it would be preferable to consider the positions in *t* (released a few days later) and the *subsequent* returns from *t+1* to *t+2* as "contemporaneous". However, if markets are efficient and information is processed in the market without publication lag, this procedure would wash out a possible causal effect. In this case, we should consider the positions in *t* and the returns from *t* to *t+1* as contemporaneous. Since there is no direct evidence about a publication effect in the literature, we chose the second "efficient market" view.[16]

The optimal lag lengths from the VAR used in the GC tests are determined from the Schwarz criterions (SC).

The VAR estimation results are used to perform a variance decomposition for those cases where the null of no-causality from speculation to returns or volatilities can be rejected. A Cholesky decomposition is applied to the error matrix. With respect to the ordering of variables, the speculation proxy is selected as the first variable, the returns as second. In our Tables, we only display the maximum variance share in the returns explained by the speculation proxy across the periods.

3. Descriptive Statistics

Table 1 (Panels A to C) provides descriptive statistics of the three speculation proxies. We skip the statistics of the futures returns because they are widely documented in the empirical literature, and they are not substantially different for our sample.

The autocorrelation coefficients are reported in the past three columns; they are significantly different from zero (indicated by bold figures) across all proxies and commodities. Most of the AC(1) coefficients are close to one and decrease slowly, which indicates a degree of persistence in most series. Since the application of standard Granger causality tests requires stationary data, we have to test for a unit root. Of course, one could argue that the three measures represent *relative* shares of speculation and exhibit upper and lower bounds by definition, and thus the series are stationary by construction. However, in finite samples, the series can well fluctuate in a range of values such that tests are unable to reject the null of a unit root.

The results of ADF unit root tests for non-stationarity are displayed in **Table 2**. They confirm that non-stationarity cannot be rejected in about one third of the cases (on a 99% confi-

[16] Of course, this problem prevails whenever a stock variable (positions) must be matched with flow variables (returns or volatilities) – even without publication lags. Taking first differences of the position data over the weekly return measurement interval does not solve the problem, since our hypotheses to be tested are explicitly related to the *level* of speculation.

dence level, using the Schwarz criterion), i.e. they behave *as if* they are non-stationary. The detailed results for the three proxies are displayed in separate panels of the Table: Panel A (Working index WT), Panel B (speculative open interest SOI), and Panel C (speculation pressure SP), each subdivided for COT- and SCOT-based measures (A1, A2, B1 etc.). On a 99% (in parentheses: 90%) significance level, the null of a unit root cannot be rejected in 10 (4), 7 (3) and 11 (4) of the 28 COT series, and in 7 (3), 5 (1) and 4 (0) of the 16 SCOT series. Thus, there *is* evidence for non-stationarity, but in most cases only on relatively low significance level. Since the construction of the speculation proxies is fairly different, it is not surprising that the time series characteristics are different across proxies and commodities. Only KC and CL are non-stationary across all three proxies.

In the cases where we are unable to reject a unit root with 99% confidence, an augmented test of GC must be applied as suggested by Toda and Yamamoto (1995), which takes into account the maximum order of integration of the non-stationary variable (which is $I(1)$ in our case), which must be added to the optimal lag length of the original VAR model. However, the GC null hypothesis is tested on only the original number of lags. Our empirical results rely on the T-Y test where it is appropriate.

4. Empirical findings

4.1 Speculative effects on returns

How does speculation affect realized returns (log price change) in subsequent periods? The results for the three speculation proxies are displayed in **Table 3,** Panels A to C, each subdivided for the COT- and SCOT-based measures (A1, A2, B1 etc.). The general observation is that the number of significant effects running from speculation to returns is small. Where such an effect is found (on the 10% significance level), two summary statistics are reported in the last column of each Panel, headed by "VAR / variance decomposition": first, a coefficient which indicates the sign of the relationship (sum of VAR parameter), and a coefficient which shows the percentage return variance explained by speculation.

- If speculation is measured by the Working WT index, 3 (2) commodities and 6 (2) maturities exhibit a significant relationship, which is negative in all cases. Thus, more unnecessary speculation Granger causes lower returns, i.e. futures price to decrease. The explained variance is below 2.2%. There is an overlap of significant effects for the COT and SCOT speculation proxies for a single commodity only: live cattle (for the longest maturity).
- In the case of speculative open interest (SOI) as speculation measure, 6 (6) commodities and 14 (12) maturities exhibit a significant relationship, which is negative without exception. That is, more speculation is associated with lower returns. However, the explained variance is extremely small (below 1.5%), with the exception Wheat (W)

using the SCOT series where explanatory power is in the range of 6% to 6.5%. There is an overlap of significant effects for the COT and SCOT speculation proxies for 2 commodities: live cattle (for the longest maturity) and cotton (for all 3 maturities). Overall, the SOI proxy seems to have the most pronounced effects for agricultural futures (cotton, wheat, corn, rice) among all the measures.

- If speculative pressure (SP) is used as speculation measure, i.e. if the sign of *net* speculation is taken into account, 4 (4) commodities and 8 (8) maturities exhibit a significant relationship, which is positive except in a single case. That is, positive speculation pressure (an overhang of long positions) is associated with higher returns (futures prices increase), negative pressure is associated with lower returns (futures price decrease). The maximum explained variance is 2.8%. There is an overlap of significant effects for the COT and SCOT speculation proxies for 2 commodities: live cattle (for the longest maturity) and coffee (for the second and third maturity).

Overall, the results can be interpreted as follows: Positive Granger causality effects of speculation on subsequent returns (i.e. positive price effects) can only be found for the speculation pressure (SP) measure. Thus, it appears that the sign of net speculation seems to have some explanatory power for this sign of subsequent returns. For the SCOT-based proxies, with a stronger bias towards speculation, the effect can be observed across all three maturities for BO (soybean oil) and KC (coffee), and for a single maturity for LC (live cattle) and LH (lean hogs). The effect for and KC and LC can also be observed for the more conservative COT-based proxy. However, the explained variance is not more than 2.8%.

In all the other tests, more speculation leads to lower subsequent returns. This is particularly true for SOI as a proxy variable, so that the general claim that “more speculation” leads to higher prices does not seem to be justified. However, the proxy is only of limited economic relevance. But the Working index does not reveal positive effects either: Significant negative effects are just observed in the SCOT data for a single maturity in two commodities (LH and LC, again), and all the other significant effects are observed in the COT data in precious metals, with the exception of a single maturity for LC (again). The explained variance of WT for LH and LC is again some 1.5%.

It does not appear that the SCOT-based speculation measures, which are more biased towards speculation, exhibit stronger effects, quite the contrary is true. This means that OTC index investing – measured indirectly through the activity of index swap dealers - does not seem to have an impact on our findings. It is interesting to observe that several significant effects are observed – across all three measures, although for all maturities – for live cattle and lean hogs (for 13 maturities out of 36); there is no other study which reports this finding. Although significant Granger causality effects are found, the explained return variance is small, with a typical value between 1% and 2%. Thus, speculation does not seem to be a major individual driver of commodity futures returns. The “public” perception, that more speculation leads to higher prices, cannot be confirmed in general, but there is some evidence for

a single proxy (net speculation pressure), but the other two proxies lead to opposite conclusions.

4.2 Speculative effects on variance

How does speculation affect the variance of realized returns in subsequent periods? Here, the mere inspection of the results displayed in **Table 4** (Panels A to C, which have the same structure as in the previous Table) reveals that the number of statistically significant effects is much larger than in the results for returns reported before. We find statistically significant effects for 40% (34%) of the analyzed contract maturities if COT (SCOT) data is used.[17] Also, the results are more mixed across the individual commodities. The findings can be summarized as follows:

- If speculation is measured by the Working WT index, 15 (7) commodities and 38 (18) maturities exhibit a significant relationship, which is negative for 11 (5) and positive for 4 (2) commodities out of 25 (12).[18] Thus, for the majority of commodities, more unnecessary speculation Granger causes lower a lower volatility in the subsequent weeks. The explained variance does not exceed 8%. There is an overlap of significant effects for the COT and SCOT speculation proxies for 7 commodities: lean hogs and cocoa (positive), and Chicago and Kansas wheat, soybean oil and meal, and sugar (negative).
- For speculative open interest (SOI) as speculation measure, 12 (6) commodities and 28 (11) maturities exhibit a significant relationship, which is negative for 9 (2) and positive for 3 (4) commodities. Thus, the use of SCOT-based measures leads to a larger number of volatility-increasing effects. The explained variance does not exceed 6%. There is an overlap of significant negative effects for the COT and SCOT speculation proxies for 2 commodities: Kansas wheat and soybean oil (for all maturities).
- If speculative pressure (SP) is used as proxy, i.e. the sign of *net* speculation is considered to be relevant, 11 (5) commodities and 24 (8) maturities exhibit a significant relationship, which is negative in 5 (3) and positive in 5 (1) cases.[19] Of course, it is a priori not clear whether an overhang of long[20] or short positions should be associated with a higher volatility – it could well be that a large overhang with either sign could be associated with a large volatility; such an effect would imply a non-linear relationship and requires a different test procedure. The mixed results (signs) which are in apparent contrast to those for the other two proxies could be a possible consequence of such an effect. There is an overlap of significant effects for the COT and

[17] Again, a significance level of 90% is selected.
[18] The sign of the relationship is the same across all maturities for essentially all commodities, except for LC if the SP is used as speculation proxy.
[19] As stated before, one commodity (LC, life cattle) is indeterminate across maturities.
[20] Net long (short) speculation increases (decreases) volatility for e.g. soybean oil and meal, rice, sugar, and occasionally wheat, while it decreases (increases) volatility for e.g. cocoa, lean hogs, feeder cattle, WTI oil, natural gas, and copper.

SCOT speculation proxies for 2 commodities, feeder cattle and cocoa (both negative), however, for a single maturity only.

Overall, the results can be summarized as follows: If speculative open interest is regarded as valid proxy and SCOT data are analyzed, one would be tempted to conclude more speculation leads to higher futures price volatility. However, the picture changes completely if the speculation is related to commercial positions: the WT index indicates a negative volatility effect for most commodities, except for lean hogs and cocoa. Overall, the results are extremely robust across the maturities of the contracts (for positive and negative effects) and the COT and SCOT data. The only heterogeneous results are reported for the speculation pressure proxy, which would not be surprising if a non-linear relationship between SP and volatility should exist.

In general, the explanatory power of the speculative proxies is considerably higher for the volatilities than for the returns. However, the fraction of variance explained is in a typical range of 2-6% and does not exceed 8%, which indicates a rather limited role of speculative effects in explaining futures volatility.

4.3 Special results for index commodities?

Are the empirical results stronger for commodities which are included in popular commodity indices? If index investing has special pricing effects on commodity futures, then the number of significant effects or the explained variance should be larger for those commodities where SCOT-data are available. Moreover, the SCOT-based speculation proxies should also provide more precise estimates of speculation. Recall that SCOT statistics were introduced for those commodities which are subject to significant index trading.

The number of significant results is measured by the total number of contracts (a total of 75 maturities for the 25 COT commodities, and 36 maturities for the 12 SCOT commodities) for which statistically significant Granger causality is observed on the 10% significance level.

For the return analysis (**Table 3**), indeed, the number of significant results is larger for the SCOT data than for the COT data (20% vs. 12%).[21] However, this is only true if SP and SOI are used as speculation proxies, not for the WT index. Therefore, speculation proxies unrelated to commercial positions might indeed indicate more significant return effects in index-related commodities.

In case of the volatility analysis (**Table 4**), the picture is different: the number of significant results is smaller for the SCOT data across all three speculation proxies (34% vs. 40%).

[21] The percentages are computed as simple averages across commodities and contracts (for each proxy), and then averaged across proxies.

With respect to the explained variance, we observe the following differences between the COT- and SCOT-results: the mean (and median) explained variance of *returns* is 2% for the SCOT data (1.7%) and is slightly larger than for the COT data with 1.6% (1.5%). But apparently, the overall figure is small for both datasets. The mean explained variance of *volatilities* is virtually identical for the SCOT and COT data, namely 3.1%, and the median is slightly larger for the SCOT data (3.4% vs. 3.2%).[22] Thus, in terms of the explained variance, the SCOT dataset reveals slightly more explanatory power for the speculation proxies, but in absolute size of the figures does not indicate substantial differences.

We therefore conclude that our empirical findings – in terms of the strength of the observed causal effects - do not differ substantially between the COT or SCOT datasets. Thus, we do not find stronger effects for index-related commodities in our results.

[22] A breakdown of the results for the individual speculation proxies, however, reveals that the explanatory power of the WT index (which we regard as the economically superior proxy) is consistently smaller for the SCOT data. The results are largely driven by the SOI proxy.

5. Summary and conclusions

Granger causality tests are very popular in the current discussion about the role of financial speculation in commodity futures markets. Unfortunately, the heterogeneity of tests in terms of speculation proxies, price variables, futures contracts, or analyzed time period makes it extremely hard to draw meaningful conclusions from the published results. Also, the focus of many papers is not on individual commodities. The main contribution of our paper is therefore to apply T-Y augmented Granger causality tests to a consistent set of futures returns and volatilities, for three maturities, using three speculation proxies applied to two data sources of position data.

Our findings can be summarized as follows: There is a substantial higher degree of spillover effects from speculation to *volatilities* than from speculation to *returns* on futures markets. In the case of volatilities, we found statistically significant effects in some 40% of the contracts (COT data), compared to 20% for returns (SCOT data). There is essentially no return effect if the WT measure is used, some positive effects for the SP measure, and negative for the SOI measure. The volatility effects are mostly negative, i.e. more speculation is followed by lower return volatility. This is particularly true if the Working index is used as speculation proxy which is widely regarded as the most meaningful measure.

Even where statistically significant effects are found, the explained variance is economically small or at best moderate: the typical values are in the range of 1-2% (for returns) and 2-6% (for volatilities).

With respect to the individual commodities, two observations are striking: First, there are essentially no destabilizing effects of speculation with respect to agricultural commodity futures prices. Where significant effects are reported, they rather point to the opposite direction: more speculation is followed by lower returns (SOI measure) and lower volatilities – with very few exceptions. Second, destabilizing effects, if any, are more frequently observed in livestock, in particular live cattle and lean hogs: the signs in the return effects are however mixed, but for several volatility effects are positive (for the WT and OI proxies, in the COT and SCOT data). This might be the first study to find effects in this commodity group with some persistence.

There is some – but less conclusive – evidence for some destabilizing effects for the soft commodities: coffee futures returns react positively to SP, but no volatility effects are observed. For sugar, negative and positive volatility effects are observed (negative for WT, positive for SOI). Cocoa volatility reacts positively to speculation measured by WT, but not to the other two proxies. Thus, the overall picture is mixed here.

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Table 1: Descriptive Statistics

The table displays descriptive statistics of the levels of the three speculation proxies used in this paper: Working T-index WT, relative speculative open interest SOI, and speculation pressure SP. The construction of the measures is described in Section 2 in the text. The abbreviations of commodities are clarified in Table 2. The statistical measures (mean, median, etc.) are standard. The extensions "cot" and "scot" of the speculation proxies refer to the CFTC position data releases (cot: Commitments of Traders Report, and "scot": Supplemental Commitments of Traders Report which contains a reclassification of "index traders"). A confidence level of 90% is applied to autocorrelation coefficient, and significant values are displayed in bold. Weekly data are used which cover the period from January 2006 to March 2015.

Panel A: Working T-Index, WT

Statistics - Working T Index (WT)

Symbol	mean		median		min		max		sted		skew		kurt		ac_1		ac_2		ac_3	
	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT
'W'	1.19	1.38	1.18	1.35	1.08	1.12	1.38	1.99	0.06	0.17	0.9	1.0	3.0	3.6	**0.97**	**0.97**	**0.94**	**0.93**	**0.92**	**0.88**
'KW'	1.13	1.16	1.11	1.13	1.02	1.02	1.36	1.52	0.09	0.12	0.8	0.8	2.7	2.7	**0.96**	**0.97**	**0.92**	**0.92**	**0.87**	**0.88**
'MW'	1.05		1.04		1.00		1.21		0.05		1.0		2.9		**0.93**		**0.87**		**0.82**	
'C'	1.11	1.13	1.07	1.09	1.02	1.03	1.36	1.45	0.08	0.09	1.2	1.6	3.6	5.2	**0.94**	**0.98**	**0.89**	**0.95**	**0.84**	**0.91**
'RR'	1.11		1.11		1.00		1.36		0.07		0.6		3.1		**0.95**		**0.90**		**0.86**	
'LH'	1.15	1.25	1.14	1.21	1.02	1.03	1.36	1.89	0.07	0.16	0.4	1.2	2.4	4.4	**0.94**	**0.97**	**0.86**	**0.92**	**0.80**	**0.87**
'LC'	1.14	1.18	1.11	1.17	1.03	1.04	1.34	1.41	0.07	0.09	0.5	0.4	2.1	2.2	**0.92**	**0.96**	**0.84**	**0.91**	**0.76**	**0.86**
'FC'	1.55	1.39	1.58	1.36	1.04	1.05	2.30	2.73	0.23	0.21	-0.2	1.8	2.9	9.9	**0.81**	**0.86**	**0.67**	**0.76**	**0.54**	**0.65**
'S'	1.10	1.12	1.07	1.09	1.03	1.03	1.32	1.47	0.06	0.08	1.3	1.6	3.9	5.3	**0.95**	**0.96**	**0.89**	**0.90**	**0.84**	**0.85**
'BO'	1.12	1.18	1.11	1.15	1.02	1.03	1.30	1.57	0.07	0.12	0.6	0.8	2.4	2.8	**0.97**	**0.97**	**0.94**	**0.93**	**0.91**	**0.89**
'SM'	1.09		1.09		1.01		1.20		0.05		0.2		1.9		**0.95**		**0.90**		**0.85**	
'CT'	1.09	1.13	1.07	1.09	1.01	1.01	1.30	1.48	0.07	0.11	0.8	0.9	2.8	2.8	**0.97**	**0.97**	**0.91**	**0.91**	**0.86**	**0.85**
'JO'	1.08		1.05		1.01		1.29		0.07		1.1		3.1		**0.96**		**0.90**		**0.84**	
'CC'	1.11	1.13	1.11	1.12	1.03	1.04	1.24	1.29	0.04	0.05	0.6	0.8	3.1	3.3	**0.92**	**0.90**	**0.81**	**0.80**	**0.71**	**0.72**
'SB'	1.08	1.11	1.05	1.07	1.00	1.00	1.26	1.36	0.07	0.09	1.0	1.1	2.9	3.1	**0.98**	**0.98**	**0.95**	**0.94**	**0.92**	**0.91**
'KC'	1.12	1.18	1.10	1.14	1.02	1.03	1.28	1.55	0.07	0.14	0.6	1.1	2.2	3.4	**0.97**	**0.98**	**0.94**	**0.94**	**0.90**	**0.91**
'HO'	1.09		1.07		1.02		1.27		0.05		1.3		4.3		**0.96**		**0.93**		**0.91**	
'CL'	1.05		1.04		1.03		1.13		0.01		2.0		11.9		**0.88**		**0.79**		**0.71**	
'NG'	1.24		1.24		1.05		1.55		0.13		0.3		2.4		**0.99**		**0.98**		**0.96**	
'PA'	1.15		1.12		1.05		1.46		0.08		1.5		4.9		**0.96**		**0.90**		**0.84**	
'PL'	1.14		1.11		1.02		1.58		0.10		1.5		5.1		**0.92**		**0.82**		**0.72**	
'SI'	1.08		1.07		1.01		1.26		0.05		1.4		4.6		**0.94**		**0.87**		**0.79**	
'GC'	1.07		1.06		1.03		1.21		0.04		1.0		3.3		**0.94**		**0.88**		**0.81**	
'HG'	1.21		1.20		1.06		1.44		0.08		0.4		2.4		**0.96**		**0.92**		**0.89**	
'LB'	1.50		1.47		1.02		3.11		0.29		1.5		7.8		**0.95**		**0.87**		**0.80**	

Statistics - Speculation to total Open Interest (SOI)

	mean		median		min		max		sted		skew		kurt		ac_1		ac_2		ac_3	
Symbol	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT
'W'	0.46	0.65	0.46	0.65	0.35	0.56	0.60	0.75	0.05	0.04	0.4	-0.2	2.4	2.3	**0.96**	**0.96**	**0.92**	**0.93**	**0.89**	**0.90**
'KW'	0.35	0.45	0.34	0.44	0.25	0.35	0.47	0.58	0.04	0.05	0.4	0.3	2.7	2.2	**0.95**	**0.97**	**0.89**	**0.93**	**0.84**	**0.89**
'MW'	0.22		0.21		0.10		0.38		0.06		0.2		2.2		**0.97**		**0.95**		**0.92**	
'C'	0.43	0.54	0.43	0.54	0.32	0.44	0.53	0.63	0.04	0.04	0.1	-0.2	3.2	2.7	**0.94**	**0.95**	**0.88**	**0.89**	**0.83**	**0.85**
'RR'	0.30		0.30		0.16		0.46		0.06		0.2		2.9		**0.94**		**0.88**		**0.83**	
'LH'	0.44	0.60	0.44	0.60	0.30	0.51	0.57	0.70	0.05	0.04	0.1	0.5	2.7	2.6	**0.95**	**0.94**	**0.90**	**0.88**	**0.84**	**0.81**
'LC'	0.44	0.58	0.44	0.58	0.35	0.49	0.52	0.63	0.03	0.02	-0.3	-0.8	2.5	3.7	**0.93**	**0.90**	**0.86**	**0.80**	**0.81**	**0.73**
'FC'	0.44	0.50	0.44	0.50	0.32	0.41	0.57	0.65	0.04	0.04	0.0	0.4	3.0	2.7	**0.92**	**0.94**	**0.84**	**0.88**	**0.78**	**0.83**
'S'	0.44	0.55	0.45	0.56	0.34	0.46	0.56	0.62	0.04	0.03	0.2	-0.4	2.5	2.6	**0.93**	**0.91**	**0.88**	**0.84**	**0.84**	**0.79**
'BO'	0.38	0.50	0.37	0.50	0.28	0.40	0.49	0.59	0.04	0.04	0.4	-0.1	2.5	2.2	**0.95**	**0.96**	**0.91**	**0.92**	**0.87**	**0.88**
'SM'	0.35		0.35		0.24		0.45		0.04		0.0		2.3		**0.94**		**0.88**		**0.84**	
'CT'	0.41	0.54	0.41	0.54	0.29	0.44	0.50	0.63	0.04	0.04	0.0	0.0	2.6	2.3	**0.93**	**0.94**	**0.86**	**0.87**	**0.80**	**0.82**
'JO'	0.39		0.40		0.25		0.53		0.05		-0.3		3.2		**0.92**		**0.85**		**0.79**	
'CC'	0.38	0.43	0.37	0.44	0.23	0.25	0.51	0.56	0.06	0.06	0.0	-0.6	2.8	3.2	**0.96**	**0.96**	**0.93**	**0.93**	**0.89**	**0.89**
'SB'	0.35	0.49	0.35	0.49	0.28	0.41	0.46	0.58	0.03	0.03	0.7	0.0	3.4	2.4	**0.92**	**0.93**	**0.83**	**0.86**	**0.77**	**0.80**
'KC'	0.45	0.56	0.45	0.57	0.33	0.45	0.57	0.66	0.05	0.04	0.0	0.1	2.5	2.7	**0.93**	**0.93**	**0.86**	**0.87**	**0.82**	**0.84**
'HO'	0.30		0.30		0.21		0.44		0.04		0.8		3.5		**0.95**		**0.92**		**0.88**	
'CL'	0.44		0.44		0.32		0.57		0.05		0.1		2.8		**0.98**		**0.96**		**0.94**	
'NG'	0.59		0.58		0.47		0.69		0.05		0.0		2.0		**0.98**		**0.97**		**0.95**	
'PA'	0.42		0.42		0.29		0.53		0.04		-0.4		3.4		**0.92**		**0.83**		**0.76**	
'PL'	0.39		0.39		0.24		0.57		0.06		0.4		3.0		**0.95**		**0.90**		**0.85**	
'SI'	0.44		0.43		0.36		0.53		0.03		0.2		3.1		**0.93**		**0.87**		**0.81**	
'GC'	0.45		0.45		0.38		0.52		0.03		0.2		2.3		**0.93**		**0.89**		**0.85**	
'HG'	0.37		0.37		0.26		0.52		0.05		0.3		2.6		**0.96**		**0.90**		**0.85**	
'LB'	0.46		0.47		0.27		0.59		0.06		-0.6		2.7		**0.93**		**0.86**		**0.79**	

Panel C: Speculative Pressure, SP

Statistics - Speculative Pressure (SP)

	mean		median		min		max		sted		skew		kurt		ac_1		ac_2		ac_3	
Symbol	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT	COT	SCOT
'W'	-0.01	0.22	0.00	0.23	-0.15	0.03	0.12	0.38	0.06	0.08	-0.2	-0.3	2.0	2.7	**0.95**	**0.96**	**0.87**	**0.91**	**0.80**	**0.87**
'KW'	0.26	0.40	0.25	0.39	-0.09	0.06	0.59	0.68	0.16	0.13	0.0	0.0	2.0	2.3	**0.97**	**0.96**	**0.91**	**0.89**	**0.86**	**0.82**
'MW'	0.40		0.43		-0.37		0.87		0.23		-0.5		2.9		**0.96**		**0.91**		**0.86**	
'C'	0.12	0.26	0.14	0.27	-0.06	0.06	0.27	0.45	0.07	0.08	-0.5	-0.3	2.7	3.1	**0.95**	**0.95**	**0.88**	**0.89**	**0.82**	**0.84**
'RR'	0.11		0.15		-0.64		0.77		0.31		-0.1		2.2		**0.97**		**0.93**		**0.89**	
'LH'	0.12	0.33	0.12	0.35	-0.13	0.12	0.35	0.53	0.11	0.08	-0.1	-0.5	2.1	2.6	**0.98**	**0.96**	**0.94**	**0.91**	**0.90**	**0.86**
'LC'	0.19	0.37	0.18	0.38	-0.01	0.20	0.44	0.54	0.10	0.07	0.2	-0.2	2.3	2.3	**0.97**	**0.95**	**0.93**	**0.89**	**0.89**	**0.83**
'FC'	0.20	0.28	0.20	0.29	-0.16	-0.08	0.49	0.56	0.15	0.15	-0.3	-0.3	2.1	2.3	**0.97**	**0.97**	**0.92**	**0.93**	**0.86**	**0.88**
'S'	0.13	0.26	0.15	0.26	-0.15	0.03	0.31	0.43	0.09	0.08	-0.8	-0.5	3.1	2.9	**0.96**	**0.95**	**0.90**	**0.88**	**0.84**	**0.82**
'BO'	0.07	0.25	0.06	0.24	-0.16	0.02	0.36	0.51	0.14	0.12	0.3	0.3	2.0	2.2	**0.96**	**0.96**	**0.89**	**0.91**	**0.83**	**0.86**
'SM'	0.19		0.21		-0.22		0.49		0.15		-0.8		3.5		**0.96**		**0.91**		**0.86**	
'CT'	0.14	0.32	0.15	0.30	-0.22	0.08	0.48	0.61	0.14	0.11	-0.1	0.4	2.5	2.2	**0.96**	**0.95**	**0.91**	**0.89**	**0.86**	**0.83**
'JO'	0.24		0.26		-0.41		0.67		0.21		-0.3		2.6		**0.96**		**0.90**		**0.85**	
'CC'	0.20	0.28	0.23	0.30	-0.14	-0.03	0.51	0.59	0.15	0.13	-0.5	-0.4	2.4	2.5	**0.96**	**0.96**	**0.91**	**0.90**	**0.85**	**0.84**
'SB'	0.14	0.29	0.16	0.29	-0.05	0.14	0.34	0.50	0.09	0.07	-0.3	0.2	2.1	2.6	**0.95**	**0.92**	**0.88**	**0.82**	**0.81**	**0.72**
'KC'	0.08	0.24	0.08	0.25	-0.13	0.03	0.34	0.51	0.12	0.11	0.0	0.0	1.8	2.0	**0.97**	**0.97**	**0.92**	**0.92**	**0.88**	**0.88**
'HO'	0.06		0.07		-0.16		0.27		0.09		-0.4		2.4		**0.94**		**0.87**		**0.81**	
'CL'	0.09		0.08		0.01		0.21		0.05		0.6		2.6		**0.98**		**0.97**		**0.95**	
'NG'	-0.08		-0.08		-0.19		0.04		0.05		0.0		2.5		**0.98**		**0.96**		**0.94**	
'PA'	0.58		0.60		0.14		0.81		0.14		-0.8		3.3		**0.95**		**0.88**		**0.82**	
'PL'	0.63		0.66		0.07		0.94		0.16		-0.6		2.7		**0.93**		**0.84**		**0.74**	
'SI'	0.19		0.20		-0.01		0.43		0.09		-0.1		2.6		**0.95**		**0.86**		**0.77**	
'GC'	0.28		0.29		0.03		0.48		0.09		-0.4		2.4		**0.94**		**0.88**		**0.82**	
'HG'	-0.06		-0.05		-0.51		0.32		0.18		-0.2		2.7		**0.98**		**0.94**		**0.91**	
'LB'	0.05		0.01		-0.37		0.69		0.20		0.6		3.1		**0.95**		**0.89**		**0.82**	

Table 2: Unit root tests for speculation proxies

The table contains ADF (augmented Dickey Fuller) test statistics of unit root tests for the three speculation proxies used in this paper: The F-statistic and its p-value test the null hypothesis of no-stationarity. If the null of non-stationarity for the levels cannot be rejected with 90% confidence (as displayed on the respective first row, I(0)), then the test is also applied to first differences and the results are displayed in the second row labelled as I(1). The results are displayed in separate Panels for three speculation proxies: Working T-index WT (Panel A), relative speculative open interest SOI (Panel B), and speculation pressure SP (Panel C). The construction of the measures is described in Section 2 in the text. Each speculation proxy is calculated with CFTC position data from two data sources: the COT Commitments of Traders Reports, and SCOT Supplemental Commitments of Traders Reports which contains a reclassification of "index traders". Weekly data are used which cover the period from January 2006 to March 2015.

Panel A: Working T-Index, WT

WT									
COT					SCOT				
			F-Statistic	p-value				F-Statistic	p-value
'W '	'Wheat (CBo'	I(0)	-3.814973	0.0165	'W '	'Wheat (CBo'	I(0)	-4.590003	0.0012
		I(1)					I(1)		
'KW'	'Wheat (KBo'	I(0)	-3.631809	0.0282	'KW'	'Wheat (KBo'	I(0)	-3.736641	0.0209
		I(1)					I(1)		
'MW'	'Wheat (MGE	I(0)	-5.396481	0	'MW'	'Wheat (MGE	I(0)		
		I(1)					I(1)		
'C '	'Corn'	I(0)	-4.32207	0.0031	'C '	'Corn'	I(0)	-3.619796	0.0292
		I(1)					I(1)		
'RR'	'Rough Rice'	I(0)	-3.996083	0.0094	'RR'	'Rough Rice'	I(0)		
		I(1)					I(1)		
'LH'	'Lean Hogs'	I(0)	-4.338139	0.003	'LH'	'Lean Hogs'	I(0)	-3.690443	0.0239
		I(1)					I(1)		
'LC'	'Live Cattle'	I(0)	-5.014788	0.0002	'LC'	'Live Cattle'	I(0)	-4.057645	0.0077
		I(1)					I(1)		
'FC'	'Feeder Cattl	I(0)	-4.751669	0.0006	'FC'	'Feeder Cattl	I(0)	-25.51344	0
		I(1)					I(1)		
'S '	'Soybeans'	I(0)	-3.642091	0.0274	'S '	'Soybeans'	I(0)	-3.770089	0.0189
		I(1)					I(1)		
'BO'	'Soybean Oil	I(0)	-5.387554	0	'BO'	'Soybean Oil	I(0)	-4.588729	0.0012
		I(1)					I(1)		
'SM'	'Soybean Me	I(0)	-2.974951	0.1404	'SM'	'Soybean Me	I(0)		
		I(1)	-16.26851	0			I(1)		
'CT'	'Cotton'	I(0)	-3.831337	0.0157	'CT'	'Cotton'	I(0)	-2.72159	0.2283
		I(1)					I(1)	-12.44951	0
'JO'	'Orange Juice	I(0)	-4.05691	0.0077	'JO'	'Orange Juice	I(0)		
		I(1)					I(1)		
'CC'	'Cocoa (US)'	I(0)	-5.679292	0	'CC'	'Cocoa (US)'	I(0)	-4.998866	0.0002
		I(1)					I(1)		
'SB'	'Sugar (US)'	I(0)	-2.693063	0.24	'SB'	'Sugar (US)'	I(0)	-2.955141	0.1462
		I(1)	-17.85465	0			I(1)	-17.57718	0
'KC'	'Coffee (US)'	I(0)	-3.057376	0.118	'KC'	'Coffee (US)'	I(0)	-3.19247	0.0871
		I(1)	-14.13464	0			I(1)		
'HO'	'Heating Oil'	I(0)	-3.763291	0.0193	'HO'	'Heating Oil'	I(0)		
		I(1)					I(1)		
'CL'	'WTI (US)'	I(0)	-2.934771	0.1524	'CL'	'WTI (US)'	I(0)		
		I(1)	-25.02735	0			I(1)		
'NG'	'Natural Gas	I(0)	-4.353386	0.0028	'NG'	'Natural Gas	I(0)		
		I(1)					I(1)		
'PA'	'Palladium'	I(0)	-4.014127	0.0089	'PA'	'Palladium'	I(0)		
		I(1)					I(1)		
'PL'	'Platinum'	I(0)	-4.192749	0.0049	'PL'	'Platinum'	I(0)		
		I(1)					I(1)		
'SI'	'Silver'	I(0)	-4.908481	0.0003	'SI'	'Silver'	I(0)		
		I(1)					I(1)		
'GC'	'Gold'	I(0)	-3.836606	0.0155	'GC'	'Gold'	I(0)		
		I(1)					I(1)		
'HG'	'Copper (US)	I(0)	-4.879423	0.0004	'HG'	'Copper (US)	I(0)		
		I(1)					I(1)		
'LB'	'Lumber'	I(0)	-5.008754	0.0002	'LB'	'Lumber'	I(0)		
		I(1)					I(1)		

Panel B: Speculative Open Interest, SOI

SOI									
COT					SCOT				
			F-Statistic	p-value				F-Statistic	p-value
'W '	'Wheat (CBo'	I(0)	-3.71382	0.0223	'W '	'Wheat (CBo'	I(0)	-3.495004	0.041
		I(1)					I(1)		
'KW'	'Wheat (KBo'	I(0)	-3.96538	0.0104	'KW'	'Wheat (KBo'	I(0)	-3.971232	0.0102
		I(1)					I(1)		
'MW'	'Wheat (MGE	I(0)	-2.626392	0.2687	'MW'	'Wheat (MGE	I(0)		
		I(1)	-22.45215	0			I(1)		
'C '	'Corn'	I(0)	-5.23808	0.0001	'C '	'Corn'	I(0)	-5.186743	0.0001
		I(1)					I(1)		
'RR'	'Rough Rice'	I(0)	-3.749481	0.0201	'RR'	'Rough Rice'	I(0)		
		I(1)					I(1)		
'LH'	'Lean Hogs'	I(0)	-4.178092	0.0052	'LH'	'Lean Hogs'	I(0)	-3.524823	0.0379
		I(1)					I(1)		
'LC'	'Live Cattle'	I(0)	-5.388334	0	'LC'	'Live Cattle'	I(0)	-4.158575	0.0055
		I(1)					I(1)		
'FC'	'Feeder Cattl	I(0)	-4.615782	0.0011	'FC'	'Feeder Cattl	I(0)	-4.062982	0.0076
		I(1)					I(1)		
'S '	'Soybeans'	I(0)	-6.655633	0	'S '	'Soybeans'	I(0)	-5.680997	0
		I(1)					I(1)		
'BO'	'Soybean Oil	I(0)	-5.599974	0	'BO'	'Soybean Oil	I(0)	-4.823318	0.0005
		I(1)					I(1)		
'SM'	'Soybean Me	I(0)	-4.916506	0.0003	'SM'	'Soybean Me	I(0)		
		I(1)					I(1)		
'CT'	'Cotton'	I(0)	-4.17018	0.0053	'CT'	'Cotton'	I(0)	-3.958226	0.0106
		I(1)					I(1)		
'JO'	'Orange Juice	I(0)	-6.157663	0	'JO'	'Orange Juice	I(0)		
		I(1)					I(1)		
'CC'	'Cocoa (US)'	I(0)	-4.524428	0.0015	'CC'	'Cocoa (US)'	I(0)	-4.192974	0.0049
		I(1)					I(1)		
'SB'	'Sugar (US)'	I(0)	-5.572807	0	'SB'	'Sugar (US)'	I(0)	-4.575224	0.0012
		I(1)					I(1)		
'KC'	'Coffee (US)'	I(0)	-2.723514	0.2275	'KC'	'Coffee (US)'	I(0)	-2.615279	0.2737
		I(1)	-6.024555	0			I(1)	-5.779638	0
'HO'	'Heating Oil'	I(0)	-4.397415	0.0024	'HO'	'Heating Oil'	I(0)		
		I(1)					I(1)		
'CL'	'WTI (US)'	I(0)	-1.683769	0.7572	'CL'	'WTI (US)'	I(0)		
		I(1)	-15.05055	0			I(1)		
'NG'	'Natural Gas	I(0)	-4.302083	0.0034	'NG'	'Natural Gas	I(0)		
		I(1)					I(1)		
'PA'	'Palladium'	I(0)	-5.157607	0.0001	'PA'	'Palladium'	I(0)		
		I(1)					I(1)		
'PL'	'Platinum'	I(0)	-3.886608	0.0133	'PL'	'Platinum'	I(0)		
		I(1)					I(1)		
'SI'	'Silver'	I(0)	-4.811921	0.0005	'SI'	'Silver'	I(0)		
		I(1)					I(1)		
'GC'	'Gold'	I(0)	-4.335998	0.003	'GC'	'Gold'	I(0)		
		I(1)					I(1)		
'HG'	'Copper (US)	I(0)	-5.588393	0	'HG'	'Copper (US)	I(0)		
		I(1)					I(1)		
'LB'	'Lumber'	I(0)	-4.24924	0.004	'LB'	'Lumber'	I(0)		
		I(1)					I(1)		

Panel C: Speculative Pressure, SP

SP									
COT					SCOT				
			F-Statistic	p-value				F-Statistic	p-value
'W '	'Wheat (CBo'	I(0)	-5.223423	0.0001	'W '	'Wheat (CBo'	I(0)	-5.627741	0
		I(1)					I(1)		
'KW'	'Wheat (KBo'	I(0)	-4.270751	0.0038	'KW'	'Wheat (KBo'	I(0)	-4.721007	0.0007
		I(1)					I(1)		
'MW'	'Wheat (MGE	I(0)	-4.291186	0.0035	'MW'	'Wheat (MGE	I(0)		
		I(1)					I(1)		
'C '	'Corn'	I(0)	-4.359639	0.0027	'C '	'Corn'	I(0)	-4.261138	0.0039
		I(1)					I(1)		
'RR'	'Rough Rice'	I(0)	-3.830877	0.0158	'RR'	'Rough Rice'	I(0)		
		I(1)					I(1)		
'LH'	'Lean Hogs'	I(0)	-3.970732	0.0102	'LH'	'Lean Hogs'	I(0)	-3.658962	0.0261
		I(1)					I(1)		
'LC'	'Live Cattle'	I(0)	-3.88488	0.0134	'LC'	'Live Cattle'	I(0)	-3.686567	0.0241
		I(1)					I(1)		
'FC'	'Feeder Cattl	I(0)	-3.947699	0.011	'FC'	'Feeder Cattl	I(0)	-3.662142	0.0259
		I(1)					I(1)		
'S '	'Soybeans'	I(0)	-3.740995	0.0206	'S '	'Soybeans'	I(0)	-4.17631	0.0052
		I(1)					I(1)		
'BO'	'Soybean Oil	I(0)	-4.809005	0.0005	'BO'	'Soybean Oil	I(0)	-4.711666	0.0007
		I(1)					I(1)		
'SM'	'Soybean Me	I(0)	-3.6585	0.0261	'SM'	'Soybean Me	I(0)		
		I(1)					I(1)		
'CT'	'Cotton'	I(0)	-4.060358	0.0076	'CT'	'Cotton'	I(0)	-4.089352	0.007
		I(1)					I(1)		
'JO'	'Orange Juice	I(0)	-2.731033	0.2245	'JO'	'Orange Juice	I(0)		
		I(1)	-17.16197	0			I(1)		
'CC'	'Cocoa (US)'	I(0)	-4.071245	0.0074	'CC'	'Cocoa (US)'	I(0)	-4.302088	0.0034
		I(1)					I(1)		
'SB'	'Sugar (US)'	I(0)	-4.206944	0.0047	'SB'	'Sugar (US)'	I(0)	-5.180066	0.0001
		I(1)					I(1)		
'KC'	'Coffee (US)'	I(0)	-3.224711	0.0808	'KC'	'Coffee (US)'	I(0)	-3.258869	0.0745
		I(1)					I(1)		
'HO'	'Heating Oil'	I(0)	-4.057859	0.0077	'HO'	'Heating Oil'	I(0)		
		I(1)					I(1)		
'CL'	'WTI (US)'	I(0)	-3.468551	0.044	'CL'	'WTI (US)'	I(0)		
		I(1)					I(1)		
'NG'	'Natural Gas	I(0)	-2.047346	0.5733	'NG'	'Natural Gas	I(0)		
		I(1)	-23.78016	0			I(1)		
'PA'	'Palladium'	I(0)	-4.14397	0.0058	'PA'	'Palladium'	I(0)		
		I(1)					I(1)		
'PL'	'Platinum'	I(0)	-4.573661	0.0012	'PL'	'Platinum'	I(0)		
		I(1)					I(1)		
'SI'	'Silver'	I(0)	-5.617024	0	'SI'	'Silver'	I(0)		
		I(1)					I(1)		
'GC'	'Gold'	I(0)	-4.014484	0.0089	'GC'	'Gold'	I(0)		
		I(1)					I(1)		
'HG'	'Copper (US)	I(0)	-3.028388	0.1255	'HG'	'Copper (US)	I(0)		
		I(1)	-17.58599	0			I(1)		
'LB'	'Lumber'	I(0)	-4.239144	0.0042	'LB'	'Lumber'	I(0)		
		I(1)					I(1)		

Table 3: Speculative effects on returns

The table contains the results of Granger causality tests (respectively, Y-T augmented Granger causality tests where the speculation proxy is non-stationary) that speculative positions do not "cause" subsequent futures returns. The F-statistic and p-value of the test are displayed in the third 4th to 6th columns. For those cases where a significant effect is found with 90% confidence, the results of a variance decomposition is displayed in the 7th to 9th columns, which show the impact (sum of the VAR parameters) and explained variance (in percentages). The results are displayed in separate Panels for three speculation proxies: Working T-index WT (Panel A), relative speculative open interest SOI (Panel B), and speculation pressure SP (Panel C). The construction of the measures is described in Section 2 in the text. Each speculation proxy is calculated with CFTC position data from two data sources: the COT Commitments of Traders Reports, and SCOT Supplemental Commitments of Traders Reports which contains a reclassification of "index traders" (Subpanels A1, A2, etc.). The abbreviations of commodities are clarified in Table 2. Weekly data are used which cover the period from January 2006 to March 2015.

Panel A1: Working T-Index, WT COT

			WT COT does not Granger Cause return			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	0.00957	0.30615	0.66599				sum of Var Parameter
		p-value	0.9905	0.7364	0.5142				VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	1.02449	0.84724	0.4789				sum of Var Parameter
		p-value	0.3815	0.4685	6.97E-01				VD in percent
'MW'	'Wheat (MGE)'	F-Statistic	0.4164	0.77686	1.18637				sum of Var Parameter
		p-value	0.519	0.3785	0.2766				VD in percent
'C '	'Corn'	F-Statistic	1.19847	1.11986	1.31471				sum of Var Parameter
		p-value	0.3098	0.3406	0.2689				VD in percent
'RR'	'Rough Rice'	F-Statistic	0.01948	0.13991	0.43586				sum of Var Parameter
		p-value	0.889	0.7085	0.8995				VD in percent
'LH'	'Lean Hogs'	F-Statistic	0.67656	2.57455	0.24184				sum of Var Parameter
		p-value	0.5667	1.09E-01	0.6231				VD in percent
'LC'	'Live Cattle'	F-Statistic	1.24568	2.69754	7.12515			-0.021403	sum of Var Parameter
		p-value	0.2815	0.1012	0.0079			1.412086	VD in percent
'FC'	'Feeder Cattle'	F-Statistic	0.72782	0.80966					sum of Var Parameter
		p-value	0.394	0.3687					VD in percent
'S '	'Soybeans'	F-Statistic	0.39086	0.62405	0.75023				sum of Var Parameter
		p-value	0.7596	0.5362	0.4728				VD in percent
'BO'	'Soybean Oil'	F-Statistic	1.26564	1.50201	2.07E+00				sum of Var Parameter
		p-value	0.2612	0.221	0.1507				VD in percent
'SM'	'Soybean Meal'	F-Statistic	0.76999	0.76102	0.72875				sum of Var Parameter
		p-value	0.5112	0.5164	0.5352				VD in percent
'CT'	'Cotton'	F-Statistic	0.27204	0.54262	0.8664				sum of Var Parameter
		p-value	0.8456	0.6533	0.4584				VD in percent
'JO'	'Orange Juice'	F-Statistic	1.06075	1.10263	0.58611				sum of Var Parameter
		p-value	0.347	0.3328	0.6244				VD in percent
'CC'	'Cocoa (US)'	F-Statistic	0.1611	0.03547	0.01202				sum of Var Parameter
		p-value	0.8513	0.9652	0.988				VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.11356	0.27212	0.77074				sum of Var Parameter
		p-value	0.9522	0.8455	0.5108				VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.32615	0.30283	0.30921				sum of Var Parameter
		p-value	0.8604	0.8761	0.8718				VD in percent
'HO'	'Heating Oil'	F-Statistic	0.33173	0.34764	0.549				sum of Var Parameter
		p-value	0.7178	0.7065	0.5779				VD in percent
'CL'	'WTI (US)'	F-Statistic	0.57381	0.37526	0.34722				sum of Var Parameter
		p-value	0.6325	0.7709	0.7912				VD in percent
'NG'	'Natural Gas (US)'	F-Statistic	1.56591	0.11051	0.02144				sum of Var Parameter
		p-value	0.2114	0.7397	0.8836				VD in percent
'PA'	'Palladium'	F-Statistic	0.74681	0.76261					sum of Var Parameter
		p-value	0.4744	0.467					VD in percent
'PL'	'Platinum'	F-Statistic	4.65188	4.46065		-0.000465	-0.000422		sum of Var Parameter
		p-value	0.01	0.012		2.123944	2.070111		VD in percent
'SI'	'Silver'	F-Statistic	0.03057	0.02786	0.02868				sum of Var Parameter
		p-value	0.9699	0.9725	0.9717				VD in percent
'GC'	'Gold'	F-Statistic	2.56785	2.58328	2.6309	-0.006978	-0.007102	-0.006712	sum of Var Parameter
		p-value	0.0538	0.0528	0.0495	1.642979	1.635991	1.65E+00	VD in percent
'HG'	'Copper (US)'	F-Statistic	0.05229	0.13484	0.13941				sum of Var Parameter
		p-value	0.8192	0.7136	0.709				VD in percent
'LB'	'Lumber'	F-Statistic	0.38057	0.21021					sum of Var Parameter
		p-value	0.6837	0.8105					VD in percent

Panel A2: Working T-Index, WT SCOT

			WT SCOT does not Granger Cause return			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	0.03642	0.53033	0.88179				sum of Var Parameter
		p-value	0.8487	0.4668	0.3482				VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	1.02449	1.07074	0.94467				sum of Var Parameter
		p-value	0.3815	0.3611	0.4188				VD in percent
'MW'	'Wheat (MGE)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'C '	'Corn'	F-Statistic	0.6301	0.52704	0.57014				sum of Var Parameter
		p-value	0.5959	0.6639	0.6349				VD in percent
'RR'	'Rough Rice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LH'	'Lean Hogs'	F-Statistic	1.06305	1.89192	0.9288		-0.010023		sum of Var Parameter
		p-value	0.3742	0.0943	0.4266		1.555609		VD in percent
'LC'	'Live Cattle'	F-Statistic	1.37174	1.71228	4.03117			-0.017039	sum of Var Parameter
		p-value	0.2547	0.1816	0.0184			1.579586	VD in percent
'FC'	'Feeder Cattle'	F-Statistic	0.75171	0.00391					sum of Var Parameter
		p-value	0.3864	0.9502					VD in percent
'S '	'Soybeans'	F-Statistic	0.52111	0.41734	0.3442				sum of Var Parameter
		p-value	0.6679	0.7406	0.7934				VD in percent
'BO'	'Soybean Oil'	F-Statistic	1.54794	1.73641	1.65E+00				sum of Var Parameter
		p-value	0.2013	0.1587	0.1778				VD in percent
'SM'	'Soybean Meal'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CT'	'Cotton'	F-Statistic	0.26957	0.40256	0.58061				sum of Var Parameter
		p-value	0.8473	0.7512	0.628				VD in percent
'JO'	'Orange Juice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CC'	'Cocoa (US)'	F-Statistic	0.0169	0.01441	0.00492				sum of Var Parameter
		p-value	0.8966	0.9045	0.9441				VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.1095	0.23386	0.67658				sum of Var Parameter
		p-value	0.9545	0.8728	0.5667				VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.49503	0.49331	0.54112				sum of Var Parameter
		p-value	0.7394	0.7407	0.7056				VD in percent
'HO'	'Heating Oil'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CL'	'WTI (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'NG'	'Natural Gas (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PA'	'Palladium'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PL'	'Platinum'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'SI'	'Silver'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'GC'	'Gold'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'HG'	'Copper (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LB'	'Lumber'	F-Statistic							sum of Var Parameter
		p-value							VD in percent

Panel B1: Speculative Open Interest, SOI COT

			SOI_COT does not Granger Cause return			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	1.99631	2.15482	2.43572			-0.055144	sum of Var Parameter
		p-value	0.137	0.1171	0.0886			2.076743	VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	0.76461	0.78592	0.88424				sum of Var Parameter
		p-value	0.4661	0.4563	0.4137				VD in percent
'MW'	'Wheat (MGE)'	F-Statistic	2.84836	2.77467	2.50076	-0.012315	-0.00958	-0.014944	sum of Var Parameter
		p-value	0.0589	0.0634	0.0831	1.410485	1.154703	1.117197	VD in percent
'C '	'Corn'	F-Statistic	1.63772	1.9596	2.19971				sum of Var Parameter
		p-value	0.2013	0.1622	0.1387				VD in percent
'RR'	'Rough Rice'	F-Statistic	1.87611	1.58464	1.36382				sum of Var Parameter
		p-value	0.1543	0.2061	0.2567				VD in percent
'LH'	'Lean Hogs'	F-Statistic	0.0989	0.89339	2.94644			-0.031444	sum of Var Parameter
		p-value	0.7533	0.345	0.0867			0.569002	VD in percent
'LC'	'Live Cattle'	F-Statistic	0.52988	0.03049	0.08458				sum of Var Parameter
		p-value	0.467	0.8614	0.7713				VD in percent
'FC'	'Feeder Cattle'	F-Statistic	1.45574	2.30009					sum of Var Parameter
		p-value	0.2282	0.13					VD in percent
'S '	'Soybeans'	F-Statistic	0.64833	1.6161	2.39708				sum of Var Parameter
		p-value	0.4211	0.2043	0.1222				VD in percent
'BO'	'Soybean Oil'	F-Statistic	1.40824	1.71898	2.17549				sum of Var Parameter
		p-value	0.2359	0.1905	0.1409				VD in percent
'SM'	'Soybean Meal'	F-Statistic	1.03196	1.79469	2.56765				sum of Var Parameter
		p-value	0.3102	0.181	0.1097				VD in percent
'CT'	'Cotton'	F-Statistic	3.7289	5.29054	5.6039	-8.92E-02	-0.095348	-0.084002	sum of Var Parameter
		p-value	0.0541	0.0219	0.0183	1.101359	1.38E+00	1.29E+00	VD in percent
'JO'	'Orange Juice'	F-Statistic	0.20427	0.04435	0.00026				sum of Var Parameter
		p-value	0.6515	0.8333	0.9872				VD in percent
'CC'	'Cocoa (US)'	F-Statistic	0.00011	0.033	0.06745				sum of Var Parameter
		p-value	0.9915	0.8559	0.7952				VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.57566	0.63681	0.80289				sum of Var Parameter
		p-value	0.4484	0.4253	0.3707				VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.16464	0.22628	0.30546				sum of Var Parameter
		p-value	0.8482	0.7976	0.7369				VD in percent
'HO'	'Heating Oil'	F-Statistic	3.2608	4.32899	4.36184	-0.079479	-0.08286	-0.076401	sum of Var Parameter
		p-value	0.0716	0.038	0.0373	0.887883	1.200112	1.203823	VD in percent
'CL'	'WTI (US)'	F-Statistic	2.36764	2.63816	2.41993	-0.096612	-0.087719	-0.076268	sum of Var Parameter
		p-value	0.0948	0.0725	0.09	1.281187	1.384304	1.299451	VD in percent
'NG'	'Natural Gas (US)'	F-Statistic	0.40152	0.08862	0.54967				sum of Var Parameter
		p-value	0.5266	0.7661	0.4588				VD in percent
'PA'	'Palladium'	F-Statistic	0.33652	0.33339					sum of Var Parameter
		p-value	0.5621	0.5639					VD in percent
'PL'	'Platinum'	F-Statistic	0.22595	0.23193					sum of Var Parameter
		p-value	0.7978	0.7931					VD in percent
'SI'	'Silver'	F-Statistic	1.6821	1.68859	1.69616				sum of Var Parameter
		p-value	0.1953	0.1944	0.1934				VD in percent
'GC'	'Gold'	F-Statistic	0.19759	0.18744	0.1694				sum of Var Parameter
		p-value	0.6569	0.6653	0.6808				VD in percent
'HG'	'Copper (US)'	F-Statistic	0.07755	0.22747	0.25815				sum of Var Parameter
		p-value	0.7808	0.6336	0.6116				VD in percent
'LB'	'Lumber'	F-Statistic	0.98663	0.10645					sum of Var Parameter
		p-value	0.3211	0.7444					VD in percent

Panel B2: Speculative Open Interest, SOI SCOT

			SOI_SCOT does not Granger Cause			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	4.14904	4.27542	4.08601	-0.070162	-0.095553	-0.086904	sum of Var Parameter
		p-value	0.0164	0.0144	0.0174	6.431997	6.6077	5.943394	VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	0.00992	0.36194	0.55824				sum of Var Parameter
		p-value	0.9207	0.5477	0.4553				VD in percent
'MW'	'Wheat (MGE)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'C '	'Corn'	F-Statistic	1.88562	2.59853	3.20741			-0.080789	sum of Var Parameter
		p-value	0.1703	0.1076	0.0739			6.34E-01	VD in percent
'RR'	'Rough Rice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LH'	'Lean Hogs'	F-Statistic	0.58672	4.29773	1.1172		-0.065243		sum of Var Parameter
		p-value	0.624	0.0141	0.3281		1.597897		VD in percent
'LC'	'Live Cattle'	F-Statistic	2.51805	2.24522	2.77046	-0.056557	-0.043532	-0.040375	sum of Var Parameter
		p-value	0.1132	0.1347	0.0967	0.43774	0.644666	0.507938	VD in percent
'FC'	'Feeder Cattle'	F-Statistic	2.71237	3.43575		-0.035051			sum of Var Parameter
		p-value	0.1002	0.0644		1.281124			VD in percent
'S '	'Soybeans'	F-Statistic	1.17915	2.08105	2.40961				sum of Var Parameter
		p-value	0.2781	0.1498	0.1213				VD in percent
'BO'	'Soybean Oil'	F-Statistic	0.62213	0.88122	1.19082				sum of Var Parameter
		p-value	0.4307	0.3483	0.2757				VD in percent
'SM'	'Soybean Meal'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CT'	'Cotton'	F-Statistic	2.33724	3.71305	3.75159	-1.11E-01	-0.129639	-0.112728	sum of Var Parameter
		p-value	0.0977	0.0251	0.0242	1.0914	1.58E+00	1.49E+00	VD in percent
'JO'	'Orange Juice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CC'	'Cocoa (US)'	F-Statistic	0.00703	0.02802	0.03623				sum of Var Parameter
		p-value	0.9332	0.8671	0.8491				VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.44808	0.41072	0.42261				sum of Var Parameter
		p-value	0.5036	0.5219	0.516				VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.00746	0.00774	0.04903				sum of Var Parameter
		p-value	0.9926	0.9923	0.9522				VD in percent
'HO'	'Heating Oil'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CL'	'WTI (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'NG'	'Natural Gas (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PA'	'Palladium'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PL'	'Platinum'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'SI'	'Silver'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'GC'	'Gold'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'HG'	'Copper (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LB'	'Lumber'	F-Statistic							sum of Var Parameter
		p-value							VD in percent

Panel C1: Speculative Pressure, SP COT

			SP_COT does not Granger Cause			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBo'	F-Statistic	1.10023	0.00048	0.01353				sum of Var Parameter
		p-value	0.2947	0.9826	0.9075				VD in percent
'KW'	'Wheat (KBo'	F-Statistic	0.09525	0.08561	0.25227				sum of Var Parameter
		p-value	0.9092	0.918	0.7771				VD in percent
'MW'	'Wheat (MGI	F-Statistic	1.04594	1.65011	2.50838			0.013058	sum of Var Parameter
		p-value	0.3719	0.177	0.0582			1.661617	VD in percent
'C '	'Corn'	F-Statistic	0.16974	0.36277	0.4814				sum of Var Parameter
		p-value	0.8439	0.6959	0.6182				VD in percent
'RR'	'Rough Rice'	F-Statistic	0.83477	0.79659	1.45521				sum of Var Parameter
		p-value	0.4752	0.4962	0.2261				VD in percent
'LH'	'Lean Hogs'	F-Statistic	0.55763	1.54519	1.42026				sum of Var Parameter
		p-value	0.6935	0.188	0.2261				VD in percent
'LC'	'Live Cattle'	F-Statistic	2.50207	2.75213	3.30764	0.02144	0.01857	-0.029008	sum of Var Parameter
		p-value	0.0417	0.0277	0.0201	1.93553	2.176594	2.274949	VD in percent
'FC'	'Feeder Cattl	F-Statistic	0.80125	0.35735					sum of Var Parameter
		p-value	0.5248	0.8389					VD in percent
'S '	'Soybeans'	F-Statistic	0.62159	0.48069	0.20481				sum of Var Parameter
		p-value	0.6013	0.6959	0.8931				VD in percent
'BO'	'Soybean Oil	F-Statistic	1.92488	1.97503	1.89914				sum of Var Parameter
		p-value	0.1247	0.1169	0.1289				VD in percent
'SM'	'Soybean Me	F-Statistic	0.1903	0.35753	0.24737				sum of Var Parameter
		p-value	0.903	0.7837	0.8632				VD in percent
'CT'	'Cotton'	F-Statistic	0.25659	0.7966	0.63626				sum of Var Parameter
		p-value	0.7738	0.4515	0.5297				VD in percent
'JO'	'Orange Juic	F-Statistic	1.30277	1.29145	1.93179				sum of Var Parameter
		p-value	0.268	0.2724	0.104				VD in percent
'CC'	'Cocoa (US)'	F-Statistic	0.68147	0.64883	0.75979				sum of Var Parameter
		p-value	0.5637	0.584	0.5171				VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.43923	0.35138	0.29592				sum of Var Parameter
		p-value	0.6448	0.7039	0.744				VD in percent
'KC'	'Coffee (US)'	F-Statistic	1.93025	2.07978	2.17124		0.016028	0.018399	sum of Var Parameter
		p-value	0.1043	0.0824	0.0712		1.611063	1.685739	VD in percent
'HO'	'Heating Oil'	F-Statistic	0.54548	1.10672	1.07879				sum of Var Parameter
		p-value	0.5799	0.3315	0.3408				VD in percent
'CL'	'WTI (US)'	F-Statistic	1.78306	1.09063	0.86899				sum of Var Parameter
		p-value	0.1495	0.3527	0.457				VD in percent
'NG'	'Natural Gas	F-Statistic	0.01756	0.70257	1.50683				sum of Var Parameter
		p-value	0.9826	0.5509	0.212				VD in percent
'PA'	'Palladium'	F-Statistic	0.59129	0.59461					sum of Var Parameter
		p-value	0.554	0.5522					VD in percent
'PL'	'Platinum'	F-Statistic	4.11229	3.99435		0.004208	0.00422		sum of Var Parameter
		p-value	0.017	0.019		1.713562	1.673718		VD in percent
'SI'	'Silver'	F-Statistic	0.18404	0.19036	0.18462				sum of Var Parameter
		p-value	0.832	0.8267	0.8315				VD in percent
'GC'	'Gold'	F-Statistic	0.39822	0.40998	0.41621				sum of Var Parameter
		p-value	0.6717	0.6639	0.6598				VD in percent
'HG'	'Copper (US)	F-Statistic	0.93157	0.96042	0.90181				sum of Var Parameter
		p-value	0.4253	0.4112	0.4401				VD in percent
'LB'	'Lumber'	F-Statistic	1.17798	1.07712					sum of Var Parameter
		p-value	0.3176	0.3584					VD in percent

Panel C2: Speculative Pressure, SP SCOT

			SP_SCOT does not Granger Cause			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBo'	F-Statistic	0.18264	1.61591	1.73326				sum of Var Parameter
		p-value	0.6693	0.2043	0.1886				VD in percent
'KW'	'Wheat (KBo'	F-Statistic	0.20823	0.15637	0.19846				sum of Var Parameter
		p-value	0.8121	0.8553	0.8201				VD in percent
'MW'	'Wheat (MGE	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'C '	'Corn'	F-Statistic	0.95426	1.40804	1.77505				sum of Var Parameter
		p-value	0.3858	0.2456	0.1706				VD in percent
'RR'	'Rough Rice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LH'	'Lean Hogs'	F-Statistic	1.51315	2.80676	1.84574		0.024657		sum of Var Parameter
		p-value	0.1972	0.0253	0.138		2.0844		VD in percent
'LC'	'Live Cattle'	F-Statistic	0.62909	1.88783	2.45452			0.017644	sum of Var Parameter
		p-value	0.5965	0.1307	0.0625			2.294036	VD in percent
'FC'	'Feeder Cattl	F-Statistic	0.58481	0.37698					sum of Var Parameter
		p-value	0.6738	0.8251					VD in percent
'S '	'Soybeans'	F-Statistic	1.20219	1.34966	1.36025				sum of Var Parameter
		p-value	0.3015	0.2603	0.2576				VD in percent
'BO'	'Soybean Oil	F-Statistic	2.86208	2.94962	2.84662	0.013227	0.014999	0.018649	sum of Var Parameter
		p-value	0.0364	0.0324	0.0372	1.68784	1.626255	1.49545	VD in percent
'SM'	'Soybean Me	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CT'	'Cotton'	F-Statistic	0.36351	0.9647	0.80598				sum of Var Parameter
		p-value	0.6954	0.3818	0.4473				VD in percent
'JO'	'Orange Juice	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CC'	'Cocoa (US)'	F-Statistic	0.97073	0.7635	0.84617				sum of Var Parameter
		p-value	0.4063	0.5149	0.4691				VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.89315	0.55201	0.35025				sum of Var Parameter
		p-value	0.4101	0.5762	0.7047				VD in percent
'KC'	'Coffee (US)'	F-Statistic	3.12893	3.39435	3.57709	0.020559	0.023577	0.024515	sum of Var Parameter
		p-value	0.0148	0.0094	0.0069	2.418087	2.597253	2.733523	VD in percent
'HO'	'Heating Oil'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CL'	'WTI (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'NG'	'Natural Gas	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PA'	'Palladium'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PL'	'Platinum'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'SI'	'Silver'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'GC'	'Gold'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'HG'	'Copper (US)	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LB'	'Lumber'	F-Statistic							sum of Var Parameter
		p-value							VD in percent

Table 4: Speculative effects on volatility

The table contains the results of Granger causality tests (respectively, Y-T augmented Granger causality tests where the speculation proxy is non-stationary) that speculative positions do not "cause" the variance of subsequent futures returns. The weekly variance is measured by squared returns. The F-statistic and p-value of the test are displayed in the third 4th to 6th columns. For those cases where a significant effect is found with 90% confidence, the results of a variance decomposition is displayed in the 7th to 9th columns, which show the impact (sum of the VAR parameters) and explained variance (in percentages). The results are displayed in separate Panels for three speculation proxies: Working T-index WT (Panel A), relative speculative open interest SOI (Panel B), and speculation pressure SP (Panel C). The construction of the measures is described in Section 2 in the text. Each speculation proxy is calculated with CFTC position data from two data sources: the COT Commitments of Traders Reports, and SCOT Supplemental Commitments of Traders Reports which contains a reclassification of "index traders" (Subpanels A1, A2, etc.). The abbreviations of commodities are clarified in Table 2. Weekly data are used which cover the period from January 2006 to March 2015.

Panel A1: Working T-Index, WT COT

			WT_COT does not Granger Cause vola			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	6.05246	3.0636	2.00331	-0.009015	-0.005735		sum of Var Parameter
		p-value	0.0025	0.0476	0.136	5.123659	3.760056		VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	4.45615	4.18168	2.99722	-0.004612	-0.00406	-0.002916	sum of Var Parameter
		p-value	0.0121	0.0158	0.0509	2.686135	3.024322	2.433866	VD in percent
'MW'	'Wheat (MGE)'	F-Statistic	3.09417	2.28512	1.65893	-0.005563			sum of Var Parameter
		p-value	0.0792	0.1313	0.1984	1.631934			VD in percent
'C '	'Corn'	F-Statistic	3.74751	3.3228	2.29986	-4.54E-03	-0.003701		sum of Var Parameter
		p-value	0.0535	0.069	0.13	1.093241	1.01E+00		VD in percent
'RR'	'Rough Rice'	F-Statistic	0.80791	0.86349	0.83461				sum of Var Parameter
		p-value	0.3692	0.3532	0.3614				VD in percent
'LH'	'Lean Hogs'	F-Statistic	2.39518	1.52106	4.1793	0.002239		0.00095	sum of Var Parameter
		p-value	0.0923	0.2181	0.0415	1.583293		1.28918	VD in percent
'LC'	'Live Cattle'	F-Statistic	0.00138	0.2024	0.94294				sum of Var Parameter
		p-value	0.9704	0.976	0.332				VD in percent
'FC'	'Feeder Cattle'	F-Statistic	0.33436	0.58571					sum of Var Parameter
		p-value	0.5634	0.4445					VD in percent
'S '	'Soybeans'	F-Statistic	4.76342	4.75682	4.59489	-0.00351	-0.003694	-0.003261	sum of Var Parameter
		p-value	0.009	0.009	0.0106	3.092314	3.547874	4.209767	VD in percent
'BO'	'Soybean Oil'	F-Statistic	4.30885	4.91957	5.02102	-0.003824	-0.003919	-0.003849	sum of Var Parameter
		p-value	0.014	0.0077	0.007	4.653944	5.390993	5.663651	VD in percent
'SM'	'Soybean Meal'	F-Statistic	6.29263	13.1714	13.8543	-0.007986	-0.010337	-0.009135	sum of Var Parameter
		p-value	0.002	0.000003	0.000001	3.641955	6.722214	8.050147	VD in percent
'CT'	'Cotton'	F-Statistic	1.1995	1.10302	1.1995				sum of Var Parameter
		p-value	0.3095	0.3475	0.3095				VD in percent
'JO'	'Orange Juice'	F-Statistic	1.13002	1.52158	1.11029				sum of Var Parameter
		p-value	0.3239	0.2194	0.3303				VD in percent
'CC'	'Cocoa (US)'	F-Statistic	2.75556	3.51991	3.80129	0.007579	0.006732	0.006511	sum of Var Parameter
		p-value	0.0646	0.0304	0.023	1.31975	1.511248	1.640488	VD in percent
'SB'	'Sugar (US)'	F-Statistic	6.4231	6.25173	3.52996	-0.013762	-0.012911	-0.008482	sum of Var Parameter
		p-value	0.0003	0.0004	0.0149	6.273065	5.87149	3.369042	VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.5785	0.6883	0.76591				sum of Var Parameter
		p-value	0.6294	0.5595	0.5136				VD in percent
'HO'	'Heating Oil'	F-Statistic	4.67898	4.62827	4.6566	-0.010614	-0.007912	-0.006747	sum of Var Parameter
		p-value	0.0097	0.0102	0.0099	4.089296	4.386972	4.431285	VD in percent
'CL'	'WTI (US)'	F-Statistic	0.59669	0.13048	0.0366				sum of Var Parameter
		p-value	0.551	0.942	0.9641				VD in percent
'NG'	'Natural Gas (US)'	F-Statistic	5.10791	4.62259	5.57526	-0.004464	-0.002175	-0.001202	sum of Var Parameter
		p-value	0.0243	0.0321	0.0186	1.431037	1.444319	1.564546	VD in percent
'PA'	'Palladium'	F-Statistic	8.57391	8.46719		0.008047	0.007882		sum of Var Parameter
		p-value	0.0036	0.0038		2.642898	2.600012		VD in percent
'PL'	'Platinum'	F-Statistic	3.31375	3.22354		0.001842	0.001816		sum of Var Parameter
		p-value	0.0199	0.0225		4.735843	4.63961		VD in percent
'SI'	'Silver'	F-Statistic	0.94445	0.93695	0.94559				sum of Var Parameter
		p-value	0.3896	0.3925	0.3892				VD in percent
'GC'	'Gold'	F-Statistic	0.33201	0.32384	0.31474				sum of Var Parameter
		p-value	0.7176	0.7235	0.7301				VD in percent
'HG'	'Copper (US)'	F-Statistic	31.2973	31.6813	32.0895	-0.01039	-0.010066	-0.009699	sum of Var Parameter
		p-value	0.00000004	0.00000003	0.00000003	7.440139	7.47006	7.482989	VD in percent
'LB'	'Lumber'	F-Statistic	0.23838	0.54155					sum of Var Parameter
		p-value	0.788	0.5822					VD in percent

Panel A2: Working T-Index, WT SCOT

			WT_SCOT does not Granger Cause vola			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	4.3424	2.41556	1.45443	-0.002865	-0.001868		sum of Var Parameter
		p-value	0.0135	0.0904	0.2346	5.142309	3.810255		VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	2.48769	2.12027	1.79622	-0.0034018	-0.00285		sum of Var Parameter
		p-value	0.0599	0.0968	0.147	3.275752	3.542285		VD in percent
'MW'	'Wheat (MGE)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'C '	'Corn'	F-Statistic	1.66612	1.60965	1.46093				sum of Var Parameter
		p-value	0.1735	0.1863	0.2245				VD in percent
'RR'	'Rough Rice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LH'	'Lean Hogs'	F-Statistic	4.15092	1.31503	2.26917	0.001669	0.0005894	0.000436	sum of Var Parameter
		p-value	0.0064	0.2688	0.0797	4.440158	1.608286	2.269327	VD in percent
'LC'	'Live Cattle'	F-Statistic	1.81281	1.79203	0.2363				sum of Var Parameter
		p-value	0.1252	0.1292	0.7896				VD in percent
'FC'	'Feeder Cattle'	F-Statistic	0.00533	0.01989					sum of Var Parameter
		p-value	0.9418	0.8879					VD in percent
'S '	'Soybeans'	F-Statistic	2.12025	2.52182	2.17661	-0.002663	-0.002727	-0.002261	sum of Var Parameter
		p-value	0.0968	0.0572	0.09	2.364164	3.139186	3.605401	VD in percent
'BO'	'Soybean Oil'	F-Statistic	8.67142	3.58746	3.59069	-0.002323	-0.001853	-0.001782	sum of Var Parameter
		p-value	0.0034	0.0284	0.0283	3.33726	3.579294	3.630084	VD in percent
'SM'	'Soybean Meal'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CT'	'Cotton'	F-Statistic	1.49771	1.31571	1.2325				sum of Var Parameter
		p-value	0.2144	0.2686	0.2973				VD in percent
'JO'	'Orange Juice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CC'	'Cocoa (US)'	F-Statistic	1.96112	5.0055	5.67366		0.004362	0.004185	sum of Var Parameter
		p-value	0.162	0.0257	0.0176		1.069573	1.22538	VD in percent
'SB'	'Sugar (US)'	F-Statistic	6.12172	5.98761	3.41525	-0.009886	-0.009282	-0.00613	sum of Var Parameter
		p-value	0.0004	0.0005	0.0174	5.920283	5.556627	3.202456	VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.83204	0.91812	0.93788				sum of Var Parameter
		p-value	0.4767	0.4319	0.4221				VD in percent
'HO'	'Heating Oil'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CL'	'WTI (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'NG'	'Natural Gas (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PA'	'Palladium'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PL'	'Platinum'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'SI'	'Silver'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'GC'	'Gold'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'HG'	'Copper (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LB'	'Lumber'	F-Statistic							sum of Var Parameter
		p-value							VD in percent

Panel B1: Speculative Open Interest, SOI COT

			SOI_COT does not Granger Cause vola			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	4.00495	1.70638	0.65988	-0.041038			sum of Var Parameter
		p-value	0.0188	0.1826	0.5174	1.756423			VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	5.18532	5.40638	3.75839	-0.010451	-0.009861	-0.006961	sum of Var Parameter
		p-value	0.0059	0.0048	0.024	3.269703	4.138902	3.329955	VD in percent
'MW'	'Wheat (MGE)'	F-Statistic	0.19501	0.29566	0.25864				sum of Var Parameter
		p-value	0.8229	0.7442	0.7722				VD in percent
'C '	'Corn'	F-Statistic	0.19632	0.20951	0.50813				sum of Var Parameter
		p-value	0.6579	0.6474	0.4763				VD in percent
'RR'	'Rough Rice'	F-Statistic	0.68853	0.67953	0.48982				sum of Var Parameter
		p-value	0.5028	0.5073	0.613				VD in percent
'LH'	'Lean Hogs'	F-Statistic	1.6061	0.85634	0.03451				sum of Var Parameter
		p-value	0.2057	0.3552	0.8527				VD in percent
'LC'	'Live Cattle'	F-Statistic	0.0063	0.77979	2.11899				sum of Var Parameter
		p-value	0.9368	0.5387	0.1461				VD in percent
'FC'	'Feeder Cattle'	F-Statistic	0.30434	0.38012					sum of Var Parameter
		p-value	0.5814	0.5378					VD in percent
'S '	'Soybeans'	F-Statistic	0.39202	0.06917	0.05248				sum of Var Parameter
		p-value	0.5315	0.7927	0.8189				VD in percent
'BO'	'Soybean Oil'	F-Statistic	7.93173	7.8849	8.05369	-0.002703	-0.002869	-0.002878	sum of Var Parameter
		p-value	0.0004	0.0004	0.0004	3.863667	4.078359	4.136363	VD in percent
'SM'	'Soybean Meal'	F-Statistic	1.50268	8.61912	13.4335	-0.003462	-0.007147	-0.007665	sum of Var Parameter
		p-value	0.2209	0.0035	0.0003	0.388864	2.337641	4.122513	VD in percent
'CT'	'Cotton'	F-Statistic	0.97751	0.86834	0.33813				sum of Var Parameter
		p-value	0.377	0.4203	0.5612				VD in percent
'JO'	'Orange Juice'	F-Statistic	1.69253	2.63642	2.52457				sum of Var Parameter
		p-value	0.1939	0.1051	0.1127				VD in percent
'CC'	'Cocoa (US)'	F-Statistic	4.46521	4.71934	4.99344	-0.005054	-0.003861	-0.003578	sum of Var Parameter
		p-value	0.0351	0.0303	0.0259	0.986696	1.214758	1.367697	VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.40762	0.44507	0.38489				sum of Var Parameter
		p-value	0.5235	0.505	0.5353				VD in percent
'KC'	'Coffee (US)'	F-Statistic	1.85809	1.92709	2.21239				sum of Var Parameter
		p-value	0.1571	0.1467	0.1106				VD in percent
'HO'	'Heating Oil'	F-Statistic	3.1134	1.36784	1.30421	-0.006624			sum of Var Parameter
		p-value	0.0783	0.2428	0.254	2.521204			VD in percent
'CL'	'WTI (US)'	F-Statistic	0.93971	2.24177	2.63325		0.004742	0.00341	sum of Var Parameter
		p-value	0.3915	0.0636	0.0494		3.83243	2.945885	VD in percent
'NG'	'Natural Gas (US)'	F-Statistic	4.23006	3.37496	2.91459	-0.00987	-0.004509	-0.002109	sum of Var Parameter
		p-value	0.0403	0.0668	0.0884	1.298412	1.00251	0.845098	VD in percent
'PA'	'Palladium'	F-Statistic	0.4425	0.43894					sum of Var Parameter
		p-value	0.5062	0.508					VD in percent
'PL'	'Platinum'	F-Statistic	2.43699	2.19923		-0.001819			sum of Var Parameter
		p-value	0.0885	0.112		1.554395			VD in percent
'SI'	'Silver'	F-Statistic	14.1332	14.0587	13.9185	0.029167	0.028932	0.028426	sum of Var Parameter
		p-value	0.0002	0.0002	0.0002	3.837544	3.821303	3.799476	VD in percent
'GC'	'Gold'	F-Statistic	2.87621	2.74435	2.66229	0.004571	0.004496		sum of Var Parameter
		p-value	0.0906	0.0983	0.1034	1.47928	1.485861		VD in percent
'HG'	'Copper (US)'	F-Statistic	11.3124	11.5763	11.8318	-0.009611	-0.009364	-0.009063	sum of Var Parameter
		p-value	0.0008	0.0007	0.0006	3.232234	3.257003	3.219725	VD in percent
'LB'	'Lumber'	F-Statistic	0.75815	1.53726					sum of Var Parameter
		p-value	0.3843	0.2156					VD in percent

Panel B2: Speculative Open Interest, SOI SCOT

			SOI_SCOT does not Granger Cause vola			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	1.95424	0.58106	0.45481				sum of Var Parameter
		p-value	0.1428	0.5597	0.6348				VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	10.0771	10.191	8.23806	-0.011974	-0.011164	-0.008447	sum of Var Parameter
		p-value	0.00005	0.00005	0.0003	5.331199	6.484671	5.940309	VD in percent
'MW'	'Wheat (MGE)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'C '	'Corn'	F-Statistic	0.12163	0.09495	0.00147				sum of Var Parameter
		p-value	0.7274	0.7581	0.9694				VD in percent
'RR'	'Rough Rice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LH'	'Lean Hogs'	F-Statistic	1.48308	1.12451	2.94053			0.001478	sum of Var Parameter
		p-value	0.2183	0.3257	0.0538			1.818963	VD in percent
'LC'	'Live Cattle'	F-Statistic	0.80094	0.70401	4.95625			0.001252	sum of Var Parameter
		p-value	0.3713	0.5895	0.0265			2.529184	VD in percent
'FC'	'Feeder Cattle'	F-Statistic	0.40133	0.15662					sum of Var Parameter
		p-value	0.5267	0.6925					VD in percent
'S '	'Soybeans'	F-Statistic	6.22059	4.62472	2.38207	0.007089	0.005442		sum of Var Parameter
		p-value	0.013	0.032	0.1234	1.909424	1.563558		VD in percent
'BO'	'Soybean Oil'	F-Statistic	9.54542	9.74999	10.1531	-0.004119	-0.004192	-0.004176	sum of Var Parameter
		p-value	0.00009	0.00007	0.00005	4.870406	5.185869	5.402133	VD in percent
'SM'	'Soybean Meal'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CT'	'Cotton'	F-Statistic	0.83449	0.50429	0.16688				sum of Var Parameter
		p-value	0.4754	0.6795	0.8463				VD in percent
'JO'	'Orange Juice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CC'	'Cocoa (US)'	F-Statistic	0.73699	1.1692	1.4647				sum of Var Parameter
		p-value	0.3911	0.2801	0.2268				VD in percent
'SB'	'Sugar (US)'	F-Statistic	3.25371	2.25104	0.63921	0.011207			sum of Var Parameter
		p-value	0.0719	0.1342	0.4244	1.044394			VD in percent
'KC'	'Coffee (US)'	F-Statistic	1.47011	1.64049	1.80343				sum of Var Parameter
		p-value	0.2309	0.195	0.1659				VD in percent
'HO'	'Heating Oil'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CL'	'WTI (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'NG'	'Natural Gas (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PA'	'Palladium'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PL'	'Platinum'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'SI'	'Silver'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'GC'	'Gold'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'HG'	'Copper (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LB'	'Lumber'	F-Statistic							sum of Var Parameter
		p-value							VD in percent

Panel C1: Speculative Pressure, SP COT

			SP_COT does not Granger Cause vola			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	2.43716	1.71787	1.06839				sum of Var Parameter
		p-value	0.0885	0.1806	0.3444				VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	3.04466	2.56591	1.63324	0.00214	0.0018		sum of Var Parameter
		p-value	0.0485	0.0779	0.1964	2.238464	2.452332		VD in percent
'MW'	'Wheat (MGE)'	F-Statistic	1.77562	0.57587	0.21403				sum of Var Parameter
		p-value	0.1833	0.4483	0.6438				VD in percent
'C '	'Corn'	F-Statistic	0.10129	0.26773	0.73505				sum of Var Parameter
		p-value	0.9037	0.7652	0.48				VD in percent
'RR'	'Rough Rice'	F-Statistic	2.22436	1.2868	0.82971	0.000705			sum of Var Parameter
		p-value	0.0846	0.2742	0.478	3.100328			VD in percent
'LH'	'Lean Hogs'	F-Statistic	1.74676	0.98733	1.75882				sum of Var Parameter
		p-value	0.1385	0.414	0.136				VD in percent
'LC'	'Live Cattle'	F-Statistic	1.80541	2.24333	1.96322		-2.6E-05	6.8E-05	sum of Var Parameter
		p-value	0.1103	0.0491	0.099		2.265282	1.967992	VD in percent
'FC'	'Feeder Cattle'	F-Statistic	3.28087	2.57934		-0.000342	-0.000244		sum of Var Parameter
		p-value	0.0208	0.053		2.288867	1.883624		VD in percent
'S '	'Soybeans'	F-Statistic	1.13312	1.19192	0.97231				sum of Var Parameter
		p-value	0.3352	0.3123	0.4055				VD in percent
'BO'	'Soybean Oil'	F-Statistic	6.32293	5.74085	3.26885	0.007828	0.007125	0.00472	sum of Var Parameter
		p-value	0.002	0.0034	0.0389	3.390299	3.09483	1.698085	VD in percent
'SM'	'Soybean Meal'	F-Statistic	2.18314	2.74592	2.20024	0.001809	0.0018121	0.0013829	sum of Var Parameter
		p-value	0.0892	0.0425	0.0873	2.273118	2.871685	2.767447	VD in percent
'CT'	'Cotton'	F-Statistic	0.06954	0.01579	0.15664				sum of Var Parameter
		p-value	0.9328	0.9843	0.8551				VD in percent
'JO'	'Orange Juice'	F-Statistic	0.99894	1.05375	1.09732				sum of Var Parameter
		p-value	0.3931	0.3685	0.3499				VD in percent
'CC'	'Cocoa (US)'	F-Statistic	3.53613	1.9236	2.07702	-0.002406			sum of Var Parameter
		p-value	0.0299	0.1472	0.1264	1.684807			VD in percent
'SB'	'Sugar (US)'	F-Statistic	6.32293	5.74085	3.26885	0.007828	0.007125	0.00472	sum of Var Parameter
		p-value	0.002	0.0034	0.0389	3.390299	3.09483	1.698085	VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.65482	0.83188	0.85721				sum of Var Parameter
		p-value	0.5802	0.4768	0.4632				VD in percent
'HO'	'Heating Oil'	F-Statistic	0.8764	1.44437	1.75386				sum of Var Parameter
		p-value	0.417	0.23	0.186				VD in percent
'CL'	'WTI (US)'	F-Statistic	4.2868	5.06754	5.37409	-0.014293	-0.009574	-0.008714	sum of Var Parameter
		p-value	0.0143	0.0066	0.0049	4.13596	4.841894	5.398708	VD in percent
'NG'	'Natural Gas (US)'	F-Statistic	4.59232	1.39162	1.07312	0.013193			sum of Var Parameter
		p-value	0.0106	0.2497	0.3428	3.230604			VD in percent
'PA'	'Palladium'	F-Statistic	2.28955	2.23882					sum of Var Parameter
		p-value	0.1024	0.1077					VD in percent
'PL'	'Platinum'	F-Statistic	1.91526	1.86392					sum of Var Parameter
		p-value	0.1262	0.1348					VD in percent
'SI'	'Silver'	F-Statistic	0.27901	0.29038	0.29591				sum of Var Parameter
		p-value	0.7567	0.7481	0.744				VD in percent
'GC'	'Gold'	F-Statistic	1.49236	1.48121	1.51315				sum of Var Parameter
		p-value	0.2225	0.2242	0.2193				VD in percent
'HG'	'Copper (US)'	F-Statistic	3.91294	3.8165	3.8165	-0.002468	-0.002391	-0.002309	sum of Var Parameter
		p-value	0.0089	0.0101	0.0101	4.208553	4.117223	4.126318	VD in percent
'LB'	'Lumber'	F-Statistic	1.3562	0.469					sum of Var Parameter
		p-value	0.2586	0.6259					VD in percent

Panel C2: Speculative Pressure, SP SCOT

			SP_SCOT does not Granger Cause vola			VAR/Variance Decomposition			
			maturity	maturity	maturity	maturity	maturity	maturity	
			52	183	365	52	183	365	
'W '	'Wheat (CBoT)'	F-Statistic	6.82233	4.07554	2.38895	0.005558	0.003868		sum of Var Parameter
		p-value	0.0093	0.0441	0.1229	2.036392	1.407653		VD in percent
'KW'	'Wheat (KBoT)'	F-Statistic	1.78664	1.60633	0.84044				sum of Var Parameter
		p-value	0.1687	0.2017	0.4322				VD in percent
'MW'	'Wheat (MGE)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'C '	'Corn'	F-Statistic	0.19058	0.42157	1.7206				sum of Var Parameter
		p-value	0.6626	0.5165	0.1902				VD in percent
'RR'	'Rough Rice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LH'	'Lean Hogs'	F-Statistic	2.63287	1.651	1.13202	-0.002212			sum of Var Parameter
		p-value	0.0494	0.1768	0.3357	2.91039			VD in percent
'LC'	'Live Cattle'	F-Statistic	2.72624	2.73126	2.54488	-0.000405	5.9E-05	0.000122	sum of Var Parameter
		p-value	0.0665	0.0191	0.0389	1.272666	2.622133	2.51788	VD in percent
'FC'	'Feeder Cattle'	F-Statistic	2.44347	2.08242		-0.000313			sum of Var Parameter
		p-value	0.0634	0.1017		1.90874			VD in percent
'S '	'Soybeans'	F-Statistic	1.31447	2.30716	2.16299				sum of Var Parameter
		p-value	0.2696	0.1007	0.1161				VD in percent
'BO'	'Soybean Oil'	F-Statistic	0.17726	0.11497	1.15486				sum of Var Parameter
		p-value	0.8376	0.8914	0.316				VD in percent
'SM'	'Soybean Meal'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CT'	'Cotton'	F-Statistic	0.32298	0.55192	1.05191				sum of Var Parameter
		p-value	0.7241	0.5762	0.3501				VD in percent
'JO'	'Orange Juice'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CC'	'Cocoa (US)'	F-Statistic	2.85176	1.1326	1.23034	-0.00242			sum of Var Parameter
		p-value	0.0587	0.3231	0.2931	1.473287			VD in percent
'SB'	'Sugar (US)'	F-Statistic	0.14118	0.07915	0.17795				sum of Var Parameter
		p-value	0.8684	0.9239	0.837				VD in percent
'KC'	'Coffee (US)'	F-Statistic	0.57712	0.74403	0.82004				sum of Var Parameter
		p-value	0.6303	0.5262	0.4832				VD in percent
'HO'	'Heating Oil'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'CL'	'WTI (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'NG'	'Natural Gas (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PA'	'Palladium'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'PL'	'Platinum'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'SI'	'Silver'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'GC'	'Gold'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'HG'	'Copper (US)'	F-Statistic							sum of Var Parameter
		p-value							VD in percent
'LB'	'Lumber'	F-Statistic							sum of Var Parameter
		p-value							VD in percent

Appendix

Table App1: Rollover schedule of commodity contracts

Commodity	BD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wheat	12	03	05	05	07	07	09	09	12	12	12	03	03
Kansas Wheat	12	03	05	05	07	07	09	09	12	12	12	03	03
Minneapolis Wheat	12	03	05	05	07	07	09	09	12	12	12	03	03
Corn	12	03	05	05	07	07	09	09	12	12	12	03	03
Rough Rice	12	03	05	05	07	07	09	09	11	11	01	01	03
Lean Hogs	12	04	04	06	06	07	08	10	10	12	12	02	02
Live Cattle	12	04	04	06	06	08	08	10	10	12	12	02	02
Feeder Cattle	12	03	04	05	08	08	08	09	10	11	01	01	03
Soybean	12	03	05	05	07	07	08	09	11	11	01	01	03
Bean Oil	12	03	05	05	07	07	08	09	12	12	12	01	03
Soybean Meal	12	03	05	05	07	07	08	09	12	12	12	01	03
Cotton	12	03	05	05	07	07	10	10	10	12	12	03	03
Orange Juice	12	03	05	05	07	07	09	09	11	11	01	01	03
Cocoa	12	03	05	05	07	07	09	09	12	12	12	03	03
Sugar	12	03	05	05	07	07	10	10	10	03	03	03	03
Coffee	12	03	05	05	07	07	09	09	12	12	12	03	03
Heating Oil	9	03	04	05	06	07	08	09	10	11	12	01	02
WTI Crude Oil	9	03	04	05	06	07	08	09	10	11	12	01	02
Natural Gas	9	03	04	05	06	07	08	09	10	11	12	01	02
Palladium	12	03	06	06	06	09	09	09	12	12	12	03	03
Platinum	12	04	04	07	07	07	10	10	10	01	01	01	04
Silver	12	03	05	05	07	07	09	09	12	12	12	03	03
Gold	12	04	04	06	06	08	08	12	12	12	12	02	02
Copper Comex	12	03	05	05	07	07	09	09	12	12	12	03	03
Lumber	12	03	05	05	07	07	09	09	11	11	01	01	03