Return Predictability Revisited

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Abstract

We are able to predict a huge amount of variation in monthly stock market returns when we use a very simple and theoretically more appealing approach of refining the observation intervals of the variables used to predict these returns. In contrast to normal short-term predictability studies which have notoriously low R^2s of around one or two percent, we find R^2s, based on price changes in economically important commodities, of up to 18 percent. Shorter intervals reveal return predictability consistent with near efficient markets based on price changes in industrial metals, and more historical intervals expose predictability consistent with the gradual information diffusion hypothesis based on price changes in energy series. This predictability is statistically and economically significant, robust to data mining adjustment, does not appear to be a consequence of time-varying risk premia, and provides investors with the opportunity to make out-of-sample economic profits. Taken together, our results provide strong support for Kendall's (1953) conclusion that "the interval of observation may be very important" for stock market return predictability tests.

Key words: observation interval, return predictability tests, market efficiency, gradual information diffusion, market timing.

JEL classification codes: C8, G1

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Abstract

We are able to predict a huge amount of variation in monthly stock market returns when we use a very simple and theoretically more appealing approach of refining the observation intervals of the variables used to predict these returns. In contrast to normal short-term predictability studies which have notoriously low R^2s of around one or two percent, we find R^2s, based on price changes in economically important commodities, of up to 18 percent. Shorter intervals reveal return predictability consistent with near efficient markets based on price changes in industrial metals, and more historical intervals expose predictability consistent with the gradual information diffusion hypothesis based on price changes in energy series. This predictability is statistically and economically significant, robust to data mining adjustment, does not appear to be a consequence of time-varying risk premia, and provides investors with the opportunity to make out-of-sample economic profits. Taken together, our results provide strong support for Kendall's (1953) conclusion that "the interval of observation may be very important" for stock market return predictability tests.

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1. Introduction

Monthly stock market returns are predictable when we refine observation intervals. We find a huge increase in the explainable variation of stock returns and in the statistical and economic significance of the predictability once we refine observation intervals. Traditional market efficiency tests use monthly observations to predict monthly returns but this seems a crude approach that is based on convention rather than theory. For instance, if markets are not fully informationally efficient but rather respond with a slight delay it is plausible that recent information might better predict stock market returns. Using a full month of data to predict may increase noise levels and understate, or even fully mask, the actual predictability present. Our results confirm this intuition. Price changes of industrial metal commodities (particularly aluminum and zinc) measured over intervals of less than one month predict monthly stock returns in many countries around the world. This predictability is economically and statistically significant, robust to data mining adjustment and survives the usual robustness checks used in the literature.[1]

Our approach of varying the commodity return observation interval used to predict monthly stock returns should also work if information is gradually diffusing into stock market returns as suggested by Hong and Stein (1999). We find that it does. Our results generalize the finding of Driesprong, Jacobsen and Maat (2008). We show that information from price changes in many energy commodities other than crude oil gradually diffuses into stock markets around the world over periods of more than one month. Again, these results are

[1] We initially look at the ability of commodity returns to predict US equity index returns but before concluding they possess predictive power over any given interval we check this predictability holds in a range of international markets. We then check that the predictability holds, both in the US and internationally, in the most recent sub-period. Essentially, we follow the same path the finance literature takes in the discovery of new anomalies. Often these are first documented for the US and subsequently other studies focus on the existence of similar patterns in markets in different countries and over different time periods.

present in many countries in the world, are robust to data mining adjustment, and satisfy all the usual robustness checks.

The predictability we document is very strong. We use a general-to-specific approach to determine the most important commodities in each market. This results in an R^2 of 18.5% in the US, which is substantially larger than the 1 or 2% R^2s often reported for regressions using other predictors to forecast US equity market returns. For instance, Goetzmann and Jorion (1993) find that the R^2 of a regression that uses dividend yields to predict one month US equity market returns is just 1%.

We also show that these predictability findings cannot be attributed to time-varying risk premia. This distinguishes our results from the literature that studies whether stock returns might be predictable from variables like dividend yields and interest rates.[2] Based on Schwert's (2003) intuition that when predictability is a consequence of time-varying risk premia stock market returns below the risk free rate should not be forecastable, Driesprong, Jacobsen and Maat (2008) develop a new test to verify whether predictability is caused by time-varying risk premia. Even though their test is harsh and asks a lot from the data we find that commodity price changes frequently predict stock returns lower than the short term interest rate and therefore pass their test. Our focus on (log) changes in commodity prices also ensures that our results are not hampered by persistency and overlapping sample problems that some (e.g. Campbell and Yogo, 2006) argue might invalidate return predictability results based on these other variables such as dividend yields.

2 See for instance the discussion in the July 2008 special issue of the Review of Financial Studies on the predictability of stock returns using these variables.

Last but not least, we show our results are highly economically significant. A simple trading rule that uses past movements in commodity prices to generate an out-of-sample signal to an investor to invest in the equity market or T-bills results in a Sharpe ratio that is almost three times larger than the buy-and-hold Sharpe ratio (after trading costs are accounted for) in the US over the 2003-2008 period. International results are similar and at times considerably larger than in the US. For instance, in UK and Japan the Sharpe ratios are 0.16 and 0.35 compared to 0.05 and 0.06 for a buy-and-hold portfolio.

Our paper contributes to the literature, as we are the first to show that changing measurement intervals has dramatic consequences for conclusions regarding stock market return predictability.[3] Interestingly, the suggestion that this might be the case has been around for many years. In one of the first statistical analyses of stock returns in 1953 - the study that stood at the cradle of the efficient market hypothesis - Kendall concluded (p. 18) that "the interval of observation may be very important" for return predictability tests, but this assumption seems to have been ignored in the return predictability literature ever since. Our results suggest that Kendall's warning is warranted. Had Kendall's famous *Demon of Chance*[4] given him not weekly observations but observations at a different frequency, he would most likely not have concluded that stock returns followed a random walk and, taking this argument one step further, the efficient market hypothesis might never have been put forward. Our reconsideration of Kendall's seminal work using more recent knowledge is similar in spirit to Brown, Goetzmann, and Kumar (1998) who revisit one of the other seminal works on the efficient market hypothesis (Cowles, 1934) and conclude that more recent techniques

[3] Other researchers, such as Campbell and Thompson (2008), use different intervals (e.g. monthly and annual) in return predictability studies to ensure robustness, but they do not link them to the efficient markets and gradual information diffusion hypotheses as we do.

[4] Kendall's quote (p. 13) that "The series looks like a "wandering" one as if once a week the Demon of Chance drew a random number ... and added it to the current price to determine next week's price" is quoted in many textbooks (For instance Brealey and Myers (1996): Principles of Corporate Finance (5th international edition, pg. 324).)

support the opposite conclusion to that made by Cowles. In other words, using insights and knowledge available today they find evidence against market efficiency.

The lack of consideration given to measurement intervals by the return predictability literature is surprising as many studies in other areas of finance find that the choice of observation intervals can have a big impact on findings.[5] In these examples there is often a lack of theoretical guidance regarding the appropriate interval of observation. However, in the return predictability area theory suggests that using monthly returns to predict monthly returns may understate true predictability.

There are several plausible theoretical arguments why commodity price movements might predict stock returns. Commodities are a major input in most production processes which means that any firm that does not pass commodity price increases on to the consumer via an increase in the price of their finished goods will suffer margin erosion and a decline in profitability, which can be expected to adversely affect stock returns. However, if firms respond to commodity price increases by increasing the price of their finished goods then inflation is likely to increase. Bloch et al (2004) find that firms are more likely to pass on cost increases to the consumer rather than absorb them so it is unsurprising that Boughton and Branson (1988) find that commodity price increases are a leading indicator of inflation. Inflation typically has a negative affect on stock returns (e.g. Fama and Schwert, 1977) so it seems fair to assume that rational market participants will respond to commodity price increases by reducing their stock valuations. Driesprong, Jacobsen and Maat (2008) suggest similar ways in which information in oil price changes may gradually diffuse into stock

5 Levhari and Levy (1977) show return intervals play a critical role in beta estimation, Ait-Sahalia, Mykland, and Zhang (2005) find the interval of observation is important for optimal variance estimates, Chance and Hemler (2001) find inferences regarding the timing ability of mutual fund managers are sensitive to the interval used, while Busse (2001) shows that fund manager performance varies depending on the interval of observation. More detail on this work and other literature in this area is provided in Section 2.

returns. Alternatively, lower commodity prices may be the result of lower future expected demand and be interpreted by the market as a signal of lower future economic growth. The recent rapid decrease of oil prices in October 2008 during the financial crisis may be an extreme example of this phenomenon.

Given the above, we suggest it is unsurprising that those commodities that are most important to the global economy (energy commodities and industrial metals) are those that display the strongest predictability. Goldman Sachs allocates weights to each commodity within their commodity index based on "the amount of that commodity flowing through the economy". These weights, which change over time, are dominated by energy related commodities such as West Texas Intermediate crude oil and Brent crude oil, but in October 2006 copper and aluminum were allocated the two largest weights of any non-energy related commodities.

As we increase the number of observation intervals we need to carefully address the concern that any return predictability found is simply due to data mining bias. To ensure our results are not due to data mining we use the Bonferroni adjustment to adjust our significance levels for the fact we are testing 22 'different' daily periods and 1 monthly period.[6] We also apply the data mining bootstrapping adjustment approach of Rapach and Wohar (2005) and find that these results are almost identical the Bonferroni-adjustment results so we do not report these in order to save space.

We also confirm that our approach of refining intervals is important using Monte Carlo simulations in the spirit of Bollerslev and Hodrick (1995). These simulations show that a conventional monthly interval may overlook many realistic forms of return predictability in

[6] The Bonferroni adjustment involves dividing the p-value significance level (e.g. 5%) by the number of models being tested (e.g. 23). The resulting p-value of 0.21% is then used to determine the critical t-value at the 5% level (e.g. 2.85).

the cases of near market efficiency and gradual information diffusion. For instance, if only information in the last trading day or last trading week of a month predicts future stock returns, the traditional monthly approach will not pick this up, even if that predictability is strong. We present one such simulation result in Appendix Figure 1.[7]

As well as the international, time-varying risk premia, sub-period, and economic significance robustness checks mentioned above, we also show that our results are not driven by liquidity issues. The commodities we select are all among those that are the most actively traded, but we show that our results are qualitatively identical regardless of whether we use futures commodities data, which tend to more actively traded, or spot commodities data, which are not subject to potential rollover issues. We demonstrate our results are not driven by different closing times of equity and commodity markets. Introducing a one trading day lag between monthly stock returns and subsequent cumulative commodity returns does not change our conclusions. We calculate equity market monthly returns from the middle of each month rather than the end and calculate cumulative daily commodity returns from this start point to show that seasonalities around month end are not driving the results.

The rest of the paper is structured as follows. We discuss papers that consider the implications of the interval of observation in other finance contexts in Section 2. Section 3 contains our data and methodology. We present and discuss our main results in Section 4 and robustness checks in Section 5. Section 6 concludes the paper.

[7] We generate numerous other simulation results, which are available from the authors upon request.

2. Interval of Observation Implications in Other Areas of Finance

Results in many areas in finance are sensitive to the interval of observation. The earliest work in this area dates back to empirical tests of the Capital Asset Pricing Model (CAPM). With no guidance from the theoretical literature, empirical researchers chose data of various frequencies[8] and arrived at differing results. This led to Levhari and Levy (1977, p. 92) showing that the "assumed (investment) horizon plays a crucial role in empirical testing."[9] This finding resulted in subsequent beta estimation research giving careful consideration to interval of observations issues. Some researchers (e.g. Hawawini, 1983) use data of different intervals to verify the robustness of their results, while others, such as Gencay, Selcuk, and Whitcher (2006), use more advanced econometric techniques to address this issue.

Ait-Sahalia, Mykland, and Zhang (2005) consider the optimal sampling frequency in the intraday market microstructure literature where - as they state - one encounters somewhat ad hoc interval choices ranging from five minutes to as long as 30 minutes. They then show that the choice of the interval of observation is important for optimal variance estimates. Bandi and Russell (2006) point out that increasing intraday data frequency generates more information about the true underlying variance but also leads to noise accumulation. Ghysels, Santa-Clara, and Valkanov (2005) focus on volatility processes using a regression technique which uses daily data to generate more precise estimates of monthly variables. They show that this a mixed data sampling, or MIDAS approach generates risk-return relationship results that are more in line with theoretical models than previous empirical tests. Ghysels, Santa-Clara, and Valkanov (2005, p. 519) carefully consider the optimal data frequency for the left

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[8] For instance, Miller and Scholes (1982) use annual data, Douglas (1969) uses quarterly data, Black, Jensen, and Scholes (1972) use monthly data, and Roll (1969) uses weekly data. See Levhari and Levy (1977) for an excellent review of this work.

[9] We thank Joel Hasbrouck for bringing this paper to our attention.

hand side of regression equations and suggest that the monthly frequency strikes the "best balance between sample size and the signal-to-noise ratio".

Researchers have also shown that conclusions about the ability of professional market timers to add value seem sensitive to the data interval studied. Chance and Hemler (2001, p. 378) point out "inferences regarding timing ability can vary dramatically depending on how frequently recommendations are observed." Goetzmann, Ingersoll and Ivkovic (2000) state the consequences of a misspecified interval (monthly in case of daily timers) for the Henriksson and Merton market timing test quite clearly (page 258): "we show that the use of monthly data essentially implies that most standard timing tests are misspecified; it should thus come as little surprise that few researchers to date have found evidence of timing ability by professional managers." Other conclusions regarding the behavior of mutual fund managers also seem sensitive to the interval of observation used to judge them. Brown, Harlow, and Starks (1996) document results using monthly fund return data which suggest that funds that have been underperforming increase their risk relative to out-performing funds. However, Busse (2001) shows that this effect totally disappears when daily data are used.

As noted in the introduction, we believe there are good reasons to considering different intervals of observation in short term return predictability tests.[10] If markets are near efficient then predictability tests that rely on a full month of data to make a prediction may be less accurate than tests that use only the most recent few days of data. On the other hand, longer time periods need to be considered if the gradual information diffusion hypothesis holds.

[10] There are also theoretical reasons to carefully consider interval of observation issues in event studies, as several papers point out. Berkman and Truong (2008) highlight the relevance of this for earnings announcement event studies, while Kappou, Brooks, and Ward (2007) stress the importance of this for studies investigating index additions and deletions.

3. Data and Methodology

Our return predictability tests are based on two alternative approaches. The first is consistent with the idea of the efficient markets hypothesis, which is based on the notion that markets should impound information very quickly, if not instantly. Indeed, if markets are fairly efficient it seems reasonable to assume that markets will aggregate information much faster than a month. Therefore if an investor wants to predict next month's return, it makes more sense intuitively to use shorter intervals (i.e. the last trading week of the previous month) than the conventional approach of using a full month of past information to test whether predictability is present. As the Monte Carlo experiments discussed in the introduction illustrate, using all information in the last month might increase noise and underestimate true predictability.

The second approach is consistent with the gradual information diffusion hypothesis of Hong and Stein (1999), which suggests it takes time for price sensitive information to be reflected in prices. If information diffuses more slowly into prices than previously thought monthly intervals may not pick up this delayed effect. Therefore there might be a need to consider more historical intervals of observation instead of more recent intervals. While this depends on the speed of information diffusion, we suggest that if information is diffusing more gradually this will also show in our approach of introducing more lags (over and above the standard one-month lag) with predictability results becoming stronger as more historical information is used. There is some evidence to support this in the recent paper of Hong, Torous, and Valkanov (2007) who find that some US industries lead the US stock market.

Using monthly data they show that this gradual information diffusion can take up to two months.[11]

We consider monthly prediction intervals because this aligns with the common practice of institutional investors to predict one month ahead. Moreover, this also makes it easier to compare predictability results with the traditional approach. Last but not least, a monthly interval is consistent with Ghysels, Santa-Clara, and Valkanov (2005, p. 519) who consider the optimal data frequency for the left hand side of regression equations and suggest that the monthly frequency strikes the "best balance between sample size and the signal-to-noise ratio". Therefore, we assume an investor who is interested in predicting monthly stock market returns based on past information. Every month at the beginning of the month this investor wants to test whether stock market returns in month *T* depend on changes in information in the near past. In that case the traditional regression equation would be as follows:

$$r_T^m = \mu + \alpha x_{T-1}^m + \varepsilon_t \qquad (1)$$

Where x_{T-1}^m is the change of information in the last month. To allow for models of near efficient markets we estimate the following:

$$r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t \qquad (2)$$

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[11] There are also numerous other papers that present evidence consistent with the gradual information diffusion hypothesis. What follows is an incomplete summary. Lo and MacKinlay (1990) show returns on large stocks lead those on small stocks. Brennan, Jegadeesh, and Swaminathan (1993) suggest this is related to analyst coverage. Badrinath, Kale, and Noe (1995) suggest institutional ownership drives this gradual diffusion, while Hou (2007) finds that the slow diffusion of industry specific information is the major cause of lead-lag effects in stock returns. More recently, attention has turned to the economic linkages between firms in an attempt to explain lead-lag relationships. Cohen and Frazzini (2006) show investors appear to be slow to factor in the implications for a supplier firm of a positive or negative shock to the customer firm. Menzly and Ozbas (2006) show that it is profitable to take long (short) positions in industries which have up and downstream industries that have recently performed well (poorly).

Where x_{t-1}^{d} denotes a change in information over the last trading day of the previous month, the last two trading days of the previous month and so on up to 22 trading days. Throughout the paper we use a capital *T* to denote a time period of a full month and normal *t*'s to denote shorter interval of cumulated daily changes.[12] We use log returns and log changes so alpha measures the total net response of investors with respect to the sum of all daily changes up to 22 trading days. We stop at 22 days as this is the average number of trading days in a month.[13,14]

We also consider the alternative hypothesis which suggests that information diffuses into prices gradually. This involves estimating the following regression:

$$r_T^m = \mu + \alpha x_{(T-1)-(t-1)}^m + \varepsilon_t \qquad (3)$$

Where $x_{(T-1)-(t-1)}^m$ is the monthly change in commodity return for various daily lags. Therefore in our first regression we investigate the ability of last month's commodity return lagged by one day to predict this month's stock return. In our second regression we investigate the ability of last month's commodity return lagged by two days to predict this month's stock return, and so on. Our final regression uses the monthly return at a lag of 22 days. We depict near term efficient market and slow information diffusion hypotheses in Figures 1a and 1b.

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[12] We use cumulative regressions, as there may be patterns in subsequent days, particularly if information is gradually diffusing and the coefficient for individual days may not pick this up.

[13] Our right hand side approach is somewhat similar to the MIDAS technique of Ghysels, Santa-Clara, and Valkanov (2005) in that daily data is used to predict a monthly left hand side variable. The difference is that we are interested in determining return predictability across different intervals so we cumulate daily data over different frequencies and compare the economic and statistical significance of the α's from each frequency. Ghysels, Santa-Clara, and Valkanov (2005) focus on generating the most accurate measure of variance and using this to verify the risk-return relationship. They therefore use a decay function to determine the optimal weights of each daily variance. They then convert the optimally weighted daily variance to a monthly variance for use in their predictions of monthly returns.

[14] To be clear, we keep the start date of the month for each stock market return fixed and we do not increase the frequency of observations if the cumulative intervals for the commodities are smaller than a month. This allows us to use longer sample periods as we can keep using monthly data for the MSCI stock market returns and it prevents arbitrary choices and also avoids any potential overlapping samples problem.

Please insert Figures 1a, 1b around here

We are careful to ensure our results are not due to data mining. In our near market efficiency tests we use the Bonferroni adjustment to adjust our significance levels for the fact we are testing 22 'different' daily periods and 1 monthly period or a total of 23 different intervals. In our gradual information diffusion tests we are considering the standard monthly interval and 22 variations of this, starting with the monthly interval lagged by one month and one day and ending with the monthly interval lagged by one month and 22 days. Therefore in these tests we are again considering 23 alternatives. Bonferroni t-values with 23 searches are 10%: t = 2.64, 5%: t = 2.85 and 1%: t = 3.34, respectively.[15] We also apply the data snooping bootstrapping approach of Rapach and Wohar (2005) and find that these results are almost identical the Bonferroni-adjustment results so we do not report these in order to save space.

We follow Kendall (1953) and study commodity data and stock returns but we focus on a more recent period for which daily data are available (sample periods vary depending on data availability for the individual commodities but in 1970 or later). Using commodity returns as regressors ensures our test statistics will provide correct inferences and our analysis will not be biased due to persistency problems. Since the seminal paper of Stambaugh (1999) many authors have highlighted the econometric problems that arise in predictive regressions involving a persistent explanatory variable (see Campbell and Yogo (2006) for a good review). Given the low first order correlation of commodity returns (see Table 1), persistency

[15] The Bonferroni adjustment involves dividing the p-value significance level (e.g. 5%) by the number of models being tested (e.g. 23). The resulting p-value of 0.21% is then used to determine the critical t-value at the 5% level (e.g. 2.85).

is not a problem in our analysis so t-statistics should lead to correct inferences.[16]

We choose the 22 commodities with the largest world production over the last five years (2003-2008), as measured by the Goldman Sachs Commodity Index, which have daily data available for a reasonable time period. Goldman Sachs suggest that the weight they assign to each commodity is in proportion to the amount of that commodity flowing through the economy because "the impact that doubling the price of corn has on inflation and on economic growth depends directly on how much corn is used (or produced) in the economy."[17]

Our sample includes West Texas Intermediate crude oil, Brent crude oil, unleaded gas, heating oil, gasoil, natural gas, aluminum, copper, lead, nickel, zinc, gold, silver, wheat, corn, soybeans, cotton, sugar, coffee, cocoa, live cattle, and hogs. Goldman Sachs classifies the first six commodities as "energy", the next five as "industrial metals", the next two are "precious metals", the next seven as "agriculture", and the last two as "livestock". We are confident these 22 commodities give us a good representation of the entire commodity universe as they are also well represented in the Dow Jones / AIG and IMF commodity indices. Moreover, we feel that if stock markets will respond to past changes in commodity prices the effect should be strongest for the most important commodities in an economic sense.

We generate our core results with spot data as these do not suffer from rollover issues, but we verify that the results are qualitatively identical if futures data are used. We source

[16] Of our 22 commodity series, only 3 have first order autocorrelation that is statistically significant at the 5% level. These include West Texas crude oil, gold, and sugar. Gold and sugar do not display strong predictive ability so they do not feature prominently in our analysis or conclusions. West Texas crude oil is a strong predictor, however we verify that this "crude oil" result shows up in an identical fashion when Brent crude oil, which has very low first order autocorrelation is used.

[17] http://www2.goldmansachs.com/services/securities/products/sp-gsci-commodity-ndex/approach.html

commodity data from both Global Financial Data (GFD) and DataStream, selecting each series from the source with longest history of daily data. Our stock market data is the MSCI total return series in USD for all developed markets that have been in the MSCI from 1970. In addition to the US this involves Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, and the UK. We also include a World Index and a World Index which excludes the US. These data are sourced from DataStream. We use USD returns in our core tests but verify the results are qualitatively identical if local currency returns are used.

Table 1 contains the summary statistics of our data. All statistics are based on monthly returns. With the exception of hogs, all commodities have positive average monthly returns, which is unsurprising given inflation and the commodity boom of the last five years. Gasoil has had the biggest gains, with a mean monthly return of 2.01%, although this series is reasonably short, commencing in 1999. By way of comparison, the mean monthly return of the MSCI US index is 0.82%. The commodity series tend to be more risky than equity series. Live cattle has the lowest standard deviation at 5.69%, but this is still above the standard deviation of the MSCI US index (4.36%) and many of the international markets.

Please insert Table 1 around here

We check correlations between the commodity series using both daily and monthly returns. If all the commodities are highly correlated and we find a common interval generates the largest statistical and economic significance then our results could be interpreted as being one "commodity result" rather than different results for each commodity. The results presented in Appendix Table 1 indicate that individual commodities are typically not highly correlated.

Both the daily and monthly results show that Energy commodities are the only ones that consistently have correlation coefficients of above 0.6. Our results presented in Section 4 indicate while West Texas crude oil and Brent crude oil have a common interval that generates the strongest significance, gasoil and heating oil have quite different maximum intervals to these. This indicates that correlation between commodities is not the major driver of our results.

We will now follow an approach similar to the approach often used in the financial literature, where a phenomenon is first documented for the US market and then verified using data from other countries and other time periods. So we first consider the US market and consider which commodities price changes seem to significantly predict stock market returns based on the near efficiency approach or the gradual information approach. If we find that a commodity price change measured over some interval predicts the US market – based on Bonferroni t-values - we shortlist it as a possible candidate. After we have identified all the likely candidates (see Table 4) we proceed and use these candidates in our analysis. We consider the performance of these candidates in different countries and time periods and perform several other robustness checks. For all candidates we then report an overview on how they perform on the different tests (see Table 11). We are reluctant to give a final verdict but we feel we can safely state that at least for oil (gradually diffusing starting after 6 days)[18], zinc (near efficient one day) and aluminum (near efficient 17 days) we find very strong evidence that log changes in these variables measured over these intervals predict stock returns in markets around the world. We conclude our analysis with an out-of-sample test of the economic significance of trading strategies over the 2003-2008 period. Our trading rule is based on the

[18] As already documented by Driesprong, Jacobsen and Maat (2008)

three variables (oil, aluminum and zinc) reported above. The economic significance of this rule is very strong in all countries (see Table 12).

4. Core Results

We first present our monthly regression results for the US in Table 2 Panel A. These indicate that increases in the prices of West Texas crude oil, Brent crude oil, unleaded gas, heating oil, gasoil, aluminum, copper, nickel, and sugar in a given month predict, on average, decreases in the US equity market in the following month, based on statistical significance at the 10% level or more. The economic impact of this predictability is frequently large. For instance, a one standard deviation increase in the price of aluminum in any given month reduces the expected excess return on the stock market the next month by 0.75%. To put this into perspective, the expected excess return on the stock market in any given month in the absence of any movement in the aluminum price is just 0.59%[19] so a one standard deviation increase in the price of aluminum reduces the expected excess stock market return to -0.16%. One might argue that these results are already interesting. Apart from oil price changes[20], the forecastibility of stock returns using these other commodities has to the best of our knowledge not been documented before.

However, the strong predictability for the US using conventional intervals seems the exception rather than the rule. While UK equity returns are also predictable using commodity price changes based on conventional intervals, the results are weaker than for the US (see Table 2 Panel B). Commodities that predict equity returns in the US based on monthly returns, such as unleaded gas, gasoil, copper, and sugar do not predict UK equity market returns. The UK is typical of other international markets in this respect (see Appendix Table

[19] This is measured over the duration of our aluminum series which is January 1989 – February 2008.
[20] See Driesprong, Jacobsen and Maat (2008)

2). Equity returns in the US are predicted by monthly returns in a broader range of commodities than equity returns in any international market.[21]

Please insert Table 2 around here

We now turn our attention to the results generated by our near efficiency and gradual information diffusion regression approaches as specified in equations 2 and 3 respectively. The results displayed in Table 3 indicate each of the commodities that predict US equity market returns based on monthly commodity price movements also have strong predictability based on either returns of shorter intervals (near efficiency regressions), lagged intervals (gradual information diffusion regressions), or both. To address data mining concerns we report statistically significant results based on Bonferroni significance levels at the 10% level or better (based on 23 intervals) as well as normal significance levels. Our approach is to start with all 22 "candidate" commodities and subject this to increasingly strict robustness tests to determine which commodities appear to predict equity market returns.

Movements in West Texas crude oil and Brent crude oil predict equity market returns under both approaches but display stronger predictability under the gradual information diffusion regime. On the other hand, predictability is only solely evident or stronger in heating oil, gasoil, aluminum, copper, and nickel in the near efficiency regressions. There are also instances of predictability in this new approach that is not evident in monthly regressions. Zinc, gold, silver, soybeans, and cotton show predictability in intervals less than one month

[21] We are most interested in the ability of changes in commodity prices in a given month to predict equity returns in the following month, but we also briefly consider the contemporaneous movement in monthly commodity prices and equity returns. These results, which are presented in Appendix Table 2, indicate that there is frequently a positive contemporaneous relationship between commodity price movements and equity market returns. This may be support for the hypothesis we suggested in the introduction. Lower commodity prices may be the result of lower future expected demand and be interpreted by the market as a signal of lower future economic growth. However, we leave a more detailed examination of this interesting result to future research.

that is not evident at the monthly level, while lead, corn, and live cattle produces predictability in the gradual information regressions that is not in the monthly data.

Please insert Table 3 around here

In Figures 2a, 2b, and 2c we plot the t-statistics of a range of commodities over consecutive days. It is evident that the predictive power of both West Texas crude oil and Brent crude oil increases as the monthly interval is lagged by extra days. For example, the t-statistic for West Texas crude oil is -3.51 when the monthly interval is lagged by 1 day but this decreases to -4.65 when the monthly interval is lagged by 6 days. This indicates that information regarding the impact of changes in the price of crude oil takes more than one month to diffuse into the market. On the other hand, information pertaining to changes in the prices of gasoil, heating oil, aluminum, copper, and nickel enters the market more quickly than a month. For instance, aluminum, and nickel both show maximum predictability (based on t-statistics) at intervals of 17 days.

Please insert Figures 2a, 2b, 2c around here

It is also clear that slope coefficients and R^2s often increase (in absolute terms) considerably as the interval moves from a monthly one to the interval that produces the largest (in absolute terms) t-statistic. We present these results in full in Appendix Tables 3 and 4 but provide a summary in Figures 3a and 3b. The R^2 of copper increases from under 1% at 1 and 2 day intervals to over 4% at four day intervals, the interval that generates the strongest t-statistic for copper. Copper's R^2 then declines in line with the weaker t-statistics only to begin increasing around day 15. Copper's alpha follows a similar trend to its t-statistic and R^2. The economic significance is strongest based on the four-day interval.

Please insert Figures 3a and 3b around here

The next step we take is that of forming a short list of commodities candidates that appear to predict equity returns based on our near efficiency and gradual information diffusion regression approaches. In order to make the short list a commodity must have at least one interval that is statistically significant based on Bonferroni t-statistics. If a commodity has multiple intervals that are significant we select the interval which generates the maximum t-statistic (in absolute terms). We include two intervals for copper because it is highly significant for periods around 4 days and 16 days (see Figure 3). We then subject each commodity we choose in Table 4 to a range of robustness checks in Section 5. It is immediately obvious from the results in Table 4 that predictability is considerably stronger when an interval other than the monthly one is used in case of all commodities. The t-statistic for copper is -4.63 for a 4-day interval compared to -2.45 for a monthly interval. Another example is West Texas crude oil which has a t-statistic of -4.65 for an interval of one month lagged by 6 days compared to that for the traditional one month interval with no lag of -3.74. Parameter estimates of the coefficients and the R^2's tell the same story. Both are substantially higher than the full monthly estimates in all cases.

Please insert Table 4 around here

5. Robustness Checks

5.1. International Markets

Now that we have narrowed our commodity candidates down from 22 to 12 (including two intervals for copper) we subject them to a range of robustness checks. The first robustness test we apply relates to how well the US results hold in international markets.[22] We proceed as follows: Firstly, we run regressions for the interval that generated the largest t-statistic (in absolute terms) in the US for international markets. We then adjust this interval both downwards and upwards by one day to ensure different market closing times are not influencing our results. We repeat this analysis for each country for each commodity that made our short list. The full results are presented in Appendix Tables 6, 7, and 8 but we provide a summary of these in Table 5.

Since individual country results are not independent due to the correlation of international stock markets we supplement our individual country results with the estimation of a system of equations with one joint Wald test that alpha = 0 for each country. We estimate this using both a system of OLS and a system of Seeming Unrelated Regressions (SUR) using all other countries jointly. These results, which we present in Table 5, indicate that our US results hold internationally for the majority of our commodities. We are able to reject the null hypothesis of no predictability (joint test that alpha equals zero) at the 1% level (for the interval that produced the highest absolute t-statistic in the US) for international markets for West Texas crude oil, Brent crude oil, heating oil, gasoil, aluminum, copper, zinc, and sugar under both the OLS and SUR approaches.

In the third column of results we present a count of the number of instances where a commodity generates statistically significant returns (at the 10% level or better) for the individual countries. The count is out of 17. West Texas crude oil, Brent crude oil, heating oil, aluminum, nickel, zinc, and sugar are all significant in over half the international markets. We also present t-statistics for alpha for the World Index and the World excluding US Index. For

[22] The presented results relate to international indices expressed in US$ but the results for local currency international indices, which are available from the authors on request, are qualitatively identical.

the World Index West Texas crude oil, Brent crude oil, heating oil, gasoil, aluminum, copper, nickel, soybeans, sugar, and live cattle are all significant, while West Texas crude oil, Brent crude oil, gasoil, aluminum, nickel, sugar, and live cattle are all significant in the World X US index at the 10% level or better. Again, our more refined intervals suggest stronger evidence of predictability. For instance, while 17 day cumulative aluminum returns predict equity market returns in 13 of the 17 international markets, monthly movements in the price of aluminum predict equity market returns in just 2 of the 17 international equity markets (see Appendix Table 2). This result is not unique to aluminum, many of the other commodities which predict equity market returns internationally in Table 5, such as gasoil, copper, do not show much predictability at the monthly level.

Please insert Table 5 around here

5.2. Sub-period Analysis

Now that we have demonstrated that our proposition regarding the importance of return interval measurement for predictability tests holds internationally, we turn our attention to the most recent sub-period of our data. We re-run our tests for the 198902 to 200802 period and present results in Table 6. We only present results for the most recent sub-period as many of our daily commodity series begin in the mid to late 1980s or later so do not have results for the 1970-1988 sub-period.

These results are similar to those in Table 5 in that we estimate again a system of equations with one joint test that alpha = 0 for each country using both the OLS and Seeming Unrelated Regression (SUR) approaches. In both cases we report the Wald test statistics. The difference is that we include US results in with the international results in Table 6 and we report the individual t-statistics for the US and the World Market in the last two columns.[23] We also present a count of the number of countries where each commodity is significant (out of 18) at the 10% level, together with t-statistics for alpha. Our OLS and SUR system results indicate that our earlier conclusions also hold in the most recent sub-period. West Texas crude oil, Brent crude oil, heating oil, gasoil, aluminum, copper and, to a lesser extent, nickel, zinc, and sugar, soybeans all predict equity market returns in the most recent sub-period in the international markets we consider. The individual country count results indicate that West Texas crude oil, Brent crude oil, gasoil, aluminum, copper, nickel, and zinc all predict equity returns in over half the countries we consider in the most recent sub-period. All commodities except live cattle predict equity returns in the US in the most recent period, while West Texas crude oil, Brent crude oil, gasoil, aluminum, copper, and nickel predict the international index. Overall, we conclude that the predictability we document for the entire period strongly holds in the most recent sub-period.

Please insert Table 6 around here

5.3. Controlling for Other Return Predictors

We now turn our attention to whether movements in commodity prices predict equity market returns after we control for other well-known return predictors. We present results for the US equity market in Table 7. In each instance we use the commodity return interval that generated the largest t-statistic (in absolute terms) as presented in Table 4. In Panel A we include variables that have been shown to be good proxies for the business cycle and time-varying risk premia. Authors who have highlighted the importance of the business cycle in explaining stock returns (e.g. Fama and French, 1989) suggest that it is rational to expect

[23] Individual results for each country are available from the authors on request

there to be a relationship between variables that measure present and future business conditions based on economic cycles and the stock returns of companies that operate within the economy. For instance, an increasing default spread indicates increasing risks within the economy. We follow Hong et al (2007) and include the lagged market return (RM), inflation (Inf), the default spread (Def Spr), dividend yield (Div Yld), and volatility (Vol). [24]

In Panel B we control for the Fama and French risk factors, momentum, and liquidity. These data are sourced from Ken French's website, with the exception of our liquidity factor data which are sourced from Lubos Pastor. In Panel C we control for other factors that have been shown to predict returns such as the month of January, the Halloween effect (e.g. Bouman and Jacobsen, 2002). Consistent with previous literature, each of the control variables in Panel A are lagged by a month, but all other control variables are contemporaneous (with the exception of the market return which is lagged in each panel).

Our Table 7 Panel A results reveal that each of our commodities remain statistically significant when business cycle variables are included. This confirms that commodity returns are not acting as proxies for some other well-known return determinants.[25] We test whether time-varying risk premia explanations can explain our results more explicitly using the stricter tests proposed by Driesprong, Jacobsen, and Maat (2008) in Table 8, but at this point we conclude that our results are robust to these adjustments. Our Panel B results indicate that our commodity results are not proxying for the Fama and French (1993) factors or momentum

[24] Inflation is measured as changes in the Consumers Price Index. The default spread is measured as the difference in yield between BAA and AAA bonds, The dividend yield is the dividend yield on the S&P 500, and volatility is derived from AR(1)-EGARCH(1,1) using S&P500 data from 1900m01-2008m02. All these data are sourced from Global Financial Data (GFD).

[25] In line with previous research we also find evidence that increases in inflation have a negative impact on future stock returns as predicted by Fama and Schwert (1977), while increases in divided yield and volatility have a positive impact on stock returns as reported by Fama (1989) and Hong et al (2007) respectively. Finally, increases (decreases) in the default spread predict negative (positive) stock returns.

or liquidity. A similar result is in Panel C. While the statistical significance of heating oil and zinc is removed when the January Effect and the Halloween Indicator are introduced, each of our other commodity variables remains statistically significant.

Please insert Table 7 around here

5.4. Time-Varying Risk Premia

We now investigate whether our results might be driven by time-varying risk premia using a relatively new approach. Driesprong, Jacobsen, and Maat (2008) highlight that a negative relation between movements in a predictor variable and stock market returns, such as that which we find for the vast majority of our commodity series[26] casts doubt on a time-varying risk premia explanation. Increases in commodity prices lead to increased risks in an economy (via inflation and other mechanisms as described in Section 1) and as a result should lead to higher rather than lower returns in the future on average. Nevertheless, we follow Schwert (2003) and Driesprong, Jacobsen, and Maat (2008) and utilize an extreme standard to determine whether the predictability we document is due to time-varying risk premia. We investigate whether excess returns are predicatively negative because such a finding cannot be due to a risk-based explanation and is therefore indicative of a true inefficiency.

Commodity price changes frequently predict negative excess returns. We have previously demonstrated that our near efficiency and gradual information diffusion results are stronger (in terms of alpha, t-statistics, and R^2s) than our monthly results but our point is equally well illustrated with our weaker monthly results so we use them. Our monthly regression results for aluminum suggest the following expected return equation.

[26] All our commodity series that have a statistically significant negative relation with future stock returns with the exception of zinc which has a positive relation.

$$E_{t-1}\left[r_t\right] = 0.009 - 0.125_{t-1}^{alu\min ium} \tag{4}$$

The monthly standard deviation for aluminum returns is 5.98% and the average US T-bill monthly rate is 0.36% over the period covered by our aluminum series. This suggests that an aluminum price increase of one standard deviation in any given month predicts an expected excess return the following month of -0.22% or -0.0022 [(0.009 – 0.125 × (0.0009 + 0.0598) – 0.0036]. However, as Driesprong, Jacobsen, and Maat (2008) point out, the regression specified in equation 4 assumes a stable relation regardless of the sign and size of aluminum price changes. If there is in fact no relation for large aluminum price increases, the very price changes that imply negative excess returns, it would mean we are unable to rule out a time-varyng risk premia explanation for our results. To address this possibility we follow Driesprong, Jacobsen, and Maat (2008) and test whether the relation between lagged aluminum price changes and stock returns is statistically significant in periods when excess expected stock returns are negative. This involves estimating, for each commodity separately, the following regression equation 5 and 6 for our near efficiency and gradual information diffusion scenarios respectively:

$$r_T^m = \mu + \alpha_1 x_{t-1}^d + D_t \alpha_2 x_{t-1}^d + \varepsilon_t \tag{5}$$

$$r_T^m = \mu + \alpha_1 x_{(T-1)-(t-1)}^m + \alpha_2 D_t x_{(T-1)-(t-1)}^m + \varepsilon_t \tag{6}$$

The dummy variable D_t equals 1 if the expected excess returns (based on our core results in Section 4) are negative and 0 otherwise. This means that α_1 measures the delayed stock market reaction to commodity price decreases and small increases while α_2 measures this relation for large commodity price increases which imply negative excess returns. The sum of α_1 and α_2 represents the absolute value of the lagged reaction of the equity market to large commodity price increases.[27] We follow Driesprong, Jacobsen, and Maat (2008) and use the Wald test to determine if the sum of α_1 and α_2 is statistically significantly different from zero. If our results are due to time-varying risk premia we should not be able to reject this null hypothesis. This test is difficult to pass if there are numerous observations but is especially difficult if there are only a limited number of observations as there is in our sample. We attempt to overcome this by estimating results jointly for all countries in our sample using both OLS and SUR approaches to estimate the system of equations. We present our results in Table 8.[28]

Our results indicate that there is strong evidence that time-varying risk premia does not explain our core results. We are able to reject the time-varying risk premia explanation at the interval that generates the largest t-statistic in the US and the interval one day either side of this (used to account for timing differences in global markets) for West Texas crude oil, Brent crude oil, heating oil, gasoil, aluminum, nickel, zinc, sugar and live cattle based on an OLS approach, and for West Texas crude oil, Brent crude oil, heating oil, gasoil, aluminum, copper, zinc, soybeans, and sugar based on the SUR approach.

Please insert Table 8 around here

5.5. Economic Significance

In this section we present results relating to the economic significance of predictability we document earlier. We compare the economic significance of each commodity series at the

[27] The interested reader should refer to Driesprong, Jacobsen, and Maat (2008) for a more detailed discussion of this methodology.
[28] We also present results for individual countries in Appendix Table 12.

interval that generates the largest t-statistic (in absolute terms) to that from the monthly interval and also compare these to the economic significance of other variables that have been shown to predict equity markets. We focus on the US equity market for two reasons. Firstly, data for other return predictors is not available for many international markets. Secondly, the ability of monthly commodity returns to predict equity market returns is strongest in the US so the differences in economic significance between the most appropriate interval and the monthly interval are likely to under rather than overstate the result for all other markets.

We follow Hong et al (2007) and report the "Economic Significance" as the response of the market return to a two-standard deviation shock in each commodity return. The lower and upper bounds of this estimate based on the coefficient standard errors are reported in parentheses. The "Absolute Relative Significance" is calculated by dividing the economic significance by the standard deviation of the market return. We report results for the commodity return interval that generates the largest t-statistic in Panel A of Table 9, the monthly commodity return in Panel B and other return predictors in Panel C.

Please insert Table 9 around here

Turning to the results presented in Panel A, we see that a two standard deviation shock in the seventeen day cumulative return of aluminum results in a 2.1% change in the return of the US equity market in the following month, and this represents approximately 48% of market volatility. Movements in each of our commodities contribute a large amount of market volatility. The relative significance of a two standard deviation shock ranges from 0.27 for live cattle to 1.58 for zinc.

The importance of considering intervals outside the monthly interval is evident when one compares the relative significance for the same commodity in panels A and B. All the commodities have larger relative significance in Panel A than they do at the monthly level in Panel B and these differences are frequently large. For instance, the relative significance of copper based on a five-day cumulative return is 0.99 compared to 0.19 at the monthly level. The importance of commodity price movements in explaining stock returns is also clearly evident when one compares the relative significance of commodities to those of other well known return predictors. As mentioned earlier, we follow previous authors and lag the return on market variable, and business cycle control variable but all other control variables are contemporaneous. The commodity variables have, on average, much larger levels of Relative Significance than any of the lag control variables. This result applies regardless of whether commodity returns are measured at the monthly level of at the intervals used previously in the paper. The largest control variable economic significance is the book-to-market variable at 0.80 followed by momentum at 0.74. However, copper, zinc, and soybeans each have higher levels of economic significance in Panel A (0.99, 1.58, and 0.83 respectively).

5.5. General-to-Specific Results

We adopt a general-to-specific approach to determine the commodities that jointly predict equity returns in each market. We begin with each of the commodities and intervals specified in Table 4 with a few minor exceptions. Brent crude oil and West Texas crude oil are highly correlated so we only include West Texas crude oil in our reported tests.[29] Multicollinearity is not an issue in the remaining commodities. The gasoil series is short (commences in 1999) so we also exclude this series. Our results relate to the February 1989 to February 2003 period. The start point was chosen to coincide with the start point of our shortest (excluding gasoil)

[29] Similar results are obtained if Brent crude oil is used instead of West Texas crude oil.

commodity series. We finish in February 2003 to allow us five years of out-of-sample testing, which we discuss in Section 5.9.[30]

Our general-to-specific approach is similar to that outlined in Hoover and Perez (1999). We begin with a regression that uses all commodities in Table 4 (excluding Brent crude oil and gasoil) to predict an equity market returns and remove any commodities that are insignificant at the 10% level. We start by removing the least significant commodity, then re-run the regression and exclude the next least significant commodity and so on. We finish when only statistically significant commodities remain.[31] We also repeat the general-to-specific methodology for monthly return intervals. These results allow us to determine the explanatory power of commodity returns based on traditional intervals and quantify the difference in explanatory power between these intervals and the ones we apply throughout this paper.

Our results presented in Table 10 Panel A indicate that a large amount of the variation in monthly stock returns can be explained by movements in commodity prices over previous intervals. The R^2 for the US regression is 18.5% which is extremely large compared to those reported by authors who have investigated the ability of other variables to predict equity market returns. For instance, Goetzmann and Jorion (1993) find that the R^2 of a regression that uses dividend yields to predict one month US equity market returns is just 1%. There is also strong predictability in international markets. Australia, Canada, Hong Kong, Japan, Switzerland, the UK, World, and World X US have R^2s in excess of 10% and Germany, Italy, Netherlands, Singapore, Spain, and Sweden have R^2s of over 5%. West Texas crude oil is an

[30] Results are qualitatively similar if we would include the last five years.

[31] Some authors have criticized the general-to-specific approach on the basis that it represents data mining, but Hoover and Perez (1999) refute this in a comprehensive article. They state (p. 188) "the empirical size and power of specifications produced from general-to-specific searches, with one caveat (which does not apply here, JMN), conform well to the theoretical size and power one would expect if one knew-and knew that one knew-the true specification a priori. Test statistics based on such searched specifications therefore bear the conventional interpretation one would ascribe to one-shot tests."

important predictor in 16 of the 20 markets, zinc is an important predictor in 13 of the 20 markets, while aluminum is statistically significant following the general-to-specific approach in 10 of the 20 markets. The other commodities appear less important as they all remain significant in four markets or less.

We report our monthly general-to-specific results in Panel B of Table 10. We generate this using the same process as outlined earlier. We start with all commodities and remove insignificant commodities (starting with the least significant first). It is clear that explanatory power is lower when conventional monthly intervals are used. For instance, in the case of the US and the World X US the R^2s are 7.6%, and 4.2% compared to 18.5% and 15.0% respectively when non-monthly intervals are used. This trend is repeated in all countries, with some of the R^2 diverging by an order of magnitude (Australia has an R^2 of 13.1% when intervals other than monthly are used and an R^2 of 1.5% when monthly intervals are used). It illustrates the strong impact our refined measurement has.

It is also worth emphasizing that, while smaller than those in Panel A, even the R^2s from monthly commodity regressions are still relatively large compared to those reported for other predictors such as dividend yield (typically around 1%). Nine of the 18 countries we study have R^2s in excess of 3% and they sometimes exceed this by a big margin (e.g., US 7.6%, Italy 10.6%).

Please insert Table 10 around here

5.7. Other Robustness Checks

As mentioned in the introduction, we verify that our results are robust to the use of either spot or futures data, introducing a one-day lag between the monthly equity market return on the left hand side of our regressions and the near market efficiency and gradual information diffusion return intervals on the right hand side of our regressions, and the measurement of monthly equity market returns starting at the middle of a month rather than the end of a month. We present the results relating to these robustness checks in Appendix Table 14, 15, and 16.

5.8. Results Summary

We present a summary of the performance of our 12 commodity candidates in each of the robustness tests outlined earlier in Table 11. We report summary information for our international, sub-period, other return predictors, Driesprong, Jacobsen, and Maat (2008) time-varying risk premia, and general-to-specific robustness tests and also report whether a commodity passed or failed these robustness tests on average. Our summary information for the international tests, include the number of markets that are statistically significant, whether the joint test across all markets based on SUR is statistically significant, and whether there is significance in the World excluding US index. Equivalent results are presented for our sub-period robustness tests, with these also including the US.

The other return predictor tests include those where we include business cycle variables, the Fama and French, market, size, and book-to-market factors and momentum and liquidity. We also consider control variables such as the Halloween indicator of Bouman and Jacobsen (2002). Our next test is that of Driesprong, Jacobsen, and Maat (2008) which relates to time-varying risk premia. In all instances we judge a result to be statistically significance if this shows at the 10% level or better at either the interval specified in columns 2 and 3 or the interval one day before or after (to account for differences in international exchange closing times). Our penultimate test is for economic significance using the method advocated by Hong, Torous, and Valkanov (2007). Finally, we consider the general-to-specific test we report in Panel A of Table 10, which involves including all commodities in a joint regression for each market and systematically removing statistically insignificant commodities.

We acknowledge that passing judgment as to whether a commodity series is a useful predictor of equity returns is somewhat of a subjective exercise so the objective of Table 11 is to provide the reader with summary information from which they can make their own decisions. Nonetheless we interpret a commodity as passing the robustness tests overall if it: 1) predicts equity returns in a range of markets outside the US and also passes our joint test, 2) has predictive power in the majority of markets in the most recent sub-period and also passes the joint test in this sub-period, 3) remains statistically significant when either business cycle or Fama and French (and momentum and liquidity) factors are included, 4) has predictability that is not due to time-varying risk premia based on the strict test of Driesprong, Jacobsen, and Maat (2008), and 5) remains statistically significant after our economic significance and general-to-specific tests in a wide range of markets. Based on these criteria, West Texas crude oil, Brent crude oil, aluminum, and zinc are the commodities with the strongest predictive power.

Please insert Table 11 around here

5.9. Out-of-Sample Economic Significance

We now consider whether the predictability of commodities is economically significant out-of-sample. We develop a trading rule which generates a signal for the investor to invest in the equity market or T-bills each month. If the forecast equity market return is greater than the current risk-free rate it generates a signal to invest in the equity market, otherwise it signals that the investor should invest in t-bills. Anyone wishing to implement this strategy using index futures or some other instrument would incur transactions costs. Driesprong, Jacobsen, and Maat (2008) suggest that 0.1% is likely to be a conservative estimate of the costs incurred. However, we demonstrate that the profits on offer greater exceed these.

Our economic significance results build on our general-to-specific results so we choose the starting point of March 2003 to ensure they provide an out-of-sample estimate of economic significance. Table 12 panel A contains annualized mean returns and return standard deviations and Sharpe ratios for a buy-and-hold strategy. In Panel B we report the out-of-sample results to a trading rule that generates a signal to enter the market based on the past performance of West Texas crude oil, aluminum, and zinc, the three commodities that have the strongest and most robust predictive power, as presented in Table 11. We report mean returns and standard deviation of returns (both annualized), Sharpe ratios, and the percentage of correct predictions (the proportion of months that both forecast equity return and realized equity returns are higher or lower than the risk free rate), and the number of switches signaled by the trading rule.

Please insert Table 12 around here

A comparison of the Panel B trading rule results for each country to the buy-and-hold results shows just how much value is added by using movements in the price of West Texas crude oil, aluminum, and zinc to time the equity market. As an example, the Sharpe ratio for the trading rule in the US is 0.483 compared to just 0.076 for a buy-and-hold strategy in the US. The trading rule allows larger annual returns to be earned on average even though it allows the investor to spend large periods out of the market during which no risk is incurred. This strong performance is achieved even though the trading rule only correctly signals equity market out-performance 50% of the time. This indicates that the out-performance following correct signals is substantially more than the under-performance following incorrect signals. The international trading rule results are similar to those in the US. Sharpe ratios are consistently five times larger for the trading rule than the buy-and-hold approach and are sometimes ten times larger. It is clear that the economic significance is well in excess of reasonable estimates of transactions costs. The trading rules switch around 30 times in the five year period, or 6 times per year. Transactions costs would therefore be in the vicinity of 0.6% p.a. Mean returns after transactions costs are higher for the trading rule than the buy-and-hold approach in all countries except the US, and the trading rule Sharpe ratios are substantially higher in all countries including the US. Overall we conclude that a trading rule that uses commodity price movements to time the market can generate economically important out-of-sample profits.

6. Conclusions

We show that monthly stock market returns are more predictable when refined observation intervals are employed. It is conventional to use monthly observations to predict monthly returns but there is no apparent theoretical reason behind this. If markets are near efficient then shorter intervals seem more appropriate. Using a full month of data may increase noise and understate or completely obscure the shorter term predictability that is present. Alternatively, if information takes time to diffuse into prices then it makes sense to use more historical intervals than simply one month.

Our results suggest that price changes of industrial metal commodities (aluminum and zinc) measured over intervals of less than one month predict monthly stock returns in the US and many countries around the world. We also find that the information contained in price changes in energy series takes longer than one month to be fully reflected in equity market prices. The predictability we document is economically and statistically significant, robust to data mining adjustment and survives the usual robustness checks used in the literature. The predictability is sometimes evident despite there being no predictability in the monthly data and is always stronger than that documented using monthly return prediction intervals.

Although we appear to be the first to show that changing measurement intervals has a big impact on conclusions regarding stock market return predictability, the suggestion that this might be the case has been around for many years. In a seminal paper Kendall concluded (p. 18) that "the interval of observation may be very important" for return predictability tests, but this assumption seems to have been ignored in the return predictability literature ever since.

Our results are likely to be of interest to the professional investment community. It seems very likely that value can be added using commodities as predictors of equity market returns. Checking for predictability using flexible rather than fixed return intervals is also likely to add value in other areas of the return predictability universe.

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Table 1: Summary Statistics

Monthly	Source	Start Date	Obs	Mean (%)	Std Dev (%)	Min (%)	Max (%)	Skewness	Kurtosis	rho(1)
Panel A: Commodities										
WT Crude Oil	GFD	198304	299	0.41	9.24	-35.25	37.14	-0.01	5.43	0.12*
Brent Crude Oil	GFD	198706	249	0.68	10.54	-36.51	38.85	0.18	4.53	-0.03
Unleaded Gas	GFD	198606	261	0.60	12.58	-44.36	67.03	0.62	6.67	-0.09
Heating Oil	DS	198301	302	0.41	9.34	-34.87	32.46	-0.11	4.84	0.07
GasOil	DS	199902	109	2.01	9.22	-27.17	26.56	-0.20	3.47	-0.01
Natural Gas	DS	199401	170	0.87	16.98	-53.81	39.44	-0.15	3.24	-0.04
Aluminum	GFD	198901	230	0.09	5.98	-24.50	30.07	0.19	6.33	-0.02
Copper	DS	197701	374	0.48	7.20	-34.51	26.46	-0.07	5.70	0.00
Lead	GFD	198901	230	0.71	7.45	-19.14	24.83	0.30	3.65	0.06
Nickel	GFD	198902	229	0.25	9.57	-35.05	31.02	-0.17	4.05	0.09
Zinc	GFD	198901	230	0.28	7.46	-23.11	26.39	0.21	4.04	0.03
Gold	GFD	197001	458	0.72	5.72	-24.40	25.53	0.59	7.08	0.11*
Silver	DS	197302	421	0.54	9.24	-64.59	43.63	-0.35	11.23	0.09
Wheat	GFD	197001	458	0.40	7.99	-30.94	33.41	0.04	4.30	0.07
Corn	DS	197001	458	0.33	7.22	-25.31	40.95	0.59	7.01	0.01
Soybeans	DS	197001	458	0.39	8.54	-57.90	44.46	-0.30	11.35	-0.09
Cotton	DS	197701	374	0.04	8.01	-73.95	27.28	-2.00	22.63	0.00
Sugar	DS	197302	421	0.10	11.59	-31.10	51.53	0.47	4.56	0.13*
Coffee	DS	198101	326	0.08	10.79	-47.20	41.91	0.33	5.20	-0.10
Cocoa	DS	198402	289	0.03	8.01	-28.79	29.69	0.33	3.94	-0.09
Live Cattle	DS	197001	458	0.26	5.69	-23.68	17.72	-0.41	4.82	-0.08
Hogs	DS	197601	386	-0.03	8.95	-30.07	27.59	-0.02	3.56	-0.02

Panel B: Equity Indices										
Monthly	Source	Start Date	Obs	Mean (%)	Std Dev (%)	Min (%)	Max (%)	Skewness	Kurtosis	rho(1)
US	MSCI USD	197001	458	0.82	4.36	-23.86	16.37	-0.56	5.59	0.02
Australia	MSCI USD	197001	458	0.83	7.08	-58.90	22.72	-1.63	15.05	-0.03
Austria	MSCI USD	197001	458	0.94	5.81	-26.51	24.77	0.03	5.79	0.09
Belgium	MSCI USD	197001	458	1.09	5.40	-20.89	23.72	-0.23	5.81	0.10
Canada	MSCI USD	197001	458	0.90	5.53	-24.89	16.53	-0.79	5.72	0.04
Denmark	MSCI USD	197001	458	1.14	5.31	-18.73	22.12	-0.11	3.92	-0.02
France	MSCI USD	197001	458	0.94	6.35	-26.38	23.77	-0.36	4.63	0.07
Germany	MSCI USD	197001	458	0.91	6.10	-27.91	21.26	-0.56	5.01	0.00
Hong Kong	MSCI USD	197001	458	1.29	10.31	-56.98	63.05	-0.53	9.94	0.08
Italy	MSCI USD	197001	458	0.62	7.08	-24.10	27.00	-0.03	3.79	0.05
Japan	MSCI USD	197001	458	0.86	6.23	-21.55	21.72	0.03	3.58	0.10
Netherlands	MSCI USD	197001	458	1.10	5.24	-19.60	22.85	-0.62	5.31	0.00
Norway	MSCI USD	197001	458	1.05	7.60	-32.64	22.67	-0.57	4.94	0.09
Singapore	MSCI USD	197001	458	0.98	8.27	-53.35	42.70	-0.47	9.17	0.10
Spain	MSCI USD	197001	458	0.88	6.35	-31.89	23.68	-0.46	5.46	0.07
Sweden	MSCI USD	197001	458	1.16	6.74	-25.15	20.63	-0.37	3.89	0.04
Switzerland	MSCI USD	197001	458	0.99	5.22	-19.41	21.98	-0.32	4.54	0.06
United Kingdom	MSCI USD	197001	458	0.93	6.19	-24.25	44.73	0.49	9.27	0.07
World	MSCI USD	197001	458	0.83	4.10	-18.59	13.73	-0.63	4.79	0.08
World X US	MSCI USD	197001	458	0.89	4.74	-17.82	15.63	-0.43	4.13	0.09

Notes: Summary statistics are based on commodity data from Global Financial Data (GFD) and Datastream (DS). Equity market series are MSCI total return series in USD from Datastream. All statistics are calculated based on monthly returns. *denotes statistical significance at the 5% level.

Table 2: Monthly Regression Analysis

		Panel A: US							Panel B: UK	
		Const	t(Const)	alpha	t(alpha)	R2	Adj-R2	Obs	alpha	t(alpha)
Energy	WT Crude Oil	0.010	**4.17**	-0.089	**-3.74**	3.77%	3.44%	298	-0.092	**-2.95**
	Brent Crude Oil	0.008	**3.30**	-0.081	**-3.63**	3.97%	3.57%	248	-0.056	**-2.30**
	Unleaded Gas	0.009	**3.37**	-0.041	**-1.86**	1.40%	1.02%	260	-0.018	-0.77
	Heating Oil	0.010	**4.36**	-0.101	**-4.06**	4.88%	4.56%	301	-0.084	**-2.53**
	GasOil	0.003	0.86	-0.088	**-2.33**	3.95%	3.04%	108	-0.055	-1.14
	Natural Gas	0.007	**2.26**	0.022	0.94	0.83%	0.24%	169	0.021	1.07
Industrial Metals	Aluminum	0.009	**3.31**	-0.125	**-3.05**	3.48%	3.06%	229	-0.096	**-1.87**
	Copper	0.010	**4.48**	-0.062	**-2.45**	1.11%	0.84%	373	-0.021	-0.60
	Lead	0.009	**3.25**	-0.015	-0.56	0.08%	-0.36%	229	-0.016	-0.45
	Nickel	0.009	**3.28**	-0.053	**-2.07**	1.61%	1.17%	228	-0.045	**-1.70**
	Zinc	0.008	**3.24**	0.005	0.14	0.01%	-0.43%	229	0.030	0.81
Precious Metals	Gold	0.009	**4.14**	-0.040	-1.51	0.27%	0.05%	458	-0.021	-0.50
	Silver	0.008	**3.90**	-0.024	-1.50	0.24%	0.01%	420	-0.047	-1.44
	Wheat	0.008	**3.94**	0.016	0.69	0.09%	-0.13%	458	0.010	0.25
Agriculture	Corn	0.009	**4.17**	-0.032	-1.08	0.28%	0.06%	457	-0.020	-0.48
	Soybeans	0.008	**4.13**	-0.017	-0.79	0.11%	-0.11%	457	0.007	0.21
	Cotton	0.009	**4.41**	0.029	1.08	0.30%	0.03%	373	0.047	1.44
	Sugar	0.008	**3.94**	-0.042	**-1.73**	1.23%	1.00%	420	-0.006	-0.15
	Coffee	0.010	**4.07**	0.002	0.11	0.00%	-0.31%	325	0.037	1.17
	Cocoa	0.010	**4.01**	-0.044	-1.32	0.67%	0.32%	288	-0.020	-0.50
Livestock	Live Cattle	0.009	**4.11**	-0.035	-1.10	0.22%	0.00%	457	-0.032	-0.62
	Hogs	0.009	4.45	0.044	1.44	0.86%	0.60%	385	0.060	**1.82**

Notes: Estimation results of regression (1) $r_T^m = \mu + \alpha x_{T-1}^m + \varepsilon_t$ in the text, where r_T^m is the monthly return on the equity market index in month *T* and x_{T-1}^m is the return on the commodity series in month *T-1*. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. Panel A contains US results, while Panel B contains UK results. Statistically significant results at the 10% level are highlighted in bold.

Table 3: US Near Efficiency and Gradual Information Diffusion t-statistics

	Energy						Industrial Metals					Precious Met		Agriculture							Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel A: Near Efficiency																						
1	-0.61	**-2.16**	-0.14	**-2.01**	-0.96	0.83	1.21	**-1.85**	0.20	0.26	**2.88***	1.19	-0.77	0.54	-0.32	**-2.30**	-0.43	0.46	-0.70	0.59	0.17	-0.40
2	-0.19	-0.03	0.26	-1.62	-0.20	0.78	-0.20	-1.24	-0.45	-0.55	1.60	0.24	-1.18	-0.38	-0.59	**-2.13**	0.57	-0.46	0.07	0.57	0.84	-0.41
3	-0.08	-0.34	1.10	-0.35	0.34	0.75	-1.56	**-4.11***	-0.65	-1.07	0.97	-0.83	-1.58	-0.36	-1.23	**-2.87***	-0.45	-0.19	-0.38	0.12	-0.26	-0.22
4	-1.25	-0.84	0.57	-0.94	-0.14	0.64	-1.27	**-4.63***	-1.08	-1.01	0.39	-0.60	**-1.81**	-0.29	-0.89	**-1.81**	-1.32	-0.70	-0.60	-1.09	0.23	0.08
5	0.16	-0.65	0.82	-0.58	-0.07	0.89	-1.25	**-2.79***	-1.11	-0.29	1.08	-0.78	-1.27	0.56	-0.55	-1.64	-1.25	-0.73	0.11	-0.62	0.62	0.21
6	0.76	0.15	0.68	-0.06	0.34	0.93	-1.41	**-2.69***	-1.10	-0.29	1.45	-0.24	-0.96	-0.04	-0.81	**-1.72**	**-2.19**	-0.81	0.20	-0.97	0.65	0.19
7	0.38	-0.37	0.51	-0.91	-0.04	0.09	-1.36	**-2.36**	-0.87	0.11	0.76	-0.39	-1.12	-0.13	-1.39	**-1.98**	**-1.83**	-0.08	0.40	-1.04	0.64	0.20
8	-0.20	-0.42	0.40	-0.87	-0.52	0.33	**-2.13**	**-2.42**	-0.96	-0.21	0.66	-0.43	**-1.89**	-0.38	-1.27	**-1.97**	-1.48	0.45	-0.17	-1.25	0.55	0.18
9	-1.11	-1.21	0.04	-1.25	-1.37	0.96	**-2.45**	-1.61	-0.64	-0.82	0.38	-0.31	-1.35	-0.23	-1.11	**-1.89**	-0.99	0.24	-0.13	-1.14	0.40	0.18
10	**-1.69**	**-1.84**	-0.15	**-1.92**	**-1.93**	0.66	**-2.59**	**-1.71**	-1.05	**-1.84**	-0.19	-0.49	**-2.03**	0.50	-0.64	-1.11	-0.78	-0.11	0.24	-1.19	1.03	0.82
11	**-2.27**	**-2.41**	-0.28	**-2.69***	**-1.68**	0.77	**-2.57**	-1.61	-0.99	-1.51	0.50	-1.25	**-2.61**	0.54	-0.99	-1.29	-1.14	-0.21	0.03	-1.04	1.14	0.41
12	**-1.86**	**-2.50**	-0.07	**-2.70***	**-1.71**	0.88	**-3.09***	**-1.83**	-1.19	**-1.99**	0.05	-1.62	**-2.32**	0.30	-1.06	-0.88	-0.80	-0.77	-0.34	-1.49	0.68	0.44
13	-1.38	**-2.94***	0.05	**-2.42**	**-1.73**	1.23	**-3.04***	**-2.56**	-0.95	**-2.04**	0.24	**-1.91**	**-2.36**	0.35	-1.13	-0.97	-0.48	-0.94	-0.45	**-1.78**	0.73	0.44
14	**-2.14**	**-2.68***	-0.50	**-2.81***	**-2.14**	0.87	**-3.11***	**-2.60**	-1.18	**-2.16**	0.04	**-1.79**	**-1.66**	0.36	-1.05	-0.82	-0.07	-0.89	-0.09	**-1.94**	0.32	0.69
15	**-2.54**	**-2.94***	-0.60	**-2.97***	**-2.60**	0.84	**-3.48***	**-3.12***	-0.84	**-2.56**	0.17	**-2.09**	**-2.56**	0.46	-1.23	-0.69	-0.15	-0.94	-0.46	-1.52	-0.05	1.09
16	**-2.77***	**-2.84***	-0.84	**-3.28***	**-3.13***	0.74	**-3.43***	**-3.42***	-1.35	**-2.74***	0.17	**-2.17**	**-2.33**	0.45	-1.27	-0.57	0.17	-1.11	-0.52	-1.15	-0.17	1.23
17	**-3.03***	**-2.86***	-1.29	**-3.92***	**-2.88***	0.64	**-3.73***	**-3.24***	-1.30	**-2.76***	0.24	**-1.75**	**-1.97**	1.26	-1.30	-0.38	0.47	-1.22	-0.25	-0.99	-0.24	1.41
18	**-2.91***	**-3.23***	-1.30	**-3.75***	**-2.31**	0.89	**-3.35***	**-3.28***	-0.98	**-2.59**	0.23	**-1.91**	**-1.97**	0.85	-1.29	-0.62	0.39	**-1.65**	-0.43	-1.18	-0.72	1.30
19	**-3.45***	**-3.05***	-1.35	**-4.15***	**-2.77***	0.89	**-3.34***	**-2.97***	-0.39	**-2.27**	0.25	-1.36	-1.48	0.86	-1.36	-0.57	0.43	-1.57	-0.11	-1.17	-0.72	1.42
20	**-3.52***	**-3.28***	**-1.69**	**-4.22***	**-2.60**	1.09	**-2.80***	**-3.23***	-0.03	**-2.05**	0.27	-1.38	-1.48	0.99	-1.18	-0.67	0.50	-1.64	0.12	-1.31	-1.02	1.30
21	**-3.38***	**-3.00***	-1.58	**-3.99***	**-2.44**	1.06	**-3.13***	**-2.70***	-0.28	**-1.96**	-0.26	**-1.67**	-1.55	0.96	-1.41	-0.75	0.64	**-1.83**	0.09	-1.44	-1.24	1.31
22	**-3.30***	**-3.20***	**-1.75**	**-3.74***	**-2.04**	1.40	**-3.03***	**-2.29**	-0.74	**-1.82**	-0.11	-1.37	-1.46	0.35	-1.29	-0.92	0.88	**-1.92**	0.16	-1.34	-1.25	1.23

	Energy						Industrial Metals					Precious Met		Agriculture						Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel B: Gradual Information Diffusion																						
1	**-3.51***	**-3.20***	**-1.91**	**-3.70***	**-1.76**	1.17	**-3.11***	**-1.69**	-0.59	**-1.74**	-0.37	**-1.74**	-1.42	0.27	-1.21	-0.49	1.35	**-1.75**	0.08	-1.48	**-1.91**	1.40
2	**-3.16***	**-3.36***	**-2.07**	**-3.42***	**-1.82**	0.88	**-2.89***	**-1.79**	-0.46	-1.33	-0.43	-0.93	-0.84	0.98	-0.97	-0.21	0.91	**-1.67**	-0.09	-1.51	**-2.65***	1.23
3	**-2.97***	**-3.37***	**-2.44**	**-3.27***	**-2.26**	0.94	**-2.90***	-0.55	-0.95	-1.16	-0.56	-0.89	-0.72	1.12	-0.74	0.28	1.58	**-1.92**	0.61	-1.20	**-2.38**	1.29
4	**-2.81***	**-3.31***	**-2.48**	**-3.06***	**-2.01**	0.83	**-3.29***	-0.36	-0.69	-0.87	-0.54	-0.78	-0.59	1.13	-0.92	-0.01	**2.04**	**-1.97**	0.99	-0.79	**-2.68***	1.25
5	**-3.03***	**-3.10***	**-2.23**	**-3.35***	**-2.09**	0.96	**-3.29***	-0.75	-1.06	-1.19	-0.72	-0.72	-0.71	0.28	-1.24	-0.29	**1.86**	**-2.33**	0.61	-1.05	**-2.78***	0.99
6	**-4.65***	**-3.72***	**-2.37**	**-4.06***	**-2.55**	0.76	**-2.97***	-0.68	-1.56	-1.31	-1.01	-0.83	-0.93	0.55	-1.45	-0.59	**2.24**	**-2.35**	0.56	-0.94	**-2.62**	1.01
7	**-3.52***	**-3.09***	**-2.43**	**-3.69***	**-1.98**	1.36	**-2.69***	-0.55	**-1.66**	-1.12	-0.61	-0.71	-1.00	0.85	-1.22	-0.76	**2.27**	**-2.52**	0.30	-0.81	**-2.42**	1.00
8	**-3.47***	**-3.22***	**-2.24**	**-3.45***	-1.32	1.25	**-1.93**	-0.04	-1.43	-0.89	-0.54	-0.19	-0.56	1.47	-1.31	-0.73	**2.56**	**-3.09***	1.08	-0.71	**-2.33**	0.89
9	**-3.06***	**-2.37**	**-1.98**	**-2.85***	-0.60	1.05	**-1.90**	-0.48	-1.48	-0.47	-0.20	-0.36	-0.75	0.93	**-1.69**	-1.22	**1.95**	**-3.01***	0.92	-0.80	**-2.00**	1.15
10	**-2.91***	**-2.18**	**-2.02**	**-2.60**	-0.52	0.92	-1.46	-0.15	-1.25	0.15	0.19	-0.59	-0.86	0.18	**-2.07**	**-1.80**	**1.70**	**-2.98***	0.48	-0.78	**-2.53**	0.46
11	**-1.95**	-1.62	**-2.01**	**-2.21**	-0.69	1.06	-0.96	-0.35	-1.08	-0.22	-0.04	-0.11	-0.50	0.17	**-2.10**	**-1.84**	1.32	**-3.37***	0.64	-0.90	**-2.50**	0.57
12	**-1.97**	-0.98	**-2.44**	**-1.90**	-0.10	1.14	-0.19	-0.06	-0.77	0.33	0.41	0.32	-0.28	0.17	**-2.01**	**-1.74**	1.18	**-3.41***	0.70	-0.44	**-2.26**	0.57
13	**-1.96**	-0.83	**-2.26**	-1.50	0.03	0.60	-0.37	0.30	-1.26	0.46	0.28	0.40	-0.32	-0.07	**-2.00**	**-1.66**	1.03	**-2.73***	0.60	-0.38	**-2.19**	0.87
14	**-1.69**	-0.60	**-2.15**	-1.17	0.43	1.16	-0.11	0.28	-1.01	0.32	0.36	0.30	-0.46	-0.30	**-2.10**	-1.50	0.43	**-2.47**	0.12	-0.38	**-2.04**	0.79
15	-1.64	-0.33	**-2.16**	-1.29	0.22	0.64	-0.02	0.47	-1.23	0.37	0.08	0.43	-0.14	-0.28	**-2.01**	-1.57	0.52	**-2.52**	0.03	-0.50	**-1.88**	1.00
16	-1.19	0.05	**-2.16**	-0.92	0.55	0.95	0.06	0.55	-1.05	0.31	-0.08	0.45	-0.29	-0.62	**-1.95**	-1.57	0.01	**-2.62**	-0.38	-0.96	-1.53	1.09
17	-0.44	0.28	-1.44	-0.24	0.52	1.28	0.36	0.04	-0.84	0.42	-0.18	0.29	-0.37	-1.11	**-1.70**	-1.39	-0.50	**-2.43**	-0.29	-0.93	-1.16	1.12
18	-0.42	0.51	-1.36	-0.12	0.73	0.83	0.39	0.53	-1.09	0.32	-0.06	0.52	-0.32	-0.76	-1.46	-1.01	-0.14	**-1.80**	0.13	-0.82	-0.67	1.41
19	0.54	0.34	-0.54	0.34	0.97	1.03	0.40	0.70	-1.59	0.00	-0.55	0.23	-0.43	-0.61	-1.64	-1.01	-0.42	**-1.71**	-0.25	-1.22	-0.44	1.41
20	0.43	0.51	-0.36	0.84	0.60	0.63	0.03	0.49	**-1.74**	-0.38	-0.55	0.26	-0.44	-0.67	**-1.70**	-0.87	-0.69	-1.57	-0.37	-1.31	-0.17	1.58
21	0.29	0.14	-0.27	0.56	0.67	0.33	0.25	0.31	**-1.87**	0.06	0.26	0.18	-0.78	-0.75	-1.48	-0.86	-0.93	-1.21	-0.20	-0.99	-0.20	1.59
22	0.31	0.59	-0.05	0.61	0.65	-0.12	-0.07	-0.17	-1.33	0.10	0.38	-0.07	-0.92	-0.24	-1.21	-0.81	-1.01	-0.64	0.01	-1.18	-0.36	1.19

Notes: Panel A Near Efficiency results are t-statistics for alpha from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ in the text, while the Panel B Gradual Information Diffusion results are t-statistics for alpha from regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text . t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. The Bonferroni correction has been applied. Based on 23 different alternatives the critical t-statistic for the 10% level of significance is 2.63. t-statistics of this level and higher are denoted with a *. The critical normal t-statistic at the 10% level is 1.65. t-statistics of this level and higher are in bold.

Table 4: Commodity Short List

	Predictability Type	Interval	alpha	Max (t) Interval t(alpha)	R2	alpha	Monthly t(alpha)	R2
WT Crude Oil	Gradual Information Diffusion	One Month Lagged 6 Days	-0.106	**-4.65**	5.73%	-0.089	**-3.74**	3.77%
Brent Crude Oil	Gradual Information Diffusion	One Month Lagged 6 Days	-0.085	**-3.72**	4.20%	-0.081	**-3.63**	3.97%
Heating Oil	Near Efficiency	20 Day Cumulative Return	-0.111	**-4.22**	4.94%	-0.101	**-4.06**	4.88%
GasOil	Near Efficiency	16 Day Cumulative Return	-0.148	**-3.13**	7.05%	-0.088	**-2.33**	3.95%
Aluminum	Near Efficiency	17 Day Cumulative Return	-0.186	**-3.73**	5.57%	-0.125	**-3.05**	3.48%
Copper	Near Efficiency	4 Day Cumulative Return	-0.309	**-4.63**	4.15%	-0.062	**-2.45**	1.11%
Copper	Near Efficiency	16 Day Cumulative Return	-0.117	**-3.42**	2.51%	-0.062	**-2.45**	1.11%
Nickel	Near Efficiency	17 Day Cumulative Return	-0.077	**-2.76**	2.66%	-0.053	**-2.07**	1.61%
Zinc	Near Efficiency	1 Day Cumulative Return	0.324	**2.88**	2.19%	0.005	0.14	0.01%
Soybeans	Near Efficiency	3 Day Cumulative Return	-0.200	**-2.87**	1.29%	-0.017	-0.79	0.11%
Sugar	Gradual Information Diffusion	One Month Lagged 12 Days	-0.063	**-3.41**	2.97%	-0.042	**-1.73**	1.23%
Live Cattle	Gradual Information Diffusion	One Month Lagged 5 Days	-0.092	**-2.78**	1.34%	-0.035	-1.10	0.22%

Notes: Commodities that predict equity market returns in the US in a statistically significant manner (based on Bonferroni-adjusted t-statistics) and the interval that generates the largest t-statistic (in absolute terms). Monthly results for each commodity are presented with statistically significant results at the 10% level (based on normal t-statistics) highlighted in bold.

Table 5: International Results

	Interval			OLS Wald stats	SUR Wald stats	Count out of 17	World	World X US
WT Crude Oil	Int-1	GID	5	**104.54**	**50.32**	10	**-2.96**	**-2.23**
	Int	GID	6	**150.34**	**56.70**	13	**-4.40**	**-3.21**
	Int+ 1	GID	7	**120.31**	**54.10**	12	**-3.46**	**-2.78**
Brent Crude Oil	Int-1	GID	5	**100.36**	**45.63**	11	**-2.98**	**-2.38**
	Int	GID	6	**127.55**	**48.64**	12	**-3.43**	**-2.69**
	Int+ 1	GID	7	**107.94**	**45.79**	13	**-3.11**	**-2.63**
Heating Oil	Int-1	NE	19	**95.77**	**53.16**	8	**-2.50**	-1.41
	Int	NE	20	**98.58**	**61.71**	8	**-2.63**	-1.48
	Int+ 1	NE	21	**109.51**	**59.00**	9	**-2.61**	-1.52
GasOil	Int-1	NE	15	**88.53**	**46.01**	12	**-2.23**	**-1.88**
	Int	NE	16	**102.84**	**48.05**	13	**-2.60**	**-2.10**
	Int+ 1	NE	17	**60.56**	**48.56**	6	**-2.15**	-1.52
Aluminum	Int-1	NE	16	**92.93**	**37.83**	12	**-3.05**	**-2.47**
	Int	NE	17	**88.12**	**38.68**	13	**-3.10**	**-2.39**
	Int+ 1	NE	18	**68.45**	**33.89**	8	**-2.74**	**-2.09**
Copper	Int-1	NE	3	**29.83**	**32.29**	2	**-3.32**	-1.48
	Int	NE	4	**42.95**	**52.58**	4	**-3.48**	-1.51
	Int+ 1	NE	5	**29.97**	**52.13**	2	**-2.53**	-1.39
Copper	Int-1	NE	15	**44.91**	**36.56**	4	**-2.50**	-1.46
	Int	NE	16	**45.38**	**36.27**	4	**-2.45**	-1.25
	Int+ 1	NE	17	**39.63**	**31.87**	4	**-2.38**	-1.21
Nickel	Int-1	NE	16	**52.60**	20.93	11	**-2.48**	**-1.94**
	Int	NE	17	**44.05**	20.19	11	**-2.27**	-1.64
	Int+ 1	NE	18	**53.39**	18.25	11	**-2.18**	**-1.69**
Zinc	Int-1	NE	N/A	N/A	N/A	N/A	N/A	N/A
	Int	NE	1	**108.81**	**34.64**	16	3.48	3.66
	Int+ 1	NE	2	**38.43**	18.41	9	2.03	2.26
Soybeans	Int-1	NE	2	24.85	18.74	4	-1.56	-0.89
	Int	NE	3	17.34	15.54	0	**-1.90**	-0.67
	Int+ 1	NE	4	7.84	14.48	0	-0.78	0.24
Sugar	Int-1	GID	11	**84.76**	**36.94**	8	**-3.09**	**-2.28**
	Int	GID	12	**79.79**	**40.69**	8	**-3.04**	**-2.19**
	Int+ 1	GID	13	**64.81**	**33.59**	4	**-2.45**	**-1.83**
Live Cattle	Int-1	GID	4	**34.40**	19.51	3	**-2.54**	**-1.82**
	Int	GID	5	**40.04**	21.81	4	**-2.66**	**-1.90**
	Int+ 1	GID	6	**35.48**	23.06	3	**-2.46**	-1.59

Notes: "NE" refers to a near efficiency interval, while "GID" refers to a gradual information diffusion interval. The first two result columns contain Wald statistics for the joint test of the null hypothesis that alpha (slope coefficient) equals zero for each country using both an OLS and SUR approaches Significance at the 10% level or greater is denoted in bold. The third results column contains the number of countries where there is significance at the 10% level or better. The final two columns contain t-statistics for the World and World excluding the US. t-statistics that are significant at the 10% level are highlighted in bold.

Table 6: Sub-Period Analysis

		Interval		OLS Wald stats	SUR Wald stats	Count out of 18	US	World
WT Crude Oil	Int-1	GID	5	**62.69**	**30.58**	8	**-2.59**	-1.62
	Int	GID	6	**113.20**	**39.34**	14	**-4.00**	**-2.68**
	Int+ 1	GID	7	**107.85**	**40.42**	13	**-3.37**	**-2.32**
Brent Crude Oil	Int-1	GID	5	**89.29**	**47.58**	11	**-3.12**	**-1.96**
	Int	GID	6	**125.45**	**49.75**	12	**-3.79**	**-2.47**
	Int+ 1	GID	7	**120.07**	**45.49**	13	**-3.50**	**-2.54**
Heating Oil	Int-1	NE	19	**43.36**	**44.94**	4	**-3.36**	-0.40
	Int	NE	20	**45.59**	**48.28**	4	**-3.18**	-0.39
	Int+ 1	NE	21	**49.77**	**46.18**	3	**-3.00**	-0.46
GasOil	Int-1	NE	15	**88.53**	**46.01**	13	**-2.60**	**-1.88**
	Int	NE	16	**102.84**	**48.05**	14	**-3.13**	**-2.10**
	Int+ 1	NE	17	**60.56**	**48.56**	7	**-2.88**	-1.52
Aluminum	Int-1	NE	16	**92.93**	**37.83**	13	**-3.43**	**-2.47**
	Int	NE	17	**88.12**	**38.68**	14	**-3.73**	**-2.39**
	Int+ 1	NE	18	**68.45**	**33.89**	9	**-3.35**	**-2.09**
Copper	Int-1	NE	3	25.10	20.61	4	**-2.50**	-1.14
	Int	NE	4	**28.62**	**29.65**	4	**-2.97**	-1.20
	Int+ 1	NE	5	**18.88**	**32.41**	2	**-2.11**	-0.89
Copper	Int-1	NE	15	**67.11**	24.72	9	**-3.21**	**-2.55**
	Int	NE	16	**69.40**	**29.55**	11	**-3.76**	**-2.41**
	Int+ 1	NE	17	**48.41**	24.23	9	**-3.33**	**-2.09**
Nickel	Int-1	NE	16	**52.60**	20.93	12	**-2.74**	**-1.94**
	Int	NE	17	**44.05**	20.19	12	**-2.76**	-1.64
	Int+ 1	NE	18	**53.39**	18.25	12	**-2.59**	**-1.69**
Zinc	Int-1	NE	N/A	N/A	N/A	N/A	0.14	0.23
	Int	NE	1	**108.81**	**34.64**	17	**2.88**	3.66
	Int+ 1	NE	2	**38.43**	18.41	9	1.60	2.26
Soybeans	Int-1	NE	2	**42.76**	25.73	10	**-3.44**	-0.90
	Int	NE	3	19.86	17.43	1	**-2.57**	-0.37
	Int+ 1	NE	4	**29.20**	20.99	6	**-2.65**	-0.48
Sugar	Int-1	GID	11	**26.95**	20.15	6	**-2.72**	-1.04
	Int	GID	12	21.11	20.09	3	**-2.14**	-0.76
	Int+ 1	GID	13	17.07	21.48	2	**-1.78**	-0.52
Live Cattle	Int-1	GID	4	8.15	12.97	1	-0.42	-0.62
	Int	GID	5	9.26	13.34	1	-0.55	-0.51
	Int+ 1	GID	6	11.05	14.56	0	-0.48	-0.69

Notes: "NE" refers to a near efficiency interval, while "GID" refers to a gradual information diffusion interval. All results relate to the post recent sub-period of 1989-2008 for each country. The first two result columns contain Wald statistics for the joint test of the null hypothesis that alpha (slope coefficient) equals zero for each country using both an OLS and SUR approaches Significance at the 10% level or greater is denoted in bold. The third results column contains the number of countries where there is significance at the 10% level or better. The final two columns contain t-statistics for the US and the World. t-statistics that are significant at the 10% level are highlighted in bold.

Table 7: US market: Other Return Predictors

Panel A: Business Cycle and TVRP Variables

	constant	Com	RM	Inf	Def Spr	Div Yld	Vol	Adj R2	Obs
WT Crude Oil	0.001	**-0.097**	-0.019	-0.771	**-1.821**	**0.615**	0.126	6.09%	297
Brent Crude Oil	0.013	**-0.076**	-0.023	-0.892	**-3.815**	0.350	0.179	5.71%	247
Heating Oil	0.000	**-0.107**	-0.019	**-1.870**	**-1.448**	**0.704**	0.113	6.36%	301
GasOil	-0.011	**-0.189**	-0.090	-0.505	**-14.282**	**4.410**	**0.734**	19.12%	109
Aluminum	0.020	**-0.176**	-0.032	**-1.259**	**-3.666**	0.328	0.066	7.42%	229
Copper	-0.002	**-0.298**	0.003	**-1.915**	**-1.373**	**0.657**	0.177	5.92%	373
Copper	-0.003	**-0.114**	0.029	**-1.825**	**-1.286**	**0.662**	0.168	4.31%	373
Nickel	0.015	**-0.069**	-0.026	-1.174	**-3.649**	0.409	0.116	4.54%	228
Zinc	0.009	**0.461**	-0.082	**-1.279**	**-4.943**	0.488	0.357	6.65%	229
Soybeans	-0.011	**-0.212**	-0.005	**-2.381**	-1.061	**0.706**	0.311	4.30%	457
Sugar	-0.010	**-0.063**	-0.024	**-2.197**	**-1.309**	**0.741**	**0.301**	5.76%	420
Live Cattle	-0.011	**-0.103**	0.003	**-2.435**	**-1.032**	**0.731**	**0.287**	4.51%	456

Panel B: Fama and French Factors, Liquidity, and Momentum

	constant	Com	RM	Size	BM	Liquidity	Mom	Adj R2	Obs
WT Crude Oil	0.013	**-0.086**	0.022	**-0.257**	**-0.668**	-0.103	**0.274**	36.07%	283
Brent Crude Oil	0.012	**-0.065**	0.039	**-0.221**	**-0.659**	-0.110	**0.272**	34.92%	233
Heating Oil	0.013	**-0.099**	0.028	**-0.266**	**-0.685**	**-0.108**	**0.278**	35.88%	287
GasOil	0.010	**-0.107**	0.045	-0.159	**-0.525**	**-0.186**	**0.207**	41.60%	95
Aluminum	0.013	**-0.128**	0.039	**-0.197**	**-0.610**	**-0.177**	**0.156**	31.26%	215
Copper	0.013	**-0.197**	0.023	**-0.191**	**-0.666**	-0.071	**0.285**	32.36%	359
Copper	0.013	**-0.085**	0.039	**-0.186**	**-0.667**	-0.076	**0.290**	31.92%	359
Nickel	0.013	**-0.077**	0.058	**-0.219**	**-0.629**	**-0.175**	**0.152**	30.97%	214
Zinc	0.012	**0.241**	0.017	**-0.219**	**-0.646**	**-0.172**	**0.152**	29.84%	215
Soybeans	0.013	-0.099	-0.032	-0.043	**-0.550**	**-0.139**	**0.295**	27.67%	443
Sugar	0.013	**-0.051**	-0.028	-0.093	**-0.603**	**-0.119**	**0.290**	30.62%	406
Live Cattle	0.013	**-0.082**	-0.020	-0.046	**-0.558**	**-0.134**	**0.296**	28.70%	442

Panel C: Other Return Predictors

	alpha	Com	RM	Jan	Hall	Adj R2	Obs
WT Crude Oil	0.007	**-0.103**	-0.013	0.002	0.005	4.89%	297
Brent Crude Oil	0.005	**-0.081**	0.014	-0.003	0.006	3.11%	247
Heating Oil	0.005	0.001	0.000	0.004	**0.008**	-0.28%	301
GasOil	0.003	**-0.105**	0.006	-0.017	0.004	2.06%	108
Aluminum	0.005	**-0.197**	0.006	-0.005	0.008	4.48%	229
Copper	0.005	**-0.113**	0.045	0.003	**0.008**	2.14%	373
Copper	0.005	**-0.324**	0.021	0.002	**0.008**	4.23%	373
Nickel	0.005	**-0.085**	0.015	-0.005	0.008	1.87%	228
Zinc	0.006	0.009	-0.030	-0.007	0.007	-0.88%	229
Soybeans	0.005	**-0.293**	0.016	0.006	**0.007**	1.23%	457
Sugar	0.005	**-0.065**	-0.003	0.006	**0.007**	3.24%	420
Live Cattle	0.004	**-0.071**	0.020	0.006	**0.007**	0.97%	456

Notes: Regression results for the US market for each commodity after controlling for other well-known return predictors. In each instance we use the interval that generated the largest t-statistic, as specified in Table 4. Variables that are statistically significant at the 10% level are highlighted in bold.

Table 8: Time-Varying Risk Premia Test Results

		Interval		OLS Wald stats	OLS pvalue	SUR Wald stats	SUR pvalue
WT Crude Oil	Int-1	GID	5	**47.87**	0.00	**29.84**	0.03
	Int	GID	6	**53.73**	0.00	**29.64**	0.03
	Int+ 1	GID	7	**42.91**	0.00	**38.79**	0.00
Brent Crude Oil	Int-1	GID	5	12.40	0.78	**27.60**	0.05
	Int	GID	6	**24.87**	0.10	**34.18**	0.01
	Int+ 1	GID	7	15.91	0.53	**32.37**	0.01
Heating Oil	Int-1	NE	19	24.98	0.10	**39.46**	0.00
	Int	NE	20	**28.90**	0.04	**35.98**	0.00
	Int+ 1	NE	21	**30.59**	0.02	**40.40**	0.00
GasOil	Int-1	NE	15	**44.04**	0.00	**27.37**	0.04
	Int	NE	16	**36.41**	0.00	18.29	0.31
	Int+ 1	NE	17	23.08	0.11	17.75	0.34
Aluminum	Int-1	NE	16	**117.74**	0.00	**29.29**	0.03
	Int	NE	17	**86.29**	0.00	**32.50**	0.01
	Int+ 1	NE	18	**91.12**	0.00	**28.70**	0.04
Copper	Int-1	NE	3	12.52	0.77	23.42	0.14
	Int	NE	4	14.80	0.61	**27.96**	0.05
	Int+ 1	NE	5	18.05	0.39	22.28	0.17
Copper	Int-1	NE	15	22.85	0.15	**32.13**	0.01
	Int	NE	16	15.46	0.56	**30.81**	0.02
	Int+ 1	NE	17	16.35	0.50	**30.89**	0.02
Nickel	Int-1	NE	16	10.09	0.86	12.45	0.71
	Int	NE	17	**29.04**	0.02	15.11	0.52
	Int+ 1	NE	18	24.63	0.08	13.38	0.65
Zinc	Int-1	NE	N/A				
	Int	NE	1	**50.81**	0.00	**28.55**	0.04
	Int+ 1	NE	2	**44.67**	0.00	**31.01**	0.02
Soybeans	Int-1	NE	2	19.18	0.32	13.97	0.67
	Int	NE	3	15.26	0.58	14.17	0.66
	Int+ 1	NE	4	12.65	0.76	**22.29**	0.17
Sugar	Int-1	GID	11	**47.34**	0.00	**34.86**	0.01
	Int	GID	12	**41.54**	0.00	**28.92**	0.04
	Int+ 1	GID	13	**35.96**	0.00	**30.19**	0.03
Live Cattle	Int-1	GID	4	**59.79**	0.00	16.14	0.51
	Int	GID	5	**50.00**	0.00	16.18	0.51
	Int+ 1	GID	6	**77.29**	0.00	18.45	0.36

Notes: "NE" refers to a near efficiency interval, while "GID" refers to a gradual information diffusion interval. Estimation results for the regression $r_T^m = \mu + \alpha_1 x_{t-1}^d + D_t \alpha_2 x_{t-1}^d + \varepsilon_t$ (near efficiency) and $r_T^m = \mu + \alpha_1 x_{T-1-t-1}^m + D_t \alpha_2 x_{T-1-t-1}^m + \varepsilon_t$ (gradual information diffusion) based on the interval specified in Table 4. The dummy variable D_t equals 1 if the expected excess returns (based on our core results in Section 4) are negative and 0 otherwise. The sum of α_1 and α_2 represents the absolute value of the lagged reaction of the equity market for the large commodity price increases. We follow Driesprong, Jacobsen, and Maat (2008) and use the Wald test to determine if the sum of α_1 and α_2 is statistically significantly different from zero.

Table 9: Economic Significance

Panel A: Max t Commodity Interval Return

	Interval		Economic Significance	Bounds	Absolute Relative Significance
WT Crude Oil	GID	6	-0.018	(-0.0271,-0.0087)	0.41
Brent Crude Oil	GID	6	-0.016	(-0.0266,-0.0054)	0.37
Heating Oil	NE	20	-0.020	(-0.0300,-0.0101)	0.46
GasOil	NE	16	-0.035	(-0.0515,-0.0182)	0.80
Aluminum	NE	17	-0.021	(-0.0343,-0.0078)	0.48
Copper	NE	4	-0.043	(-0.0627,-0.0233)	0.99
Copper	NE	16	-0.016	(-0.0263,-0.0065)	0.38
Nickel	NE	17	-0.013	(-0.0255,-0.0010)	0.30
Zinc	NE	1	0.069	(0.0327,0.1048)	1.58
Soybeans	NE	3	-0.036	(-0.0585,-0.0137)	0.83
Sugar	GID	12	-0.015	(-0.0234,-0.0060)	0.34
Cattle	GID	5	-0.012	(-0.0192,-0.0043)	0.27

Panel B: Monthly Commodity Return

	Economic Significance	Bounds	Absolute Relative Significance
WT Crude Oil	-0.015	(-0.0247,-0.0060)	0.35
Brent Crude Oil	-0.016	(-0.0258,-0.0062)	0.37
Heating Oil	-0.018	(-0.0273,-0.0082)	0.41
GasOil	-0.021	(-0.0344,-0.0072)	0.48
Aluminum	-0.013	(-0.0240,-0.0029)	0.31
Copper	-0.008	(-0.0161,-0.0007)	0.19
Nickel	-0.007	(-0.0186,0.0038)	0.17
Zinc	0.002	(-0.0079,0.0118)	0.05
Soybeans	-0.003	(-0.0104,0.0041)	0.07
Sugar	-0.010	(-0.0209,0.0017)	0.22
Live Cattle	-0.006	(-0.0135,0.0013)	0.14

Panel C: Other Return Predictors

	Economic Significance	Bounds	Absolute Relative Significance
RM	0.002	(-0.0072,0.0109)	0.04
Inf	-0.009	(-0.0162,-0.0010)	0.20
Def Spr	0.000	(-0.0076,0.0078)	0.00
Div Yiel	0.007	(-0.0014,0.0158)	0.17
Vol	0.006	(-0.0020,0.0139)	0.14
Size	0.011	(-0.0019,0.0240)	0.25
BM	-0.035	(-0.0466,-0.0229)	0.80
Liquidity	-0.009	(-0.0226,0.0054)	0.20
Mom	0.032	(0.0206,0.0441)	0.74
Jan	0.004	(-0.0048,0.0133)	0.10
Hall	0.008	(0.0008,0.0150)	0.18

Notes: "NE" refers to a near efficiency interval, while "GID" refers to a gradual information diffusion interval. "Economic Significance" as the response of the market return to a two-standard deviation shock in each commodity return. The lower and upper bounds of this estimate based on the coefficient standard errors are reported in parentheses. The "Absolute Relative Significance" is calculated by dividing the economic significance by the standard deviation of the market return.

Table 10: General to Specific Results

Panel A: Max t Commodity Interval Return

	US	Aus	Aut	Bel	Can	Den	Fra	Ger	HK	Ita	Jap	Net	Nor	Sin	Spa	Swe	Swi	UK	Wor	Wor X US
Constant	**2.83**	**2.17**	0.58	**3.11**	1.51	**2.35**	1.54	1.24	1.59	**2.00**	-0.80	**2.30**	0.47	0.44	**3.08**	**1.91**	**2.83**	**2.10**	**1.85**	0.80
WT Crude Oil	**-3.38**	**-2.89**		**-2.68**	**-2.57**	**-2.34**	**-1.96**	**-1.79**		**-3.57**	**-2.44**	**-1.94**			**-2.91**	**-3.11**	**-1.74**	**-3.29**	**-4.25**	**-3.30**
Heating Oil					**1.836**				**1.868**		**2.551**							**1.67**	**1.96**	**2.34**
Aluminum	**-2.78**	**-2.33**			**-2.47**						**-2.66**	**-2.85**	**-1.83**				**-3.70**	**-1.82**	**-2.88**	**-2.74**
Copper				**-1.86**	**-2.04**				**-2.75**										**-2.43**	**-1.85**
Copper	**-1.82**							**-3.88**		**-1.74**								**-2.10**		
Nickel			**-2.37**				**-3.01**		**-3.19**					**-3.17**						
Zinc	**2.25**	**5.00**			**3.20**		**2.87**	**1.78**	**4.57**		**2.06**	**2.36**		**2.46**			**1.77**	**2.28**	**3.14**	**3.10**
Soybeans	**-2.52**											**-1.91**								
Sugar																				
Live Cattle						**-2.37**														
R^2	0.185	0.131	0.046	0.044	0.118	0.042	0.085	0.092	0.203	0.096	0.102	0.095	0.020	0.065	0.065	0.056	0.138	0.130	0.182	0.150
Adj. R^2	0.160	0.115	0.040	0.036	0.091	0.034	0.068	0.076	0.184	0.088	0.080	0.073	0.014	0.054	0.061	0.051	0.122	0.103	0.157	0.124

Panel B: Monthly Commodity Interval Return

	US	Aus	Aut	Bel	Can	Den	Fra	Ger	HK	Ita	Jap	Net	Nor	Sin	Spa	Swe	Swi	UK	World	World X US
Constant	**2.64**	**2.17**	0.73	**3.03**	**1.08**		**2.70**	**1.67**	1.05	**1.95**	-1.05	**2.07**		0.29	**3.13**	**1.90**	**2.43**	**1.66**	1.19	1.19
WT Crude Oil	**-2.46**	**-1.70**		**-2.55**			**-1.82**	**-2.58**		**-3.88**					**-2.20**	**-3.55**				
Heating Oil																				
Aluminum	**-2.94**		**-1.97**		**-3.09**						**-1.99**	**-2.12**					**-2.44**	**-2.68**	**-3.17**	**-3.17**
Copper																				
Copper																				
Nickel									**-2.48**					**-2.71**			**-1.97**			
Zinc																	**1.80**			
Soybeans																				
Sugar																				
Live Cattle		**-1.67**																		
R^2	0.076	0.015	0.035	0.037	0.025		0.029	0.032	0.025	0.106	0.018	0.018		0.029	0.044	0.045	0.084	0.036	0.042	0.042
Adj. R^2	0.065	0.007	0.030	0.033	0.019		0.025	0.028	0.019	0.102	0.012	0.012		0.023	0.040	0.041	0.068	0.030	0.037	0.037

Notes: Our starting point is all commodities specified in Table 4. Intervals in Panel A are also those recorded in Table 4. Intervals in Panel B are monthly. We begin by including all commodities in a regression for each country and then follow the approach outlined in Hoover and Perez (1999) and remove commodities that are not statistically significant (starting with the least significant first). We continue this process until we are left with commodities that are statistically significant. We do not include Brent crude oil because of its high correlation with West Texas crude oil or gasoil because this series is very short (commenced in 1999). All results are relate to the 198902 to 200302 period. t-statistics that are statistically significant at the 10% level are highlighted in bold.

Table 11: Results Summary

			International			Sub-Period			Return Predictors			DJM	Economic	General to
			Mkts out of 17	SUR	World x US	Mkts out of 18	SUR	World x US	Bus Cycle	FF 5 Factor	Other	TVRP SUR	Sig	Specific
WT Crude Oil	GID	6	12	Yes	Yes	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Brent Crude Oil	GID	6	12	Yes	Yes	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Heating Oil	NE	20	8	Yes	No	4	Yes	Yes	Yes	Yes	No	Yes	Yes	No
GasOil	NE	16	10	Yes	Yes	11	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Aluminum	NE	17	11	Yes	Yes	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Copper	NE	4	3	Yes	No	3	Yes	No	Yes	Yes	Yes	Yes	Yes	No
Copper	NE	16	4	Yes	No	10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Nickel	NE	17	11	Yes	Yes	12	No	No	Yes	Yes	Yes	No	Yes	No
Zinc	NE	1	13	Yes	No	13	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Soybeans	NE	3	1	No	No	6	No	No	Yes	No	Yes	Yes	Yes	No
Sugar	GID	12	7	Yes	Yes	4	No	No	Yes	Yes	Yes	Yes	Yes	No
Live Cattle	GID	5	3	No	Yes	1	No	No	Yes	Yes	Yes	No	Yes	No

Notes: "NE" refers to a near efficiency interval, while "GID" refers to a gradual information diffusion interval. Summary results are presented for our International, Sub-Period, Other Return Predictor, and Driesprong, Jacobsen, and Maat (2008) time-varying risk premia robustness tests. We then make an overall judgment as to whether a commodity passes or fails these robustness tests on average. We report three types of summary information for our international tests, including the number of markets that are statistically significant, whether the joint test across all markets based on SUR is statistically significant, and whether there is significance in the World excluding US index. We report equivalent results for our sub-period robustness checks. The only difference is that the US index is included in the market significance count and the joint test. Our other return predictor tests include those which include business cycle variables, the Fama and French three factors and size and liquidity, and other return predictors. Our time-varying risk premia test is based on Driesprong, Jacobsen, and Maat (2008). In all of the tests described above we judge a result to be statistically significance if this shows at the 10% level or better at either the interval specified in columns 2 and 3 or the interval one day before or after (to account for differences in international exchange closing times). The economic significance and general-to-specific results are a summary of those presented in Tables 10 and 11 respectively.

Table 12: Out-of-Sample Economic Significance

Panel A: Buy and Hold

	US	Aus	Aut	Bel	Can	Den	Fra	Ger	HK	Ita	Jap	Net	Nor	Sin	Spa	Swe	Swi	UK	Wor	Wor X US
Mean	0.099	0.099	0.112	0.130	0.108	0.137	0.112	0.109	0.155	0.074	0.103	0.132	0.126	0.118	0.106	0.140	0.119	0.111	0.100	0.107
St Dev	0.151	0.245	0.201	0.187	0.191	0.184	0.220	0.211	0.357	0.245	0.216	0.181	0.263	0.287	0.220	0.233	0.181	0.215	0.142	0.164
Sharpe	0.076	0.029	0.063	0.086	0.058	0.050	0.038	0.071	0.092	-0.039	0.058	0.111	0.045	0.063	0.008	0.090	0.083	0.049	0.083	0.085

Panel B: Max t interval - West Texas Crude Oil, Aluminum, Zinc all included

	US	Aus	Aut	Bel	Can	Den	Fra	Ger	HK	Ita	Jap	Net	Nor	Sin	Spa	Swe	Swi	UK	Wor	Wor X US
Mean	0.096	0.232	0.146	0.204	0.229	0.188	0.183	0.212	0.205	0.132	0.126	0.201	0.256	0.216	0.125	0.194	0.143	0.137	0.118	0.151
St Dev	0.071	0.125	0.128	0.112	0.107	0.128	0.112	0.136	0.123	0.105	0.102	0.112	0.181	0.098	0.120	0.164	0.111	0.096	0.072	0.084
Sharpe	0.265	0.368	0.122	0.354	0.525	0.222	0.277	0.279	0.430	0.135	0.354	0.309	0.332	0.531	0.079	0.231	0.224	0.161	0.352	0.415
% of correct predictions	0.483	0.533	0.367	0.500	0.583	0.417	0.500	0.483	0.633	0.417	0.567	0.517	0.517	0.583	0.433	0.483	0.483	0.467	0.533	0.533
No. of switch out of 60	30	33	30	30	31	30	31	31	32	33	32	30	36	31	29	31	34	31	24	25

Notes: Panel A contains annualized mean returns and return standard deviations and Sharpe ratios for the 200303-200802 period. In Panel B we report the out-of-sample results to a trading rule that generates a signal to enter the market based on the past performance of West Texas crude oil, aluminum, and zinc, the three commodities that consistently performed the best in the general to specific results in Table 10. Each month the trading rule signals a position in the equity market or T-bills. If the forecast equity return is higher than the current risk free rate, it signals an equity market position, otherwise, it signals a position in the T-bills. We report mean returns and standard deviation of returns (both annualized), Sharpe ratios, and the percentage of correct predictions (the proportion of months that both forecast equity return and realized equity returns are higher or lower than the risk free rate).

Figure 1a: Near efficient market hypothesis: $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ **(equation 2)**

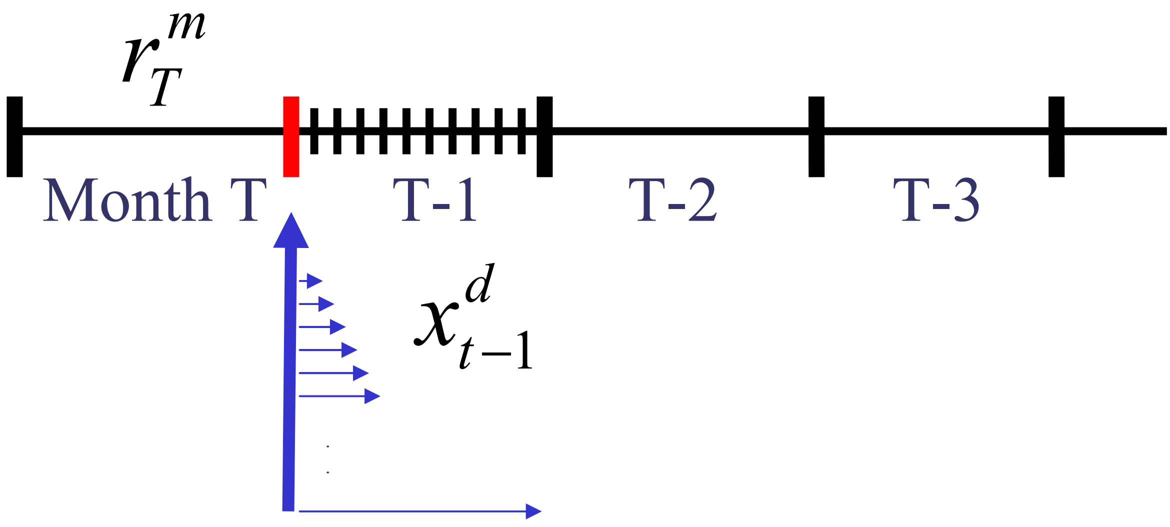


Figure 1b: Gradual diffusion market hypothesis: $r_T^m = \mu + \alpha x_{(T-1)-(t-1)}^m + \varepsilon_t$ **(equation 3)**

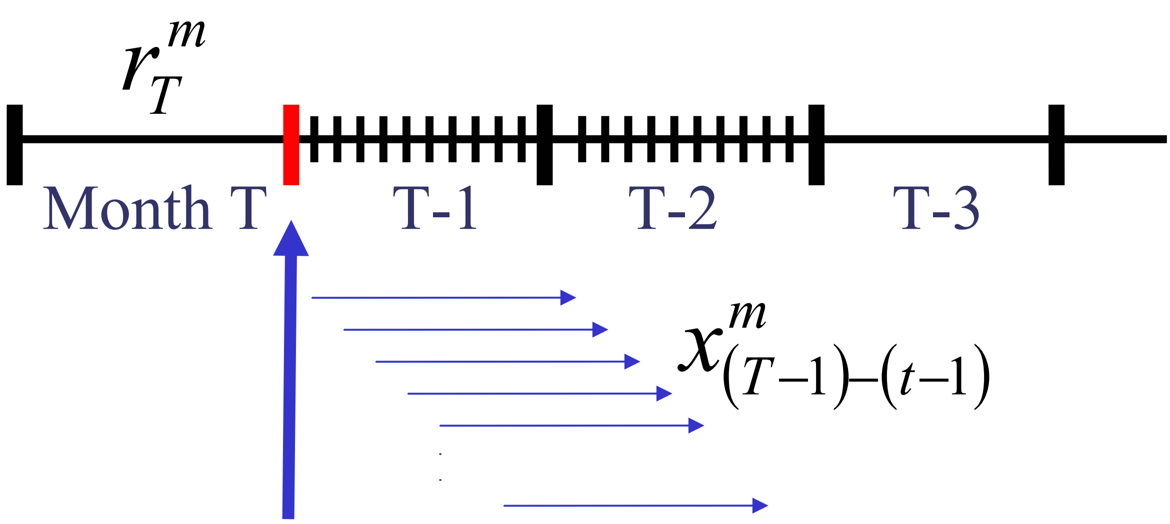


Figure 2a: Gradual Information Diffusion

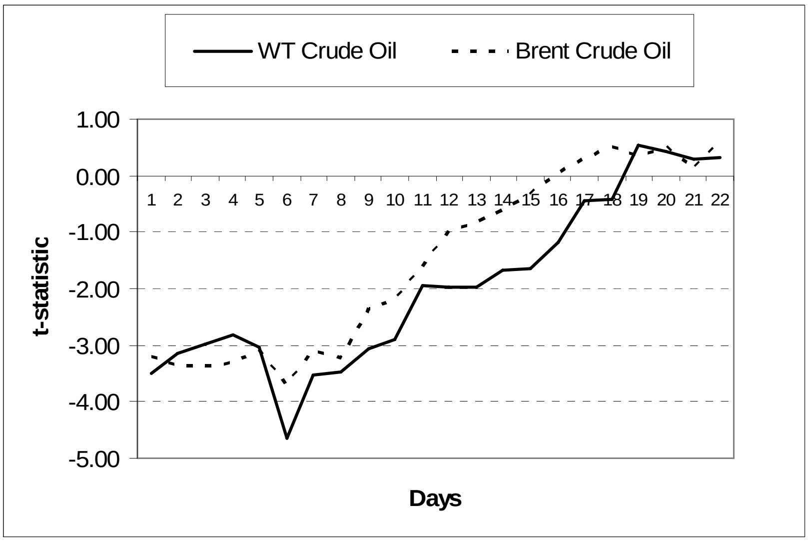


Figure 2b: Near Efficiency

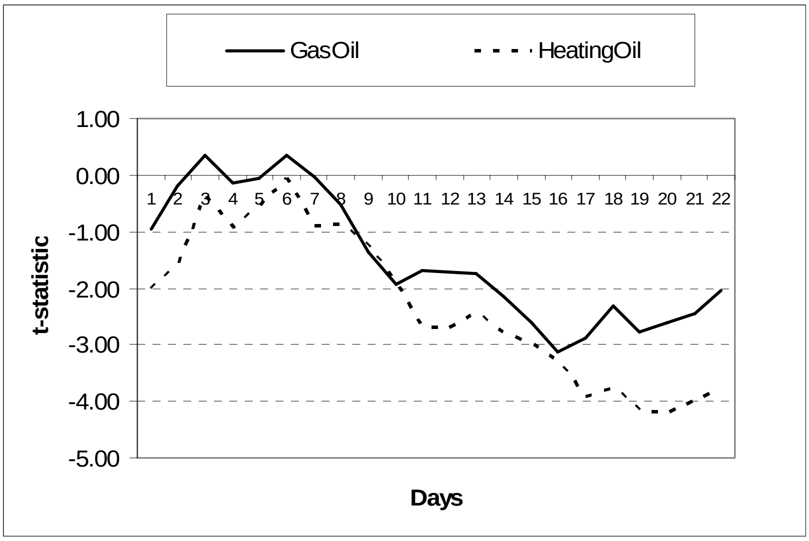


Figure 2c: Near Efficiency

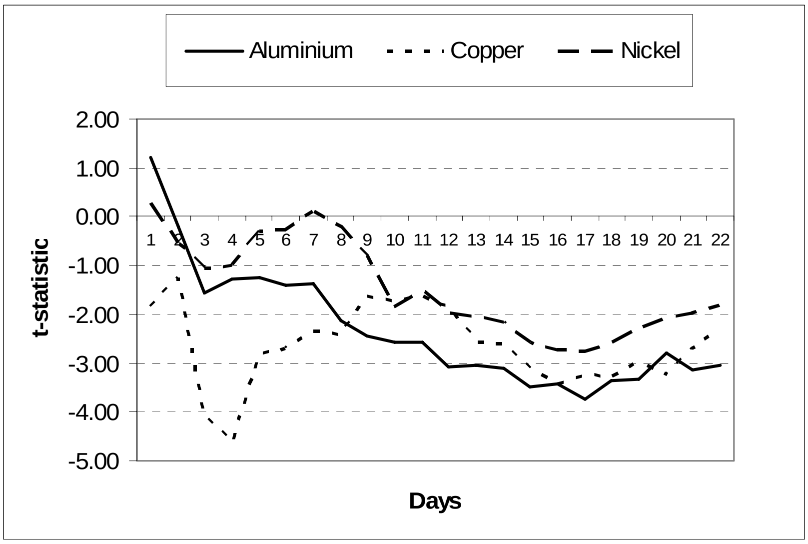


Figure 3a: Copper R^2s and t-statistic

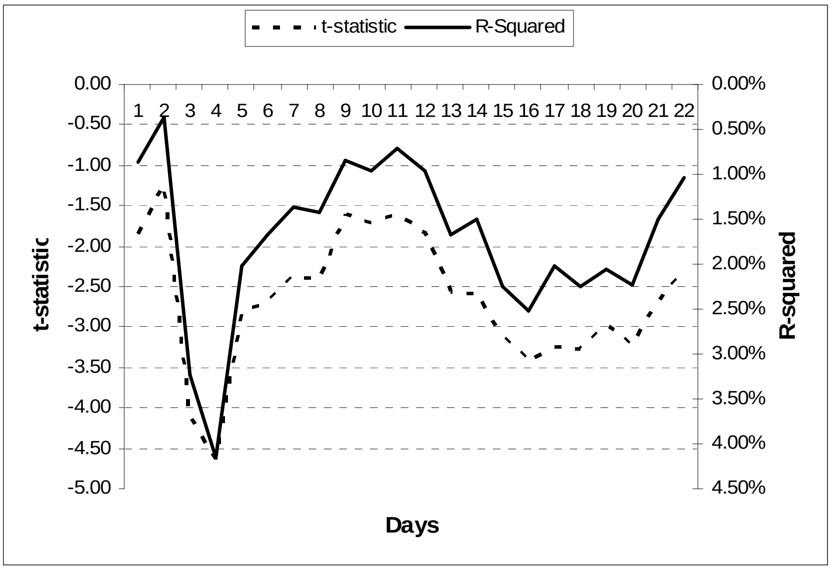
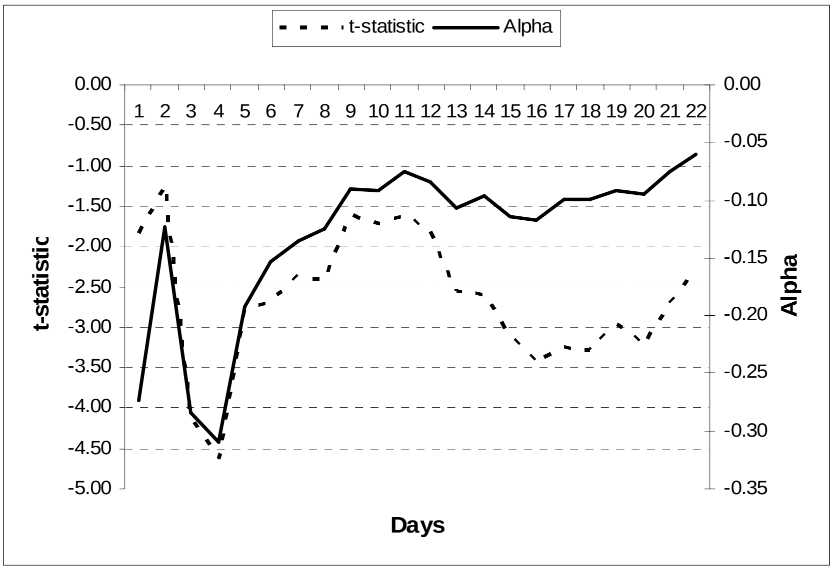


Figure 3b: Copper Alpha and t-statistic



Appendix Table 1: Correlations of Daily and Monthly Commodity Returns

	Energy						Industrial Metals					Precious Met		Agriculture							Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel A: Daily																						
W Oil	1.00	0.59	**0.64**	**0.76**	0.55	0.26	0.04	0.05	0.01	0.04	0.01	0.17	0.13	0.05	0.06	0.05	0.03	0.02	0.02	0.01	0.01	0.03
B Oil	0.59	1.00	0.49	0.58	**0.81**	0.15	0.04	0.06	0.03	0.06	0.05	0.16	0.13	0.02	0.03	0.03	0.04	0.03	0.01	0.03	0.01	0.01
U Gas	**0.64**	0.49	1.00	**0.69**	0.46	0.25	0.01	0.04	0.00	0.02	0.00	0.14	0.09	0.03	0.05	0.04	0.05	0.04	0.00	0.02	0.00	0.02
H Oil	**0.76**	0.58	**0.69**	1.00	**0.64**	0.37	0.03	0.06	0.03	0.04	0.01	0.18	0.13	0.04	0.07	0.07	0.03	0.03	0.01	0.02	0.02	0.01
G Oil	0.55	**0.81**	0.46	**0.64**	1.00	0.22	0.07	0.12	0.06	0.09	0.08	0.14	0.14	0.07	0.07	0.07	0.09	0.10	0.05	0.07	0.03	0.01
N Gas	0.26	0.15	0.25	0.37	0.22	1.00	0.00	0.04	0.01	0.02	-0.02	0.07	0.04	0.02	0.08	0.09	0.03	0.03	0.01	0.01	0.05	0.02
Alum	0.04	0.04	0.01	0.03	0.07	0.00	1.00	0.24	0.36	0.37	0.44	0.08	0.10	0.03	0.02	0.04	0.01	0.04	0.05	0.03	0.02	0.01
Copp	0.05	0.06	0.04	0.06	0.12	0.04	0.24	1.00	0.18	0.23	0.26	0.30	0.32	0.06	0.09	0.12	0.08	0.12	0.05	0.05	0.07	0.05
Lead	0.01	0.03	0.00	0.03	0.06	0.01	0.36	0.18	1.00	0.35	0.48	0.09	0.07	0.04	0.02	0.02	0.01	0.04	0.03	0.05	0.01	0.00
Nick	0.04	0.06	0.02	0.04	0.09	0.02	0.37	0.23	0.35	1.00	0.40	0.07	0.08	0.02	0.04	0.03	0.03	0.04	0.03	0.01	0.03	0.03
Zinc	0.01	0.05	0.00	0.01	0.08	-0.02	0.44	0.26	0.48	0.40	1.00	0.10	0.11	0.03	0.04	0.03	0.02	0.05	0.05	0.07	0.03	0.00
Gold	0.17	0.16	0.14	0.18	0.14	0.07	0.08	0.30	0.09	0.07	0.10	1.00	**0.62**	0.07	0.11	0.14	0.08	0.11	0.05	0.12	0.05	0.04
Silv	0.13	0.13	0.09	0.13	0.14	0.04	0.10	0.32	0.07	0.08	0.11	**0.62**	1.00	0.12	0.17	0.21	0.08	0.13	0.08	0.12	0.07	0.06
Whea	0.05	0.02	0.03	0.04	0.07	0.02	0.03	0.06	0.04	0.02	0.03	0.07	0.12	1.00	0.44	0.35	0.09	0.10	0.03	0.04	0.07	0.05
Corn	0.06	0.03	0.05	0.07	0.07	0.08	0.02	0.09	0.02	0.04	0.04	0.11	0.17	0.44	1.00	**0.66**	0.18	0.10	0.06	0.05	0.09	0.09
Soyb	0.05	0.03	0.04	0.07	0.07	0.09	0.04	0.12	0.02	0.03	0.03	0.14	0.21	0.35	**0.66**	1.00	0.18	0.12	0.08	0.07	0.11	0.11
Cott	0.03	0.04	0.05	0.03	0.09	0.03	0.01	0.08	0.01	0.03	0.02	0.08	0.08	0.09	0.18	0.18	1.00	0.08	0.03	0.04	0.04	0.08
Suga	0.02	0.03	0.04	0.03	0.10	0.03	0.04	0.12	0.04	0.04	0.05	0.11	0.13	0.10	0.10	0.12	0.08	1.00	0.06	0.07	0.02	0.02
Coff	0.02	0.01	0.00	0.01	0.05	0.01	0.05	0.05	0.03	0.03	0.05	0.05	0.08	0.03	0.06	0.08	0.03	0.06	1.00	0.11	0.02	0.00
Coco	0.01	0.03	0.02	0.02	0.07	0.01	0.03	0.05	0.05	0.01	0.07	0.12	0.12	0.04	0.05	0.07	0.04	0.07	0.11	1.00	0.02	0.03
L Cat	0.01	0.01	0.00	0.02	0.03	0.05	0.02	0.07	0.01	0.03	0.03	0.05	0.07	0.07	0.09	0.11	0.04	0.02	0.02	0.02	1.00	0.37
Hogs	0.03	0.01	0.02	0.01	0.01	0.02	0.01	0.05	0.00	0.03	0.00	0.04	0.06	0.05	0.09	0.11	0.08	0.02	0.00	0.03	0.37	1.00

	Energy						Industrial Metals					Precious Met		Agriculture						Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel B: Monthly																						
W Oil	1.00	**0.92**	**0.67**	**0.87**	**0.88**	0.33	0.20	0.07	0.04	0.05	0.01	0.22	0.14	-0.07	-0.10	-0.02	0.10	-0.07	-0.03	0.11	-0.04	0.07
B Oil	**0.92**	1.00	**0.62**	**0.82**	**0.86**	0.25	0.19	0.11	0.01	0.08	0.02	0.19	0.08	-0.04	-0.16	-0.02	0.10	0.02	-0.01	0.10	-0.07	0.04
U Gas	**0.67**	**0.62**	1.00	**0.60**	**0.66**	0.27	0.16	0.10	-0.02	0.08	0.07	0.03	0.00	-0.11	0.02	-0.01	0.13	-0.07	0.04	0.06	-0.11	0.07
H Oil	**0.87**	**0.82**	**0.60**	1.00	**0.95**	0.48	0.19	0.10	0.00	0.14	-0.02	0.19	0.09	-0.02	-0.10	0.00	0.06	-0.03	-0.05	0.09	-0.01	0.04
G Oil	**0.88**	**0.86**	**0.66**	**0.95**	1.00	0.39	0.17	0.21	0.01	0.19	0.12	0.20	0.14	-0.02	-0.06	0.00	0.10	0.11	-0.01	0.03	-0.10	-0.06
N Gas	0.33	0.25	0.27	0.48	0.39	1.00	0.06	0.06	0.02	0.10	0.03	0.14	0.02	0.02	0.05	0.09	0.01	0.08	-0.12	-0.14	-0.12	0.06
Alum	0.20	0.19	0.16	0.19	0.17	0.06	1.00	0.58	0.30	0.46	0.39	0.15	0.18	0.08	0.04	0.12	0.07	0.03	0.08	-0.04	0.05	0.01
Copp	0.07	0.11	0.10	0.10	0.21	0.06	0.58	1.00	0.36	0.45	0.47	0.36	0.37	0.19	0.11	0.21	0.16	0.18	0.09	0.10	0.10	0.07
Lead	0.04	0.01	-0.02	0.00	0.01	0.02	0.30	0.36	1.00	0.32	0.45	0.13	0.21	0.07	-0.05	-0.05	0.07	0.06	0.14	0.07	0.07	-0.09
Nick	0.05	0.08	0.08	0.14	0.19	0.10	0.46	0.45	0.32	1.00	0.43	0.16	0.23	0.01	0.11	0.09	0.01	-0.04	0.10	-0.05	0.05	0.03
Zinc	0.01	0.02	0.07	-0.02	0.12	0.03	0.39	0.47	0.45	0.43	1.00	0.09	0.22	0.06	0.06	-0.01	0.03	0.10	0.10	0.05	0.02	0.04
Gold	0.22	0.19	0.03	0.19	0.20	0.14	0.15	0.36	0.13	0.16	0.09	1.00	**0.70**	0.05	0.07	0.16	0.06	0.22	0.06	0.17	0.03	0.06
Silv	0.14	0.08	0.00	0.09	0.14	0.02	0.18	0.37	0.21	0.23	0.22	**0.70**	1.00	0.13	0.16	0.16	0.07	0.18	0.06	0.19	0.07	0.09
Whea	-0.07	-0.04	-0.11	-0.02	-0.02	0.02	0.08	0.19	0.07	0.01	0.06	0.05	0.13	1.00	0.48	0.41	0.05	0.14	0.07	0.01	0.18	0.14
Corn	-0.10	-0.16	0.02	-0.10	-0.06	0.05	0.04	0.11	-0.05	0.11	0.06	0.07	0.16	0.48	1.00	**0.69**	0.26	0.15	0.10	0.04	0.15	0.15
Soyb	-0.02	-0.02	-0.01	0.00	0.00	0.09	0.12	0.21	-0.05	0.09	-0.01	0.16	0.16	0.41	**0.69**	1.00	0.26	0.15	0.19	0.05	0.18	0.17
Cott	0.10	0.10	0.13	0.06	0.10	0.01	0.07	0.16	0.07	0.01	0.03	0.06	0.07	0.05	0.26	0.26	1.00	0.06	0.08	0.17	-0.07	0.00
Suga	-0.07	0.02	-0.07	-0.03	0.11	0.08	0.03	0.18	0.06	-0.04	0.10	0.22	0.18	0.14	0.15	0.15	0.06	1.00	0.07	0.08	0.00	-0.04
Coff	-0.03	-0.01	0.04	-0.05	-0.01	-0.12	0.08	0.09	0.14	0.10	0.10	0.06	0.06	0.07	0.10	0.19	0.08	0.07	1.00	0.08	-0.02	0.03
Coco	0.11	0.10	0.06	0.09	0.03	-0.14	-0.04	0.10	0.07	-0.05	0.05	0.17	0.19	0.01	0.04	0.05	0.17	0.08	0.08	1.00	0.02	-0.01
L Cat	-0.04	-0.07	-0.11	-0.01	-0.10	-0.12	0.05	0.10	0.07	0.05	0.02	0.03	0.07	0.18	0.15	0.18	-0.07	0.00	-0.02	0.02	1.00	0.24
Hogs	0.07	0.04	0.07	0.04	-0.06	0.06	0.01	0.07	-0.09	0.03	0.04	0.06	0.09	0.14	0.15	0.17	0.00	-0.04	0.03	-0.01	0.24	1.00

Notes: Correlation coefficients greater than 0.6 are highlighted in bold.

Appendix Table 2: International Monthly Regression Results (t-statistics)

	US	Aus	Aut	Bel	Can	Den	Fra	Ger	HK	Ita	Jap	Net	Nor	Sin	Spa	Swe	Swi	UK
WT Crude Oil	**-3.74**	**-1.68**	-1.14	**-2.68**	-0.94	**-1.84**	**-2.06**	**-2.88**	0.29	**-3.86**	-0.52	**-3.28**	-0.37	-0.05	**-2.20**	**-3.80**	**-2.83**	**-2.95**
Brent Crude Oil	**-3.63**	-1.65	-0.84	**-1.76**	-0.79	**-2.12**	**-1.70**	**-2.52**	0.68	**-3.85**	0.12	**-2.15**	-0.48	-0.85	**-2.41**	**-3.54**	**-2.45**	**-2.30**
Unleaded Gas	**-1.86**	0.79	0.27	**-1.82**	0.47	-0.56	-1.02	**-1.81**	0.84	**-1.90**	1.03	-1.19	0.73	-0.37	-0.08	-1.21	-0.95	-0.77
Heating Oil	**-4.06**	-1.13	-1.44	**-2.52**	-0.66	-1.56	**-2.30**	**-2.73**	-0.18	**-3.28**	-0.34	**-2.90**	-0.96	-0.73	**-1.84**	**-3.00**	**-2.79**	**-2.53**
GasOil	**-2.33**	-1.63	-0.85	-1.31	-0.29	-1.54	-1.39	-1.63	0.38	**-1.77**	0.34	-1.44	**-1.67**	-1.08	-1.30	**-2.50**	-0.70	-1.14
Natural Gas	0.94	**1.93**	1.36	0.37	**1.76**	1.07	1.21	0.44	**2.00**	0.70	**1.91**	0.57	1.28	**1.70**	**2.59**	0.78	0.78	1.07
Aluminum	**-3.05**	-1.20	-1.12	-0.74	**-1.68**	-0.65	-1.07	-1.06	-1.43	-0.78	-1.38	-1.28	-0.35	-1.47	-0.87	-1.02	**-2.28**	**-1.87**
Copper	**-2.45**	-0.43	-0.17	-1.28	-0.25	-1.26	-1.57	**-2.46**	-0.21	-0.68	0.39	-1.27	-0.71	-0.25	0.33	-0.12	**-2.45**	-0.60
Lead	-0.56	0.68	0.53	0.66	-0.26	0.74	-0.67	-0.29	-0.48	0.47	0.38	0.09	1.39	0.47	-0.26	-0.79	-0.23	-0.45
Nickel	**-2.07**	-0.65	-1.19	-0.53	-1.06	-1.25	-1.23	**-1.72**	**-2.23**	-0.71	0.40	**-1.71**	-1.33	**-1.69**	-1.15	-1.38	**-2.45**	**-1.70**
Zinc	0.14	-0.54	0.75	0.64	0.01	-0.23	0.68	-0.62	0.53	0.63	0.50	0.72	0.99	-0.12	-0.12	0.05	0.69	0.81
Gold	-1.51	1.13	0.85	-0.94	1.25	-0.23	-0.73	-0.31	-0.89	1.07	0.22	-0.60	0.37	1.37	-0.45	0.45	-0.98	-0.50
Silver	-1.50	0.34	0.66	-1.46	-0.15	-0.48	-1.03	-1.25	-1.25	1.28	0.09	-1.05	-0.51	0.06	-0.85	0.36	-0.88	-1.44
Wheat	0.69	**2.08**	**1.89**	0.99	**2.16**	0.84	1.46	0.61	0.75	**1.79**	-1.06	0.27	0.70	1.03	1.47	0.44	0.62	0.25
Corn	-1.08	1.15	**1.67**	-1.22	0.09	0.63	-0.52	-0.27	-0.71	0.77	-0.56	-1.08	0.67	-0.18	0.34	0.48	0.03	-0.48
Soybeans	-0.79	1.28	0.04	-0.16	-0.05	0.82	0.35	0.06	-1.09	1.24	-0.92	-0.56	1.42	0.01	1.54	0.57	0.09	0.21
Cotton	1.08	1.39	-0.19	-0.08	**2.15**	1.47	-0.98	-0.13	1.26	-0.59	-1.02	0.50	**2.08**	**1.94**	0.86	0.92	1.45	1.44
Sugar	**-1.73**	-0.49	0.74	0.07	0.18	0.20	-0.67	-0.43	-1.02	0.09	0.34	-0.46	-1.05	-1.43	-0.56	-0.26	-0.62	-0.15
Coffee	0.11	1.09	-1.11	-0.55	0.35	-0.27	-0.18	-0.64	0.78	0.25	0.02	0.42	-0.06	-0.39	0.74	0.10	-1.16	1.17
Cocoa	-1.32	-0.17	0.62	-0.34	-0.91	-1.38	-0.89	-1.01	0.72	-1.12	-0.56	-0.02	-0.66	0.18	-1.48	-1.30	0.45	-0.50
Live Cattle	-1.10	0.24	-0.23	-0.34	-1.13	-1.63	-0.01	-0.54	0.98	-0.87	-0.04	-0.93	-0.20	-0.61	1.07	0.03	-0.85	-0.62
Hogs	1.44	1.64	1.78	2.14	1.10	1.85	2.04	2.23	3.02	1.18	0.80	2.68	1.70	3.26	2.38	2.71	1.89	1.82

Notes: t-statistics for alpha in regression (1) $r_T^m = \mu + \alpha x_{T-1}^m + \varepsilon_t$ in the text, where r_T^m is the monthly return on the equity market index in month *T* and x_{T-1}^m is the return on the commodity series in month *T-1*. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors (highlighted in bold if statistically significant at the 10% level).

Appendix Table 3: Contemporaneous Monthly Regression Results (t-statistics)

	US	Aus	Aut	Bel	Can	Den	Fra	Ger	HK	Ita	Jap	Net	Nor	Sin	Spa	Swe	Swi	UK
WT Crude Oil	**-1.73**	1.55	-0.34	**-1.92**	**1.70**	0.55	-1.37	-0.78	0.01	-0.44	0.02	0.49	**3.27**	0.23	-1.51	-0.86	-1.31	-0.86
Brent Crude Oil	-1.57	**1.79**	-0.57	**-2.47**	1.13	0.26	-1.04	-1.31	-0.66	0.10	0.36	0.08	**2.71**	-0.07	-1.31	-0.21	**-1.84**	-1.00
Unleaded Gas	-0.44	1.51	0.17	-0.70	**2.49**	1.34	0.42	0.29	0.28	**1.87**	1.45	0.83	**4.12**	-0.16	-0.28	0.60	-1.32	0.69
Heating Oil	-1.35	1.43	-0.25	-0.84	**2.29**	0.47	-0.48	-0.23	0.25	-0.22	0.34	1.12	**3.25**	0.06	-1.30	-1.15	-0.46	0.04
GasOil	-0.61	**1.77**	1.16	-0.24	**3.11**	0.30	0.83	-0.24	1.17	**2.47**	**2.65**	0.88	**2.68**	**1.94**	-0.62	0.59	-0.51	0.46
Natural Gas	0.25	1.46	0.95	-0.09	**2.74**	0.25	1.35	-0.16	0.91	1.40	**2.00**	0.67	**1.90**	-0.37	0.60	0.00	0.94	1.54
Aluminum	1.03	**2.94**	0.69	**1.87**	**2.63**	**2.10**	1.60	1.24	0.78	1.58	**2.75**	**2.21**	**2.30**	**1.82**	1.50	**2.04**	1.20	1.34
Copper	**2.94**	**7.57**	**6.59**	**3.23**	**5.57**	**2.98**	**3.56**	**3.59**	**3.69**	**3.37**	**2.08**	**4.59**	**4.01**	**3.13**	**3.59**	**2.87**	**3.94**	**5.73**
Lead	**1.77**	**4.37**	**3.37**	**2.69**	**4.45**	**3.58**	**2.92**	**2.78**	**2.21**	1.36	0.69	**3.26**	**4.15**	**3.38**	**3.42**	**3.62**	**3.06**	**4.14**
Nickel	**3.62**	**2.77**	1.45	**2.13**	**4.89**	**2.86**	**3.24**	**2.38**	**2.43**	**2.97**	0.96	**3.72**	**3.14**	**2.52**	**2.25**	**3.63**	**1.93**	**2.44**
Zinc	1.56	**3.04**	**1.92**	**1.98**	**3.57**	1.47	**2.32**	**1.80**	1.29	**2.36**	1.19	**2.41**	**3.11**	**2.31**	**2.26**	**3.87**	**1.85**	**2.67**
Gold	-0.73	**4.57**	**4.03**	**4.03**	**2.81**	**1.70**	**3.66**	**2.42**	1.09	**2.81**	**4.03**	**3.51**	**4.20**	0.74	1.33	1.34	**4.80**	1.50
Silver	**1.69**	**8.35**	**2.41**	**3.47**	**6.57**	1.61	**3.36**	1.04	1.48	**2.34**	**2.32**	**2.56**	**6.25**	**2.08**	1.17	**2.81**	**3.67**	**3.72**
Wheat	1.09	0.66	**-1.78**	-0.69	1.24	-0.63	0.63	-0.87	-0.95	-0.10	0.29	-0.56	1.62	-0.18	-0.68	-0.12	0.00	-0.62
Corn	0.36	0.52	0.07	-0.25	1.32	0.16	1.01	-0.66	0.71	-0.62	-0.23	-0.08	**2.22**	0.68	0.11	0.54	-0.28	-1.11
Soybeans	-0.77	0.46	-0.18	0.32	0.72	0.99	0.85	-0.63	1.29	-0.77	0.20	0.13	**1.91**	0.28	-0.09	0.52	0.04	-1.08
Cotton	0.79	**3.84**	0.41	0.58	**1.93**	1.33	0.57	1.34	**2.69**	**2.16**	0.47	1.06	0.77	0.02	1.27	**1.69**	0.06	0.18
Sugar	-0.26	**2.17**	-0.05	1.17	1.44	0.28	0.86	0.33	-1.03	0.48	-0.40	0.32	**2.56**	-0.17	1.30	0.67	0.90	-0.06
Coffee	0.79	0.20	**2.51**	1.22	-0.32	0.98	1.48	**1.83**	-0.09	0.52	0.78	0.31	**1.77**	0.49	0.78	0.96	0.47	-0.53
Cocoa	-1.26	0.41	0.39	-0.37	-0.40	0.58	0.00	-0.34	-0.70	-0.56	0.12	-0.12	0.93	-1.30	-0.07	-0.43	0.56	-0.41
Live Cattle	1.07	0.62	0.14	1.51	**1.66**	1.58	1.35	1.44	1.26	0.83	0.65	1.63	**2.17**	0.52	1.48	**1.93**	1.15	0.79
Hogs	0.80	1.12	-0.68	-0.90	0.52	-0.67	1.31	0.08	-0.55	0.09	2.13	-0.14	0.37	-1.01	0.15	0.12	-0.24	0.73

Notes: t-statistics for alpha in regression (1) $r_T^m = \mu + \alpha x_T^m + \varepsilon_t$ in the text, where r_T^m is the monthly return on the equity market index in month *T* and x_{T-1}^m is the return on the commodity series in month *T-1*. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors (highlighted in bold if statistically significant at the 10% level).

Appendix Table 4: US Near Efficiency and Gradual Information Diffusion alphas

	Energy						Industrial Metals					Precious Met		Agriculture							Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel A: Near Efficiency																						
1	-0.06	-0.21	-0.01	-0.22	-0.20	0.07	0.19	-0.27	0.02	0.04	0.32	0.23	-0.08	0.05	-0.05	-0.29	-0.08	0.05	-0.08	0.11	0.03	-0.05
2	-0.02	0.00	0.01	-0.13	-0.03	0.05	-0.03	-0.12	-0.04	-0.06	0.15	0.03	-0.09	-0.03	-0.07	-0.20	0.05	-0.03	0.01	0.08	0.12	-0.04
3	0.00	-0.02	0.05	-0.03	0.05	0.04	-0.22	-0.28	-0.05	-0.09	0.09	-0.06	-0.08	-0.02	-0.12	-0.20	-0.04	-0.01	-0.03	0.01	-0.03	-0.02
4	-0.06	-0.04	0.02	-0.06	-0.02	0.03	-0.18	-0.31	-0.08	-0.08	0.03	-0.04	-0.08	-0.02	-0.07	-0.12	-0.11	-0.03	-0.04	-0.09	0.02	0.01
5	0.01	-0.04	0.03	-0.03	-0.01	0.03	-0.14	-0.19	-0.06	-0.02	0.07	-0.05	-0.06	0.03	-0.04	-0.10	-0.09	-0.03	0.01	-0.04	0.06	0.02
6	0.03	0.01	0.03	0.00	0.03	0.04	-0.13	-0.15	-0.06	-0.02	0.10	-0.01	-0.04	0.00	-0.05	-0.10	-0.13	-0.03	0.01	-0.06	0.05	0.01
7	0.01	-0.01	0.02	-0.05	0.00	0.00	-0.11	-0.14	-0.04	0.01	0.05	-0.02	-0.04	0.00	-0.08	-0.09	-0.11	0.00	0.02	-0.06	0.05	0.01
8	-0.01	-0.02	0.01	-0.04	-0.04	0.01	-0.16	-0.12	-0.04	-0.01	0.04	-0.02	-0.05	-0.01	-0.06	-0.09	-0.09	0.01	-0.01	-0.06	0.04	0.01
9	-0.04	-0.04	0.00	-0.05	-0.08	0.03	-0.15	-0.09	-0.03	-0.04	0.02	-0.02	-0.04	-0.01	-0.05	-0.07	-0.05	0.01	0.00	-0.05	0.02	0.01
10	-0.05	-0.06	0.00	-0.07	-0.11	0.02	-0.18	-0.09	-0.05	-0.08	-0.01	-0.03	-0.05	0.02	-0.03	-0.04	-0.04	0.00	0.01	-0.05	0.06	0.05
11	-0.07	-0.07	-0.01	-0.10	-0.12	0.02	-0.17	-0.08	-0.04	-0.05	0.03	-0.06	-0.06	0.02	-0.04	-0.04	-0.05	-0.01	0.00	-0.04	0.06	0.02
12	-0.06	-0.08	0.00	-0.10	-0.11	0.03	-0.18	-0.08	-0.05	-0.06	0.00	-0.07	-0.06	0.01	-0.04	-0.03	-0.04	-0.02	-0.01	-0.06	0.03	0.02
13	-0.05	-0.09	0.00	-0.09	-0.11	0.04	-0.16	-0.11	-0.04	-0.07	0.01	-0.08	-0.06	0.01	-0.04	-0.03	-0.02	-0.03	-0.01	-0.07	0.04	0.02
14	-0.08	-0.09	-0.01	-0.11	-0.13	0.02	-0.18	-0.10	-0.04	-0.07	0.00	-0.07	-0.04	0.01	-0.04	-0.02	0.00	-0.02	0.00	-0.08	0.01	0.03
15	-0.09	-0.09	-0.02	-0.11	-0.13	0.02	-0.20	-0.11	-0.03	-0.08	0.01	-0.07	-0.05	0.01	-0.04	-0.02	-0.01	-0.02	-0.01	-0.06	0.00	0.05
16	-0.09	-0.08	-0.02	-0.12	-0.15	0.02	-0.19	-0.12	-0.05	-0.08	0.01	-0.07	-0.05	0.01	-0.04	-0.02	0.01	-0.03	-0.01	-0.04	-0.01	0.05
17	-0.10	-0.08	-0.03	-0.12	-0.13	0.02	-0.19	-0.10	-0.05	-0.08	0.01	-0.05	-0.04	0.04	-0.04	-0.01	0.01	-0.03	-0.01	-0.04	-0.01	0.05
18	-0.09	-0.08	-0.03	-0.11	-0.10	0.02	-0.16	-0.10	-0.03	-0.07	0.01	-0.06	-0.04	0.02	-0.04	-0.01	0.01	-0.04	-0.01	-0.04	-0.03	0.04
19	-0.09	-0.08	-0.03	-0.11	-0.11	0.02	-0.16	-0.09	-0.01	-0.06	0.01	-0.04	-0.03	0.02	-0.04	-0.01	0.01	-0.04	0.00	-0.04	-0.03	0.04
20	-0.09	-0.08	-0.04	-0.11	-0.10	0.03	-0.12	-0.09	0.00	-0.05	0.01	-0.04	-0.03	0.02	-0.04	-0.02	0.01	-0.04	0.00	-0.05	-0.03	0.04
21	-0.08	-0.07	-0.03	-0.10	-0.10	0.03	-0.13	-0.07	-0.01	-0.05	-0.01	-0.04	-0.02	0.02	-0.04	-0.02	0.02	-0.04	0.00	-0.05	-0.04	0.04
22	-0.08	-0.07	-0.04	-0.09	-0.08	0.03	-0.12	-0.06	-0.02	-0.05	0.00	-0.04	-0.02	0.01	-0.04	-0.02	0.02	-0.05	0.00	-0.04	-0.04	0.04

	Energy						Industrial Metals					Precious Met		Agriculture							Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel B: Gradual Information Diffusion																						
1	-0.09	-0.08	-0.05	-0.09	-0.07	0.03	-0.13	-0.04	-0.02	-0.05	-0.01	-0.05	-0.02	0.01	-0.04	-0.01	0.04	-0.05	0.00	-0.05	-0.06	0.04
2	-0.08	-0.08	-0.05	-0.09	-0.07	0.02	-0.12	-0.04	-0.01	-0.04	-0.01	-0.03	-0.01	0.02	-0.03	-0.01	0.03	-0.04	0.00	-0.05	-0.08	0.04
3	-0.08	-0.08	-0.06	-0.09	-0.09	0.02	-0.11	-0.01	-0.03	-0.03	-0.02	-0.02	-0.01	0.03	-0.02	0.01	0.04	-0.04	0.01	-0.04	-0.07	0.04
4	-0.07	-0.08	-0.06	-0.09	-0.07	0.02	-0.12	-0.01	-0.02	-0.02	-0.02	-0.02	-0.01	0.03	-0.03	0.00	0.05	-0.05	0.02	-0.03	-0.08	0.04
5	-0.08	-0.08	-0.05	-0.10	-0.07	0.02	-0.11	-0.02	-0.04	-0.03	-0.03	-0.02	-0.01	0.01	-0.04	-0.01	0.05	-0.05	0.01	-0.04	-0.09	0.03
6	-0.11	-0.08	-0.05	-0.10	-0.08	0.02	-0.11	-0.02	-0.05	-0.03	-0.04	-0.03	-0.02	0.01	-0.05	-0.01	0.06	-0.05	0.01	-0.03	-0.09	0.03
7	-0.08	-0.07	-0.05	-0.09	-0.07	0.03	-0.09	-0.01	-0.05	-0.03	-0.02	-0.02	-0.02	0.02	-0.04	-0.02	0.06	-0.06	0.01	-0.03	-0.09	0.03
8	-0.07	-0.07	-0.05	-0.08	-0.04	0.03	-0.07	0.00	-0.04	-0.02	-0.02	-0.01	-0.01	0.03	-0.04	-0.02	0.07	-0.07	0.02	-0.03	-0.09	0.02
9	-0.06	-0.05	-0.04	-0.07	-0.02	0.02	-0.06	-0.01	-0.04	-0.01	-0.01	-0.01	-0.02	0.02	-0.05	-0.03	0.06	-0.07	0.02	-0.03	-0.08	0.03
10	-0.06	-0.05	-0.04	-0.06	-0.02	0.02	-0.05	0.00	-0.04	0.00	0.01	-0.02	-0.02	0.00	-0.07	-0.05	0.05	-0.06	0.01	-0.03	-0.10	0.01
11	-0.05	-0.04	-0.04	-0.05	-0.03	0.02	-0.04	-0.01	-0.03	-0.01	0.00	0.00	-0.01	0.00	-0.07	-0.05	0.04	-0.07	0.01	-0.03	-0.11	0.01
12	-0.05	-0.02	-0.05	-0.05	0.00	0.02	-0.01	0.00	-0.03	0.01	0.01	0.01	-0.01	0.00	-0.07	-0.05	0.03	-0.06	0.02	-0.02	-0.10	0.01
13	-0.04	-0.02	-0.05	-0.04	0.00	0.01	-0.01	0.01	-0.04	0.01	0.01	0.01	-0.01	0.00	-0.07	-0.05	0.03	-0.06	0.01	-0.01	-0.10	0.02
14	-0.03	-0.01	-0.04	-0.03	0.02	0.02	0.00	0.01	-0.03	0.01	0.01	0.01	-0.01	-0.01	-0.07	-0.05	0.01	-0.05	0.00	-0.01	-0.09	0.02
15	-0.03	-0.01	-0.04	-0.03	0.01	0.01	0.00	0.02	-0.04	0.01	0.00	0.02	0.00	-0.01	-0.06	-0.05	0.01	-0.05	0.00	-0.02	-0.08	0.03
16	-0.03	0.00	-0.04	-0.02	0.02	0.02	0.00	0.02	-0.03	0.01	0.00	0.02	-0.01	-0.01	-0.07	-0.06	0.00	-0.05	-0.01	-0.03	-0.07	0.03
17	-0.01	0.01	-0.03	-0.01	0.02	0.03	0.01	0.00	-0.03	0.01	0.00	0.01	-0.01	-0.03	-0.06	-0.06	-0.01	-0.04	-0.01	-0.03	-0.05	0.03
18	-0.01	0.01	-0.02	0.00	0.03	0.02	0.02	0.02	-0.04	0.01	0.00	0.02	-0.01	-0.02	-0.05	-0.04	0.00	-0.03	0.00	-0.03	-0.03	0.03
19	0.01	0.01	-0.01	0.01	0.05	0.02	0.02	0.02	-0.06	0.00	-0.02	0.01	-0.01	-0.01	-0.05	-0.04	-0.01	-0.03	-0.01	-0.04	-0.02	0.03
20	0.01	0.01	-0.01	0.02	0.03	0.01	0.00	0.01	-0.06	-0.01	-0.02	0.01	-0.01	-0.02	-0.05	-0.03	-0.02	-0.02	-0.01	-0.04	-0.01	0.04
21	0.01	0.00	0.00	0.01	0.03	0.01	0.01	0.01	-0.06	0.00	0.01	0.01	-0.02	-0.02	-0.05	-0.03	-0.02	-0.02	0.00	-0.03	-0.01	0.04
22	0.01	0.02	0.00	0.02	0.03	0.00	0.00	0.00	-0.04	0.00	0.01	0.00	-0.02	-0.01	-0.04	-0.03	-0.03	-0.01	0.00	-0.03	-0.02	0.03

Notes: Panel A Near Efficiency results are alphas from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ in the text, while the Panel B Gradual Information Diffusion results are alphas from regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text .

Appendix Table 5: US Near Efficiency and Gradual Information Diffusion R^2s

	Energy						Industrial Metals					Precious Met		Agriculture							Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel A: Near Efficiency																						
1	0.09	1.00	0.01	0.85	0.73	0.34	0.39	0.86	0.01	0.04	2.19	0.38	0.11	0.07	0.02	1.06	0.06	0.07	0.15	0.16	0.01	0.03
2	0.01	0.00	0.02	0.57	0.03	0.35	0.02	0.36	0.06	0.17	0.96	0.01	0.33	0.05	0.09	0.83	0.06	0.06	0.00	0.18	0.19	0.03
3	0.00	0.03	0.45	0.04	0.13	0.36	1.25	3.23	0.13	0.53	0.46	0.09	0.46	0.03	0.37	1.29	0.04	0.01	0.06	0.01	0.02	0.01
4	0.36	0.15	0.11	0.21	0.02	0.33	1.05	4.15	0.38	0.57	0.08	0.06	0.56	0.03	0.19	0.60	0.44	0.11	0.15	0.44	0.02	0.00
5	0.01	0.14	0.23	0.09	0.00	0.39	0.82	2.01	0.40	0.05	0.46	0.11	0.34	0.07	0.07	0.50	0.40	0.13	0.00	0.14	0.12	0.02
6	0.15	0.01	0.17	0.00	0.09	0.52	0.92	1.66	0.36	0.04	0.83	0.01	0.17	0.00	0.16	0.59	0.89	0.14	0.01	0.36	0.11	0.01
7	0.03	0.04	0.09	0.26	0.00	0.00	0.77	1.37	0.23	0.01	0.27	0.03	0.21	0.00	0.41	0.63	0.85	0.00	0.04	0.45	0.12	0.01
8	0.01	0.04	0.06	0.22	0.20	0.06	1.71	1.42	0.29	0.02	0.21	0.03	0.42	0.02	0.32	0.63	0.55	0.05	0.01	0.51	0.08	0.01
9	0.25	0.34	0.00	0.41	1.20	0.60	2.00	0.85	0.16	0.29	0.07	0.02	0.32	0.01	0.23	0.53	0.21	0.01	0.01	0.35	0.03	0.01
10	0.62	0.74	0.01	0.96	2.53	0.27	2.90	0.96	0.51	1.42	0.02	0.05	0.53	0.05	0.08	0.18	0.15	0.00	0.02	0.42	0.24	0.27
11	1.05	1.54	0.03	2.03	2.79	0.49	2.81	0.72	0.33	0.72	0.12	0.27	0.84	0.05	0.18	0.22	0.27	0.01	0.00	0.30	0.29	0.07
12	0.92	1.87	0.00	2.24	3.03	0.69	3.63	0.97	0.50	1.21	0.00	0.44	0.75	0.02	0.19	0.12	0.15	0.16	0.03	0.78	0.10	0.08
13	0.65	2.75	0.00	2.12	3.50	1.24	3.11	1.66	0.30	1.54	0.03	0.64	0.80	0.02	0.23	0.16	0.07	0.24	0.05	1.09	0.11	0.08
14	1.54	2.67	0.09	2.86	5.13	0.59	4.24	1.50	0.47	1.88	0.00	0.53	0.46	0.02	0.22	0.12	0.00	0.19	0.00	1.27	0.02	0.21
15	2.00	2.94	0.13	3.34	5.51	0.61	5.14	2.24	0.21	2.32	0.02	0.61	0.81	0.04	0.32	0.09	0.01	0.23	0.05	0.82	0.00	0.59
16	2.45	2.78	0.22	4.02	7.05	0.47	5.18	2.51	0.60	2.67	0.02	0.63	0.66	0.04	0.35	0.06	0.01	0.34	0.07	0.47	0.01	0.68
17	3.07	3.00	0.54	4.86	5.60	0.37	5.57	2.02	0.60	2.66	0.03	0.38	0.52	0.35	0.41	0.03	0.07	0.50	0.02	0.36	0.01	0.80
18	2.77	3.28	0.63	4.41	3.88	0.73	4.56	2.24	0.32	2.48	0.03	0.46	0.49	0.15	0.40	0.07	0.05	0.93	0.05	0.51	0.12	0.71
19	2.94	2.74	0.72	4.48	4.78	0.70	4.67	2.06	0.04	1.95	0.03	0.23	0.29	0.14	0.43	0.06	0.06	0.93	0.00	0.53	0.11	0.83
20	3.29	3.14	1.20	4.94	4.49	0.97	3.33	2.22	0.00	1.51	0.04	0.22	0.27	0.18	0.32	0.08	0.08	0.94	0.00	0.67	0.19	0.68
21	3.09	2.90	1.01	4.72	4.45	0.98	3.93	1.51	0.02	1.52	0.03	0.31	0.26	0.18	0.46	0.11	0.13	1.22	0.00	0.70	0.27	0.70
22	3.09	3.44	1.38	4.19	3.28	1.68	3.32	1.04	0.16	1.28	0.00	0.22	0.23	0.02	0.39	0.15	0.22	1.56	0.01	0.66	0.28	0.61

	Energy						Industrial Metals					Precious Met		Agriculture						Livestock	
	W Oil	B Oil	U Gas	H Oil	G Oil	N Gas	Alum	Copp	Lead	Nick	Zinc	Gold	Silv	Whea	Corn	Soyb	Cott	Suga	Coff	Coco	L Cat	Hogs
Panel B: Gradual Information Diffusion																						
1	3.52	3.41	1.64	4.01	2.49	1.13	3.96	0.57	0.12	1.20	0.06	0.37	0.23	0.01	0.37	0.04	0.52	1.43	0.00	0.74	0.55	0.82
2	3.21	3.83	1.83	3.73	2.71	0.74	2.98	0.56	0.06	0.77	0.07	0.12	0.10	0.17	0.24	0.01	0.27	1.16	0.00	0.78	0.93	0.64
3	3.12	3.95	2.54	3.62	3.54	0.83	2.65	0.06	0.33	0.50	0.14	0.10	0.08	0.24	0.13	0.02	0.66	1.50	0.08	0.50	0.79	0.65
4	2.54	3.64	2.40	3.42	2.64	0.63	3.02	0.02	0.18	0.32	0.12	0.09	0.06	0.23	0.21	0.00	1.06	1.48	0.18	0.23	1.08	0.59
5	3.32	3.38	2.04	3.98	2.84	0.74	2.76	0.12	0.48	0.59	0.22	0.09	0.11	0.01	0.40	0.02	0.86	2.01	0.07	0.47	1.34	0.32
6	5.73	4.20	1.96	4.57	3.68	0.50	2.75	0.09	0.93	0.70	0.47	0.12	0.17	0.06	0.54	0.06	1.33	2.05	0.06	0.32	1.29	0.35
7	3.91	3.06	1.92	3.71	2.49	1.18	2.10	0.06	0.96	0.56	0.14	0.09	0.22	0.13	0.33	0.10	1.13	2.26	0.02	0.31	1.33	0.33
8	2.76	3.18	1.46	2.77	0.97	0.92	1.17	0.00	0.84	0.34	0.11	0.01	0.07	0.27	0.38	0.09	1.44	3.31	0.25	0.26	1.27	0.27
9	1.94	1.83	1.25	2.00	0.28	0.56	1.04	0.06	0.95	0.09	0.02	0.02	0.13	0.13	0.78	0.27	0.93	3.08	0.19	0.26	1.01	0.43
10	1.85	1.59	1.39	1.67	0.20	0.47	0.70	0.01	0.74	0.01	0.02	0.07	0.18	0.01	1.25	0.70	0.68	2.92	0.06	0.26	1.73	0.06
11	1.10	0.95	1.30	1.19	0.37	0.43	0.35	0.03	0.62	0.03	0.00	0.00	0.06	0.00	1.14	0.69	0.47	3.29	0.11	0.35	1.90	0.10
12	1.07	0.34	2.04	1.07	0.01	0.56	0.02	0.00	0.31	0.06	0.07	0.02	0.02	0.00	1.13	0.80	0.36	2.97	0.13	0.09	1.60	0.10
13	1.12	0.23	1.87	0.71	0.00	0.18	0.05	0.03	0.74	0.10	0.03	0.04	0.03	0.00	1.14	0.90	0.23	2.31	0.10	0.06	1.62	0.20
14	0.61	0.14	1.40	0.37	0.19	0.75	0.01	0.03	0.44	0.05	0.04	0.02	0.05	0.01	1.15	0.79	0.04	2.03	0.00	0.06	1.18	0.17
15	0.56	0.05	1.26	0.41	0.05	0.23	0.00	0.08	0.75	0.06	0.00	0.05	0.01	0.01	1.07	0.96	0.06	1.77	0.00	0.10	1.04	0.25
16	0.38	0.00	1.19	0.28	0.31	0.53	0.00	0.09	0.45	0.04	0.00	0.05	0.02	0.07	1.18	1.21	0.00	1.68	0.04	0.38	0.75	0.29
17	0.06	0.04	0.53	0.02	0.26	1.06	0.04	0.00	0.29	0.06	0.01	0.02	0.03	0.25	0.99	1.15	0.07	1.36	0.03	0.34	0.51	0.35
18	0.05	0.12	0.44	0.01	0.51	0.38	0.06	0.07	0.49	0.04	0.00	0.05	0.02	0.12	0.70	0.61	0.01	0.68	0.01	0.25	0.21	0.51
19	0.09	0.06	0.07	0.04	1.15	0.61	0.06	0.11	1.13	0.00	0.08	0.01	0.04	0.07	0.76	0.62	0.05	0.56	0.02	0.48	0.09	0.49
20	0.06	0.13	0.03	0.21	0.46	0.17	0.00	0.05	1.44	0.04	0.09	0.02	0.04	0.08	0.70	0.39	0.13	0.43	0.05	0.52	0.01	0.59
21	0.03	0.01	0.02	0.10	0.54	0.05	0.03	0.02	1.29	0.00	0.02	0.01	0.12	0.11	0.61	0.41	0.21	0.24	0.01	0.26	0.02	0.57
22	0.03	0.15	0.00	0.11	0.46	0.01	0.00	0.01	0.69	0.00	0.05	0.00	0.19	0.01	0.47	0.38	0.26	0.08	0.00	0.40	0.05	0.32

Notes: Panel A Near Efficiency results are R^2s (expressed in percent) from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ in the text, while the Panel B Gradual Information Diffusion results are R^2s (expressed in percent) from regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text .

Appendix Table 6: International Results – t-statistics

Panel A:	WT Crude Oil			Brent Crude Oil			Heating Oil			Gas Oil			Aluminum			Copper			Copper		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	17	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	6	7	5	6	7	19	20	21	15	16	17	16	17	18	4	5	6	15	16	17
USA	**-3.03**	**-4.65**	**-3.52**	**-3.10**	**-3.72**	**-3.09**	**-4.15**	**-4.22**	**-3.99**	**-2.60**	**-3.13**	**-2.88**	**-3.43**	**-3.73**	**-3.35**	**-4.11**	**-4.63**	**-2.79**	**-3.12**	**-3.42**	**-3.24**
Australia	**-2.23**	**-3.48**	**-2.82**	**-2.77**	**-2.88**	**-2.71**	-1.06	-0.96	-1.03	**-2.35**	**-2.26**	-1.61	-1.56	-1.57	-1.00	-0.46	-0.11	0.71	-0.92	-0.84	-0.80
Austria	-0.64	-0.99	-1.06	-1.42	-1.60	**-1.70**	-1.06	-1.12	-1.38	**-2.06**	**-2.07**	-1.44	**-2.15**	**-2.05**	**-1.77**	-0.35	0.14	0.33	-0.78	-0.73	-0.55
Belgium	**-1.83**	**-2.30**	**-2.05**	**-1.89**	**-2.16**	**-2.14**	**-2.11**	**-2.20**	**-2.31**	**-2.88**	**-2.59**	**-1.90**	-1.47	-1.49	-1.27	-0.68	-0.89	-0.69	-1.19	-1.13	-1.32
Canada	-1.32	**-2.27**	-1.34	-1.33	-1.62	-1.08	-0.65	-0.66	-0.74	-0.37	-0.67	-0.29	**-2.17**	**-2.24**	**-2.01**	-1.40	**-1.67**	-0.28	-0.23	-0.45	-0.28
Denmark	-1.60	**-2.30**	**-1.69**	**-2.85**	**-3.05**	**-2.93**	-1.18	-1.02	-1.33	-1.33	**-1.77**	-1.33	**-1.87**	**-1.73**	-1.32	0.13	0.31	0.65	-1.08	-1.09	-1.19
France	**-2.08**	**-2.54**	**-1.91**	**-1.99**	**-2.29**	**-1.73**	**-1.94**	**-1.96**	**-2.12**	**-1.98**	**-2.15**	-1.59	**-2.25**	**-2.27**	**-1.83**	-1.51	-1.42	-1.63	**-2.19**	**-2.14**	**-1.84**
Germany	**-2.09**	**-2.63**	**-1.98**	**-2.35**	**-2.51**	**-2.14**	**-2.16**	**-2.27**	**-2.46**	**-1.88**	**-2.02**	-1.60	**-2.27**	**-2.16**	-1.53	-1.54	**-1.88**	**-1.76**	**-2.94**	**-3.00**	**-2.97**
Hong Kong	0.07	-0.02	0.16	-0.09	-0.10	0.16	-0.25	-0.10	-0.16	0.12	-0.14	0.27	-1.50	**-1.81**	-1.59	-0.58	-1.15	-0.34	-0.98	-1.16	-1.37
Italy	**-3.08**	**-3.30**	**-2.87**	**-3.51**	**-3.48**	**-3.45**	**-2.83**	**-2.93**	**-3.02**	**-2.29**	**-2.62**	**-1.76**	-1.03	-0.88	-0.71	-1.23	-0.96	-1.21	-1.62	-1.62	-1.46
Japan	-1.55	**-2.35**	**-2.38**	-1.39	**-1.68**	-1.65	-0.25	-0.15	-0.11	0.53	0.24	0.20	**-1.89**	**-1.69**	**-1.69**	-0.87	-0.72	-1.57	-1.16	-0.64	-0.56
Netherlands	**-2.33**	**-3.45**	**-2.86**	**-2.78**	**-3.38**	**-3.63**	**-2.39**	**-2.48**	**-2.50**	**-2.27**	**-2.25**	**-1.77**	**-2.47**	**-2.50**	**-2.06**	**-2.00**	**-2.61**	**-1.93**	**-1.76**	**-1.87**	**-1.73**
Norway	-0.28	-1.02	-0.85	-0.94	-1.52	**-1.86**	-1.11	-0.90	-0.83	**-2.12**	**-2.21**	**-1.81**	**-1.90**	**-1.80**	-1.40	0.43	0.85	**2.07**	-0.57	-0.91	-1.20
Singapore	-0.54	-0.83	-0.44	-0.96	-1.06	-1.05	-0.63	-0.82	-0.57	-1.07	-1.08	-1.10	**-2.42**	**-2.04**	**-1.67**	-1.38	-0.96	-0.07	-1.01	-1.18	-1.27
Spain	**-2.14**	**-2.57**	**-3.01**	**-2.59**	**-2.88**	**-3.18**	-1.44	-1.37	**-1.68**	**-1.67**	**-1.96**	-1.34	-1.54	-1.27	-1.06	0.42	0.96	1.14	-1.23	-0.97	-0.64
Sweden	**-2.77**	**-3.10**	**-2.80**	**-3.09**	**-3.41**	**-3.40**	**-2.84**	**-2.96**	**-2.86**	**-2.08**	**-2.80**	**-2.85**	**-1.94**	**-1.87**	-1.53	-0.45	-0.19	0.18	-0.76	-0.73	-0.57
Switzerland	**-2.02**	**-2.44**	**-2.34**	**-2.54**	**-2.98**	**-2.87**	**-2.79**	**-2.68**	**-2.63**	**-2.15**	**-2.10**	-1.33	**-3.33**	**-3.34**	**-3.19**	-0.67	-1.08	-1.01	**-2.97**	**-2.89**	**-2.80**
UK	**-2.37**	**-3.32**	**-2.35**	**-2.76**	**-2.87**	**-2.68**	**-2.13**	**-2.44**	**-2.24**	**-2.54**	**-2.57**	**-1.78**	**-2.83**	**-2.77**	**-2.43**	**-2.11**	**-2.17**	-0.64	-0.65	-0.75	-0.95
World	**-2.96**	**-4.40**	**-3.46**	**-2.98**	**-3.43**	**-3.11**	**-2.50**	**-2.63**	**-2.61**	**-2.23**	**-2.60**	**-2.15**	**-3.05**	**-3.10**	**-2.74**	**-3.32**	**-3.48**	**-2.53**	**-2.50**	**-2.45**	**-2.38**
World X US	**-2.23**	**-3.21**	**-2.78**	**-2.38**	**-2.69**	**-2.63**	-1.41	-1.48	-1.52	**-1.88**	**-2.10**	-1.52	**-2.47**	**-2.39**	**-2.09**	-1.48	-1.51	-1.39	-1.46	-1.25	-1.21

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	NE	NE	NE	NE	NE	NE	NE	NE	NE	GID	GID	GID	GID	GID	GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	**-2.74**	**-2.76**	**-2.59**	N/A	**2.88**	1.60	**-2.13**	**-2.87**	**-1.81**	**-3.37**	**-3.41**	**-2.73**	**-2.68**	**-2.78**	**-2.62**
Australia	-0.21	-0.20	-0.55	N/A	**4.82**	**2.54**	0.06	-0.74	-0.14	-0.64	-0.27	-0.80	-1.63	-1.49	-1.18
Austria	-1.51	-1.28	-1.46	N/A	1.43	0.26	-1.37	-0.35	0.33	-0.46	-0.41	0.03	0.49	0.66	1.10
Belgium	-0.88	-0.96	-1.11	N/A	**2.72**	**1.88**	-0.94	-0.29	-0.23	-0.68	-0.74	-0.39	-0.96	-1.17	-0.82
Canada	**-1.71**	**-1.98**	**-2.05**	N/A	**3.47**	**1.84**	-0.91	-1.36	-0.57	**-1.80**	-1.50	-1.51	**-3.02**	**-3.25**	**-3.07**
Denmark	**-1.83**	**-1.68**	**-1.87**	N/A	**1.71**	0.80	0.17	0.07	0.65	-0.89	-0.74	-0.36	**-2.18**	**-2.10**	**-1.79**
France	**-2.20**	**-2.08**	**-2.06**	N/A	**3.70**	**2.25**	**-1.73**	-1.35	-0.94	-1.38	-1.44	-1.02	-0.45	-0.66	-0.45
Germany	**-2.13**	**-2.05**	**-2.04**	N/A	**3.19**	1.03	**-2.28**	-0.87	-0.57	-1.65	**-1.80**	-1.11	-0.44	-0.45	-0.22
Hong Kong	**-2.59**	**-2.65**	**-2.69**	N/A	**2.71**	**1.66**	-1.33	-1.20	0.15	**-3.33**	**-3.26**	**-3.07**	0.06	-0.21	0.00
Italy	-1.25	-0.94	-1.01	N/A	**2.67**	**1.77**	-0.04	-0.19	0.31	-0.66	-0.57	-0.56	-1.29	**-1.81**	-1.58
Japan	-0.65	-0.22	-0.25	N/A	**1.86**	**1.68**	0.34	-0.21	0.75	-1.48	-1.42	-1.21	-1.43	-1.16	-0.84
Netherlands	**-2.30**	**-2.34**	**-2.20**	N/A	**3.37**	1.51	**-2.55**	-1.58	-0.98	**-1.81**	**-2.11**	**-1.75**	-1.31	-1.57	-1.30
Norway	**-2.24**	**-1.81**	**-1.92**	N/A	**1.78**	0.58	-0.27	-0.08	-0.05	**-1.91**	**-1.89**	-1.60	-1.44	-1.25	-1.42
Singapore	**-2.25**	**-1.87**	**-1.96**	N/A	**2.28**	0.88	-0.63	-0.68	0.47	**-2.83**	**-2.89**	**-2.92**	-0.95	-0.97	-0.96
Spain	-1.49	-1.09	-1.51	N/A	**2.72**	**1.84**	-0.45	-0.17	-0.30	**-2.03**	**-2.04**	**-1.95**	-0.01	0.03	0.04
Sweden	**-2.30**	**-1.98**	**-2.12**	N/A	**1.96**	1.36	**-1.73**	-1.22	-0.66	**-1.68**	-1.19	-0.86	-1.02	-1.31	-1.08
Switzerland	**-2.75**	**-2.77**	**-2.73**	N/A	**2.14**	0.50	-1.15	-0.04	0.48	**-1.93**	**-1.89**	-1.43	-1.56	-1.57	-1.15
UK	**-2.19**	**-1.89**	**-1.86**	N/A	**3.35**	**1.66**	-0.65	-0.99	-0.11	-1.58	**-1.69**	-1.56	**-1.86**	**-1.89**	**-1.80**
World	**-2.48**	**-2.27**	**-2.18**	N/A	**3.48**	**2.03**	-1.56	**-1.90**	-0.78	**-3.09**	**-3.04**	**-2.45**	**-2.54**	**-2.66**	**-2.46**
World X US	**-1.94**	-1.64	**-1.69**	N/A	**3.66**	**2.26**	-0.89	-0.67	0.24	**-2.28**	**-2.19**	**-1.83**	**-1.82**	**-1.90**	-1.59

Notes: t-statistics for alpha from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. The Bonferroni correction has been applied so based on 23 different alternatives the critical t-statistic at the 10% level is 2.63. t-statistics of this level and higher are in bold.

Appendix Table 7: International Results – alphas

Panel A:	WT Crude Oil			Brent Crude Oil			Heating Oil			Gas Oil			Aluminum			Copper			Copper		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	17	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	6	7	5	6	7	19	20	21	15	16	17	16	17	18	4	5	6	15	16	17
USA	-0.08	-0.11	-0.08	-0.08	-0.08	-0.07	-0.11	-0.11	-0.10	-0.13	-0.15	-0.13	-0.19	-0.19	-0.16	-0.28	-0.31	-0.19	-0.11	-0.12	-0.10
Australia	-0.07	-0.09	-0.08	-0.09	-0.08	-0.08	-0.04	-0.04	-0.04	-0.12	-0.12	-0.08	-0.10	-0.09	-0.06	-0.06	-0.01	0.07	-0.05	-0.05	-0.04
Austria	-0.04	-0.06	-0.06	-0.09	-0.10	-0.09	-0.04	-0.05	-0.06	-0.13	-0.12	-0.08	-0.25	-0.22	-0.19	-0.04	0.01	0.03	-0.05	-0.04	-0.03
Belgium	-0.07	-0.09	-0.08	-0.07	-0.07	-0.07	-0.12	-0.11	-0.11	-0.25	-0.24	-0.17	-0.11	-0.11	-0.09	-0.08	-0.10	-0.08	-0.06	-0.06	-0.07
Canada	-0.04	-0.06	-0.04	-0.04	-0.05	-0.03	-0.02	-0.02	-0.03	-0.03	-0.05	-0.02	-0.13	-0.12	-0.11	-0.13	-0.15	-0.03	-0.01	-0.02	-0.01
Denmark	-0.05	-0.07	-0.05	-0.09	-0.09	-0.08	-0.05	-0.04	-0.05	-0.12	-0.15	-0.11	-0.14	-0.12	-0.09	0.01	0.03	0.06	-0.05	-0.05	-0.05
France	-0.09	-0.10	-0.08	-0.07	-0.08	-0.06	-0.11	-0.10	-0.11	-0.16	-0.19	-0.13	-0.17	-0.16	-0.12	-0.18	-0.18	-0.20	-0.15	-0.14	-0.11
Germany	-0.10	-0.13	-0.10	-0.11	-0.12	-0.10	-0.12	-0.12	-0.13	-0.22	-0.25	-0.19	-0.19	-0.17	-0.12	-0.19	-0.24	-0.20	-0.16	-0.16	-0.14
Hong Kong	0.00	0.00	0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	0.01	-0.01	0.02	-0.16	-0.16	-0.13	-0.10	-0.20	-0.06	-0.07	-0.08	-0.08
Italy	-0.18	-0.18	-0.16	-0.13	-0.13	-0.12	-0.19	-0.18	-0.19	-0.17	-0.20	-0.13	-0.09	-0.08	-0.06	-0.16	-0.14	-0.15	-0.10	-0.09	-0.08
Japan	-0.07	-0.10	-0.09	-0.05	-0.06	-0.05	-0.01	-0.01	-0.01	0.03	0.01	0.01	-0.17	-0.14	-0.14	-0.09	-0.07	-0.14	-0.07	-0.04	-0.03
Netherlands	-0.06	-0.09	-0.07	-0.07	-0.09	-0.08	-0.09	-0.09	-0.09	-0.19	-0.20	-0.15	-0.15	-0.14	-0.12	-0.17	-0.23	-0.15	-0.07	-0.07	-0.06
Norway	-0.01	-0.04	-0.04	-0.04	-0.06	-0.07	-0.06	-0.05	-0.04	-0.21	-0.23	-0.18	-0.16	-0.15	-0.13	0.06	0.11	0.24	-0.03	-0.05	-0.07
Singapore	-0.03	-0.04	-0.02	-0.05	-0.06	-0.05	-0.03	-0.04	-0.03	-0.09	-0.09	-0.08	-0.22	-0.17	-0.14	-0.18	-0.12	-0.01	-0.06	-0.07	-0.07
Spain	-0.13	-0.15	-0.15	-0.12	-0.13	-0.12	-0.10	-0.09	-0.11	-0.13	-0.16	-0.10	-0.12	-0.10	-0.08	0.05	0.11	0.12	-0.06	-0.05	-0.03
Sweden	-0.15	-0.16	-0.15	-0.17	-0.18	-0.16	-0.16	-0.16	-0.16	-0.25	-0.31	-0.28	-0.17	-0.16	-0.13	-0.05	-0.02	0.02	-0.04	-0.04	-0.03
Switzerland	-0.07	-0.09	-0.08	-0.09	-0.10	-0.09	-0.10	-0.09	-0.09	-0.13	-0.13	-0.09	-0.28	-0.26	-0.23	-0.07	-0.11	-0.09	-0.14	-0.13	-0.12
UK	-0.07	-0.10	-0.07	-0.08	-0.08	-0.07	-0.08	-0.09	-0.08	-0.14	-0.15	-0.10	-0.17	-0.16	-0.13	-0.17	-0.20	-0.06	-0.03	-0.04	-0.04
World	-0.08	-0.11	-0.09	-0.08	-0.09	-0.07	-0.08	-0.08	-0.08	-0.12	-0.14	-0.11	-0.18	-0.16	-0.14	-0.20	-0.22	-0.16	-0.09	-0.08	-0.07
World X US	-0.08	-0.10	-0.09	-0.07	-0.08	-0.07	-0.06	-0.06	-0.06	-0.11	-0.13	-0.09	-0.16	-0.14	-0.13	-0.11	-0.12	-0.10	-0.06	-0.05	-0.04

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	NE	NE	NE	NE	NE	NE	NE	NE	NE	GID	GID	GID	GID	GID	GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	-0.08	-0.08	-0.07	N/A	0.32	0.15	-0.20	-0.20	-0.12	-0.07	-0.06	-0.06	-0.08	-0.09	-0.09
Australia	-0.01	-0.01	-0.02	N/A	0.75	0.34	0.01	-0.10	-0.02	-0.02	-0.01	-0.03	-0.09	-0.09	-0.07
Austria	-0.10	-0.08	-0.09	N/A	0.33	0.06	-0.16	-0.04	0.03	-0.01	-0.01	0.00	0.02	0.03	0.05
Belgium	-0.04	-0.04	-0.05	N/A	0.39	0.22	-0.12	-0.03	-0.02	-0.02	-0.02	-0.01	-0.05	-0.06	-0.04
Canada	-0.06	-0.06	-0.06	N/A	0.49	0.25	-0.10	-0.12	-0.04	-0.05	-0.04	-0.04	-0.12	-0.14	-0.14
Denmark	-0.07	-0.06	-0.06	N/A	0.29	0.11	0.02	0.01	0.06	-0.02	-0.02	-0.01	-0.10	-0.10	-0.09
France	-0.09	-0.08	-0.08	N/A	0.51	0.25	-0.24	-0.15	-0.10	-0.05	-0.05	-0.04	-0.02	-0.03	-0.02
Germany	-0.10	-0.09	-0.10	N/A	0.56	0.15	-0.30	-0.10	-0.06	-0.04	-0.05	-0.03	-0.02	-0.02	-0.01
Hong Kong	-0.15	-0.13	-0.13	N/A	1.12	0.45	-0.26	-0.27	0.03	-0.13	-0.13	-0.13	0.01	-0.02	0.00
Italy	-0.05	-0.04	-0.04	N/A	0.43	0.24	-0.01	-0.03	0.05	-0.02	-0.02	-0.02	-0.07	-0.09	-0.08
Japan	-0.03	-0.01	-0.01	N/A	0.36	0.22	0.04	-0.02	0.08	-0.03	-0.03	-0.03	-0.06	-0.05	-0.04
Netherlands	-0.07	-0.07	-0.07	N/A	0.51	0.18	-0.28	-0.15	-0.09	-0.05	-0.06	-0.05	-0.05	-0.06	-0.05
Norway	-0.10	-0.07	-0.08	N/A	0.49	0.12	-0.04	-0.01	-0.01	-0.08	-0.08	-0.07	-0.08	-0.07	-0.09
Singapore	-0.11	-0.08	-0.09	N/A	0.67	0.19	-0.11	-0.11	0.07	-0.11	-0.11	-0.12	-0.07	-0.07	-0.07
Spain	-0.07	-0.04	-0.06	N/A	0.45	0.22	-0.06	-0.02	-0.03	-0.05	-0.05	-0.05	0.00	0.00	0.00
Sweden	-0.11	-0.09	-0.10	N/A	0.40	0.20	-0.24	-0.14	-0.07	-0.04	-0.03	-0.02	-0.05	-0.07	-0.06
Switzerland	-0.10	-0.09	-0.09	N/A	0.30	0.06	-0.14	0.00	0.05	-0.05	-0.05	-0.04	-0.07	-0.07	-0.05
UK	-0.06	-0.05	-0.05	N/A	0.33	0.14	-0.09	-0.12	-0.01	-0.06	-0.06	-0.06	-0.09	-0.11	-0.10
World	-0.07	-0.06	-0.06	N/A	0.37	0.18	-0.13	-0.13	-0.05	-0.06	-0.05	-0.05	-0.07	-0.08	-0.07
World X US	-0.06	-0.05	-0.05	N/A	0.45	0.22	-0.08	-0.06	0.02	-0.05	-0.04	-0.04	-0.06	-0.07	-0.06

Notes: alphas from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4.

Appendix Table 8: International Results – R^2s

Panel A:	WT Crude Oil			Brent Crude Oil			Heating Oil			Gas Oil			Aluminum			Copper			Copper		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	17	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	6	7	5	6	7	19	20	21	15	16	17	16	17	18	4	5	6	15	16	17
USA	3.32	5.73	3.91	3.38	4.20	3.06	4.48	4.94	4.72	5.51	7.05	5.60	5.18	5.57	4.56	3.23	4.15	2.01	2.24	2.51	2.02
Australia	1.06	1.66	1.34	1.79	1.64	1.57	0.29	0.26	0.31	3.03	2.86	1.56	0.78	0.84	0.39	0.05	0.00	0.10	0.20	0.16	0.15
Austria	0.31	0.79	0.95	1.96	2.75	2.54	0.29	0.38	0.65	3.46	2.93	1.33	3.25	3.00	2.27	0.03	0.00	0.02	0.17	0.13	0.07
Belgium	1.62	2.38	2.02	1.61	2.04	1.89	3.39	3.03	3.44	10.79	10.02	5.68	1.18	1.20	0.95	0.15	0.25	0.19	0.39	0.40	0.57
Canada	0.60	1.45	0.49	0.69	0.87	0.39	0.14	0.16	0.22	0.14	0.40	0.08	1.41	1.50	1.23	0.38	0.58	0.02	0.02	0.07	0.02
Denmark	0.93	1.65	0.90	2.87	3.45	2.83	0.55	0.36	0.63	2.73	4.42	2.55	1.57	1.32	0.85	0.00	0.03	0.11	0.33	0.35	0.39
France	2.31	3.02	2.18	1.58	2.20	1.41	2.28	2.26	2.78	5.43	6.75	3.69	2.32	2.30	1.58	0.60	0.65	0.96	1.66	1.64	1.11
Germany	2.50	3.75	2.69	3.07	4.04	2.67	2.49	2.48	3.09	5.96	7.14	4.41	2.09	1.84	0.99	0.67	1.12	0.98	2.15	2.07	1.86
Hong Kong	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.06	1.00	1.12	0.87	0.09	0.40	0.04	0.19	0.26	0.33
Italy	7.06	6.68	5.90	4.16	4.51	4.05	5.08	5.46	6.07	5.85	7.76	3.94	0.49	0.36	0.25	0.36	0.31	0.44	0.63	0.56	0.44
Japan	1.17	2.36	1.99	0.66	1.01	0.86	0.03	0.01	0.01	0.17	0.03	0.02	1.62	1.22	1.28	0.14	0.11	0.50	0.35	0.11	0.08
Netherlands	1.55	2.81	2.21	2.09	3.22	3.09	2.29	2.15	2.44	6.27	6.82	4.06	2.16	2.16	1.61	0.80	1.61	0.84	0.55	0.58	0.48
Norway	0.03	0.33	0.28	0.37	0.83	1.24	0.46	0.32	0.30	5.49	6.26	4.30	1.27	1.21	0.93	0.05	0.17	1.02	0.06	0.17	0.28
Singapore	0.14	0.33	0.10	0.46	0.62	0.58	0.10	0.21	0.11	1.10	1.07	0.83	2.12	1.55	1.12	0.39	0.19	0.00	0.21	0.26	0.28
Spain	3.45	4.72	5.67	3.59	4.53	4.52	1.42	1.36	2.12	3.24	4.58	2.09	0.88	0.61	0.46	0.03	0.23	0.32	0.28	0.17	0.06
Sweden	4.18	4.93	4.30	5.31	6.41	5.53	3.39	3.79	3.94	5.66	8.50	7.54	1.30	1.19	0.94	0.04	0.01	0.01	0.12	0.10	0.05
Switzerland	1.93	2.84	2.43	3.33	4.67	3.73	2.50	2.38	2.46	5.63	5.54	2.52	7.58	7.24	6.45	0.12	0.38	0.31	2.24	2.34	2.13
UK	2.05	3.50	1.96	2.75	3.06	2.63	1.83	2.30	2.02	7.19	7.42	3.80	3.25	3.20	2.50	0.80	1.14	0.11	0.13	0.16	0.21
World	3.69	6.45	4.73	3.60	4.70	3.64	2.51	2.73	2.81	5.00	6.31	4.29	4.44	4.25	3.51	1.81	2.34	1.48	1.57	1.42	1.16
World X US	2.58	4.47	3.49	2.48	3.37	2.79	1.12	1.18	1.29	3.92	4.85	2.65	2.84	2.48	2.05	0.41	0.56	0.48	0.54	0.37	0.31

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1 NE	Int NE	Int+1 NE	Int-1 NE	Int NE	Int+1 NE	Int-1 NE	Int NE	Int+1 NE	Int-1 GID	Int GID	Int+1 GID	Int-1 GID	Int GID	Int+1 GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	2.67	2.66	2.48	N/A	2.19	0.96	0.83	1.29	0.60	3.29	2.97	2.31	1.08	1.34	1.29
Australia	0.02	0.01	0.10	N/A	7.04	2.91	0.00	0.12	0.00	0.11	0.02	0.17	0.56	0.48	0.34
Austria	1.49	1.12	1.58	N/A	0.85	0.05	0.30	0.02	0.02	0.04	0.03	0.00	0.05	0.08	0.24
Belgium	0.41	0.49	0.76	N/A	2.06	1.31	0.18	0.02	0.01	0.24	0.28	0.07	0.23	0.33	0.18
Canada	0.76	0.83	0.99	N/A	3.09	1.53	0.13	0.29	0.05	1.02	0.68	0.65	1.58	2.01	2.06
Denmark	1.07	0.86	1.13	N/A	1.02	0.27	0.01	0.00	0.11	0.21	0.13	0.03	1.07	1.05	0.86
France	1.80	1.64	1.98	N/A	3.22	1.50	0.55	0.33	0.19	0.80	0.82	0.45	0.04	0.09	0.04
Germany	1.62	1.49	1.90	N/A	2.68	0.38	1.00	0.17	0.08	0.78	0.91	0.37	0.05	0.05	0.01
Hong Kong	2.38	2.11	2.35	N/A	7.21	2.29	0.26	0.40	0.01	2.74	2.60	2.53	0.00	0.01	0.00
Italy	0.41	0.21	0.29	N/A	1.46	0.94	0.00	0.01	0.04	0.13	0.10	0.10	0.27	0.46	0.38
Japan	0.11	0.01	0.02	N/A	1.05	0.81	0.02	0.01	0.14	0.38	0.41	0.31	0.29	0.18	0.10
Netherlands	1.38	1.30	1.47	N/A	3.53	0.91	1.15	0.50	0.23	1.28	1.57	1.11	0.28	0.38	0.28
Norway	1.24	0.80	0.94	N/A	1.69	0.20	0.01	0.00	0.00	1.62	1.55	1.08	0.33	0.28	0.39
Singapore	1.60	0.96	1.21	N/A	3.05	0.50	0.07	0.12	0.07	2.84	2.70	2.91	0.20	0.23	0.21
Spain	0.71	0.32	0.77	N/A	1.72	0.80	0.04	0.01	0.02	0.73	0.73	0.69	0.00	0.00	0.00
Sweden	1.37	0.98	1.34	N/A	1.00	0.51	0.51	0.27	0.08	0.56	0.29	0.16	0.20	0.30	0.21
Switzerland	2.63	2.50	2.83	N/A	1.28	0.10	0.27	0.00	0.07	1.54	1.54	0.92	0.56	0.54	0.32
UK	1.21	0.88	1.09	N/A	1.93	0.69	0.09	0.22	0.00	1.58	1.41	1.35	0.72	0.91	0.81
World	1.90	1.54	1.76	N/A	2.88	1.30	0.40	0.63	0.11	2.79	2.52	1.88	0.95	1.09	0.97
World X US	1.03	0.69	0.97	N/A	3.21	1.52	0.13	0.09	0.01	1.39	1.28	0.94	0.57	0.59	0.43

Notes: R^2s (in percent) from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4.

Appendix Table 9: International Sub Period Analysis – t-statistics

Panel A:	WT Crude Oil			Brent Crude Oil			Heating Oil			Gas Oil			Aluminum			Copper			Copper		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	17	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	6	7	5	6	7	19	20	21	15	16	17	16	17	18	4	5	6	15	16	17
USA	**-2.59**	**-4.00**	**-3.37**	**-3.12**	**-3.79**	**-3.50**	**-3.36**	**-3.18**	**-3.00**	**-2.60**	**-3.13**	**-2.88**	**-3.43**	**-3.73**	**-3.35**	**-2.50**	**-2.97**	**-2.11**	**-3.21**	**-3.76**	**-3.33**
Australia	**-2.53**	**-3.73**	**-3.56**	**-2.53**	**-2.86**	**-2.95**	-0.91	-0.79	-0.84	**-2.35**	**-2.26**	-1.61	-1.56	-1.57	-1.00	-1.43	-1.00	-0.08	-1.60	**-1.83**	-1.38
Austria	-0.57	-1.06	-1.16	-1.18	-1.43	-1.60	-0.27	-0.58	-0.76	**-2.06**	**-2.07**	-1.44	**-2.15**	**-2.05**	**-1.77**	-0.96	-0.75	-0.08	-1.06	-0.90	-0.58
Belgium	-1.24	**-1.92**	**-2.03**	-1.56	**-1.98**	**-2.29**	-1.27	-1.46	-1.56	**-2.88**	**-2.59**	**-1.90**	-1.47	-1.49	-1.27	-0.64	-0.99	-0.65	-1.55	-1.28	-1.27
Canada	-1.18	**-1.98**	-1.35	-1.12	-1.49	-1.18	-0.22	-0.21	-0.20	-0.37	-0.67	-0.29	**-2.17**	**-2.24**	**-2.01**	-1.08	-1.25	-0.37	-1.53	**-2.02**	**-1.80**
Denmark	**-1.83**	**-2.57**	**-1.91**	**-2.85**	**-3.13**	**-3.09**	-0.72	-0.72	-0.97	-1.33	**-1.77**	-1.33	**-1.87**	**-1.73**	-1.32	0.51	0.36	0.76	-1.46	-1.54	-1.44
France	**-1.67**	**-2.38**	**-2.30**	**-2.12**	**-2.58**	**-2.72**	-1.24	-1.37	-1.37	**-1.98**	**-2.15**	-1.59	**-2.25**	**-2.27**	**-1.83**	-0.81	-0.71	-0.73	**-2.29**	**-2.13**	**-1.80**
Germany	-1.51	**-2.14**	**-1.84**	**-2.15**	**-2.41**	**-2.32**	-1.26	-1.39	-1.48	**-1.88**	**-2.02**	-1.60	**-2.27**	**-2.16**	-1.53	-1.47	**-1.84**	-1.55	**-3.42**	**-3.49**	**-3.05**
Hong Kong	0.26	-0.12	0.13	0.27	0.09	0.21	0.49	0.45	0.43	0.12	-0.14	0.27	-1.50	**-1.81**	-1.59	**-2.14**	**-2.54**	**-2.12**	**-2.09**	**-2.48**	**-2.08**
Italy	**-2.11**	**-2.28**	**-1.99**	**-3.07**	**-3.19**	**-3.36**	**-1.95**	**-2.07**	**-2.15**	**-2.29**	**-2.62**	**-1.76**	-1.03	-0.88	-0.71	0.72	0.55	0.58	-1.63	-1.56	-1.30
Japan	-1.02	**-2.05**	**-1.94**	-1.02	-1.49	-1.49	0.91	1.34	1.46	0.53	0.24	0.20	**-1.89**	**-1.69**	**-1.69**	-0.36	-0.31	-0.45	-1.34	-0.91	-0.81
Netherlands	-1.63	**-2.57**	**-2.18**	**-2.41**	**-3.08**	**-3.41**	-1.42	-1.44	-1.39	**-2.27**	**-2.25**	**-1.77**	**-2.47**	**-2.50**	**-2.06**	-1.46	-1.61	-1.10	**-2.33**	**-2.34**	**-1.83**
Norway	-0.58	-1.19	-1.60	-0.67	-1.37	**-1.91**	-0.92	-0.76	-0.81	**-2.12**	**-2.21**	**-1.81**	**-1.90**	**-1.80**	-1.40	0.11	0.26	1.09	-1.18	-1.37	-1.51
Singapore	-0.60	-0.84	-0.66	-0.73	-0.94	-0.99	-0.34	-0.54	-0.62	-1.07	-1.08	-1.10	**-2.42**	**-2.04**	**-1.67**	**-2.12**	**-1.86**	-0.92	**-2.06**	**-2.53**	**-2.05**
Spain	**-1.68**	**-2.36**	**-2.70**	**-2.31**	**-2.75**	**-3.12**	-0.94	-0.96	-1.28	**-1.67**	**-1.96**	-1.34	-1.54	-1.27	-1.06	-0.14	0.20	0.50	-1.59	-1.59	-1.22
Sweden	**-2.31**	**-2.79**	**-2.58**	**-2.87**	**-3.22**	**-3.22**	**-2.06**	**-2.12**	**-2.11**	**-2.08**	**-2.80**	**-2.85**	**-1.94**	**-1.87**	-1.53	-0.53	-0.47	-0.17	**-1.83**	**-1.78**	-1.29
Switzerland	-1.50	**-1.92**	**-2.16**	**-2.21**	**-2.77**	**-2.88**	**-1.82**	**-1.74**	-1.63	**-2.15**	**-2.10**	-1.33	**-3.33**	**-3.34**	**-3.19**	-0.63	-0.57	-0.44	**-2.65**	**-2.72**	**-2.40**
UK	**-2.13**	**-2.99**	**-2.70**	**-2.36**	**-2.59**	**-2.71**	-1.24	-1.37	-1.23	**-2.54**	**-2.57**	**-1.78**	**-2.83**	**-2.77**	**-2.43**	**-1.69**	-1.54	-1.01	**-2.82**	**-2.78**	**-2.57**
World	**-2.20**	**-3.54**	**-2.94**	**-2.60**	**-3.23**	**-3.14**	-1.43	-1.45	-1.44	**-2.23**	**-2.60**	**-2.15**	**-3.05**	**-3.10**	**-2.74**	**-1.96**	**-2.22**	-1.62	**-3.08**	**-3.20**	**-2.85**
World X US	-1.62	**-2.68**	**-2.32**	**-1.96**	**-2.47**	**-2.54**	-0.40	-0.39	-0.46	**-1.88**	**-2.10**	-1.52	**-2.47**	**-2.39**	**-2.09**	-1.14	-1.20	-0.89	**-2.55**	**-2.41**	**-2.09**

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	NE	NE	NE	NE	NE	NE	NE	NE	NE	GID	GID	GID	GID	GID	GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	**-2.74**	**-2.76**	**-2.59**	N/A	**2.88**	1.60	**-3.44**	**-2.57**	**-2.65**	**-2.72**	**-2.14**	**-1.78**	-0.42	-0.55	-0.48
Australia	-0.21	-0.20	-0.55	N/A	**4.82**	**2.54**	**-1.73**	-1.32	**-1.75**	**-1.82**	**-1.68**	**-1.77**	-1.20	-1.02	-0.95
Austria	-1.51	-1.28	-1.46	N/A	1.43	0.26	-0.81	-0.31	-0.37	-0.48	-0.34	0.39	0.14	0.59	0.83
Belgium	-0.88	-0.96	-1.11	N/A	**2.72**	**1.88**	-0.68	-0.45	-1.02	0.37	0.43	0.83	-0.86	-0.84	-0.84
Canada	**-1.71**	**-1.98**	**-2.05**	N/A	**3.47**	**1.84**	**-1.76**	-1.32	-1.02	-1.31	-1.00	-1.10	-0.28	-0.31	-0.28
Denmark	**-1.83**	**-1.68**	**-1.87**	N/A	**1.71**	0.80	-0.40	-0.16	-0.85	0.15	0.91	1.64	**-1.76**	**-1.75**	-1.63
France	**-2.20**	**-2.08**	**-2.06**	N/A	**3.70**	**2.25**	**-2.24**	-1.22	**-1.99**	-1.35	-1.17	-0.76	0.03	-0.12	-0.38
Germany	**-2.13**	**-2.05**	**-2.04**	N/A	**3.19**	1.03	**-2.14**	-1.12	**-2.04**	-1.58	-1.28	-0.47	-0.44	-0.63	-0.61
Hong Kong	**-2.59**	**-2.65**	**-2.69**	N/A	**2.71**	**1.66**	**-1.92**	-1.62	**-1.67**	**-2.26**	**-1.82**	-1.50	0.28	0.50	0.86
Italy	-1.25	-0.94	-1.01	N/A	**2.67**	**1.77**	-1.34	-0.38	-0.99	0.12	0.23	0.14	-0.96	-1.23	-1.28
Japan	-0.65	-0.22	-0.25	N/A	**1.86**	**1.68**	0.66	0.26	0.50	-0.14	-0.15	-0.24	-0.54	-0.24	-0.40
Netherlands	**-2.30**	**-2.34**	**-2.20**	N/A	**3.37**	1.51	**-2.42**	-1.58	**-1.79**	-0.56	-0.62	-0.26	-0.09	-0.25	-0.07
Norway	**-2.24**	**-1.81**	**-1.92**	N/A	**1.78**	0.58	-1.12	-0.79	-1.57	-1.45	-1.42	-1.14	-1.12	-1.09	-1.23
Singapore	**-2.25**	**-1.87**	**-1.96**	N/A	**2.28**	0.88	-0.61	-0.47	-1.06	**-2.03**	-1.64	-1.38	0.65	0.93	1.07
Spain	-1.49	-1.09	-1.51	N/A	**2.72**	**1.84**	-1.16	-0.04	-0.64	**-1.99**	-1.59	-1.50	-0.25	-0.44	-0.79
Sweden	**-2.30**	**-1.98**	**-2.12**	N/A	**1.96**	1.36	**-1.79**	-1.02	-1.38	**-1.65**	-1.28	-0.89	-0.81	-0.80	-1.07
Switzerland	**-2.75**	**-2.77**	**-2.73**	N/A	**2.14**	0.50	**-1.66**	-0.67	-0.53	-0.22	-0.23	0.23	-0.14	-0.07	-0.10
UK	**-2.19**	**-1.89**	**-1.86**	N/A	**3.35**	**1.66**	**-1.68**	-0.74	-0.56	-1.17	-0.87	-0.43	-0.44	-0.49	-0.47
World	**-2.48**	**-2.27**	**-2.18**	N/A	**3.48**	**2.03**	**-1.96**	-1.20	-1.32	**-1.87**	-1.38	-1.04	-0.59	-0.60	-0.69
World X US	**-1.94**	-1.64	**-1.69**	N/A	**3.66**	**2.26**	-0.90	-0.37	-0.48	-1.04	-0.76	-0.52	-0.62	-0.51	-0.69

Notes: t-statistics for alpha from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4. Results relate to the sub-period 1989-2008. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. The Bonferroni correction has been applied so based on 23 different alternatives the critical t-statistic at the 10% level is 2.63. t-statistics of this level and higher are in bold.

Appendix Table 10: International Sub Period Analysis – alphas

Panel A:	WT Crude Oil			Brent Crude Oil			Heating Oil			Gas Oil			Aluminum			Copper			Copper		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	17	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	6	7	5	6	7	19	20	21	15	16	17	16	17	18	4	5	6	15	16	17
USA	-0.07	-0.10	-0.09	-0.08	-0.09	-0.08	-0.10	-0.10	-0.09	-0.13	-0.15	-0.13	-0.19	-0.19	-0.16	-0.26	-0.28	-0.22	-0.15	-0.16	-0.14
Australia	-0.08	-0.10	-0.10	-0.08	-0.08	-0.09	-0.04	-0.04	-0.04	-0.12	-0.12	-0.08	-0.10	-0.09	-0.06	-0.19	-0.14	-0.01	-0.10	-0.11	-0.08
Austria	-0.04	-0.08	-0.09	-0.08	-0.10	-0.09	-0.01	-0.03	-0.04	-0.13	-0.12	-0.08	-0.25	-0.22	-0.19	-0.14	-0.10	-0.01	-0.10	-0.08	-0.05
Belgium	-0.05	-0.08	-0.08	-0.06	-0.07	-0.07	-0.07	-0.07	-0.08	-0.25	-0.24	-0.17	-0.11	-0.11	-0.09	-0.08	-0.13	-0.08	-0.09	-0.07	-0.07
Canada	-0.04	-0.07	-0.04	-0.04	-0.04	-0.03	-0.01	-0.01	-0.01	-0.03	-0.05	-0.02	-0.13	-0.12	-0.11	-0.14	-0.16	-0.05	-0.09	-0.11	-0.09
Denmark	-0.07	-0.09	-0.07	-0.09	-0.10	-0.08	-0.03	-0.03	-0.04	-0.12	-0.15	-0.11	-0.14	-0.12	-0.09	0.06	0.05	0.08	-0.09	-0.10	-0.08
France	-0.07	-0.09	-0.09	-0.07	-0.09	-0.08	-0.06	-0.06	-0.06	-0.16	-0.19	-0.13	-0.17	-0.16	-0.12	-0.10	-0.09	-0.09	-0.12	-0.11	-0.08
Germany	-0.09	-0.13	-0.11	-0.11	-0.12	-0.10	-0.08	-0.09	-0.09	-0.22	-0.25	-0.19	-0.19	-0.17	-0.12	-0.21	-0.28	-0.24	-0.21	-0.20	-0.16
Hong Kong	0.02	-0.01	0.01	0.02	0.01	0.01	0.03	0.03	0.03	0.01	-0.01	0.02	-0.16	-0.16	-0.13	-0.40	-0.47	-0.40	-0.21	-0.23	-0.18
Italy	-0.10	-0.10	-0.09	-0.12	-0.12	-0.12	-0.11	-0.12	-0.11	-0.17	-0.20	-0.13	-0.09	-0.08	-0.06	0.09	0.07	0.07	-0.11	-0.10	-0.08
Japan	-0.04	-0.09	-0.08	-0.04	-0.06	-0.05	0.05	0.06	0.06	0.03	0.01	0.01	-0.17	-0.14	-0.14	-0.04	-0.04	-0.06	-0.11	-0.07	-0.06
Netherlands	-0.06	-0.08	-0.07	-0.06	-0.08	-0.08	-0.07	-0.06	-0.06	-0.19	-0.20	-0.15	-0.15	-0.14	-0.12	-0.17	-0.20	-0.14	-0.12	-0.12	-0.09
Norway	-0.03	-0.06	-0.08	-0.03	-0.06	-0.08	-0.06	-0.05	-0.05	-0.21	-0.23	-0.18	-0.16	-0.15	-0.13	0.02	0.05	0.20	-0.09	-0.10	-0.10
Singapore	-0.03	-0.05	-0.04	-0.04	-0.05	-0.05	-0.02	-0.03	-0.04	-0.09	-0.09	-0.08	-0.22	-0.17	-0.14	-0.34	-0.29	-0.15	-0.17	-0.19	-0.14
Spain	-0.09	-0.13	-0.14	-0.11	-0.13	-0.13	-0.05	-0.05	-0.06	-0.13	-0.16	-0.10	-0.12	-0.10	-0.08	-0.02	0.03	0.08	-0.11	-0.11	-0.07
Sweden	-0.15	-0.18	-0.16	-0.16	-0.17	-0.16	-0.14	-0.14	-0.14	-0.25	-0.31	-0.28	-0.17	-0.16	-0.13	-0.09	-0.08	-0.03	-0.13	-0.12	-0.08
Switzerland	-0.06	-0.08	-0.08	-0.08	-0.10	-0.09	-0.08	-0.07	-0.07	-0.13	-0.13	-0.09	-0.28	-0.26	-0.23	-0.07	-0.06	-0.05	-0.16	-0.16	-0.13
UK	-0.07	-0.09	-0.08	-0.07	-0.07	-0.07	-0.05	-0.05	-0.04	-0.14	-0.15	-0.10	-0.17	-0.16	-0.13	-0.19	-0.17	-0.11	-0.15	-0.14	-0.12
World	-0.07	-0.10	-0.09	-0.07	-0.08	-0.08	-0.05	-0.05	-0.05	-0.12	-0.14	-0.11	-0.18	-0.16	-0.14	-0.18	-0.20	-0.16	-0.14	-0.14	-0.11
World X US	-0.06	-0.09	-0.08	-0.06	-0.08	-0.07	-0.02	-0.02	-0.02	-0.11	-0.13	-0.09	-0.16	-0.14	-0.13	-0.11	-0.12	-0.09	-0.13	-0.11	-0.09

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	NE	NE	NE	NE	NE	NE	NE	NE	NE	GID	GID	GID	GID	GID	GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	-0.08	-0.08	-0.07	N/A	0.32	0.15	-0.39	-0.27	-0.24	-0.06	-0.05	-0.05	-0.02	-0.03	-0.03
Australia	-0.01	-0.01	-0.02	N/A	0.75	0.34	-0.28	-0.19	-0.19	-0.06	-0.06	-0.06	-0.08	-0.07	-0.06
Austria	-0.10	-0.08	-0.09	N/A	0.33	0.06	-0.14	-0.05	-0.04	-0.02	-0.01	0.02	0.01	0.05	0.08
Belgium	-0.04	-0.04	-0.05	N/A	0.39	0.22	-0.11	-0.07	-0.12	0.02	0.02	0.03	-0.05	-0.05	-0.05
Canada	-0.06	-0.06	-0.06	N/A	0.49	0.25	-0.29	-0.19	-0.12	-0.04	-0.03	-0.04	-0.02	-0.02	-0.02
Denmark	-0.07	-0.06	-0.06	N/A	0.29	0.11	-0.06	-0.02	-0.09	0.00	0.03	0.05	-0.12	-0.13	-0.13
France	-0.09	-0.08	-0.08	N/A	0.51	0.25	-0.38	-0.18	-0.22	-0.05	-0.04	-0.03	0.00	-0.01	-0.03
Germany	-0.10	-0.09	-0.10	N/A	0.56	0.15	-0.37	-0.19	-0.27	-0.07	-0.05	-0.02	-0.04	-0.05	-0.06
Hong Kong	-0.15	-0.13	-0.13	N/A	1.12	0.45	-0.40	-0.29	-0.24	-0.10	-0.09	-0.08	0.03	0.05	0.09
Italy	-0.05	-0.04	-0.04	N/A	0.43	0.24	-0.23	-0.06	-0.11	0.01	0.01	0.01	-0.08	-0.10	-0.10
Japan	-0.03	-0.01	-0.01	N/A	0.36	0.22	0.12	0.04	0.07	-0.01	-0.01	-0.01	-0.04	-0.02	-0.03
Netherlands	-0.07	-0.07	-0.07	N/A	0.51	0.18	-0.40	-0.24	-0.23	-0.02	-0.02	-0.01	-0.01	-0.02	0.00
Norway	-0.10	-0.07	-0.08	N/A	0.49	0.12	-0.24	-0.14	-0.20	-0.07	-0.07	-0.06	-0.11	-0.11	-0.13
Singapore	-0.11	-0.08	-0.09	N/A	0.67	0.19	-0.12	-0.08	-0.15	-0.10	-0.08	-0.07	0.05	0.08	0.09
Spain	-0.07	-0.04	-0.06	N/A	0.45	0.22	-0.21	-0.01	-0.09	-0.08	-0.07	-0.07	-0.02	-0.04	-0.07
Sweden	-0.11	-0.09	-0.10	N/A	0.40	0.20	-0.39	-0.21	-0.21	-0.07	-0.06	-0.05	-0.08	-0.08	-0.11
Switzerland	-0.10	-0.09	-0.09	N/A	0.30	0.06	-0.24	-0.10	-0.07	-0.01	-0.01	0.01	-0.01	0.00	-0.01
UK	-0.06	-0.05	-0.05	N/A	0.33	0.14	-0.23	-0.09	-0.06	-0.03	-0.02	-0.01	-0.02	-0.03	-0.03
World	-0.07	-0.06	-0.06	N/A	0.37	0.18	-0.23	-0.14	-0.13	-0.05	-0.04	-0.03	-0.03	-0.03	-0.04
World X US	-0.06	-0.05	-0.05	N/A	0.45	0.22	-0.12	-0.05	-0.05	-0.03	-0.03	-0.02	-0.03	-0.03	-0.04

Notes: alphas from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4. Results relate to the sub-period 1989-2008.

Appendix Table 11: International Sub Period Analysis – R^2s

Panel A:	WT Crude Oil			Brent Crude Oil			Heating Oil			Gas Oil			Aluminum			Copper			Copper		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	17	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	6	7	5	6	7	19	20	21	15	16	17	16	17	18	4	5	6	15	16	17
USA	3.33	5.70	4.89	4.07	5.24	4.48	4.65	4.54	4.27	5.51	7.05	5.60	5.18	5.57	4.56	2.60	3.25	2.14	4.10	4.87	3.83
Australia	2.22	3.69	3.65	2.43	2.86	3.39	0.45	0.38	0.43	3.03	2.86	1.56	0.78	0.84	0.39	0.84	0.45	0.00	1.09	1.31	0.72
Austria	0.40	1.43	1.79	1.53	2.46	2.50	0.02	0.14	0.27	3.46	2.93	1.33	3.25	3.00	2.27	0.30	0.16	0.00	0.65	0.43	0.18
Belgium	1.04	2.44	2.85	1.37	2.14	2.62	1.34	1.54	1.94	10.79	10.02	5.68	1.18	1.20	0.95	0.15	0.44	0.18	0.94	0.63	0.59
Canada	0.66	1.62	0.74	0.57	0.85	0.55	0.03	0.03	0.03	0.14	0.40	0.08	1.41	1.50	1.23	0.50	0.61	0.07	0.85	1.30	0.92
Denmark	1.76	2.87	1.69	3.01	3.76	3.13	0.27	0.24	0.48	2.73	4.42	2.55	1.57	1.32	0.85	0.09	0.05	0.19	0.90	0.96	0.82
France	1.52	2.97	3.07	2.12	3.18	2.97	1.01	1.09	1.20	5.43	6.75	3.69	2.32	2.30	1.58	0.22	0.21	0.23	1.60	1.23	0.79
Germany	2.09	3.85	3.42	3.03	4.29	3.32	1.22	1.35	1.65	5.96	7.14	4.41	2.09	1.84	0.99	0.74	1.33	1.08	3.16	2.87	2.00
Hong Kong	0.04	0.01	0.01	0.05	0.01	0.03	0.10	0.11	0.10	0.01	0.02	0.06	1.00	1.12	0.87	1.72	2.48	1.99	2.09	2.72	1.77
Italy	2.17	2.32	1.95	3.45	4.09	3.99	2.15	2.34	2.50	5.85	7.76	3.94	0.49	0.36	0.25	0.13	0.08	0.08	0.82	0.69	0.47
Japan	0.43	1.79	1.45	0.38	0.87	0.76	0.40	0.67	0.69	0.17	0.03	0.02	1.62	1.22	1.28	0.03	0.03	0.06	0.76	0.34	0.25
Netherlands	1.19	2.44	2.14	1.76	2.99	3.09	1.26	1.13	1.19	6.27	6.82	4.06	2.16	2.16	1.61	0.72	1.01	0.56	1.77	1.61	1.00
Norway	0.20	0.65	1.30	0.23	0.82	1.55	0.48	0.36	0.44	5.49	6.26	4.30	1.27	1.21	0.93	0.01	0.03	0.63	0.44	0.61	0.65
Singapore	0.23	0.49	0.35	0.35	0.64	0.70	0.05	0.15	0.21	1.10	1.07	0.83	2.12	1.55	1.12	1.46	1.08	0.32	1.74	2.14	1.33
Spain	1.89	3.80	5.04	3.35	4.73	4.97	0.40	0.44	0.80	3.24	4.58	2.09	0.88	0.61	0.46	0.01	0.01	0.11	0.90	0.88	0.42
Sweden	3.97	5.39	4.92	5.06	6.32	5.50	2.40	2.69	2.96	5.66	8.50	7.54	1.30	1.19	0.94	0.10	0.08	0.01	0.83	0.76	0.37
Switzerland	1.70	2.71	3.17	2.97	4.74	4.25	1.67	1.57	1.52	5.63	5.54	2.52	7.58	7.24	6.45	0.14	0.11	0.07	3.00	3.30	2.36
UK	2.14	3.93	3.44	2.43	3.09	3.15	0.78	0.86	0.77	7.19	7.42	3.80	3.25	3.20	2.50	1.15	0.97	0.47	3.21	3.12	2.44
World	2.72	5.86	4.89	3.28	4.93	4.25	1.10	1.07	1.12	5.00	6.31	4.29	4.44	4.25	3.51	1.24	1.60	1.12	3.56	3.43	2.58
World X US	1.55	3.92	3.35	1.94	3.25	2.95	0.10	0.09	0.12	3.92	4.85	2.65	2.84	2.48	2.05	0.34	0.44	0.29	2.15	1.73	1.21

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	NE	NE	NE	NE	NE	NE	NE	NE	NE	GID	GID	GID	GID	GID	GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	2.67	2.66	2.48	N/A	2.19	0.96	3.76	2.50	2.70	2.04	1.47	1.10	0.07	0.12	0.10
Australia	0.02	0.01	0.10	N/A	7.04	2.91	1.17	0.71	1.07	0.98	0.92	0.96	0.51	0.36	0.29
Austria	1.49	1.12	1.58	N/A	0.85	0.05	0.17	0.03	0.04	0.08	0.04	0.06	0.01	0.13	0.28
Belgium	0.41	0.49	0.76	N/A	2.06	1.31	0.20	0.10	0.46	0.08	0.11	0.40	0.24	0.22	0.23
Canada	0.76	0.83	0.99	N/A	3.09	1.53	1.26	0.77	0.42	0.61	0.36	0.41	0.04	0.04	0.03
Denmark	1.07	0.86	1.13	N/A	1.02	0.27	0.06	0.01	0.24	0.01	0.24	0.72	1.14	1.27	1.19
France	1.80	1.64	1.98	N/A	3.22	1.50	2.06	0.65	1.44	0.63	0.53	0.26	0.00	0.00	0.05
Germany	1.62	1.49	1.90	N/A	2.68	0.38	1.38	0.52	1.49	0.85	0.57	0.09	0.08	0.15	0.16
Hong Kong	2.38	2.11	2.35	N/A	7.21	2.29	1.06	0.81	0.78	1.48	1.04	0.77	0.03	0.09	0.27
Italy	0.41	0.21	0.29	N/A	1.46	0.94	0.50	0.05	0.24	0.00	0.02	0.01	0.31	0.46	0.49
Japan	0.11	0.01	0.02	N/A	1.05	0.81	0.14	0.02	0.10	0.01	0.01	0.03	0.09	0.02	0.05
Netherlands	1.38	1.30	1.47	N/A	3.53	0.91	2.50	1.26	1.61	0.12	0.15	0.03	0.00	0.02	0.00
Norway	1.24	0.80	0.94	N/A	1.69	0.20	0.46	0.24	0.68	0.85	0.86	0.54	0.55	0.51	0.66
Singapore	1.60	0.96	1.21	N/A	3.05	0.50	0.10	0.08	0.34	1.52	1.09	0.78	0.12	0.25	0.28
Spain	0.71	0.32	0.77	N/A	1.72	0.80	0.46	0.00	0.15	1.24	0.95	0.90	0.02	0.07	0.21
Sweden	1.37	0.98	1.34	N/A	1.00	0.51	1.13	0.43	0.63	0.76	0.57	0.31	0.28	0.27	0.46
Switzerland	2.63	2.50	2.83	N/A	1.28	0.10	0.95	0.21	0.15	0.02	0.03	0.03	0.01	0.00	0.00
UK	1.21	0.88	1.09	N/A	1.93	0.69	1.11	0.24	0.14	0.46	0.24	0.07	0.06	0.07	0.07
World	1.90	1.54	1.76	N/A	2.88	1.30	1.25	0.64	0.76	1.03	0.72	0.45	0.13	0.12	0.17
World X US	1.03	0.69	0.97	N/A	3.21	1.52	0.27	0.06	0.10	0.36	0.26	0.13	0.13	0.08	0.15

Notes: R^2s (in percent) from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4. Results relate to the sub-period 1989-2008.

Appendix Table 12: Time-Varying Risk Premia Test Results for Individual Countries

Panel A:	WT Crude Oil			Brent Crude Oil			Heating Oil			Gas Oil			Aluminum			Copper			Copper		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	17	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	6	7	5	6	7	19	20	21	15	16	17	16	17	18	4	5	6	15	16	17
USA	2.09	**4.19**	**6.10**	**3.41**	**2.93**	2.24	**14.97**	**17.95**	**18.26**	**5.63**	**4.83**	**4.97**	**6.37**	**10.39**	**7.17**	**8.68**	**10.04**	**4.75**	**6.28**	**4.69**	2.44
Australia	0.54	0.26	0.58	0.31	0.15	1.16	2.49	0.87	0.69	1.55	2.18	2.55	**3.94**	2.47	**2.80**	0.63	**2.76**	0.81	0.73	0.35	0.07
Austria	**7.13**	**7.65**	**10.48**	1.95	**5.68**	**5.30**	0.16	1.25	2.08	**3.63**	2.43	0.76	**6.41**	**5.41**	2.43	0.22	0.03	0.00	0.00	0.04	0.08
Belgium	**3.16**	**3.15**	0.32	1.77	**3.97**	1.14	**5.34**	**5.88**	**6.76**	**8.48**	**9.99**	**5.15**	**5.25**	**5.30**	2.03	0.04	0.57	0.01	0.02	0.23	0.01
Canada	0.12	0.11	0.31	0.02	0.03	0.33	**4.72**	**4.05**	**3.50**				**2.86**	**4.89**	**3.09**	0.58	1.03	0.01	**5.71**	2.62	**8.85**
Denmark	1.17	**3.63**	0.85	2.30	**4.90**	**4.65**	0.20	0.09	0.11	0.00	2.31	0.30	**3.32**	**4.85**	1.16	0.29	**3.40**	0.70	2.37	0.22	1.54
France	**4.42**	**5.37**	1.30	2.03	**3.94**	1.08	**3.15**	**5.51**	**6.43**	1.18	**3.06**	2.69	**3.96**	2.55	0.68	2.36	**4.17**	**4.78**	1.81	1.78	0.63
Germany	**8.44**	**7.11**	**5.41**	**3.42**	**7.00**	**3.83**	**8.05**	**8.91**	**9.92**	0.84	1.88	2.41	**5.07**	**6.08**	1.74	2.41	**5.10**	**3.08**	2.70	**2.84**	**3.26**
Hong Kong																					
Italy	**11.24**	**11.21**	**6.67**	1.65	**3.13**	1.47	**5.49**	**9.50**	**12.35**	0.41	2.47	**3.57**	**3.61**	**5.10**	**3.08**	1.22	0.23	0.84	1.58	1.87	1.62
Japan	1.42	**3.92**	1.70	0.48	**3.62**	1.55	**4.14**	0.03	0.10	1.59	0.02	0.13	**7.04**	**3.24**	**3.92**	0.04	0.01	0.57	0.06	0.00	0.00
Netherlands	1.67	2.57	1.28	0.44	2.25	1.97	**8.11**	**6.50**	**7.34**	**4.24**	**6.56**	**4.95**	**5.32**	**5.03**	1.77	0.96	2.49	0.72	2.01	0.92	0.52
Norway	0.02	0.00	0.34	0.86	0.09	0.93	1.42	1.19	0.76	1.68	**3.52**	**2.78**	0.49	0.22	0.00	0.44	0.03	0.10	0.03	0.54	0.04
Singapore	0.24	0.03	0.30	0.01	0.04	0.28	0.32	0.73	0.35	0.79	0.16	0.16	1.13	1.31	1.02	0.17	0.81	2.31	0.12	0.10	0.01
Spain	1.48	2.52	**6.78**	**3.38**	**5.82**	**4.40**	0.01	0.65	2.71	1.31	2.38	0.70	**2.95**	0.20	0.00	**4.98**	1.72	1.41	0.40	0.18	0.01
Sweden	**2.93**	**5.05**	2.33	**5.91**	**9.87**	**11.24**	**4.30**	**8.52**	**9.10**	0.72	1.68	**3.05**	2.58	2.49	0.67	0.12	0.08	**2.81**	1.03	0.12	0.44
Switzerland	**6.25**	**4.63**	**7.51**	**5.46**	**9.89**	**8.91**	**6.96**	**8.47**	**12.12**	2.63	**4.60**	2.70	**17.72**	**10.58**	**9.99**	0.91	1.92	2.00	**7.37**	**5.83**	**5.74**
UK	**3.39**	**4.19**	1.39	2.38	**4.49**	**3.91**	2.61	**5.96**	**5.22**	**4.32**	**5.37**	**3.46**	**7.54**	**5.36**	**3.01**	0.91	2.00	0.96	0.06	0.38	0.76

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	NE	NE	NE	NE	NE	NE	NE	NE	NE	GID	GID	GID	GID	GID	GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	**2.76**	**4.10**	**4.27**		2.28	**4.38**	1.11	0.00	0.12	**14.62**	**7.51**	**7.32**	1.42	**3.93**	**3.42**
Australia					**10.49**	**7.37**	1.41	0.07	0.59	0.90	0.24	1.65	0.19	0.63	0.89
Austria	0.01	0.02	0.25		0.25	1.77	0.00	0.11	0.55	0.03	0.21	**3.20**	2.27	0.88	2.09
Belgium	0.02	0.29	1.28		**3.02**	**4.63**	1.14	0.01	0.00	0.44	0.28	1.69	2.06	0.73	**6.77**
Canada	0.02	0.14	1.25		0.36	2.03	0.31	0.53	0.18	**12.59**	**3.03**	**3.61**	1.05	**4.17**	**4.53**
Denmark	0.32	2.25	0.85		0.44	0.00	0.77	0.07	1.67	0.38	0.35	2.34	**3.86**	**4.13**	0.89
France	0.98	2.08	2.48		**4.39**	**4.22**	2.54	0.38	0.07	**3.01**	2.49	**4.66**	2.23	1.02	1.05
Germany	0.55	**3.39**	**3.19**		**3.11**	1.51	0.62	0.05	0.04	0.00	0.02	0.07	0.03	0.03	0.16
Hong Kong															
Italy	1.46	**2.79**	**6.34**		2.13	**7.07**	1.53	1.39	0.47	0.01	0.91	1.46	0.43	1.21	1.65
Japan	0.37	0.06	0.08		1.34	1.80	0.01	0.05	2.22	0.17	0.67	0.27	2.37	2.39	0.57
Netherlands	1.07	2.46	**3.37**		**4.84**	**3.13**	**2.94**	**2.90**	**4.32**	**2.77**	1.75	2.28	1.20	2.56	**5.09**
Norway	0.43	1.60	1.26		0.37	0.31	0.34	0.29	**3.54**	**5.88**	**3.89**	**4.04**	0.01	0.01	0.82
Singapore	0.72	0.00	0.09		**5.40**	**2.92**	0.06	0.16	0.65	**10.01**	**4.22**	**5.23**	**2.87**	**3.88**	**3.63**
Spain	0.01	0.96	0.63		**3.75**	**5.45**	0.05	**3.13**	0.01	1.86	1.41	**3.38**	1.42	0.40	0.62
Sweden	1.58	**3.02**	**3.04**		0.25	**3.91**	0.17	0.40	0.00	0.66	0.10	0.09	0.02	0.68	0.20
Switzerland	**4.70**	**6.66**	**4.66**		0.26	0.08	0.10	0.01	2.17	**4.78**	**5.99**	**5.77**	1.54	**3.63**	2.57
UK	1.42	1.83	2.21		1.16	0.82	0.95	1.90	0.92	**6.86**	**3.68**	**4.80**	0.33	1.65	**3.96**

Notes: "NE" refers to a near efficiency interval, while "GID" refers to a gradual information diffusion interval. Estimation results for the regression $r_T^m = \mu + \alpha_1 x_{t-1}^d + D_t \alpha_2 x_{t-1}^d + \varepsilon_t$ (near efficiency) and $r_T^m = \mu + \alpha_1 x_{T-1-t-1}^m + D_t \alpha_2 x_{T-1-t-1}^m + \varepsilon_t$ (gradual information diffusion) based on the interval specified in Table 4. The dummy variable D_t equals 1 if the expected excess returns (based on our core results in Section 4) are negative and 0 otherwise. The sum of α_1 and α_2 represents the absolute value of the lagged reaction of the equity market for the large commodity price increases. We follow Driesprong, Jacobsen, and Maat (2008) and use the Wald test to determine if the sum of α_1 and α_2 is statistically significantly different from zero.

Appendix Table 13: TVRP 2

Panel A:	**WT Crude Oil**			**Brent Crude Oil**			**Heating Oil**			**Gas Oil**			**Aluminum**			**Copper**			**Copper**		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	**17**	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	GID	GID	GID	GID	GID	GID	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	5	**6**	**7**	**5**	**6**	**7**	**19**	**20**	**21**	**15**	**16**	**17**	**16**	**17**	**18**	**4**	**5**	**6**	**15**	**16**	**17**
USA	-0.05	-0.07	-0.08	-0.06	-0.06	-0.05	-0.15	-0.15	-0.15	-0.17	-0.16	-0.15	-0.19	-0.22	-0.18	-0.30	-0.31	-0.19	-0.12	-0.10	-0.07
Australia	-0.04	-0.03	-0.04	-0.03	-0.02	-0.06	-0.14	-0.08	-0.07	-0.12	-0.14	-0.14	-0.21	-0.15	-0.18	0.22	0.49	0.17	-0.09	-0.06	0.03
Austria	-0.19	-0.17	-0.18	-0.08	-0.14	-0.13	-0.04	-0.09	-0.10	-0.19	-0.15	-0.09	-0.34	-0.28	-0.19	-0.10	0.04	0.00	0.00	0.02	0.03
Belgium	-0.08	-0.08	-0.02	-0.06	-0.08	-0.04	-0.12	-0.12	-0.13	-0.28	-0.30	-0.20	-0.21	-0.20	-0.12	-0.04	-0.12	-0.01	-0.01	0.04	0.00
Canada	0.02	-0.01	-0.02	-0.01	0.01	0.03	-0.17	-0.12	-0.10				-0.16	-0.20	-0.15	-0.11	-0.14	-0.01	0.25	0.14	0.32
Denmark	-0.05	-0.09	-0.05	-0.07	-0.10	-0.09	0.03	0.02	0.02	0.00	-0.13	-0.05	-0.19	-0.21	-0.11	0.28	-0.61	-0.14	-0.13	-0.04	-0.09
France	-0.09	-0.10	-0.05	-0.06	-0.09	-0.04	-0.10	-0.12	-0.12	-0.09	-0.15	-0.12	-0.18	-0.13	-0.07	-0.25	-0.32	-0.31	-0.10	-0.09	-0.05
Germany	-0.14	-0.13	-0.11	-0.09	-0.13	-0.10	-0.17	-0.17	-0.17	-0.10	-0.16	-0.16	-0.25	-0.25	-0.13	-0.23	-0.32	-0.22	-0.11	-0.11	-0.11
Hong Kong																					
Italy	-0.19	-0.19	-0.14	-0.08	-0.10	-0.07	-0.16	-0.20	-0.22	-0.06	-0.15	-0.15	-0.24	-0.26	-0.20	-0.22	-0.10	-0.17	-0.12	-0.12	-0.11
Japan	-0.07	-0.12	-0.07	-0.04	-0.11	-0.07	0.19	-0.01	-0.03	0.12	-0.01	-0.03	-0.35	-0.21	-0.23	-0.03	0.02	-0.12	-0.02	-0.01	0.00
Netherlands	-0.05	-0.06	-0.04	-0.03	-0.06	-0.05	-0.14	-0.11	-0.12	-0.19	-0.23	-0.18	-0.20	-0.18	-0.10	-0.12	-0.19	-0.10	-0.09	-0.06	-0.04
Norway	0.02	0.00	0.04	0.06	-0.02	-0.06	-0.11	-0.09	-0.07	-0.14	-0.20	-0.16	-0.09	-0.06	0.00	0.25	-0.04	0.05	0.03	0.08	0.02
Singapore	0.03	-0.01	0.03	0.01	-0.01	-0.03	-0.05	-0.06	-0.05	-0.12	-0.05	-0.05	-0.15	-0.15	-0.13	-0.09	-0.19	-0.39	-0.04	0.03	0.01
Spain	-0.06	-0.09	-0.13	-0.10	-0.12	-0.10	-0.01	-0.05	-0.10	-0.11	-0.14	-0.07	-0.20	-0.05	0.01	0.77	0.27	0.20	-0.06	0.04	0.01
Sweden	-0.10	-0.13	-0.08	-0.15	-0.19	-0.19	-0.14	-0.19	-0.19	-0.11	-0.17	-0.21	-0.21	-0.19	-0.10	0.12	0.09	**-1.68**	-0.14	-0.05	-0.11
Switzerland	-0.10	-0.09	-0.10	-0.10	-0.13	-0.12	-0.13	-0.13	-0.16	-0.12	-0.16	-0.11	-0.37	-0.27	-0.25	-0.15	-0.19	-0.18	-0.16	-0.14	-0.13
UK	-0.07	-0.08	-0.04	-0.06	-0.08	-0.07	-0.08	-0.11	-0.10	-0.14	-0.15	-0.11	-0.22	-0.17	-0.12	-0.13	-0.18	-0.18	0.02	0.05	0.07

Panel B:	Nickel			Zinc			Soybeans			Sugar			Cattle		
	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1	Int-1	Int	Int+1
	NE	NE	NE	NE	NE	NE	NE	NE	NE	GID	GID	GID	GID	GID	GID
	16	17	18		1	2	2	3	4	11	12	13	4	5	6
USA	-0.07	-0.09	-0.09		0.29	0.28	-0.09	-0.07	-0.07	-0.06	-0.10	-0.09	-0.07	-0.09	-0.09
Australia					0.82	0.47	-0.04	0.02	-0.06	-0.04	-0.07	-0.08			
Austria	-0.01	-0.01	-0.04		0.16	-0.34	0.01	0.02	0.09	0.17	0.09	0.11	-0.01	-0.01	-0.04
Belgium	-0.01	-0.03	-0.06		0.41	0.33	-0.02	-0.02	-0.05	-0.12	-0.06	-0.21	-0.01	-0.03	-0.06
Canada	-0.01	-0.02	-0.07		0.15	0.24	-0.11	-0.05	-0.06	-0.07	-0.13	-0.14	-0.01	-0.02	-0.07
Denmark	-0.04	-0.11	-0.06		0.17	0.01	-0.02	-0.02	-0.09	-0.13	-0.14	-0.06	-0.04	-0.11	-0.06
France	-0.05	-0.07	-0.08		0.50	0.32	-0.06	-0.06	-0.08	-0.15	-0.09	-0.10	-0.05	-0.07	-0.08
Germany	-0.05	-0.11	-0.11		0.51	0.24	0.00	0.00	-0.01	0.02	0.02	-0.04	-0.05	-0.11	-0.11
Hong Kong															
Italy	-0.09	-0.13	-0.19		0.47	0.58	0.00	0.04	-0.05	-0.06	-0.10	-0.11	-0.09	-0.13	-0.19
Japan	-0.04	-0.01	-0.01		0.35	0.28	0.02	0.03	0.02	-0.13	-0.14	-0.07	-0.04	-0.01	-0.01
Netherlands	-0.05	-0.08	-0.09		0.49	0.27	-0.05	-0.04	-0.04	-0.08	-0.10	-0.15	-0.05	-0.08	-0.09
Norway	-0.05	-0.10	-0.08		0.20	-0.14	-0.11	-0.09	-0.09	-0.01	0.01	-0.08	-0.05	-0.10	-0.08
Singapore	-0.07	0.00	-0.02		0.84	0.42	-0.16	-0.10	-0.12	-0.19	-0.22	-0.21	-0.07	0.00	-0.02
Spain	0.01	-0.09	-0.05		0.57	0.47	-0.05	-0.05	-0.07	-0.22	-0.11	-0.12	0.01	-0.09	-0.05
Sweden	-0.10	-0.14	-0.13		0.17	0.47	-0.03	-0.01	0.01	0.01	-0.08	-0.05	-0.10	-0.14	-0.13
Switzerland	-0.12	-0.14	-0.11		0.12	0.06	-0.06	-0.07	-0.07	-0.07	-0.12	-0.11	-0.12	-0.14	-0.11
UK	-0.06	-0.06	-0.07		0.22	0.12	-0.09	-0.07	-0.08	-0.04	-0.09	-0.14	-0.06	-0.06	-0.07

Appendix Table 14: Comparison of Spot and Futures Data (US)

			Spot			Futures		
	Interval		Int-1	Int	Int+1	Int-1	Int	Int+1
WT Crude Oil	GID	6	**-3.03**	**-4.65**	**-3.52**	**-3.24**	**-3.44**	**-3.51**
Brent Crude Oil	GID	6	**-3.10**	**-3.72**	**-3.09**	**-2.77**	**-3.21**	**-3.07**
Heating Oil	NE	20	**-4.15**	**-4.22**	**-3.99**	**-3.79**	**-3.66**	**-3.57**
GasOil	NE	16	**-2.60**	**-3.13**	**-2.88**	**-3.61**	**-2.73**	**-2.45**
Aluminum	NE	17	**-3.43**	**-3.73**	**-3.35**	**-2.47**	**-2.48**	**-2.10**
Copper	NE	4	**-4.11**	**-4.63**	**-2.79**	**-2.54**	**-2.60**	**-2.37**
Copper	NE	16	**-3.12**	**-3.42**	**-3.24**	**-3.02**	**-3.17**	**-3.17**
Nickel	NE	17	**-2.74**	**-2.76**	**-2.59**	**-2.53**	**-2.65**	**-2.58**
Zinc	NE	1		**2.88**	1.60	0.23	2.24	0.97
Soybeans	GID	3	**-2.13**	**-2.87**	**-1.81**	**-3.66**	**-2.89**	**-2.32**
Sugar	GID	12	**-3.37**	**-3.41**	**-2.73**	**-2.17**	**-2.08**	-1.50
Live Cattle	GID	5	**-2.68**	**-2.78**	**-2.62**	-1.15	-1.28	-1.31

Notes: t-statistics for alpha from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4. Results relate to the interval specified in Table 4 and the corresponding intervals. Results are generated using both sport and futures data. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. The Bonferroni correction has been applied so based on 23 different alternatives the critical t-statistic at the 10% level is 2.63. t-statistics of this level and higher are in bold.

Appendix Table 15: Comparison of Different Market Closing Times (US)

			Normal			Lag 1 Day		
	Interval		Int-1	Int	Int+1	Int-1	Int	Int+1
WT Crude Oil	GID	6	**-3.03**	**-4.65**	**-3.52**	**-5.08**	**-3.70**	**-3.57**
Brent Crude Oil	GID	6	**-3.10**	**-3.72**	**-3.09**	**-4.29**	**-3.60**	**-3.76**
Heating Oil	NE	20	**-4.15**	**-4.22**	**-3.99**	**-4.01**	**-3.80**	**-3.56**
GasOil	NE	16	**-2.60**	**-3.13**	**-2.88**	**-2.75**	**-2.53**	**-2.08**
Aluminum	NE	17	**-3.43**	**-3.73**	**-3.35**	**-4.34**	**-3.88**	**-3.81**
Copper	NE	4	**-4.11**	**-4.63**	**-2.79**	**-3.62**	**-1.93**	**-1.80**
Copper	NE	16	**-3.12**	**-3.42**	**-3.24**	**-2.85**	**-2.67**	**-2.74**
Nickel	NE	17	**-2.74**	**-2.76**	**-2.59**	**-3.10**	**-2.86**	**-2.53**
Zinc	NE	1		**2.88**	1.60		-0.14	-0.39
Soybeans	GID	3	**-2.13**	**-2.87**	**-1.81**	-1.41	-0.61	-0.58
Sugar	GID	12	**-3.37**	**-3.41**	**-2.73**	**-3.55**	**-2.84**	**-2.52**
Live Cattle	GID	5	**-2.68**	**-2.78**	**-2.62**	**-2.41**	**-2.25**	**-2.18**

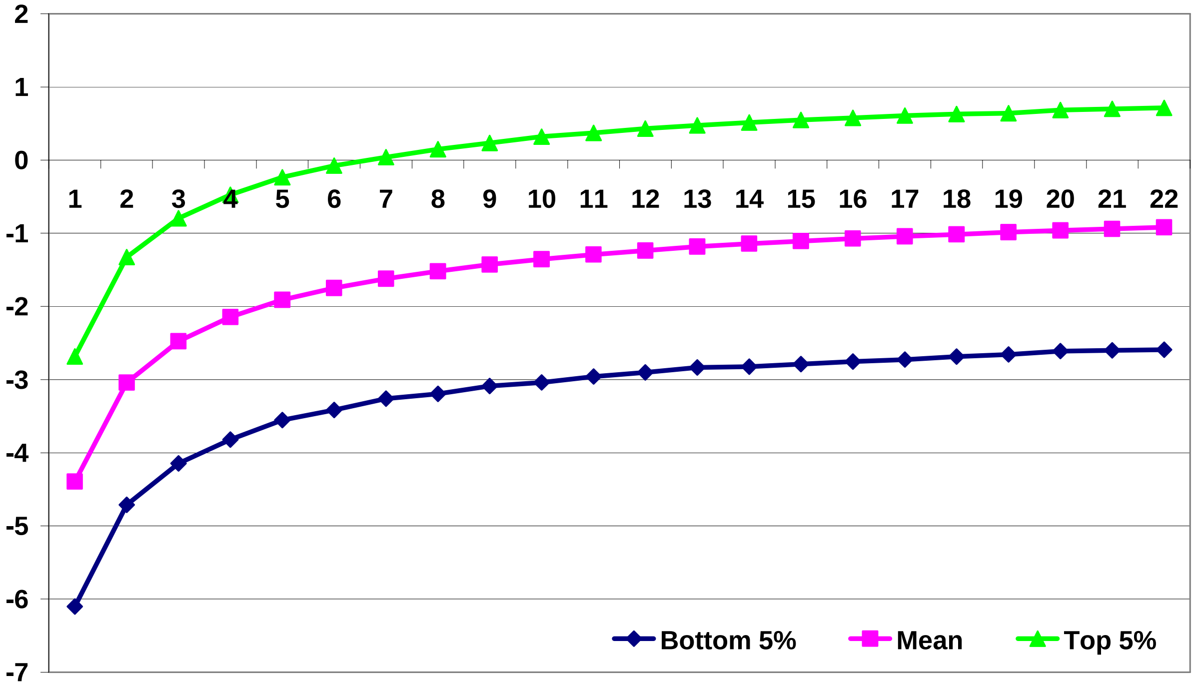
Notes: t-statistics for alpha from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4. Results relate to the interval specified in Table 4 and the interval specified in Table 4 with a one day lag. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. The Bonferroni correction has been applied so based on 23 different alternatives the critical t-statistic at the 10% level is 2.63. t-statistics of this level and higher are in bold.

Appendix Table 16: Comparison of Different Monthly Seasonalities (US)

			Normal			Mid Month		
	Interval		Int-1	Int	Int+1	Int-1	Int	Int+1
WT Crude Oil	GID	6	**-3.03**	**-4.65**	**-3.52**	**-2.57**	**-1.78**	**-2.04**
Brent Crude Oil	GID	6	**-3.10**	**-3.72**	**-3.09**	**-2.85**	-1.61	-1.59
Heating Oil	NE	20	**-4.15**	**-4.22**	**-3.99**	**-1.82**	**-2.05**	**-2.49**
GasOil	NE	16	**-2.60**	**-3.13**	**-2.88**	-1.24	-1.20	-1.18
Aluminum	NE	17	**-3.43**	**-3.73**	**-3.35**	**-3.60**	**-3.13**	**-3.72**
Copper	NE	4	**-4.11**	**-4.63**	**-2.79**	**-1.86**	-1.41	-1.62
Copper	NE	16	**-3.12**	**-3.42**	**-3.24**	**-2.34**	**-2.56**	**-2.78**
Nickel	NE	17	**-2.74**	**-2.76**	**-2.59**	-0.33	-0.33	-0.46
Zinc	NE	1		**2.88**	1.60	-1.64	0.17	-0.48
Soybeans	GID	3	**-2.13**	**-2.87**	**-1.81**	0.48	-0.43	-1.11
Sugar	GID	12	**-3.37**	**-3.41**	**-2.73**	**-2.99**	**-2.86**	**-2.20**
Live Cattle	GID	5	**-2.68**	**-2.78**	**-2.62**	-0.59	0.25	0.38

Notes: t-statistics for alpha from regression (2) $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ or regression (3) $r_T^m = \mu + \alpha x_{T-1-t-1}^m + \varepsilon_t$ in the text depending on the interval specified in Table 4. Results relate to the interval specified in Table 4. Results based on normal monthly equity returns and monthly equity returns calculated from mid-month to mid-month are presented. t-values are based on Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. The Bonferroni correction has been applied so based on 23 different alternatives the critical t-statistic at the 10% level is 2.63. t-statistics of this level and higher are in bold.

Appendix Figure 1: Simulated t-Statistics Assuming Only Last Trading Day of Previous Month Predicts US Equity Market Monthly Return (Coefficient -0.5)



Note: We simulate 10,000 commodity returns and 10,000 ε_t series. We then assume α_1 = -0.5 and that the other coefficients = 0 and estimate the 10,000 S&P 500 monthly return series using: $r_T^m = \mu + \alpha_1 x_{t-1}^d + \alpha_2 x_{t-2}^d + ... + \alpha_{22} x_{t-22}^d + \varepsilon_t$. We then calculate the cumulative daily series for each interval and run $r_T^m = \mu + \alpha x_{t-1}^d + \varepsilon_t$ 10,000 times using the simulated cumulative daily commodity series and the simulated S&P 500 monthly return series.