Trading on nearness to the recent peak prices in commodity futures markets

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Abstract

George and Hwang (2004) (henceforth GH) propose a trading strategy based on the ratio of current price to recent highest price. I find that the GH strategy is significantly profitable in the commodity futures markets. The monthly return from the GH strategy is greater than that of the traditional momentum strategy by at least 0.42%. In horse-race tests of the GH and traditional momentum strategies, the former dominate the latter. Furthermore, unlike the profits of the traditional momentum strategy, the profits of the GH strategy do not reverse in the long run.

1. Introduction

George and Hwang (2004) (henceforth GH) propose a zero-investment trading strategy that buys the quintile of stocks with current prices nearest to their 52-week highs and sells the quintile of stocks with current prices furthest from their 52-week highs. The 52-week high is the highest price of an individual stock during the past one year. They find that this trading strategy generates significant profits for a medium term of 6 or 12 months. An even more interesting finding of GH is that their strategy largely explains the profits from the traditional momentum strategies of Jegadeesh and Titman (1993) (henceforth JT), which are based on past medium-term stock returns. This finding suggests that price levels are more important than price changes in predicting future stock returns. GH interpret their results as consistent with an anchoring bias: Investors use the 52-week high as a reference point (an anchor) to assess the potential impact of news. Specifically, when prices are already near their 52-week highs, investors are reluctant to bid prices higher on good news, even if the news warrants it. The news eventually prevails and prices continue to move up, resulting in high future returns. Similarly, investors are reluctant to bid the stock prices lower on bad news when they are already far from their 52-week highs, which results in low future returns.[1]

In this paper, I examine whether the GH strategy can generate significant profit in the commodity futures markets. The use of data from another asset class provides an important out-of-sample test of whether GH's results are statistical artifacts from data-mining. The JT strategies have been extensively studied using data from different asset classes, including commodity futures (Erb & Harvey, 2006; Shen, Szakmary, & Sharma, 2006; Miffre & Rallis, 2007; Szakmary, Shen, & Sharma, 2010; Asness, Moskowitz, & Pedersen, 2013). To my knowledge, the GH strategy has not been examined in the markets of other asset classes[2]. This study fills that gap. Furthermore, the commodity futures markets feature lower transaction costs and easier short selling than the stock markets (Followill & Rodriguez, 1991; Laux & Senchack, 1992; Fleming, Ostdiek, & Whaley, 1996; Locke & Venkatesh, 1997). These features make them a more appealing setting in which to implement the GH strategy (if it is indeed profitable) than the stock markets. GH's results suggest that more than two-thirds of their strategy's profit comes from the short-selling side.

[1] The 52-week high is also interpreted as an anchor in the corporate finance work of Baker, Pan, and Wurgler (2012), who show that the 52-week high prices of targets appear to anchor the strategies of bidders in acquisition transactions.

[2] Liu, Liu, and Ma (2011) document that the GH strategy is significantly profitable in the international markets. Li and Yu (2012) show that Dow Index returns are predictable based on the nearness of the index to its 52-week high in a time-series analysis.

Using data on 25 commodity futures over the period of January 1981 to December 2013, I find that the GH strategy is significantly profitable in the commodity futures markets. Following GH, each month, I rank futures into quintiles based on the ratio of the current price to the peak price over the past one year. I term this ranking variable 'nearness to the 12-month high.' I then construct a self-financing portfolio by purchasing the top quintile and selling the bottom quintile, and hold this portfolio for the following 1, 3, 6 or 12 months. The average monthly return of this portfolio ranges from 0.76% (when the holding period is 12 months) to 1.59% (when the holding period is one month). For a given holding period, the profit from the GH strategy is always greater than the highest profit among the four JT strategies based on the returns of the past 1, 3, 6 or 12 months. On average, the GH strategy is more profitable than the JT strategies by at least 0.42% per month in the commodity futures markets.

Furthermore, I find that the GH strategy based on nearness to the 12-month high dominates the JT strategies, which is consistent with the evidence in the stock markets. In 16 horse-race tests, the GH strategy always generates significant profits whose magnitudes are affected little by the JT strategy. On the other hand, when the effect of the GH strategy is controlled, only 1 out 16 JT strategies produces significant profit with greatly reduced magnitude. To the extent that the profitability of the GH strategy is caused by investors' anchoring bias, my result suggests that investors in the commodity futures market also use the highest price during the past one year as an anchor to assess futures' values.

GH focus on the 52-week high (i.e., the 12-month high) in the stock markets because the 52-week high is routinely reported in the financial press and is therefore salient to investors. In addition to the 12-month high, I also test whether the GH strategies based on other peak prices such as the 1-, 3- and 6-month highs are significantly profitable. They are. Moreover, I find that nearness to the 1-, 3- or 6-month high has incremental power to predict future returns relative to nearness to the12-month high and to each other. This is consistent with the anchoring explanation: Unlike the 12-month high prices of stocks, those of commodity futures are not commonly singled out by newspapers or websites. This suggests that the peak prices of other horizons can be as salient as the 12-month high price; hence they can also be used as anchors by investors of commodity futures. However, I also find that these incremental predictive powers of other peak prices appear only when the holding period is extended beyond 6 months after portfolio formation. When the holding period is no more than 6 months, nearness to the 12-month high dominates the other three highs; when the holding period is beyond 6 months, nearness to the 12-month high *is dominated by* other highs. I am not aware of any extant theory (whether anchoring related or not) that can explain this phenomenon. Nevertheless, similar to strategies based on the 12-month high, the GH strategies based on the 1-, 3- and 6-month highs largely explain the corresponding JT strategies as well.

Similar to stock market evidence of GH, my results show that the profitability of the GH strategies in the commodity futures market does not reverse in the long term. The results even suggest that the profitability continues into the fourth year after portfolio formation. On the other hand, I find significant return reversal for the JT strategies in the second year after portfolio formation, which is consistent with Shen et al. (2006) and Miffre and Rallis (2007). These findings confirm GH's conclusion that the profitability of the strategies based on nearness to past peak prices is caused by investors' underreaction rather than overreaction.

In robustness tests, I find that the profitability of the GH strategies in the commodity futures markets is not compensation for risk, is not driven by a few outliers, does not disappear in the most recent years, and is not due to heterogeneity across different types of commodity futures.

2. Data, variable and methodology

I obtain the data from Datastream. It comprises the settlement prices of the following 25 US commodity futures contracts: 12 agricultural futures (cocoa, coffee C., corn, cotton #2, milk, oats, orange juice, soybean meal, soybean oil, soybeans, sugar #11, wheat), 4 livestock futures (feeder cattle, frozen pork bellies, lean hogs, live cattle), 6 metal futures (aluminium, copper, gold 100 oz, palladium, platinum, silver 1000 oz), 3 oil and gas futures (light crude oil, natural gas, unleaded gas) and the futures on lumber. The dataset spans the time period from 01 January 1980 to 31 December 2013. As explained later, past one year's data is required to calculate the ranking variables when forming portfolios, so the return series starts from 01 January 1981.

I collect the settlement price of the nearest contract of each commodity future and roll over to the next contract on the last day of the month before the contract expires (Gorton & Rouwenhorst, 2006; Shen et al., 2006; Miffre & Rallis, 2007; Gorton, Hayashi, & Rouwenhorst, 2013) Following Miffre and Rallis (2007), I calculate the monthly future return as the change in the logarithms of the settlement prices from the end of the previous month to the end of the current month. The two settlement prices used to calculate a monthly return are from the same contracts. This is to ensure that returns are not distorted by contract rollovers.

At the end of each month, for each commodity future, I calculate its average return over the previous R months (R = 1, 3, 6 or 12). These are the ranking variables used to form portfolios in the JT strategies. I also calculate the ratio of its current price to its highest price (i.e., peak price) during the past R months (R= 1, 3, 6 or 12). I term these variables 'nearness to the R-month high.' The GH strategies are based on these variables.

When contracts roll over, there is a price gap between the contract that is closed out and the contract that is entered into (Ma, Mercer, & Walker, 1992). I use the price levels adjusted for such gaps to calculate nearness to the R-month high. Specifically, on a rollover date, I calculate the price difference between the new and old contracts. Then I add this difference to the previous prices of all old contracts so that the current price and the recent peak prices are on the same level. This is to ensure that nearness to the R-month high is not affected by price gaps at rollovers. In untabulated robustness results, I repeat all analyses using *unadjusted* price levels and find similar results.

I follow the method of Jegadeesh and Titman (2001) to form portfolios and calculate portfolio returns. Specifically, at the end of each month, I sort all available futures into quintiles based on the ranking variable. The winner portfolio includes futures in the highest quintile, and the loser portfolio includes futures in the lowest quintile. The winner and loser portfolios are held for the next H months (H = 1, 3, 6 or 12). Thus, the month-t return to the winner portfolio is calculated as the equally weighted average of the month-t returns from H separate winner portfolios, each formed in one of the H consecutive months (i.e., $t - H$ to $t - 1$). For example, when the portfolios are held for 6 months (H = 6), the return to the winner portfolio in month t is the average of the six month-t returns of the portfolios formed from month $t - 6$ to month $t - 1$. The month-t return to the loser portfolio is calculated in the same way. A JT or GH strategy is one that takes a long position in the winner portfolio and a short position in the loser portfolio. Thus, the month-t return of a trading strategy is the return differential between the winner and loser portfolios.

I use the abbreviation 'JT (R, H)' to denote JT strategies with various ranking and holding periods. For example, JT (1, 3) denotes the JT strategy in which the ranking variable is calculated using the data of the past one month and the portfolios are held for three months after ranking. Put differently, in JT (1, 3), the ranking period is 1 month and the holding period is 3 months. GH (R, H) can be interpreted in the same way.

3 Empirical results

3.1 Profits from GH (12, H) strategies

In this section, I examine the profitability of the GH strategies based on nearness to the 12-month high, that is, GH (12, H). I focus on the 12-month high initially because George and Hwang (2004) find that nearness to the 52-week high has impressive return predictive power in the stock markets. It's likely that investors in the commodity futures markets use the peak price during past one year as an anchor to assess the value of futures as well.

Panel A of Table 1 reports the results. GHW (GWL) is the average monthly return to the GH winner (loser) portfolio. The average monthly profit of a GH strategy is (GHW – GHL). Across the four GH (12, H) strategies with different holding periods (H = 1, 3, 6 or 12), profits are all significantly positive. GH (12, 1) generates the highest profit of 1.59% (t = 4.59) per month, and GH (12, 12) produces the lowest profit of 0.76% (t = 3.06) per month. These results suggest that the GH (12, H) strategy is significantly profitable in the commodity futures markets.

Shen et al. (2006) and Miffre and Rallis (2007) find that the JT strategies can generate significant profits in the commodity futures markets. Since both JT and GH strategies are based on the trend of past prices, it's interesting to compare the profitability of these two types of strategies. Hence, I calculate the profits of 16 JT (R, H) strategies where R = 1, 3 6 or 12 and H = 1, 3, 6 or 12. The results are reported in Panel B of Table 1. JTW (JTL) denotes the average monthly return of the JT winner (loser) portfolio. The average monthly profit of a JT strategy is (JTW – JTL). Of the 16 JT strategies, 13 are significantly profitable at the 10% level. The three exceptions are JT (6, 12), JT (12, 6) and JT (12, 12). These results are similar to those documented by Miffre and Rallis (2007).

The comparison between Panel A and Panel B suggests that for a given holding period H, the profit of GH (12, H) is always greater than the highest profit among the four JT (R, H) strategies. For example, when H = 1, the profit of the GH (12, 1) strategy is 1.59% (t = 4.59) per month, and the highest profit among the 4 JT (R, 1) strategies is 1.10% (t = 2.98) per month. When H = 3, 6 and 12, the monthly profit of GH (12, H) *vs.* the *highest* monthly profit of JT (R, H) is as follows: 1.32% *vs.* 0.85%, 0.99% *vs.* 0.56%, and 0.76% *vs.* 0.46%. These results suggest that, on average, GH (12, H) is more profitable than JT (J, H) by at least 0.42% per month.

Furthermore, the profitability of the GH (12, H) strategies comes from both long and short sides. The returns to the winner and loser GH portfolios are both statistically significant at the 10% level across all four GH (12, H) strategies, although the contribution of the short side is about twice that of the long side. On the other hand, the profitability of the JT (R, H) strategies largely comes from the short side. In 14 of the 16 JT strategies, the returns to the JT winner portfolios are *not* statistically significant at the 10% level.

In summary, Table 1 shows that, consistent with the evidence in the stock markets, GH (12, H) strategies are significantly profitable in the commodity futures market. A preliminary comparison between GH (12, H) and JT (R, H) suggests that the profits from the former strategies are consistently higher and more statistically significant. In the next section, I run a horse race test of JT and GH to formally compare these two types of strategies.

3.2 Dominance of GH (12, H) over JT (R, H)

GH (2004) find that the GH (12, H) strategies dominate the JT (R, H) strategies in the stock markets. I use their method to compare these two types of strategies in the commodity futures markets. This method is also adopted by Park (2010) and Fuertes, Miffer, and Fernanderz-perez (2014). Specifically, for each month, I run the following regression:

$$R_{it} = b0_{jt} + b1_{jt}\, GHW_{i,\, t-j} + b2_{jt}\, GHL_{i,\, t-j} + b3_{jt}\, JTW_{i,\, t-j} + b3_{jt}\, JTL_{i,\, t-j} + e_{it} \quad (j = 1, \dots, H) \quad (1)$$

R_{it} is the return of commodity future i at month t. $GHW_{i,\, t-j}$ is a dummy variable. It equals 1 if future i falls in the top quintile sorted by the nearness to the12-month high at the end of month $t-j$, and is zero otherwise. Similarly, $GHL_{i,\, t-j}$ equals 1 if future i is in the bottom quintile sorted by the nearness to the 12-month high at the end of month $t-j$, and is zero otherwise. The variables $JTW_{i,\, t-j}$ and $JTL_{i,\, t-j}$ are defined similarly based on future i's return in the past R (R =1, 3, 6 or 12) months.

$b1_{jt}$ can be interpreted as the month-t return to a GH winner portfolio formed at the end of month $t-j$, when the effect of JT is controlled. In other words, $b1_{jt}$ is the *pure* excess return to a GH winner portfolio. $b3_{jt}$ can be interpreted as the month-t return to a JT winner portfolio formed at the end of month $t-j$, when the effect of GH is controlled. $b2_{jt}$, and $b4_{jt}$ can be interpreted similarly for a GH and JT loser portfolio. As explained earlier, the month-t return to the winner portfolio in a strategy is calculated as the average of month-t returns of H portfolios formed from month $t-H$ to $t-1$ when the holding period is H. Thus, the pure excess return to the GH winner portfolio at month t ($b1_t$) can be calculated as $\frac{1}{H}(b1_1 + b1_2 + \cdots + b1_H)$. The same method can be used to calculate $b2_t$, $b3_t$, $b4_t$. The return to a zero-investment GH strategy, when the effect of JT is controlled, is $b1_t - b2_t$. Similarly, the return to a zero-investment JT strategy, when the effect of GH is controlled, is $b3_t - b4_t$. Table 2 reports the time series averages of these month-by-month estimates, along with their t-statistics.

For each holding period H (H = 1, 3, 6 or 12), I compare the GH (12, H) strategy with four JT (R, H) strategies (R =1, 3, 6, or 12). Thus, there are 16 pairwise comparisons. GH (12, H) dominates JT (R, H) in 15 comparisons. Specifically, the profits of GH (12, H) are positive and significant in all 16 cases, and their magnitudes have changed little from those in Table 1 where the effect of JT is not controlled. In contrast, when the effect of GH is controlled, only one JT strategy (i.e., JR (1, 12)) is significantly profitable, and it has a much smaller magnitude (0.21% as compared to 0.43% per month). In the other 15 cases, the profitability of the JT strategy loses its significance.

The results from the pairwise comparisons suggest that, consistent with the stock market evidence, nearness to the 12-month high price is more relevant than past price changes in predicting future returns in the commodity futures markets.

3.3 Profits from GH (R, H) where R = 1, 3 and 6

Sections 3.1 and 3.2 focus on GH (12, H) strategies in which the ranking variable is nearness to the 12-month high. This focus follows GH (2004), who examine the return predictability of nearness to the 52-week high in the stock markets. GH do not investigate the peak prices of other time frames. One reason for their interest in the 52-week high is its salience in media coverage of the stock markets: Almost every newspaper that publishes stock prices also identifies those that have hit 52-week highs. Salience is one important factor in generating the anchoring bias. This suggests that in the stock markets, the 52-week high is more likely to be used as an anchor than other peak prices.

However, unlike in the stock markets, in the commodity futures markets the 52-week high price is not singled out by newspapers or websites. In other words, the peak price of the past one year is *not* more salient than the peak price of other time horizons in the commodity futures markets. The implication is that investors in the commodity futures markets might also use other peak prices as anchors. On the other hand, it’s also possible that investors generally prefer the one-year time frame to other horizons when considering past price trends. In that case, the past one year’s peak price might still be a predominant anchor used by investors. Therefore, it’s an empirical question whether the peak prices of other horizons have additional return predictive powers beyond the 12-month high in the commodity futures markets. To answer this question, I examine the profitability of the GH strategies in which the ranking variable is calculated as the ratio of the current price to the peak prices during the past R months (R = 1, 3 or 6), that is, nearness to the R-month high.

I first examine the profitability of the GH (1, H), GH (3, H) and GH (6, H) strategies individually, using the same method as that used in Panel A of Table 1. The results are reported in Panel A of Table 3. The combination of 3 ranking periods and 4 holding periods generates 12 strategies. Eleven of the 12 strategies are significantly profitable, with the profits ranging from 0.54% (t = 3.13) to 1.34% (t = 3.84) per month. The only strategy that is not significantly profitable is GH (1, 1). These results suggest that similar to strategies based on the 12-month high, the GH strategies based on other highs are significantly profitable as well.

Next, I use regression (1) in section 3.2 to compare the GH (R, H) and JT (R, H) strategies of the same ranking period (R = 1, 3 or 6) and holdings period (H = 1, 3, 6 or 12). The results are reported in Panel B of Table 3. GH dominates JT in 10 of the 12 pairwise comparisons. The only two exceptions are JT (1, 1) and JT (1, 3). These results suggest that even over the same time horizon, the proximity of the current price to the past peak price is more important than the past price change in predicting future returns.

Does GH (R, H) (where R = 1, 3 or 6) generate additional profit beyond GH (12, H)? A preliminary comparison between the results in Panel A of Table 3 and those in Panel A of Table 1 suggests that GH (12, H) is more profitable than the other three GH (R, H) strategies when the holding periods are no more than 6 months. But the advantage of GH (12, H) seems to disappear when the holding period is extended to 12 months. A formal test of this conjecture is conducted in Panel C of Table 3. Using the method of regression (1) in section 3.2, I run a horse-race test between GH (12, H) and each of the other three GH strategies. I examine two holding periods: the first holding period is from the 1^{st} to the 6^{th} month after portfolio formation, denoted as GH (R, 1^{st} to 6^{th}); the second holding period is from the 7^{th} to the 12^{th} month after portfolio formation, denoted as GH (R, 7^{th} to 12^{th}). GH (12, 1^{st} to 6^{th}) indeed dominates the other three GH (R, 1^{st} to 6^{th}) strategies in the pairwise comparisons; interestingly, GH (12, 7^{th} to 12^{th}) *is dominated by* the other three GH (R, 7^{th} to 12^{th}) strategies. In unreported results, I find that GH (1, 7^{th} to 12^{th}), GH (3, 7^{th} to 12^{th}) and GH (6, 7^{th} to 12^{th}) all generate additional profit in the horse-race tests, and GH (3, 7^{th} to 12^{th}) is the most profitable.

As discussed earlier, the additional predictive power of other highs beyond the 12-month high in the commodity futures markets is consistent with the anchoring explanation. However, I am not aware of any extant theories (whether anchoring related or not) that can explain why the return predictive power of the 12-month high is dominant in the early holding period and weakens as the holding period continues. This result should be of interest to future theoretical research aimed at explaining the relevance of peak price to asset returns in the capital markets.

3.4 Long term reversal?

In this section, I examine whether the profitability of GH and JT strategies reverses in the long run in the commodity futures markets. To conduct this analysis, I use regression (1), in which the subscript *j* is greater than 12. For example, when the holding period of a GH strategy is from the 13^{th} to the 24^{th} month after portfolio formation, then *j* = 13, 14…24. This is denoted as GH (R, 13^{th} to 24^{th}). I examine three long-term holding periods: 13^{th} to 24^{th} month, 25^{th} to 36^{th} month and 37^{th} to 48^{th} month. The results are reported in Table 4.

Consistent with Shen et al. (2006) and Miffre and Rallis (2007), the results show that the profitability of the JT strategies reverses during the second year after portfolio formation. Beyond 24 months, the profits of the JT strategies are not significantly different from zero. In contrast, there is *no* evidence of long-term return reversal among the GH strategies. In all 12 cases, the signs of the GH profits are positive over the long-term horizon. The results even suggest that the GH strategies continue to be profitable into the fourth year after portfolio formation: The profits in 8 out of 12 cases are significant at the 10% level. These results, consistent with the stock market findings of GH (2004), suggest that the return predictability of nearness to recent peak price results from investors' underreaction to information rather than overreaction.

3.5 Nearness to recent trough price

In this section, I examine whether the strategy based on nearness to recent trough price is as profitable as that based on nearness to recent peak price. It's possible that investors also anchor on the recent lowest price when valuing commodity futures. Again, I use regression (1) to conduct this analysis, replacing the JTH and JTL dummies with dummies based on the nearness to recent trough price, which are denoted as $GH^{Low}H$ and $GH^{Low}L$. I term this the 'GH^{Low}' strategy.

Table 5 reports the results of the pairwise comparisons between GH and GH^{Low}. The combination of 4 Rs and 4 Hs generates 16 cases, among which all of the GH strategies are significantly profitable and none of the profits from the GH^{Low} strategies are significantly different from zero. These results are consistent with those of GH (2004), who find that nearness to the 52-week low is not useful in predicting future returns in the stock markets.

3.6 Positive vs. negative profit years

Panel A of Table 2 and Panel A of Table 3 show that the GH strategies are significantly profitable on average over the time period from 1981 to 2013. It is possible that this significant average profit is driven by some extremely large profits in just a few years. In order to address this concern, I calculate the yearly average profit of a GH strategy and compare the number of positive-profit years with the number of negative-profit years. A positive-profit year is one in which the average profit from a particular strategy is positive. A negative-profit year is defined in the same way. The results are reported in Panel A of Table 6.

Across the 16 GH strategies, the average number of positive-profit years is 23, and the average number of negative-profit years is 10. Hence, it's not likely that the profitability of the GH strategies is driven by a few outliers. Furthermore, under the null hypothesis that a GH strategy is not significantly profitable, the probability of observing a positive profit in a year is 0.5, and hence the expected number of positive-profit years is 16.5. Based on the *Binomial* distribution ($\chi \sim B$ (N=33, P=0.5)), the probability of observing 23 positive-profit years among 33 years is 0.01, which rejects the null hypothesis. This result further suggests that the GH strategies are significantly profitable.

Do the negative-profit years concentrate in a certain time period such as the most recent years? To investigate this question, I separate the entire sample period into three equal sub-periods (1981-1991, 1992-2002 and 2003-2013). I then calculate the number of negative-profit years in each sub-period. The results in Panel A of Table 5 show that the negative-profit years are spread almost equally across the three sub-periods. The average number of negative-profit years in each sub-period is as follows: 3 in 1981-1991, 4 in 1992-2002 and 3 in 2003-2013.

In comparison, across the 16 JT (R, H) strategies, the average number of negative-profit years is 11; 3 occur in 1981-1991, 4 occur in 1992-2002 and the other 4 appear in 2003-2013.

3.7 Sharpe ratio

In order to gauge the profitability of the GH and JT strategies after taking risk into consideration, I calculate the Sharpe ratio (or reward-to-risk ratio) of these strategies. Following Miffre and Rallis (2007), I calculate the Sharpe ratio as the self-financing portfolio's annualized mean divided by its annualized standard deviation. Table 7 reports the results.

Over the whole sample period from 1981 to 2013, the average Sharpe ratio across the 16 GH strategies is 0.63, which is greater than the average Sharpe ratio across the 16 JT strategies of 0.40. For the three equal sub-periods (1981-1991, 1992-2002 and 2003-2013), the average Sharpe ratio across the 16 GH strategies is 0.80, 0.29 and 0.46, respectively. Hence, although the GH strategies do not outperform in the second sub-period, which covers most of the 90's, their performance revived in the most recent years. In comparison, the average Sharpe ratios of the JT strategies during the three consecutive sub-periods are 0.48, 0.43 and 0.24, respectively.

3.8 Risk adjusted returns

In this section, I test whether the profits of the GH strategies are compensation for risk. Following Miffre and Rallis (2007), I use the following multifactor model to measure the abnormal return of a portfolio:

$$R_{Pt} = \alpha + \beta_B (R_{Bt} - R_{ft}) + \beta_M (R_{Mt} - R_{ft}) + \beta_C (R_{Ct} - R_{ft}) + \varepsilon_{Pt} \qquad (2)$$

R_{Pt} is the monthly return of the winner, loser or (winner – loser) portfolio calculated from regression (1). R_{Bt}, R_{Mt} and R_{Ct} are the returns on the Datastream government bond index, the S&P composite index and the Goldman Sachs Commodity Index (GSCI), respectively. R_{ft} is the risk-free rate, which is proxied by one-month US T-bills, and ε_{Pt} is an error term. The intercept α is the abnormal return of a portfolio.

To save space, I report only the abnormal returns of the portfolios from Table 2. They appear in Table 8. In 16 pairwise comparisons of GH and JT strategies, the alphas from the GH strategies continue to be statistically significant in all cases. On the other hand, only 1 out of 16 JT strategies (i.e., JT (1, 12)) has a marginally significant alpha (t = 1.89) when the effect of GH is controlled. Hence, the GH strategies continue to dominate the JT strategies after risk adjustment. Results in other tables based on abnormal returns are similar to those based on raw returns.

3.9 Agricultural futures

In this section, I examine the profitability of the GH and JT strategies using data on a single type of commodity futures. This is to address the concern that the results documented above might be due to heterogeneity across different types of commodity futures. I examine agricultural futures because this category comprises the largest number of futures.

There are 12 agricultural futures in my sample. Hence, instead of being sorted into quintiles, these futures are sorted into terciles, so that the winner/loser portfolio has more futures in it. I then repeat the analysis from Table 2 using these 12 agricultural futures. Table 9 reports the results. Again, the GH strategies dominate the JT strategies: the GH strategies continue to be significantly profitable in all 16 cases, with the monthly profits ranging from 1.61% to 0.43%. The profits of the JT strategies are significant in only two cases, JT (1, 12) and JT (3, 12), and their magnitudes are much smaller. The results suggest that the profitability of the GH strategies in the commodity futures markets is not driven by heterogeneity among different types of commodity futures.

4. Conclusion

This paper examines the profitability of the trading strategies based on the nearness of the current price to recent peak prices in the commodity futures markets. It builds on the research of GH (2004), who find that a zero-investment strategy that buys stocks with prices close to their 52-week highs and sells stocks with prices far from their 52-week highs is significantly profitable in the stock markets. I find that the GH strategies generate significant profits in the commodity futures markets as well. The average monthly returns of the GH strategies range from 0.76% to 1.59%. They are greater than the profits from the corresponding traditional JT momentum strategies by at least 0.42%. Furthermore, the GH strategies dominate the JT strategies in horse-race tests. In addition, unlike the JT strategies, the GH strategies remain profitable in the long term. Overall, these results suggest that GH strategies are more profitable and robust than the JT strategies in the commodity futures markets.

Two prominent features of the commodity futures markets are low transaction cost and easy short-selling. Consistent with the stock market evidence, my results show that about two-thirds of the profits from the GH strategies in the commodity futures markets are attributable to the short-selling side. In addition, there are far fewer commodity futures than stocks, which implies that there is far less trading involved in implementing the strategies in the commodity futures markets. Therefore, the GH strategies implemented in the commodity futures markets are likely to be more profitable *in practice* than those implemented in the stock markets.

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Table 1 Profitability of GH (12, H) and JT (R, H) strategies

At the end of each month, I sort all available futures into quintiles based on the ranking variable. In the GH (12, H) strategy, the ranking variable is nearness to the 12-month high, which is calculated as the ratio of the future's current price to its highest price during the past 12 months. In the JT (R, H) strategy, the ranking variable is the average return of a future over the previous R months. The winner portfolio includes futures in the highest quintile, and the loser portfolio includes futures in the lowest quintile. The winner and loser portfolios are held for the next H months (H = 1, 3, 6 or 12). Thus, the month-*t* return to the winner portfolio is calculated as the equally weighted average of the month-*t* returns from H separate winner portfolios, each formed in one of the H consecutive months (i.e., $t - H$ to $t - 1$). The month-*t* return to the loser portfolio is calculated in the same way. A GH or JT strategy is one that takes a long position in the winner portfolio and a short position in the loser portfolio. Thus, the month-*t* return of a trading strategy is the return differential between the winner and loser portfolios. Panel A reports the profitability of the GH strategies. GHW (GWL) is the average monthly return to the GH winner (loser) portfolio. The average monthly profit of a GH strategy is (GHW – GHL). Panel B reports the profitability of the JT strategies. JTW (JTL) is the average monthly return of the JT winner (loser) portfolio. The average monthly profit of a JT strategy is (JTW – JTL). The sample period is from January 1981 to December 2013. *T-statistics* are in parentheses.

Panel A Profitability of GH (12, H)

	GH (12, 1)		**GH (12, 3)**		**GH (12, 6)**		**GH (12, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.55	(2.46)	0.45	(2.74)	0.30	(2.17)	0.23	(1.93)
GHL	-1.04	(-3.57)	-0.87	(-3.28)	-0.69	(-2.81)	-0.53	(-2.48)
GHW − GHL	1.59	(4.59)	1.32	(4.24)	0.99	(3.42)	0.76	(3.06)

Table 1 Continued

Panel B Profitability of JT (R, H)								
	JT (1, 1)		**JT (1, 3)**		**JT (1, 6)**		**JT (1, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
JTW	0.22	(0.80)	0.27	(1.66)	0.14	(1.09)	-0.07	(-0.8)
JTL	-0.58	(-2.15)	-0.42	(-2.51)	-0.35	(-2.62)	-0.51	(-4.55)
JT W − JTL	0.80	(2.17)	0.69	(3.10)	0.49	(3.08)	0.42	(3.72)
	JT (3, 1)		**JT (3, 3)**		**JT (3, 6)**		**JT (3, 12)**	
JTW	0.70	(2.59)	0.44	(2.21)	0.25	(1.63)	0.06	(0.50)
JTL	-0.56	(-2.09)	-0.41	(-1.91)	-0.31	(-1.8)	-0.40	(-2.79)
JT W − JTL	1.26	(3.47)	0.85	(2.91)	0.56	(2.41)	0.46	(2.55)
	JT (6, 1)		**JT (6, 3)**		**JT (6, 6)**		**JT (6, 12)**	
JTW	-0.14	(-0.53)	-0.03	(-0.15)	-0.07	(-0.42)	-0.26	(-1.92)
JTL	-1.18	(-4.15)	-0.80	(-3.25)	-0.61	(-2.85)	-0.49	(-2.78)
JT W − JTL	1.04	(2.82)	0.77	(2.37)	0.54	(1.86)	0.23	(1.00)
	JT (12, 1)		**JT (12, 3)**		**JT (12, 6)**		**JT (12, 12)**	
JTW	0.39	(1.53)	0.05	(0.25)	-0.19	(-0.99)	-0.22	(-1.28)
JTL	-0.71	(-2.61)	-0.56	(-2.25)	-0.37	(-1.63)	-0.25	(-1.23)
JT W − JTL	1.10	(2.98)	0.61	(1.88)	0.18	(0.62)	0.03	(0.11)

Table 2 Dominance of GH (12, H) over JT (R, H)

Table 2 reports the results of the Fama-MacBeth (1973) regression: $R_{it} = b0_{jt} + b1_{jt}\, GHW_{i,\, t\text{-}j} + b2_{jt}\, GHL_{i,\, t\text{-}j} + b3_{jt}\, JTW_{i,\, t\text{-}j} + b4_{jt}\, JTL_{i,\, t\text{-}j} + e_{it}$ (j =1, … , H). R_{it} is the return of commodity future i at month t. $GHW_{i,\, t\text{-}j}$ is a dummy variable. It equals 1 if future i falls in the top quintile sorted by the nearness to the12-month high at the end of month $t - j$, and is zero otherwise. Similarly, $GHL_{i,\, t\text{-}j}$ equals 1 if future i is in the bottom quintile sorted by the nearness to the 12-month high at the end of month $t - j$, and is zero otherwise. The variables $JTW_{i,\, t\text{-}j}$ and $JTL_{i,\, t\text{-}j}$ are defined similarly based on future i's return in the past R (R =1, 3, 6 or 12) months. The coefficient estimate for a given independent variable in month t is averaged over j = 1,…, H where H is the holding period of the strategy. For example, $b1_t$ is calculated as $\frac{1}{H}(b1_1 + b1_2 + \cdots + b1_H)$. $b2_t$, $b3_t$ and $b4_t$, are calculated in the same way. This table reports the time series averages of these month-by-month coefficient estimates for each independent variable. *T*-statistics are in parentheses.

	GH (12, 1) *vs.* JT (1, 1)		**GH (12, 3) *vs.* JT (1, 3)**		**GH (12, 6) *vs.* JT (1, 6)**		**GH (12, 12) *vs.* JT (1, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.36	(1.62)	0.37	(2.23)	0.25	(1.77)	0.21	(1.72)
GHL	-1.04	(-3.34)	-0.92	(-3.39)	-0.72	(-2.86)	-0.47	(-2.2)
JTW	0.10	(0.37)	0.11	(0.66)	0.05	(0.36)	-0.09	(-0.97)
JTL	-0.30	(-1.09)	-0.11	(-0.67)	-0.08	(-0.69)	-0.30	(-3.60)
GH W − GHL	1.40	(3.92)	1.29	(3.99)	0.97	(3.24)	0.68	(2.70)
JTW − JTL	0.40	(1.08)	0.22	(0.96)	0.13	(0.84)	0.21	(2.10)
	GH (12, 1) *vs.* JT (3, 1)		**GH (12, 3) *vs.* JT (3, 3)**		**GH (12, 6) *vs.* JT (3, 6)**		**GH (12, 12) *vs.* JT (3, 12)**	
GHW	0.31	(1.37)	0.40	(2.39)	0.31	(2.15)	0.24	(1.92)
GHL	-1.09	(-3.48)	-0.79	(-2.93)	-0.69	(-2.78)	-0.47	(-2.26)
JTW	0.61	(2.17)	0.19	(0.95)	0.06	(0.4)	-0.06	(-0.51)
JTL	0.05	(0.18)	-0.01	(-0.04)	0.03	(0.21)	-0.14	(-1.39)
GH W − GHL	1.40	(3.91)	1.19	(3.77)	1.00	(3.38)	0.71	(2.88)
JTW − JTL	0.56	(1.46)	0.20	(0.67)	0.03	(0.13)	0.08	(0.55)

Table 2 Continued

	GH (12, 1) *vs.* JT (6, 1)		**GH (12, 3) *vs.* JT (6, 3)**		**GH (12, 6) *vs.* JT (6, 6)**		**GH (12, 12) *vs.* JT (6, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.62	(2.53)	0.54	(3.16)	0.40	(2.86)	0.33	(2.76)
GHL	-0.80	(-2.56)	-0.82	(-3.19)	-0.68	(-2.81)	-0.53	(-2.6)
JTW	-0.42	(-1.44)	-0.35	(-1.6)	-0.26	(-1.48)	-0.38	(-2.8)
JTL	-0.52	(-1.81)	-0.17	(-0.81)	-0.10	(-0.6)	-0.09	(-0.77)
GH W − GHL	1.42	(3.73)	1.36	(4.38)	1.08	(3.77)	0.86	(3.66)
JTW − JTL	0.10	(0.27)	-0.18	(-0.56)	-0.16	(-0.63)	-0.29	(-1.51)
	GH (12, 1) *vs.* JT (12, 1)		**GH (12, 3) *vs.* JT (12, 3)**		**GH (12, 6) *vs.* JT (21, 6)**		**GH (12, 12) *vs.* JT (12, 12)**	
GHW	0.49	(2.01)	0.54	(3.17)	0.42	(3.04)	0.36	(3.07)
GHL	-1.10	(-3.34)	-1.03	(-3.66)	-0.91	(-3.7)	-0.71	(-3.37)
JTW	0.17	(0.61)	-0.18	(-0.84)	-0.32	(-1.72)	-0.33	(-1.99)
JTL	0.15	(0.57)	0.22	(1.07)	0.27	(1.65)	0.29	(2.15)
GH W − GHL	1.59	(4.02)	1.57	(4.77)	1.33	(4.59)	1.07	(4.37)
JTW − JTL	0.02	(0.05)	-0.40	(-1.34)	-0.59	(-2.26)	-0.62	(-2.76)

Table 3 GH strategies based on nearness to the 1-, 3- or 6-month high

Panel A reports the profitability of the GH strategies where the ranking variable is nearness to the 1-, 3- or 6-month high. The method is the same as that used in Panel A of Table 1. Panel B reports the results of comparing the GH (R, H) and JT (R, H) strategies of the same ranking period (R = 1, 3 or 6) and holdings period (H = 1, 3, 6 or 12). This method is the same as that used in Table 2. Panel C reports the results of comparing the GH strategy based on nearness to the 12-month high with the GH strategies based on nearness to the other three highs for two holding periods: the first holding period is from the 1st to the 6th month after portfolio formation, denoted as GH (R, 1st to 6th); the second holding period is from the 7th to the 12th month after portfolio formation, denoted as GH (R, 7th to 12th). The method is also the same as that used in Table 2 with *j* =1, … , 6 for the first holding period and *j* =7, … , 12 for the second holding period. *T*-statistics are in parentheses.

Panel A Profitability of GH (R, H) strategies (R = 1, 3 or 6)								
	GH (1, 1)		**GH (1, 3)**		**GH (1, 6)**		**GH (1, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.05	(0.21)	0.25	(1.99)	0.22	(2.16)	0.25	(3.40)
GHL	-0.37	(-1.3)	-0.43	(-2.34)	-0.32	(-2.16)	-0.39	(-3.11)
GHW − GHL	0.42	(1.2)	0.68	(3.15)	0.54	(3.13)	0.64	(4.40)
	GH (3, 1)		**GH (3, 3)**		**GH (3, 6)**		**GH (3, 12)**	
GHW	0.39	(1.62)	0.36	(2.46)	0.33	(2.92)	0.29	(3.52)
GHL	-0.76	(-2.83)	-0.77	(-3.68)	-0.54	(-2.87)	-0.56	(-3.6)
GH W − GHL	1.15	(3.17)	1.13	(4.27)	0.87	(3.82)	0.85	(4.60)
	GH (6, 1)		**GH (6, 3)**		**GH (6, 6)**		**GH (6, 12)**	
GHW	0.33	(1.49)	0.43	(2.75)	0.40	(3.26)	0.29	(2.97)
GHL	-1.01	(-3.63)	-0.62	(-2.57)	-0.54	(-2.46)	-0.58	(-3.24)
GHW − GHL	1.34	(3.84)	1.05	(3.72)	0.94	(3.67)	0.87	(4.04)

Table 3 Continued

Panel B Dominance of GH (R, H) over JT (R, H) (R =1 ,3 or 6)

	GH (1, 1) *vs.* JT (1, 1)		**GH (1, 3) *vs.* JT (1, 3)**		**GH (1, 6) *vs.* JT (1, 6)**		**GH (1, 12) *vs.* JT (1, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	-0.04	(-0.16)	0.22	(1.58)	0.21	(1.89)	0.28	(3.38)
GHL	-0.18	(-0.56)	-0.34	(-1.65)	-0.31	(-1.92)	-0.35	(-2.67)
JTW	0.23	(0.80)	0.14	(0.77)	0.02	(0.13)	-0.20	(-1.98)
JTL	-0.47	(-1.69)	-0.17	(-1.02)	-0.09	(-0.77)	-0.20	(-2.4)
GHW − GHL	0.14	(0.36)	0.56	(2.17)	0.52	(2.6)	0.63	(3.76)
JTW − JTL	0.70	(1.76)	0.31	(1.24)	0.11	(0.61)	0.00	(-0.01)
	GH (3, 1) *vs.* JT (3, 1)		**GH (3, 3) *vs.* JT (3, 3)**		**GH (3, 6) *vs.* JT (3, 6)**		**GH (3, 12) *vs.* JT (3, 12)**	
GHW	0.14	(0.56)	0.23	(1.49)	0.23	(1.89)	0.24	(2.65)
GHL	-0.56	(-1.79)	-0.77	(-3.88)	-0.53	(-2.97)	-0.55	(-3.72)
JTW	0.64	(2.42)	0.30	(1.52)	0.16	(1.03)	0.02	(0.19)
JTL	-0.20	(-0.66)	0.03	(0.14)	0.02	(0.16)	-0.02	(-0.16)
GHW − GHL	0.70	(1.69)	1.00	(3.88)	0.76	(3.37)	0.79	(4.28)
JTW − JTL	0.84	(2.16)	0.27	(0.99)	0.14	(0.65)	0.04	(0.23)
	GH (6, 1) *vs.* JT (6, 1)		**GH (6, 3) *vs.* JT (6, 3)**		**GH (6, 6) *vs.* JT (6, 6)**		**GH (6, 12) *vs.* JT (6, 12)**	
GHW	0.40	(1.7)	0.45	(2.86)	0.49	(4.23)	0.41	(4.56)
GHL	-0.83	(-2.73)	-0.49	(-2)	-0.50	(-2.39)	-0.64	(-3.77)
JTW	-0.32	(-1.13)	-0.21	(-1.01)	-0.23	(-1.3)	-0.38	(-2.79)
JTL	-0.43	(-1.59)	-0.31	(-1.55)	-0.13	(-0.92)	0.03	(0.24)
GHW − GHL	1.23	(3.21)	0.94	(3.27)	0.99	(4.05)	1.05	(5.26)
JTW − JTL	0.11	(0.30)	0.10	(0.33)	-0.10	(-0.38)	-0.41	(-2.13)

Table 3 Continued

Panel C Comparison of GH (12, H) and GH (R, H) (R=1, 3 or 6)						
	GH (12, 1 to 6) ***vs.*** **GH (1, 1 to 6)**		**GH (12, 1 to 6)** ***vs.*** **GH (3, 1 to 6)**		**GH (12, 1 to 6)** ***vs.*** **GH (6, 1 to 6)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.24	(1.65)	0.29	(1.83)	0.24	(1.61)
GHL	-0.67	(-2.72)	-0.57	(-2.31)	-0.60	(-2.43)
JTW	0.06	(0.58)	0.07	(0.58)	0.14	(1.42)
JTL	-0.18	(-1.35)	-0.28	(-1.72)	-0.15	(-0.83)
GHW − GHL	0.91	(3.10)	0.86	(2.88)	0.84	(2.85)
JTW − JTL	0.24	(1.55)	0.35	(1.79)	0.29	(1.44)
	GH (12, 7 to 12) ***vs.*** **GH (1, 7 to 12)**		**GH (12, 7 to 12)** ***vs.*** **GH (3, 7 to 12)**		**GH (12, 7 to 12)** ***vs.*** **GH (6, 7 to 12)**	
GHW	0.06	(0.39)	0.09	(0.55)	-0.02	(-0.15)
GHL	-0.27	(-1.17)	-0.09	(-0.39)	-0.07	(-0.3)
JTW	0.33	(3.31)	0.22	(1.92)	0.22	(2.37)
JTL	-0.30	(-2.33)	-0.51	(-3.5)	-0.53	(-3.27)
GHW − GHL	0.33	(1.21)	0.18	(0.65)	0.05	(0.16)
JTW − JTL	0.63	(4.16)	0.73	(4.12)	0.75	(4.03)

Table 4 Long term reversal

This table uses the regression in Table 2 to examine the profitability of the GH and JT strategies in the long term. The subscript *j* in the regression is greater than 12. For example, when the holding period of a GH strategy is from the 13th to the 24th month after portfolio formation, then *j* = 13 ,…, 24. This is denoted as GH (R, 13th to 24th). This table examines three long-term holding periods: 13th to 24th month, 25th to 36th month and 37th to 48th month. *T*-statistics are in parentheses.

	GH (1, 13 to 24) *vs.* JT (1, 13 to 24)		**GH (1, 25 to 36) *vs.* JT (1, 25 to 36)**		**GH (1, 36 to 48) *vs.* JT (1, 37 to 48)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.02	(0.25)	-0.09	(-1.1)	0.08	(0.92)
GHL	-0.32	(-2.47)	-0.29	(-2.27)	-0.31	(-2.38)
JTW	-0.43	(-4.36)	-0.05	(-0.47)	-0.28	(-2.44)
JTL	0.01	(0.08)	0.04	(0.57)	-0.13	(-1.63)
GHW − GHL	0.34	(2.21)	0.20	(1.36)	0.39	(2.36)
JTW − JTL	-0.44	(-3.6)	-0.09	(-0.81)	-0.15	(-1.13)
	GH (3, 13 to 24) *vs.* JT (3, 13 to 24)		**GH (3, 25 to 36) *vs.* JT (3, 25 to 36)**		**GH (3, 37 to 48) *vs.* JT (3, 37 to 48)**	
GHW	0.07	(0.78)	-0.06	(-0.63)	0.10	(1.17)
GHL	-0.32	(-2.26)	-0.33	(-2.37)	-0.51	(-3.48)
JTW	-0.40	(-3.17)	-0.25	(-2.08)	-0.16	(-1.19)
JTL	0.03	(0.23)	-0.10	(-0.8)	0.10	(0.74)
GHW − GHL	0.39	(2.34)	0.27	(1.67)	0.61	(3.6)
JTW − JTL	-0.43	(-2.51)	-0.15	(-0.9)	-0.26	(-1.37)

Table 4 Continued

	GH (6, 13 to 24) *vs.* JT (6, 13 to 24)		**GH (6, 25 to 36) *vs.* JT (6, 25 to 36)**		**GH (6, 37 to 48) *vs.* JT (6, 37 to 48)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.01	(0.15)	-0.01	(-0.17)	0.17	(1.77)
GHL	-0.25	(-1.59)	-0.22	(-1.41)	-0.12	(-0.81)
JTW	-0.45	(-3.14)	-0.28	(-1.95)	-0.25	(-1.53)
JTL	0.00	(-0.02)	-0.18	(-1.31)	-0.17	(-1.26)
GHW − GHL	0.26	(1.47)	0.21	(1.17)	0.29	(1.66)
JTW − JTL	-0.45	(-2.3)	-0.10	(-0.49)	-0.08	(-0.33)
	GH (12, 13 to 24) *vs.* JT (12, 13 to 24)		**GH (12, 25 to 36) *vs.* JT (12, 25 to 36)**		**GH (12, 37 to 48) *vs.* JT (12, 37 to 48)**	
GHW	0.00	(0.02)	0.02	(0.17)	0.36	(3.02)
GHL	-0.34	(-1.56)	-0.46	(-2.3)	-0.04	(-0.22)
JTW	-0.57	(-3.4)	-0.22	(-1.28)	-0.45	(-2.35)
JTL	0.16	(1.29)	-0.10	(-0.67)	-0.14	(-0.99)
GHW − GHL	0.34	(1.41)	0.48	(2.00)	0.40	(1.90)
JTW − JTL	-0.73	(-3.46)	-0.12	(-0.53)	-0.31	(-1.28)

Table 5 GH strategies based on nearness to recent trough prices

This table uses the regression in Table 2 to compare the strategy based on nearness to recent trough price, denoted as GH^{Low} strategy, with the strategy based on nearness to recent peak price. JTH and JTL dummies in the regression of Table 2 are replaced with dummies based on the nearness to recent trough price, which are denoted as $GH^{Low}H$ and $GH^{Low}L$.

	GH (1, 1) *vs.* GH^{Low} (1, 1)		**GH (1, 3) *vs.* GH^{Low} (1, 3)**		**GH (1, 6) *vs.* GH^{Low} (1, 6)**		**GH (1, 12) *vs.* GH^{Low} (1, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.20	(0.85)	0.30	(2.11)	0.25	(2.13)	0.28	(3.17)
GHL	-0.31	(-1.01)	-0.46	(-2.26)	-0.33	(-2.08)	-0.39	(-2.91)
$GH^{Low}W$	0.01	(0.02)	0.09	(0.48)	-0.06	(-0.36)	-0.19	(-1.45)
$GH^{Low}L$	-0.05	(-0.17)	0.04	(0.24)	0.02	(0.18)	0.01	(0.15)
GH W − GHL	0.51	(1.29)	0.76	(2.97)	0.58	(2.77)	0.68	(3.77)
$GH^{Low}W - GH^{Low}L$	0.06	(0.13)	0.05	(0.22)	-0.08	(-0.37)	-0.20	(-1.16)
	GH (3, 1) *vs.* GH^{Low} (3, 1)		**GH (3, 3) *vs.* GH^{Low} (3, 3)**		**GH (3, 6) *vs.* GH^{Low} (3, 6)**		**GH (3, 12) *vs.* GH^{Low} (3, 12)**	
GHW	0.27	(1.00)	0.25	(1.59)	0.28	(2.18)	0.28	(2.84)
GHL	-0.78	(-2.66)	-0.82	(-3.72)	-0.57	(-2.93)	-0.59	(-3.54)
$GH^{Low}W$	0.29	(0.97)	0.27	(1.24)	0.06	(0.34)	-0.05	(-0.36)
$GH^{Low}L$	-0.24	(-0.86)	-0.03	(-0.17)	-0.07	(-0.56)	-0.04	(-0.43)
GHW − GHL	1.05	(2.66)	1.07	(3.82)	0.85	(3.4)	0.87	(4.03)
$GH^{Low}W - GH^{Low}L$	0.53	(1.37)	0.30	(1.09)	0.13	(0.57)	-0.01	(-0.04)

Table 5 Continued

	GH (6, 1) *vs.* GH^{Low} (6, 1)		**GH (6, 3) *vs.* GH^{Low} (6, 3)**		**GH (6, 6) *vs.* GH^{Low} (6, 6)**		**GH (6, 12) *vs.* GH^{Low} (6, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.22	(0.92)	0.38	(2.37)	0.39	(2.94)	0.32	(3.08)
GHL	-0.78	(-2.66)	-0.55	(-2.2)	-0.54	(-2.43)	-0.60	(-3.25)
$GH^{Low}W$	0.12	(0.44)	0.02	(0.11)	-0.04	(-0.19)	-0.23	(-1.4)
$GH^{Low}L$	-0.36	(-1.46)	-0.26	(-1.57)	-0.13	(-1.05)	-0.09	(-0.78)
GHW − GHL	1.00	(2.72)	0.93	(3.18)	0.93	(3.44)	0.93	(3.99)
$GH^{Low}W - GH^{Low}L$	0.48	(1.34)	0.28	(1)	0.09	(0.38)	-0.14	(-0.68)
	GH (12, 1) *vs.* GH^{Low} (12, 1)		**GH (12, 3) *vs.* GH^{Low} (12, 3)**		**GH (12, 6) *vs.* GH^{Low} (12, 6)**		**GH (12, 12) *vs.* GH^{Low} (12, 12)**	
GHW	0.40	(1.67)	0.43	(2.53)	0.34	(2.3)	0.29	(2.25)
GHL	-1.04	(-3.43)	-0.83	(-3.07)	-0.67	(-2.73)	-0.52	(-2.46)
$GH^{Low}W$	0.15	(0.54)	-0.09	(-0.39)	-0.09	(-0.45)	-0.27	(-1.68)
$GH^{Low}L$	-0.13	(-0.53)	-0.26	(-1.61)	-0.18	(-1.43)	-0.13	(-1.23)
GHW − GHL	1.44	(3.94)	1.25	(3.96)	1.00	(3.41)	0.80	(3.19)
$GH^{Low}W - GH^{Low}L$	0.28	(0.77)	0.17	(0.61)	0.09	(0.38)	-0.14	(-0.68)

Table 6 Positive *vs.* negative profit years

This table compares the number of positive-profit years and the number of negative-profit years for both GH and JT strategies over the sample period from 1981 to 2013. A positive-profit year is one in which the average profit from a particular strategy is positive. A negative-profit year is defined in the same way. Under “1981-1991”, “1992-2002” and “2003-2013” reports the number of negative-profit years occurring during each of these three sub-periods.

	Positive profit	Negative profit	1981-1991	1992-2002	2003-2013		Positive profit	Negative profit	1981-1991	1992-2002	2003-2013
GH(1, 1)	17	16	2	8	6	JT (1, 1)	23	10	3	3	4
GH(1, 3)	22	11	4	5	2	JT (1, 3)	26	7	3	3	1
GH (1, 6)	22	11	4	5	2	JT (1, 6)	26	7	1	3	3
GH (1, 12)	25	8	2	3	3	JT (1, 12)	23	10	2	2	6
GH(3, 1)	23	10	1	5	4	JT (3, 1)	26	7	1	3	3
GH (3, 3)	24	9	3	3	3	JT (3, 3)	22	11	4	3	4
GH (3, 6)	23	10	2	6	2	JT (3, 6)	20	13	3	5	5
GH (3, 12)	25	8	3	3	2	JT (3, 12)	25	8	3	2	3
GH (6, 1)	25	8	1	3	4	JT (6, 1)	24	9	3	3	3
GH (6, 3)	25	8	2	3	3	JT (6, 3)	24	9	2	4	3
GH (6, 6)	22	11	2	4	5	JT (6, 6)	19	14	3	5	6
GH (6, 12)	24	9	3	3	3	JT (6, 12)	19	14	4	4	6
GH (12, 1)	25	8	0	4	4	JT (12, 1)	22	11	2	3	6
GH (12, 3)	23	10	3	3	4	JT (12, 3)	19	14	4	4	6
GH (12, 6)	23	10	4	4	2	JT (12, 6)	21	12	3	3	3
GH (12, 12)	20	13	4	6	3	JT(12, 12)	19	14	4	5	5
Average	23	10	3	4	3	Average	22	11	3	4	4

Table 7 Sharpe ratios

The table reports the Sharpe ratios of the GH and JT strategies for the entire sample period from 1981 to 2013 and for each of the three sub-periods: 1981-1991, 1992-2002 and 2003-2013. Sharpe ratio is calculated as the self-financing portfolio's annualized mean divided by its annualized standard deviation.

	1981-2013	1981-1991	1992-2002	2003-2013		1981-2013	1981-1991	1992-2002	2003-2013
GH(1, 1)	0.21	0.58	0.08	-0.07	JT (1, 1)	0.38	0.82	0.21	0.03
GH(1, 3)	0.55	0.68	0.56	0.38	JT (1, 3)	0.54	0.54	0.68	0.40
GH (1, 6)	0.54	0.73	0.22	0.68	JT (1, 6)	0.54	0.77	0.36	0.43
GH (1, 12)	0.77	0.90	0.41	1.05	JT (1, 12)	0.65	0.76	0.79	0.34
GH(3, 1)	0.55	0.58	0.11	0.09	JT (3, 1)	0.60	0.48	0.40	0.25
GH (3, 3)	0.74	0.88	0.20	0.58	JT (3, 3)	0.51	0.56	0.50	0.46
GH (3, 6)	0.66	0.97	-0.03	0.60	JT (3, 6)	0.42	0.58	0.44	0.20
GH (3, 12)	0.80	0.96	0.52	0.96	JT (3, 12)	0.44	0.39	0.68	0.28
GH (6, 1)	0.67	0.71	0.26	0.24	JT (6, 1)	0.49	0.60	0.32	0.53
GH (6, 3)	0.65	0.91	0.23	0.43	JT (6, 3)	0.41	0.53	0.31	0.38
GH (6, 6)	0.64	0.96	0.12	0.40	JT (6, 6)	0.32	0.48	0.42	0.03
GH (6, 12)	0.70	0.88	0.47	0.63	JT (6, 12)	0.17	0.17	0.31	0.05
GH (12, 1)	0.80	1.00	0.46	0.21	JT (12, 1)	0.52	0.57	0.81	0.18
GH (12, 3)	0.74	0.83	0.49	0.35	JT (12, 3)	0.33	0.35	0.52	0.09
GH (12, 6)	0.60	0.71	0.33	0.36	JT (12, 6)	0.11	0.14	0.20	-0.04
GH (12, 12)	0.53	0.57	0.13	0.52	JT(12, 12)	0.02	0.00	-0.07	0.15
Average	0.63	0.80	0.29	0.46	Average	0.40	0.48	0.43	0.24

Table 8 Risk adjusted return

This table reports the abnormal returns of the portfolios from Table 2. Abnormal return of a portfolio is calculated using the multifactor model: $R_{Pt} = \alpha + \beta_B (R_{Bt} - R_{ft}) + \beta_M (R_{Mt} - R_{ft}) + \beta_C (R_{Ct} - R_{ft}) + \varepsilon_{Pt}$. R_{Pt} is the monthly return of the winner, loser or (winner – loser) portfolio in Table 2. R_{Bt}, R_{Mt} and R_{Ct} are the returns on the Datastream government bond index, the S&P composite index and the Goldman Sachs Commodity Index (GSCI), respectively. R_{ft} is the risk-free rate, which is proxied by one-month US T-bills, and ε_{Pt} is an error term. The intercept α is the abnormal return of a portfolio.

	GH (12, 1) *vs.* JT (1, 1)		**GH (12, 3) *vs.* JT (1, 3)**		**GH (12, 6) *vs.* JT (1, 6)**		**GH (12, 12) *vs.* JT (1, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.37	(1.66)	0.33	(1.92)	0.25	(1.74)	0.21	(1.66)
GHL	-1.03	(-3.23)	-0.92	(-3.31)	-0.69	(-2.66)	-0.43	(-1.97)
JTW	0.16	(0.56)	0.11	(0.61)	0.03	(0.2)	-0.11	(-1.14)
JTL	-0.29	(-1.03)	-0.12	(-0.72)	-0.08	(-0.64)	-0.31	(-3.53)
GH W − GHL	1.40	(3.87)	1.25	(3.78)	0.94	(3.06)	0.64	(2.46)
JTW − JTL	0.45	(1.17)	0.23	(0.96)	0.11	(0.66)	0.20	(1.89)
	GH (12, 1) *vs.* JT (3, 1)		**GH (12, 3) *vs.* JT (3, 3)**		**GH (12, 6) *vs.* JT (3, 6)**		**GH (12, 12) *vs.* JT (3, 12)**	
GHW	0.29	(1.23)	0.36	(2.15)	0.31	(2.1)	0.22	(1.75)
GHL	-1.13	(-3.53)	-0.83	(-2.98)	-0.70	(-2.76)	-0.47	(-2.2)
JTW	0.60	(2.06)	0.11	(0.53)	0.01	(0.04)	-0.06	(-0.49)
JTL	0.07	(0.25)	0.03	(0.15)	0.09	(0.58)	-0.09	(-0.85)
GH W − GHL	1.42	(3.89)	1.19	(3.7)	1.01	(3.35)	0.69	(2.74)
JTW − JTL	0.53	(1.33)	0.08	(0.26)	-0.08	(-0.38)	0.03	(0.20)

Table 8 Continued

	GH (12, 1) *vs.* JT (6, 1)		GH (12, 3) *vs.* JT (6, 3)		GH (12, 6) *vs.* JT (6, 6)		GH (12, 12) *vs.* JT (6, 12)	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.60	(2.38)	0.51	(2.96)	0.39	(2.82)	0.33	(2.76)
GHL	-0.80	(-2.49)	-0.83	(-3.14)	-0.66	(-2.7)	-0.51	(-2.41)
JTW	-0.47	(-1.58)	-0.43	(-1.98)	-0.31	(-1.77)	-0.41	(-3.07)
JTL	-0.55	(-1.85)	-0.17	(-0.78)	-0.08	(-0.44)	-0.08	(-0.67)
GH W − GHL	1.40	(3.58)	1.34	(4.26)	1.05	(3.66)	0.84	(3.48)
JTW − JTL	0.08	(0.20)	-0.26	(-0.83)	-0.23	(-0.91)	-0.33	(-1.75)
	GH (12, 1) *vs.* JT (12, 1)		**GH (12, 3) *vs.* JT (12, 3)**		**GH (12, 6) *vs.* JT (21, 6)**		**GH (12, 12) *vs.* JT (12, 12)**	
GHW	0.50	(2.04)	0.49	(2.87)	0.41	(2.88)	0.35	(2.95)
GHL	-1.18	(-3.48)	-1.08	(-3.72)	-0.88	(-3.48)	-0.66	(-3.06)
JTW	0.12	(0.45)	-0.20	(-0.9)	-0.33	(-1.74)	-0.35	(-2.07)
JTL	0.25	(0.92)	0.30	(1.41)	0.27	(1.61)	0.27	(1.98)
GH W − GHL	1.68	(4.17)	1.57	(4.68)	1.29	(4.36)	1.01	(4.05)
JTW − JTL	-0.13	(-0.32)	-0.50	(-1.63)	-0.60	(-2.27)	-0.62	(-2.74)

Table 9 Agricultural Futures

This table repeats the analysis from Table 2 using these 12 agricultural futures except that these futures are sorted into terciles, instead of quintiles, to form portfolios.

	GH (12, 1) *vs*. JT (1, 1)		**GH (12, 3) *vs*. JT (1, 3)**		**GH (12, 6) *vs*. JT (1, 6)**		**GH (12, 12) *vs*. JT (1, 12)**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.55	(1.63)	0.52	(2.31)	0.60	(3.17)	0.25	(1.65)
GHL	-1.06	(-3.12)	-0.77	(-2.87)	-0.61	(-2.47)	-0.35	(-1.65)
JTW	-0.05	(-0.19)	0.00	(-0.03)	-0.14	(-1.07)	-0.17	(-1.64)
JTL	-0.24	(-0.72)	-0.16	(-0.82)	-0.18	(-1.29)	-0.39	(-3.52)
GH W − GHL	1.61	(4.53)	1.29	(4.32)	1.21	(4.23)	0.60	(2.43)
JTW − JTL	0.19	(0.52)	0.16	(0.82)	0.04	(0.33)	0.22	(2.52)
	GH (12, 1) *vs*. JT (3, 1)		**GH (12, 3) *vs*. JT (3, 3)**		**GH (12, 6) *vs*. JT (3, 6)**		**GH (12, 12) *vs*. JT (3, 12)**	
GHW	0.39	(1.27)	0.35	(1.57)	0.34	(1.86)	0.13	(0.86)
GHL	-0.78	(-2.42)	-0.71	(-2.71)	-0.59	(-2.48)	-0.30	(-1.42)
JTW	0.20	(0.72)	0.09	(0.5)	-0.06	(-0.4)	-0.05	(-0.42)
JTL	-0.46	(-1.55)	-0.15	(-0.78)	-0.30	(-2.09)	-0.36	(-3.33)
GH W − GHL	1.17	(3.09)	1.06	(3.45)	0.93	(3.21)	0.43	(1.71)
JTW − JTL	0.66	(1.98)	0.24	(1.03)	0.24	(1.32)	0.31	(2.4)

Table 9 Continued

	GH (12, 1) *vs.* JT (1, 1)		GH (12, 3) *vs.* JT (1, 3)		GH (12, 6) *vs.* JT (1, 6)		GH (12, 12) *vs.* JT (1, 12)	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
GHW	0.42	(1.37)	0.43	(1.93)	0.40	(2.28)	0.23	(1.61)
GHL	-0.86	(-2.61)	-0.71	(-2.79)	-0.57	(-2.42)	-0.31	(-1.46)
JTW	-0.12	(-0.44)	-0.29	(-1.47)	-0.09	(-0.57)	-0.24	(-1.78)
JTL	-0.23	(-0.81)	-0.17	(-0.82)	-0.09	(-0.57)	-0.18	(-1.64)
GH W − GHL	1.28	(3.38)	1.14	(3.78)	0.97	(3.56)	0.53	(2.2)
JTW − JTL	0.11	(0.31)	-0.12	(-0.44)	-0.01	(-0.03)	-0.05	(-0.34)
	GH (12, 1) *vs.* JT (3, 1)		**GH (12, 3) *vs.* JT (3, 3)**		**GH (12, 6) *vs.* JT (3, 6)**		**GH (12, 12) *vs.* JT (3, 12)**	
GHW	0.45	(1.48)	0.35	(1.52)	0.49	(2.7)	0.32	(2.32)
GHL	-1.03	(-3.36)	-0.77	(-2.97)	-0.74	(-3.1)	-0.45	(-2.11)
JTW	0.06	(0.23)	-0.01	(-0.05)	-0.20	(-1.07)	-0.21	(-1.34)
JTL	0.25	(0.93)	-0.01	(-0.07)	0.20	(1.32)	0.23	(1.9)
GH W − GHL	1.47	(3.98)	1.12	(3.53)	1.23	(4.32)	0.77	(3.15)
JTW − JTL	-0.19	(-0.56)	0.00	(0.01)	-0.40	(-1.66)	-0.44	(-2.21)