Journal of Banking & Finance 70 (2016) 214–234

Contents lists available at ScienceDirect

Journal of Banking & Finance

journal homepage: www.elsevier.com/locate/jbf

Are there exploitable trends in commodity futures prices?

Yufeng Han [a,*], Ting Hu [b], Jian Yang [c,d]

[a] Belk College of Business, University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC 28223-0001, United States
[b] School of Economics and Management, Wuhan University, Wuhan 430072, PR China
[c] The Business School, University of Colorado Denver, Denver, CO 80217, United States
[d] School of Finance, Nankai University, Tianjin 300071, PR China

ARTICLE INFO

Article history:
Received 30 April 2015
Accepted 21 April 2016
Available online 24 June 2016

JEL classification:
G11
G14

Keywords:
Commodity futures
Moving average
Timing
Predictability

ABSTRACT

We provide evidence that a simple moving average timing strategy, when applied to portfolios of commodity futures, can generate superior performance to the buy-and-hold strategy. The outperformance is very robust. It can survive the transaction costs in the futures markets, it is not concentrated in a particular subperiod, and is robust to short-sale constraints, alternative specifications of the moving average lag length, alternative construction of the continuous time-series of futures prices, and impact from data mining. The outperformance of the timing strategy is not driven by the backwardation and contango. It is stronger during recession and can not be explained by macroeconomic variables. Finally, we confirm that the outperformance of the moving average timing strategy in the commodity futures comes from the successful market timing.

1. Introduction

This paper examines the profitability of technical analysis in the commodity futures markets from a new perspective. Technical analysis has been widely used by investors in all sorts of financial markets. Many top traders and investors use it partially or exclusively (see, e.g., Schwager (1993), Covel (2005), Chincarini and Kim (2006), Lo and Hasanhodzic (2009)). In futures markets, particularly commodity futures markets, technical analysis has been widely used for many decades. Surveys show that a majority of traders in commodity futures markets use exclusively or moderately technical analysis to identify trends.

In a sharp contrast to the views of many practitioners, however, academics tend to be skeptical about technical analysis. The skepticism is probably rooted in the wide acceptance of the efficient market hypothesis (Fama, 1970) in academics, and negative empirical findings in several early and widely cited studies of technical analysis in the stock market, such as Fama and Blume (1966), van Horne and Parker (1967, 1968), James (1968), Jensen and Benington (1970), and Levy (1971). Recent studies, such as Brock et al. (1992), Lo et al. (2000), Goh et al. (2013), Neely et al. (2014), however, find strong evidence of profitability of technical analysis in stock markets.

Although commodity futures have been traded for more than one hundred years in the US, they are still a relatively unknown asset class (Gorton and Geert Rouwenhorst, 2006). Only a few empirical studies have formally investigated the profitability of technical analysis in commodity futures markets. Early studies such as Houthakker (1961) and Stevenson and Bear (1970) find that technical analysis is profitable, even though other studies such as Praetz (1975) find negative results. Most recently, Szakmary et al. (2010) find that trend-following trading strategies in commodity futures markets are profitable in at least 22 out of 28 markets. Clare et al. (2014) show that combining momentum and trend following strategies for individual commodity futures can lead to superior performance to simple momentum strategies. However, Park and Irwin (2005) show that technical trading rules generally have not been profitable in US futures markets after correcting for data snooping biases, and Marshall et al. (2008) find that quantitative market timing strategies are not consistently profitable in commodity futures markets.

Most of the existing studies on technical analysis use either market indices or individual stocks or individual commodity futures. Han et al. (2013) are the first to apply technical analysis to portfolios of stocks, and find significant and consistent gains

* Corresponding author.
E-mail addresses: yhan15@uncc.edu (Y. Han), thu@whu.edu.cn (T. Hu), jian.yang@ucdenver.edu (J. Yang).

http://dx.doi.org/10.1016/j.jbankfin.2016.04.013
0378-4266/

using a simple moving average timing strategy. One of the reasons for their success is the use of portfolios to reduce the noise and thus increase the signal-to-noise ratio. We extend the analysis to commodity futures markets.

As underscored in the literature (Gorton and Geert Rouwenhorst, 2006, p. 47, Kogan et al., 2009, p. 1345), commodity futures are markedly different from stocks and other conventional assets. Specifically, commodity futures are not claims on long-lived corporations but rather short-maturity claims on real assets, and the underlying commodities often have pronounced seasonality in price levels and volatilities. In addition, commodity futures prices are often backwardated as they decline with time-to-delivery, often mean-reverting, and their price volatility may be often correlated with the degree of backwardation. Hence, what works in the stock markets may not work in the commodity futures markets. This is especially true given the inconclusive evidence on individual commodity futures in the literature. Compared to stock markets, commodity futures markets have both advantages and challenges. The main advantages of futures markets are the lower transaction costs and easiness to short. The challenges are much fewer contracts than stocks in cross-section and that futures have expiration dates. In addition, unlike stocks, futures are more akin to a zero-sum game and do not have inherit (fundamental) values, and the prices are mostly determined by demand and supply relation. Hence, the behavior of the futures prices, or the dynamics of the futures price trends can be substantially different. Furthermore, volatility of individual commodity futures is often much higher than that of individual stocks, while returns are much lower than those of individual stocks. Therefore, the signal-to-noise ratio is much lower for the commodity futures. Given the relative few number of contracts in cross sections, this really imposes a big question about whether the portfolio approach advocated by Han et al. (2013) can work in the commodity futures markets.

Nevertheless, we find that even with these differences and challenges, the simple moving average timing performs well in futures markets with characteristics-sorted commodity futures portfolios. The basic form of our moving average timing strategy is very simple. On each trading day *t*, we compare the settlement price with the moving average price. If the settlement price is above the moving average price, we will invest for the next trading day, otherwise we will not invest in the future markets.

This paper makes the following contributions to the literature. First and foremost, extending previous studies, which often examine individual commodity futures contracts, we focus on portfolios of commodity futures sorted on certain characteristics of futures (e.g., volatility, trading volume, open interest, six-month past return, prior-month return, and past 60-month return) and document much stronger evidence for the profitability of technical analysis on commodity futures. Similar to previous studies, we find that applying the moving average timing to individual futures produces inconsistent results. For some commodity futures, the timing strategy delivers huge profits but for others it yields negative results. For the majority of the commodity futures, the timing strategy only yields modest gains over the buy-and-hold strategy. However, when we apply the moving average timing to the sorted portfolios, we find consistent and large gains over the buy-and-hold strategy. For example, applying the moving average timing to volume sorted tercile portfolios yields average returns (*t*-stat) 3.29% per annum (1.81) for the portfolio with the lowest trading volume, 4.15% per annum (2.23) for the portfolio with medium level of trading volume, and 7.44% per annum (3.15) for the portfolio with the highest trading volume, respectively. Meanwhile, the buy-and-hold strategy yields average returns (*t*-stat) 1.28% per annum (0.49) for the lowest volume portfolio, 0.90% per annum (0.34) for the medium volume portfolio, and 3.36% (0.99) for the highest volume portfolio, respectively. Because the moving average timing strategy delivers higher return with lower volatility, the Sharpe ratios are much higher, 0.29 versus 0.08, 0.36 versus 0.05, 0.50 versus 0.16, respectively, for the three volume tercile portfolios. Because Sharpe ratios do not measure performance difference intuitively, we employ a related performance measure, Modigliani–Modigliani measure (*M*2), which measures the average return while levering up the volatility to be the same as that of the buy-and-hold strategy. The differences in *M*2 are 3.41%, 5.00%, and 7.28%, respectively, for the three volume sorted tercile portfolios, all of which are statistically significantly positive. Furthermore, the percentage increases in *M*2 are 267.5%, 556.8%, and 216.8%, respectively, for the three volume-sorted portfolios. In other words, if we level up the volatility of the moving average timing strategy to be the same as the volatility of the buy-and-hold strategy, the moving average timing strategy would deliver average returns that are about four times for the lowest volume portfolio, about seven times for the medium volume portfolio, and about three times for the highest volume portfolio, respectively, of those delivered by the buy-and-hold strategy.

Second, we also comprehensively conduct robustness tests in several dimensions and further examine the sources of profitability for moving average timing. We show that the performance gains are generally robust against a number of robustness checks, including the examination of the trading behavior and break-even transaction cost (BETC), subperiod analysis, additional allowance for shorting futures portfolios in implementing the timing strategy, alternative lag window lengths for estimating the moving averages, and alternative construction of the continuous time series of futures prices. We further demonstrate that the superior performance is not due to potential data mining. To understand further the abnormal performance of moving average timing, we examine the relation of the timing performance with backwardation/contango, business cycles, and several macroeconomic variables, respectively. Our results show that the outperformance of moving average timing is not related to backwardation/contango. Similar to Han et al. (2013), Han et al. (forthcoming), and Neely et al. (2014), we find that the moving average timing strategy performs much better than the buy-and-hold strategy during recessions. We further provide evidence that the abnormal performance of the timing strategy is indeed due to successful market timing.

The rest of the paper is organized as follows: Section 2 describes the data and discusses some of the unique features associated with futures. Section 3 discusses the moving average timing strategy. Section 4 provides evidence for the profitability of the moving average timing strategy. Section 5 examines the robustness of the profitability of the moving average timing in a number of dimensions. Section 6 explores the source of the profitability with backwardation and contango, business cycles, macroeconomic variables, and the Henriksson and Merton (1981) market timing model. Section 7 examines the potential data mining issue. Section 8 concludes the paper.

2. Data

We obtain the daily settlement price, trading volume, and open interest on 35 US commodity futures contracts from Bloomberg. The data span the period from December 31, 1974 to December 31, 2013. To avoid survivorship bias, we include contracts that start trading after December 31, 1974 or are delisted before December 31, 2013. The commodity futures are 14 agricultural futures (cocoa, coffee, corn, cotton, oats, orange juice, soybean meal, soybean oil, soybeans, sugar, wheat, white wheat, rough rice, lumber), 5 livestock futures (feeder cattle, pork belly, hogs, live cattle, milk), 10 metal futures (aluminum, copper, gold, lead, nickel,