



The predictability of aggregate returns on commodity futures



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ARTICLE INFO

Article history:

Received 9 December 2013

Received in revised form 17 January 2014

Accepted 3 February 2014

Available online 8 February 2014

JEL classification:

G12

G13

G17

Keywords:

Asset pricing

Commodities

Predictability of returns

Predictive regressions

Forecasting

ABSTRACT

This paper provides evidence that aggregate returns on commodity futures (without the returns on collateral) are predictable, both in-sample and out-of-sample, by various lagged variables from the stock market, bond market, macroeconomics, and the commodity market. Out of the 32 candidate predictors we consider, we find that investor sentiment is the best in-sample predictor of short-horizon returns, whereas the level and slope of the yield curve have much in-sample predictive power for long-horizon returns. We find that it is possible to forecast aggregate returns on commodity futures out-of-sample through several combination forecasts (the out-of-sample return forecasting R^2 is up to 1.65% at the monthly frequency).

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1. Introduction

Are asset returns predictable? The 2013 Nobel Prize recipients Eugene Fama, Lars Peter Hansen and Robert Shiller find that this question “is as central as it is old” (The Royal Swedish Academy of Sciences, 2013). While several studies examine whether excess returns on asset classes such as stocks, treasuries, bonds, foreign exchange, sovereign debt, and houses are predictable (Cochrane, 2011 and the articles cited therein), there is less (up-to-date) evidence for the predictability of commodity futures returns, despite the fact that “commodity futures have [by now] moved into the investment mainstream” (Basu & Miffre, 2013).

This paper attempts to fill this research gap to some extent by studying the predictability of aggregate returns on commodity futures, that is, we test whether the null of unpredictable commodity futures returns can be rejected and seek to identify variables that show predictive power. For this purpose, we do not empirically test one specific theory of commodity futures returns and its implications, as the theory of storage of Kaldor (1939) and others. Instead, we follow an empirical asset pricing approach. That is, by working backwards, we come from the empirical side and test a large set of potential predictors. Most of these candidate predictors are standard choices in studies of return predictability of other asset classes, especially that of stocks and bonds. In addition, we

propose some new factors, of which most are commodity-specific. The empirical facts we identify should be subject to further theoretical studies that seek to propose theoretical models that capture these given empirical patterns.¹

To be somewhat more specific, we conduct predictive regressions that use the future return on an equal-weighted portfolio of 27 commodity futures (without the return on collateral) as the response variable. The right-hand sides of these regressions comprise the current values of subsets of 32 potential predictors from the stock market, bond market, macroeconomics, and the commodity market. The main sample period is from January 1972 to June 2010, with a monthly sample frequency. Predictive regressions are the most common approach to forecast aggregate returns (Kelly & Pruitt, 2013). If returns are unpredictable, regression coefficients beyond a constant should be insignificant in such models, and these models should not provide forecasts of future returns that are more accurate than the historical average of past returns. We evaluate both the in-sample (IS) and the out-of-sample (OOS) predictability. For the IS analysis, we employ single long-horizon predictive regressions with horizons of 1, 3, 12, 24, 36, 48, and 60 months ahead (Maio & Santa-Clara, 2012; among others) as well as a procedure that selects the “best” multiple-variable regression out of the variety of candidate predictors we consider, as is proposed by Bossaerts and Hillion (1999) and Zakamulin (2013). The

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¹ Fama and French (2013) describe the research philosophy of empirical asset pricing.

Table 1
Potential predictors of commodity futures returns.

Variable	Description	Studies (among others)	Proxy	Data source	Sample period
<i>Panel A: stock market</i>					
D/P	Dividend-price ratio	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010)	Log of S&P 500 dividend-price ratio (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
E/P	Earnings-price ratio	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010)	Log of S&P 500 earnings-price ratio (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
D/E	Dividend-payout ratio	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010)	Log of S&P 500 dividend-earnings ratio (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
SVAR	Stock variance	Stocks: Guo (2006); Welch and Goyal (2008); Rapach et al. (2010)	Sum of squared daily S&P 500 returns (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
B/M	Book-to-market ratio	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010)	Dow Jones Industrial Average book-market ratio (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
CSP	Polk, Thompson, and Vuolteenaho's (2006) cross-sectional premium	Stocks: Polk et al. (2006); Welch and Goyal (2008)	–	Amit Goyal	01/1972–12/2002
CRMRF	Cumulative equity premium	–	Five-year cumulative sum of Fama and French's (1993) U.S. market excess return	Kenneth R. French	01/1972–06/2010
CL	Stock liquidity	Stocks: Maio and Santa-Clara (2012)	Five-year cumulative sum of Pástor and Stambaugh's (2003) non-traded liquidity factor	Lubos Pástor	01/1972–06/2010
SENT	Investor sentiment	Baker and Wurgler (2006, 2007)	Stock market sentiment index of Baker and Wurgler (2006, 2007)	Jeffrey Wurgler	01/1972–06/2010
<i>Panel B: bond market</i>					
TBL	Treasury bills	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010); Zakamulin (2013)	Three-month U.S. Treasury bill rate (secondary market) (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
LTY	Long-term yield	Stocks: Welch and Goyal (2008); Rapach et al. (2010)	Yield on long-term U.S. government bonds (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
LTR	Long-term return	Stocks: Welch and Goyal (2008); Rapach et al. (2010)	Return on long-term U.S. government bonds (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
TMS	Term spread	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010); Zakamulin (2013)	Long-term yield minus U.S. Treasury bill rate (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
DFY	Default yield spread	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010); Zakamulin (2013)	Yield on BAA-minus yield on AAA-rated corporate bonds (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
DFR	Default return spread	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010)	Return on long-term corporate bonds minus return on long-term U.S. government bonds (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
CP	Cochrane and Piazzesi's (2005) factor	Bonds: Cochrane and Piazzesi (2005); Stocks: Maio and Santa-Clara (2012)	–	John H. Cochrane	01/1972–12/2003
<i>Panel C: macroeconomics</i>					
INFL	Inflation	Stocks: Welch and Goyal (2008) and the articles cited therein; Rapach et al. (2010); Zakamulin (2013)	U.S. CPI inflation (all urban consumers) lagged by one month (Welch & Goyal, 2008)	Amit Goyal	01/1972–06/2010
I/K	Cochrane's (1991) investment-to-capital ratio	Cochrane (1991); Welch and Goyal (2008); Rapach et al. (2010)	(The quarterly data are linearly interpolated to obtain monthly data.)	Amit Goyal	01/1972–06/2010
CAY	Lettau and Ludvigson's (2001) consumption, wealth, income ratio	Stocks: Lettau and Ludvigson (2001); Welch and Goyal (2008)	(The quarterly data are linearly interpolated to obtain monthly data.)	Amit Goyal	01/1972–06/2010
IP	Industrial production	Commodities (volatility): Prokopczuk and Symeonidis (2013)	Five-year log growth of U.S. industrial production	Federal Reserve Bank of St. Louis	01/1972–06/2010
M2	M2 money stock	Commodities (volatility): Prokopczuk and Symeonidis (2013)	Three-year log growth of the U.S. M2 money stock	Federal Reserve Bank of St. Louis	01/1972–06/2010
GDP	GDP	Stocks: Rangvid (2006)	Three-year log growth of U.S. GDP. (The quarterly data are linearly interpolated to obtain monthly data.)	Federal Reserve Bank of St. Louis	01/1972–06/2010
USD	Return on U.S. dollar	Commodities (volatility): Prokopczuk and Symeonidis (2013)	Five-year log return on a trade weighted U.S. dollar index against major currencies	Federal Reserve Bank of St. Louis	01/1978–06/2010
CVAL	Asness et al.'s (2013) value "everywhere" factor	–	Five-year log excess return on Asness et al.'s (2013) value "everywhere" factor	Tobias J. Moskowitz	12/1976–06/2010
CMOM	Asness et al.'s (2013) momentum "everywhere" factor	–	Five-year log excess return on Asness et al.'s (2013) momentum "everywhere" factor	Tobias J. Moskowitz	12/1976–06/2010
<i>Panel D: commodity market</i>					
CVAR	Commodity variance	–	Sum of squared daily CRB BLS spot index returns	Datastream	01/1972–06/2010
CCM _{spot}	Commodity spot return	–	Five-year log return on CRB BLS spot index	Datastream	01/1972–06/2010
CCM	Commodity futures return	–	Five-year log return on Asness et al.'s (2013) commodity futures portfolio	Tobias J. Moskowitz	12/1976–06/2010
C12CM _{spot}	Commodity spot momentum	–	12-month log return on CRB BLS spot index (most recent month's return is skipped)	Datastream	01/1972–06/2010

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