Economics Letters 144 (2016) 119–122

Contents lists available at ScienceDirect

Economics Letters

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

Does speculation impact what factors determine oil futures prices?

Fabian Gogolin, Fearghal Kearney *

Queen's Management School, Queen's University Belfast, BT9 5EE, UK

HIGHLIGHTS

- Consider observable and unobservable factors separately for oil futures prices.
- Assess each class of factors in subsamples split by speculative activity.
- Uncover significant outperformance utilising a composite prediction framework.

ARTICLE INFO

Article history:
Received 20 April 2016
Received in revised form
3 May 2016
Accepted 7 May 2016
Available online 14 May 2016

JEL classification:
G10
G13
G15

Keywords:
Oil futures
Speculation
Fundamentals
Statistical factors

ABSTRACT

Recent studies provide contradictory evidence about the impact of speculation on commodity prices. Rather than directly evaluating this relationship we instead use a novel approach to assess if speculation can inform our choice of factor inclusion in modelling oil futures.

1. Introduction

Recent sharp price declines in crude oil markets have increased the focus on what factors determine the observed market dynamics. Movements in commodity prices are often attributed to speculation, with Morana (2013) and Juvenal and Petrella (2015) concluding that speculative shocks are a relevant determinant of oil price changes. However, evidence from Büyüksahin and Harris (2011), and Alquist and Gervais (2013) contradict this, finding that the correlation between a speculation index and daily price changes is near zero. We approach the question of speculative impact from a different perspective; asking instead how speculation impacts the modelling accuracy of two distinct classes of factors proposed in oil futures literature. The two approaches we refer to are those comprised of observable fundamental macroeconomic, and unobservable latent principal component, factors.

Kilian and Murphy (2014) note that anyone buying crude oil not for current consumption, but for future use is a speculator from an economic point of view. In practice, we consider market participants who take positions to profit from an expected change in the price of oil as speculators. Due to the increased financialization of commodity futures markets, it has been proposed that speculation is now a major component of prices. However, not all speculation is the same. Some speculators provide liquidity and assist in price discovery, meaning that a certain level of speculation is required for a market to function correctly, whilst the activities of other speculators are said to destabilise the market and distort prices (Fattouh et al., 2013).

In this article, we refrain from defining a single value as a cut-off point for high or excessive levels of speculative activity, instead utilising a range of values corresponding to proxies for elevated levels of speculation. Our study contributes by finding that for elevated levels of speculative activity differences between the model accuracy of fundamental and latent factor approaches are uncovered; differences that are not present over the full sample

* Corresponding author. Tel.: +44 0 28 9097 4795.
E-mail addresses: F.gogolin@qub.ac.uk (F. Gogolin), F.kearney@qub.ac.uk (F. Kearney).

http://dx.doi.org/10.1016/j.econlet.2016.05.007
0165-1765/

period. The empirical analysis indicates that latent factors pick up additional price dynamics not captured by macroeconomic fundamentals, a main contribution of our study. Through the proposal of a novel composite prediction framework we demonstrate that utilising speculative positions to inform factor selection leads to statistically significantly increased accuracy in modelling oil futures price changes.

2. Empirical approach

We follow previous literature (Büyüksahin and Harris, 2011; Alquist and Gervais, 2013; Büyükşahin and Robe, 2014) by adopting the Working (1960) T index as a proxy for speculative activity. It is defined as follows:

$$T = 1 + \frac{SS}{HL + HS} \quad \text{if } HS \geq HL$$

$$T = 1 + \frac{SL}{HL + HS} \quad \text{if } HS < HL$$

where SS (SL) is the open interest of speculators (non-commercials firms) holding net short (long) positions and HS (HL) is the open interest of hedgers (commercial firms) who hold a net short (long) position. The ratio is predicated on the concept that speculators are necessary only insofar as they constitute a counterparty for hedgers. As highlighted by Büyüksahin and Harris (2011), what might be considered speculation in the market could simply be commercials not hedging or commercials taking a stance on future oil price movements. As there is no one Working's T index value that indicates *excessive* speculation we incrementally use values in the 50–90 percentile range as a measure of increasing levels of speculative activity.

In order to consistently compare the performance of the distinct classes of factors we specify structurally similar integrated models for both the unobservable principal component factors, and the observable macroeconomic factors. Firstly, motivated by Chantziara and Skiadopoulos (2008), we consider the following statistical model for oil futures returns:

$$\Delta CL_t^{\tau} = \beta_0 + \beta_1 PC1_{t-1} + \beta_2 PC2_{t-1} + \beta_3 PC3_{t-1} + \varepsilon_t,$$

where $PC1$, $PC2$, and $PC3$ denote the first, second, and third principal components of the WTI futures curve, and ΔCL denotes the log return of the continuous WTI crude oil (CL) contract of maturity τ at time t. We refer to this model henceforth, as *PC*.

Secondly, we consider a similarly constructed linear model, this time comprised of oil futures macroeconomic factors from Andreasson et al. (2016):

$$\Delta CL_t^{\tau} = \beta_0 + \beta_1 \Delta SP500_{t-1} + \beta_2 \Delta VIX_{t-1} + \beta_3 \Delta USD_{t-1} + \beta_4 \Delta EcPol_{t-1} + \varepsilon_t,$$

where $\Delta SP500$ denotes the log return of the S&P500 index, ΔVIX denotes the log change in the VIX volatility index, ΔUSD denotes the log return of the trade weighted US dollar index, and $\Delta EcPol$ denotes the log change in the economic policy uncertainty index for the United States of America. We refer to this model henceforth, as *Macro*.[1] Finally, we produce a composite prediction informed by underlying speculative activity. This approach is motivated by Bates and Granger (1969) who were pioneers in arguing that given the availability of more than one prediction of the same variable, it is rarely (if ever) optimal to identify the best of the competing predictions and use it in isolation.

In line with Chantziara and Skiadopoulos (2008) we use daily WTI crude oil CL1–CL9 prices obtained from the CME Group. The time period for our sample is January 2007–March 2016. The macroeconomic factors dataset comprises daily VIX quotes obtained from CBOE, S&P500 index values obtained from Yahoo! Finance, and Trade Weighted US Dollar Index and US Economic Policy Uncertainty Index, both obtained from FRED. The Commitment of Traders Futures Only report obtained from the CFTC, is adopted to calculate Working's T index values. Root mean squared error (RMSE) and mean absolute error (MAE) loss functions are employed to assess the predictive accuracy of each class of factors.[2] As in all empirical studies considering multiple hypothesis tests about a single dataset, there is a risk of falsely inferring significance, known as data snooping bias. We explicitly address this issue through the use of a formal multiple comparisons framework, namely the false discovery rate as proposed by Benjamini and Hochberg (1995), to check our results for robustness and uncover instances of *truly* significant outperformance.

3. Findings and analysis

After fitting both models to the data we measure the predictive accuracy of each class of factors. We can see from the RMSE and MAE measures in Table 1 that the performance of the PC and Macro factors are almost identical across the term structure of the WTI futures curve over the full sample period. As expected, a formal t-test of both performance measures for each of the maturity contracts fails to yield any significant outperformance. Random Walk performance metrics are also provided for benchmark purposes, indicating that the accuracy of both models are better than would be expected by chance alone.

We now examine if underlying speculative activity has any impact on the factors determining WTI futures returns. We do this by referring to observations with Working's T values of greater than or equal to 50, 60, 70, 80, and 90 percentile full sample index levels respectively, as "*most speculative*" with all other observations being categorised as "*least speculative*". For example, if we use the 90% percentile calculated Working's T index as the cutoff point, we refer to observations with Working's T values greater than or equal to 1.1639 as "*most speculative*" (228 days) and all other periods as "*least speculative*" (2057 days). Table 2 splits the analysis into these subsample periods based on speculative activity. Firstly, analysing the 50–90 percentile least speculative Working's T subsample we again observe very little difference in terms of predictive accuracy between the adoption of Macro and PC factors. The strongest indication of a divergence in performance is for the least speculative 80% of the sample where we observe an RMSE value of 0.0191 versus 0.0189 for Macro and PC respectively, providing an initial suggestion that Macro factors outperform in less speculative periods. The results for the subsample periods with elevated levels of speculative activity are more clear-cut however. Using the most speculative 10%–20% of the sample, we see that PC factors outperform Macro factors with MAE metrics of 0.0217 vs. 0.0220, and 0.0225 vs. 0.0230, for 80 and 90 percentile Working's T values, respectively. This demonstrates that in the sample's most speculative periods it is advantageous to adopt PC factors whereas

[1] The aim of this article is to compare two distinct classes of factors, not to prescribe a specific fundamental factor model for modelling crude oil futures. In comparison with literature outlining macroeconomic factors that model the dynamics of crude oil spot markets there is a relative paucity of literature proposing relevant fundamental determinants of oil futures prices. In further testing we specify an alternative model by including oil inventory (a factor popular in modelling oil spot prices) as an additional macroeconomic factor to those outlined in Andreasson et al. (2016). However, regression results show that the inclusion of inventory is not significant.

[2] The squared error and absolute error for each observation are used to conduct the t-tests.