Finance Research Letters 10 (2013) 131–141

Contents lists available at SciVerse ScienceDirect

Finance Research Letters

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

Leverage vs. feedback: Which Effect drives the oil market?

Sofiane Aboura [a], Julien Chevallier [b,*]

[a] DRM Finance, Université Paris Dauphine, Place du Maréchal de Lattre de Tassigny, 75775 Paris Cedex 16, France
[b] IPAG Business School, IPAG Lab, 184 Boulevard Saint-Germain, 75006 Paris, France

ARTICLE INFO

Article history:
Received 23 July 2012
Accepted 9 May 2013
Available online 17 May 2013

JEL classification:
C4
G1
Q4

Keywords:
WTI
Crude oil price
Implied volatility
Leverage effect
Feedback effect

ABSTRACT

This article brings new insights on the role played by (implied) volatility on the WTI crude oil price. An increase in the volatility subsequent to an increase in the oil price (i.e. inverse leverage effect) remains the dominant effect as it might reflect the fear of oil consumers to face rising oil prices. However, this effect is amplified by an increase in the oil price subsequent to an increase in the volatility (i.e. inverse feedback effect) with a two-day delayed effect. This lead-lag relation between the oil price and its volatility is central to any type of trading strategy based on futures and options on the OVX implied volatility index. It is of interest to traders, risk- and fund-managers.

1. Introduction

The rise of the U.S. benchmark West Texas Intermediate (WTI) futures price to 145 USD per barrel on July 3, 2008 and its collapse to below 30 USD per barrel on December 23, 2008 represents the biggest swing in the history of oil. This fact shows that the oil market exhibits a tail risk that is typically higher than for stock markets. This greater risk motivates the analysis of the oil volatility as a possible driver of oil prices.

Volatility is known to be asymmetric on equity markets due to two concomitant phenomena. First, the so-called 'leverage effect' is characterized by a surge in the volatility, subsequent to a drop in the

* Corresponding author. Address: Tel.: +33 (0)149407386; fax: +33 (0)149407255.
E-mail addresses: sofiane.aboura@dauphine.fr (S. Aboura), julien.chevallier04@univ-paris8.fr (J. Chevallier).

1544-6123/$ - see front matter
http://dx.doi.org/10.1016/j.frl.2013.05.003

stock price (see e.g. Black, 1976; Christie, 1982). Second, the so-called 'feedback effect' means that the causality can be reversed. If volatility is priced by market participants, an anticipated increase in volatility would raise the required rate of return on equity, which leads to a current stock price decline (see e.g. Campbell and Hentchel, 1992; Bekaert and Wu, 2000). Indeed, volatility is asymmetric because the feedback effect amplifies negative stock returns. These studies seem to favor the feedback effect as the dominant factor explaining the asymmetric nature of volatility.

However, contrary to equity markets, oil volatility seems to be positively correlated with past oil prices movements. While Geman and Shih (2009) have undoubtedly documented the existence of this inverse leverage effect in WTI prices, the authors mainly focus on the diffusion processes and neglect the identification of feedback effects. The same comment arises for the recent literature in energy economics (Agnolucci, 2009; Larsson and Nossman, 2011; Chang, 2012). In these contributions, the authors typically estimate various asymmetric GARCH models to take into account the inverse leverage effect in WTI prices, without a discussion on the feedback effects. Other authors have focused on the dynamic conditional correlations in WTI futures (see Lanza et al., 2006).

The originality of this article stems from the fact that previous literature has neglected the investigation of leverage and feedback effects in WTI prices – the world's most liquid commodity futures – while these effects have been investigated in-depth on equity markets. Hence, we aim at filling this gap. We formally test for the presence of feedback and leverage effects in the volatility of WTI prices by running OLS regressions in the spirit of Hibbert et al. (2008) and Fleming et al. (1995). To do so, this article uses an index of implied volatility applied to the oil market (equivalent to the VIX methodology) given that the asymmetry is stronger for implied volatility than for historical volatility (see e.g. Bollerslev and Zhou, 2006). Our study period goes from May 2007 to December 2011.

As a proxy for the Implied Volatility (IV) of the WTI price, we use the CBOE Crude Oil Volatility Index ('Oil VIX', Ticker – OVX). The OVX measures the market's expectation of 30-day volatility of crude oil prices by applying the VIX methodology to the United States Oil Fund, LP (Ticker – USO) options spanning a wide range of strike prices. In previous studies (Agnolucci, 2009; Larsson and Nossman, 2011), actual option prices were used to obtain the Black–Scholes implied volatility. To our best knowledge, this article is the first to make use of the CBOE OVX index. These CBOE indices based on the VIX methodology have been mainly used for equities (see Konstantinidi et al. (2008) for a recent contribution). In addition, Symeonidis et al. (2010) have used such data to investigate the effect of weather and environmental mood-proxies on CBOE implied volatility indices and the S&P 500 realized volatility.

For the purpose of the econometric analysis, this article employs two additional volatility series. First, we extract the conditional volatility of the WTI price from an ARMA (1, 1)–GARCH (1, 1) model (following the examination of 25 competing GARCH models) as a proxy for the historical volatility. Second, we use intraday data on WTI futures contracts to compute the realized volatility from the sum of intraday squared returns. The former time series is used to construct standardized returns, while the latter is used for robustness checks. Finally, we distinguish several sub-periods following the detection of structural breaks in the OVX index.

The article is organized as follows. Section 2 describes the data used. Section 3 presents the econometric methodology. Section 4 contains the empirical results. Section 5 summarizes the main findings and concludes.

2. Data analysis

This section details (i) the data used, (ii) the filtering process to extract the historical GARCH volatility, (iii) the computation of the realized volatility, and (iv) the structural break tests to detect instability in the implied volatility series.

2.1. Data description

The database is composed of 1172 daily closing prices for the crude oil WTI Cushing and the CBOE OVX Index. The period of time goes from May 10, 2007 to December 30, 2011. The dataset starts at the