Oil prices and news-based uncertainty: Novel evidence☆

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ABSTRACT

In this paper, using news implied volatility (NVIX) as a key variable to measure news-based uncertainty, we investigate whether the world price of oil and three classical oil shocks affect news-based uncertainty, or vice versa. Our analysis is conducted through the news mechanism that is unrelated to fundamentals. This research contributes to the literature on the effect of oil prices on news-based uncertainty by studying the dynamics, in both the time and frequency domains, using the wavelet coherence analysis. Our results illustrate that oil prices exhibit a statistically and economically significant leading role on NVIX, especially in the long run. Further, we distinguish the different impacts of oil shocks and find that the oil supply and aggregate demand shocks usually play a leading role on relatively long-term NVIX while the oil specific demand shocks are sensitive to the fluctuations of NVIX. We also find that the rules of comovement between oil prices (oil shocks) and news-based uncertainty change at different frequencies and times. They usually move together in opposite directions with the exception of the oil supply shocks and NVIX. These findings apply to both oil spot and futures markets. Our results present new and interesting implications for investors and policy makers by supporting the news reallocation channel as an important transmission mechanism from oil markets.

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1. Introduction

Few, if any, commodities have been the focus of more attention for their perceived economic significance than oil. Theoretically and empirically, the critical impact of oil price shocks on the macroeconomy and international financial markets has been well documented (Vo, 2011; Alquist et al., 2013; Awartani and Maghyereh, 2013; Feng et al., 2017; Christoffersen and Pan, 2017; Bams et al., 2017; Boubaker and Raza, 2017). However, existing studies on the price of oil and its relationship with macroeconomic and financial variables concentrate heavily on the fundamentals (Boyer and Filion, 2007; Kilian, 2009; Panopoulou and Pantelidis, 2015; Cummins et al., 2016; Pan et al., 2017). Rather surprisingly, very limited attention is devoted to the effect of oil prices through the news channel, which is unrelated to fundamentals. In response to this research gap, this paper investigates whether oil prices, as well as three classical oil shocks, affect news-based uncertainty through the news mechanism, or vice versa.

Our study differs from the extant literature about oil prices and traditional uncertainty in three distinct ways. First, we focus on investigating the price of oil and the shocks' effects through the role of the news media rather than traditional volatility channels. The extant literature typically shows that there are four channels in which oil prices impact the macroeconomy and financial markets (Wang et al., 2018). The first channel is the business cycle channel, which signifies that a large increase in oil prices is an important driver for the business cycle (e.g., economic recessions) (Hamilton, 2013). The second channel is the risk premium channel. This channel stems from the theory of investment under uncertainty and real option, which advocates that current oil price uncertainty depresses future investment and consumption (Henry, 1974; Bernanke, 1983; Brennan and Schwartz, 1985). The third channel has a closed relationship with the financialization of commodities[1] (Tang and Xiong, 2012; Cheng and Xiong, 2013) due to the increasing demand of asset reallocation between crude oil and oil futures. The fourth channel can be explained by the transmission of price information including its effect on real economic activities

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[1] Oil financialization became obvious around 2004. It is a phenomenon such as where people trade crude oil, not for fundamental reasons, but for speculation. Therefore, crude oil becomes a tool for these traders to generate income rather than through industrial production.

(Hamilton, 1983; Kilian, 2009), current and future cash flows (Jones and Kaul, 1996), and monetary policy (Bernanke et al., 1996). Beyond these four channels, our paper provides the news channel for the transmission of the price of oil and shocks' effects. Our thoughts stem from the significant role of news on stock markets around the world.

News media plays an important role in influencing stock market performance. The link between news media and stock market performance was first made by Niederhoffer (1971) who finds that stock prices are most affected when news headlines are considered to be relatively more important in investment decisions. The advancement of information and communication technologies has intensified the role of news media in financial markets. Fang and Peress (2009) show that companies without media coverage have different returns from companies with high media coverage. Tetlock's pioneering studies (Tetlock, 2007; Tetlock et al., 2008) demonstrate that news stories contain information relevant to predicting both earnings and stock returns. Subsequent studies have generally found that with a variety of news sources, information can briefly predict returns at the aggregate market level (Dougal et al., 2012) and at the individual stock level (Boudoukh et al., 2013; Chen et al., 2014). The stock market and the news related to it have been at the forefront of world news. Therefore, it is interesting for us to think about whether or not a similar relationship exists in the oil market. Recently, Narayan and Narayan (2017) find that information contained in oil price news affects stock returns, which shows the value of oil prices on stock returns from the perspective of news. Our research in this paper differs from their work in that we do not focus on stock returns. Instead, we concentrate on the price of oil itself as well as its shocks. Our study represents the first attempt at examining whether oil prices actually affect NVIX, which presents a new and interesting understanding of the spillover effects of oil.

In addition, numerous studies focus on the uncertainty with respect to oil prices (Pindyck, 2004; Kilian, 2009; Kellogg, 2014; Bredin et al., 2011). Going further, a rich volume of literature exists that investigates the relationships between oil prices and non-media news-based uncertainty (i.e., equity and policy related uncertainty or macroeconomic uncertainty) (Aloui et al., 2016; Antonakakis et al., 2014; Li et al., 2016; Yin, 2016; Joëts et al., 2017; Kang et al., 2017). Our research complements their work by showing that the effect of oil prices can spillover through the news channel and by documenting the leading role of oil prices in the fluctuations in news-based uncertainty.

Second, a distinguishing feature of our analysis is that our novel indicator covers a broad dataset of news items. Unlike the bulk of the literature that considers firm-specific news (Fang and Peress, 2009; Tetlock et al., 2008) or specific textual information including internet searches (Da et al., 2015), Twitter broadcasts (Bollen et al., 2011) and Facebook networks (Simon and Heimer, 2012), we consider common news that is likely to impact all firms. This consideration has roots in the literature that shows that oil prices affect the stock returns of all sectors (Narayan and Sharma, 2011). Manela and Moreira (2017) introduce a novel approach to portray people's perception of uncertainty from the perspective of news (i.e., NVIX) in order to estimate the uncertainty derived from the comovement between front-page news coverage from the *Wall Street Journal* and options implied volatility. They use text mining and sentiment analysis algorithms to extract information about investors' moods from relevant sources of textual data. Therefore, NVIX can capture people's concerns and reflects their uncertainty about the news text, which is useful to our study.

Third, we address this issue in both the time and frequency domains via the wavelet coherence (WTC) analysis. It is important to note that the existing literature finds different patterns concerning the role of news. Most of the research has been limited to a comparatively narrow event window within several days after a news release and provides support that the market has a short-term response to news (Tetlock, 2007; Lerman and Livnat, 2010; Loughran and McDonald, 2011; Jegadeesh and Wu, 2013; Heston and Sinha, 2017). However, Sinha (2016) shows that news stories can predict stock returns for up

to 13 weeks. As Tetlock (2007) indicates: "The sentiment theory predicts short-horizon returns will be reversed in the long run, whereas the information theory predicts they will persist indefinitely." Through the application of wavelet analysis that decomposes time series data at various time scales, we can study the relationship among time series from two dimensions–time and frequency. The wavelet analysis framework provides a new dimension for researchers in the financial field (Boubaker and Raza, 2017; He et al., 2009; Khalfaoui et al., 2015; Reboredo et al., 2017). The wavelet coherence analysis (WTC) is a specific method of the wavelet analysis framework, which can be well adapted to our research issues. Through WTC analysis, we can study the prices of oil and NVIX's behaviors in both the short term and long term, and see if the prices of oil can influence news-based uncertainty or be influenced by it more visually. We can also study whether oil prices and news-based uncertainty show different characteristics in different years. These analyses help us to comprehensively understand the relationship between oil prices and news-based uncertainty.

We also consider the effects of three kinds of oil shocks. Fundamental-based explanations of oil price movements are attributed to three shocks: (1) supply shocks, which are driven by the production of the crude oil; (2) aggregate demand shocks, which are driven by global economic activity; and (3) specific demand shocks (Kilian, 2009; Panopoulou and Pantelidis, 2015). In different time periods, these three shocks play different roles as drivers on the fluctuations of the price of oil. Based on this evidence, we explore the likely possibility that these shocks may have heterogenous effects on news-based uncertainty.

Our research reveals several interesting findings. First, we confirm that oil prices exhibit a statistically and economically significant leading role on NVIX. In contrast to the intuitive view, it is the price of oil, no matter that it is the spot price or the futures price, that leads NVIX. In particular, the leading role is more likely evidenced in the relative long term (i.e., middle and low frequencies in WTC analysis) rather than in the short term, since the significant areas usually appear in the low frequency. Second, we distinguish the different impacts of the three shocks. The oil supply shocks and the oil aggregate shocks play a leading role on NVIX while the oil specific demand shocks are sensitive to NVIX. Moreover, from 2007 to 2011 the oil specific demand shocks, which is related to commodity financialization, has the most significant area relative to the other two shocks, especially in the long run. Third, we find the rules of comovement between oil prices and news-based uncertainty that change at different times and frequencies, as well as those between oil shocks and news-based uncertainty, although our main finding–the leading role of the price of oil–is consistent. According to the results of our WTC analysis, oil prices and shocks, and news-based uncertainty usually have opposite movement directions expect for oil supply shocks. The results for West Texas Intermediate (WTI) crude oil and Brent crude oil show small differences, while the results for spot and futures prices demonstrate no remarkable differences.

The remainder of this paper is structured as follows. Section 2 reports our dataset and summary statistics. Section 3 introduces the wavelet coherence analysis. Section 4 shows the empirical results and Section 5 concludes.

2. Data: NVIX, oil prices and the oil shocks

In this paper, we use NVIX as the proxy for news-based uncertainty, which is monthly data from Manela and Moreira (2017). The monthly spot price of WTI (Cushing, OK WTI Spot Price FOB) and the monthly spot price of Brent (Europe Brent Spot Price FOB) data are from the EIA website and are used as proxies for the spot prices of WTI and Brent oil, respectively. Differences exist between these two kinds of spot prices, which both are the most widely used worldwide, since the producing areas vary and have different historical roles. To deepen our investigation into the relationship between oil prices and NVIX, we also take futures prices into consideration to compare if the relationship will change with a variation of price types. The two futures prices are