



The impact of oil price shocks on the U.S. stock market: A note on the roles of U.S. and non-U.S. oil production[☆]



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HIGHLIGHTS

- Effects of U.S. and non-U.S. oil supply shocks on U.S. stock returns are examined.
- Positive U.S. oil production shocks have positive effects on U.S. real stock returns.
- Distinguishing U.S. and non-U.S. oil supply shocks is important at industry level.
- Oil demand and supply shocks are both important in explaining U.S. stock returns.
- U.S. oil production shocks explain 9.6% of automobile industry stock returns.

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ABSTRACT

Kilian and Park (2009) find shocks to oil supply are relatively unimportant to understanding changes in U.S. stock returns. We examine the impact of both U.S. and non-U.S. oil supply shocks on U.S. stock returns in light of the unprecedented expansion in U.S. oil production since 2009. Our results underscore the importance of the disaggregation of world oil supply and of the recent extraordinary surge in the U.S. oil production for analysing impact on U.S. stock prices. A positive U.S. oil supply shock has a positive impact on U.S. real stock returns. Oil demand and supply shocks are of comparable importance in explaining U.S. real stock returns when supply shocks from U.S. and non-U.S. oil production are identified.

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1. Introduction

Kilian and Park (2009) present a novel method for examining the relationship between U.S. stock market behaviour and oil price shocks. Building on the seminal contribution in Kilian (2009), which demonstrates that demand and supply shocks in the market for oil have different effects on the United States (U.S.) economy

and the real oil price, they show that the reaction of U.S. real stock returns to an oil price shock depends on the source of the underlying cause of the oil price change. One of the major conclusions in Kilian and Park (2009) is that global oil supply shocks are much less important than global aggregate and oil-specific demand shocks in understanding aggregate U.S. stock market behaviour. Our study is concerned with the question: Do U.S. oil supply shocks affect U.S. real stock market returns?

After several decades of steady decline in the U.S. oil production, innovations and new technologies in the extraction of crude oil have resulted in an unprecedented expansion in U.S. oil production in recent years. This development is significant because an increase in U.S. crude oil production directly boosts U.S. domestic income

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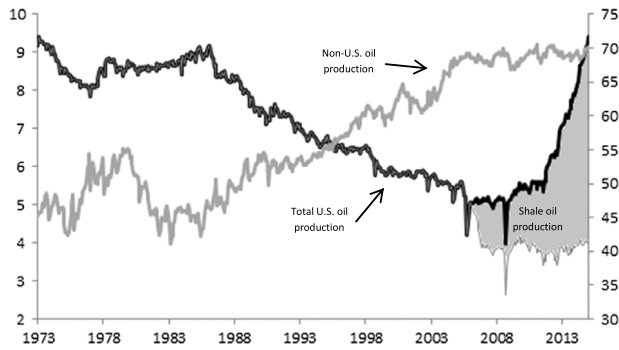


Fig. 1. Monthly U.S. and Non-U.S. oil production, 1973:01–2014:12. Notes: Data from the U.S. Department of Energy.

compared with an increase in non-U.S. crude oil production. In addition, enhanced U.S. oil production has consequences for political and economic security and hence U.S. asset markets that are likely to be different from increases in non-U.S. oil production. The recovery of U.S. oil production in recent years is illustrated in Fig. 1. We investigate the effect of disaggregating the world oil production variable in Kilian and Park's (2009) Vector Autoregressive Model (VAR) into U.S. oil production and non-U.S. oil production. Hendry and Hubrich (2011) argue that including disaggregated information improves forecast accuracy in VAR models.

In this study we revisit Kilian and Park's (2009) analysis to examine the effect of world oil supply shocks on the U.S. real stock market returns. We find that both the disaggregation of world oil supply and the unprecedented surge in the U.S. oil production since 2009 are important factors in determining U.S. real stock returns. A positive U.S. oil supply shock has a positive impact on U.S. real stock returns that is statistically significant in the fourteenth month and later. This result is sensitive to the inclusion of recent data that captures shale oil production. In a sample ending before the start of shale oil production, a positive U.S. oil supply shock has a positive statistically significant impact on U.S. real stock returns only in the twenty-first and twenty-second months.

Variance decomposition analysis shows that by disaggregating world oil production into U.S. and non-U.S. oil production supply shocks are comparable to demand shocks (in contrast to the Kilian and Park (2009) result) in explaining U.S. real stock returns.

2. Data and methodology

We utilize monthly stock and oil market data and examine the two periods: January 1973 to December 2006, and January 1973 to December 2014. The first period is examined in Kilian and Park (2009) and the second is an update that incorporates the oil production expansion in the U.S. in more recent years. The aggregate U.S. real stock market return (ret_t) is obtained by subtracting the CPI inflation rate from the log returns on the value-weighted market portfolio obtained from the Centre for Research in Security Price (CRSP). The oil supply proxy variables are given by the per cent changes in non-U.S. oil production ($\Delta prod_t^{nonUS}$) and in U.S. oil production ($\Delta prod_t^{US}$) from the U.S. Department of Energy. The global real economic activity proxy is the index of real economic activity (rea_t) constructed by Kilian (2009). The real price of oil (rpo_t) is U.S. refiner acquisition cost of imported crude oil, from the U.S. Department of Energy since 1974:01 deflated by the U.S. CPI, with the series extended back to 1973:01 following Barsky and Kilian (2002).

A structural VAR model of order p is utilized to extract the separate supply and demand-side sources underlying oil price changes and their relation to the U.S. stock market return:

$$A_0 y_t = c_0 + \sum_{i=1}^p A_i y_{t-i} + \varepsilon_t, \quad (1)$$

where $y_t = (\Delta prod_t^{nonUS}, \Delta prod_t^{US}, rea_t, rpo_t, ret_t)$ is a 5×1 vector of endogenous variables, A_0 denotes the 5×5 contemporaneous coefficient matrix, c_0 represents a 5×1 vector of constant terms, A_i refers to the 5×5 autoregressive coefficient matrices, and ε_t stands for a 5×1 vector of structural disturbances.

The identifying restrictions on A_0^{-1} , as a lower-triangle coefficient matrix in the structural VAR model, follows the setup in Kilian (2009). Kilian (2009) argues that oil production does not respond to contemporaneous changes in oil demand within a given month because of the high adjustment cost of changing oil production. Fluctuation in the real price of oil will not affect global economic activity within a given month due to the sluggishness of aggregate economic reaction. The real stock return ordered after oil shocks is motivated by Lee and Ni (2002) and Kilian and Vega (2011), who argue that oil prices are predetermined with respect to U.S. macroeconomic aggregates within a given month. We assume that non-U.S. oil production does not respond to U.S. oil supply shock within a given month. The U.S. is an oil importing country whose oil production averages 11.5% of the global oil production over January 1973 to December 2014.

3. Empirical results

In Fig. 2 we report the cumulative impulse response of U.S. real stock returns to negative one standard deviation structural shocks in non-U.S., U.S., and world oil production over 1973:01–2006:12 and over 1973:01–2014:12. Results for shocks in non-U.S. and U.S. oil production are obtained from estimation of the five variable model in Eq. (1) and results for shocks in world oil production are obtained from estimating the four variable model in Kilian and Park (2009).

The results in Fig. 2(a) based on data over 1973:01–2006:12 are in line with the Kilian and Park (2009) paper in that non-U.S. and U.S. oil production shocks are mostly not statistically significant in determining U.S. real stock returns. The result for a negative non-U.S. oil production shock on real stock returns is similar to the result for a negative world oil production shock on real stock returns reported by Kilian and Park (2009), and replicated here in the first diagram in Fig. 2(c).

Fig. 2(b) using data over 1973:01–2014:12 shows a negative U.S. oil supply shock is associated with a negative response in U.S. real stock returns that is statistically significant over most of the horizon. The response of U.S. real stock returns to a negative shock to non-U.S. oil supply is markedly different from that to a negative shock to U.S. oil supply. In Fig. 2(b) a negative innovation in non-U.S. oil supply is associated with a rise in U.S. real stock returns that is statistically significant or close to being statistically significant in the fourth through twelfth months. This result is hard to reconcile with the intuition that non-U.S. oil supply disruptions are associated with a fall in the U.S. stock market.

The result for a negative world oil supply shock on real stock returns in the Kilian and Park (2009) model over 1973:01–2014:12 are reported in the second diagram in Fig. 2(c). The impulse responses in the fourth through twelfth months range are positive and partially statistically significant, indicating a problematic result for the effect on U.S. real stock returns of both world oil supply and non-U.S. oil supply shocks for the 1973:02–2014:12 sample.

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