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Oil price shocks and policy uncertainty: New evidence on the effects of US and non-US oil production

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ABSTRACT

Important interaction has been established for US economic policy uncertainty with a number of economic and financial variables including oil prices. This paper examines the dynamic effects of US and non-US oil production shocks on economic policy uncertainty using a structural VAR model. Such an examination is motivated by the substantial increases in US oil production in recent years with implications for US political and economic security. Positive innovations in US oil production are associated with decreases in US economic policy uncertainty. The economic forecast interquartile ranges about the US CPI and about federal/state/local government expenditures are particularly sensitive to innovations in US oil supply shocks. Shocks to US oil supply disruption causes rises in the CPI forecast uncertainty and accounts for 21% of the overall variation of the CPI forecaster disagreement. Disaggregation of oil production shocks into US and non-US oil production yields novel results. Oil supply shocks identified by US and non-US origins explain as much of the variation in economic policy uncertainty as structural shocks on the demand side of the oil market.

1. Introduction

Baker et al. (2016) construct an index of economic policy uncertainty and show that it influences the business cycle and business investment. Research building on the contributions by Bloom (2009) and Baker et al. (2016) has established that economic policy uncertainty has significant implications for economic and financial activity.[1] Following the paper by Kilian (2009) connecting structural oil price shocks with the economy, Antonakakis et al. (2014) and Kang and Ratti (2013a, 2013b), among others, investigate the relationship between structural oil price shocks and economic policy uncertainty. They find that while oil price increases driven by real aggregate demand and oil-market specific demand shocks have long-term consequences for economic policy uncertainty, supply-side oil shocks do not greatly affect US economic policy uncertainty.[2] The latter result is in line with findings in the literature that supply-side oil shocks are relatively unimportant compared to demand-side oil price shocks for the macro economy by Hamilton (2009), Kilian (2009), Lippi and Nobili (2012), and Baumeister and Peersman (2013b).

In this study, we investigate the influence of US and non-US oil supply shocks on US economic policy uncertainty. Theoretically, a US oil supply shock directly influences US income, whereas a non-US oil supply shock does not. This has implications for differential effects of US and non-US production shocks on economic policy uncertainty since the influence of oil shocks is thought to work through the demand for goods in the economy. Bernanke (2006) notes that energy prices affect

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[1] A considerable literature has developed examining the connection between indices of economic policy uncertainty and stock markets in various countries: Mensi et al. (2014) for BRICS; Arouri and Roubaud (2016) for the US and China; Li et al. (2016) for China and India; Dakhlaoui and Aloui (2016) for BRIC over time; Gao and Zhang (2016) for the UK; Wu et al. (2016) for a panel of nine countries; and Chang et al. (2015) for seven OECD countries. The implications of economic policy uncertainty for sectoral returns has also been examined: Lean and Nguyen (2014) for sustainable investment returns in Asia Pacific and North America; Antonakakis et al. (2016) for U.S. sustainable investments; Balcilar et al. (2016) for gold returns and volatility; Kang et al. (2017) global oil and gas companies. Bekiros et al. (2016) argue for a non-linear forecasting connection between economic policy uncertainty stock market return volatility. Liu and Zhang (2015) find that economic policy uncertainty has forecasting power in volatility prediction models for the stock market.

[2] Literature examining the relationship between economic policy uncertainty and oil price shocks includes the following. Aloui et al. (2016) adopt a copula method to study the effect of economic policy uncertainty on crude-oil returns. Bekiros et al. (2015) find that economic policy uncertainty provides information useful in predicting the change in oil prices. Arouri et al. (2014) find that increased economic policy uncertainty in major net oil importers has a negative effect on Gulf Cooperation Council stock markets.

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aggregate activity primarily through effects on consumer spending and disposable income, an account supported by findings by Lee and Ni (2002) that oil price shocks influence activity at industry level through sector demand.[3] Disaggregated oil supply variables may have different effects on US inflation and inflation expectations and forecasts about federal/state/local government expenditures, key components in economic policy uncertainty. Montoro (2012) and Natal (2012) argue that oil price shocks affect inflation and affect the monetary policy trade-off between inflation and output stabilization. Bernanke et al. (2004) argue that monetary policy influences the transmission of oil price shocks to the economy.

Our examination of the effects of the dis-aggregation of oil production shocks into US and non-US oil production shocks yield novel results. First, the recent literature attributes only moderate effect of supply shocks to economic policy uncertainty, while our results show relative large effect.[4] Secondly, our results contribute to the literature of energy independency, supporting the view of Broadman and Hogan (1988), Anderson (1991) and Hall (1992), that an increase in energy independency has the potential to enhance not only economic growth but also has positive implications for economic policy and national security.

The investigation of the impacts of U.S. and non-U.S. oil supply shocks on U.S. economic policy uncertainty is particularly interesting given the unprecedented expansion in U.S. oil production since 2009. As observed in Fig. 1, US oil production trended downward from the mid-1980s to 2009 and then experienced a rapid expansion due to innovations and new technologies in the extraction of crude oil. These developments in US oil production have wide ranging implications that may differ from those associated with non-US oil production. Dahl and Duggan (1996) conduct a survey and find that US oil supply elasticity appears to be elastic. Kaufmann et al. (2009) find that shocks to oil prices ripple down the US oil supply chain and inventory behaviors. Hayat and Narayan (2011) report that shocks to US oil supply disruptions account for about 35% of the variation of the growth of crude oil and petroleum products ending stocks. Medlock (2012) notes that the US has more oil exporting potential driven, in part, by the recent shale gas and tight oil boom. In a recent paper Kang et al. (2016) shows that the disaggregation of world oil supply into US and non-US oil supply is an important factor in determining US real stock returns. The authors find that a positive US oil supply shock has a positive impact on US real stock returns, in contrast to the established finding that shocks to global oil production are relatively unimportant in influencing real stock returns.

Non-US oil production shows a different pattern of behavior from that of the US oil production over 1985–2015. The major fluctuations of non-US oil production are associated with the 1990–1991 Gulf War, 2003 Iraq War, 2008–2009 Global Financial Crisis, 2011 Arab Spring, and the 2014–2015 oil price down. Fig. 1 shows that in these periods, the major historical event outbreaks are followed by an increase in the economic policy uncertainty index. Shapiro and Watson (1988) also note that major oil price changes in 1970s and 1980s were driven by exogenous political events in the Middle East. Utilizing the geopolitical events as a proxy of exogenous oil supply disruption, Hamilton (2003) confirms the relation between oil price fluctuations and GDP growth.

This study estimates a structural VAR model that recognizes the separate effects of US and non-US oil production shocks and of demand side influences on US economic policy uncertainty. Structural oil price shocks are found to explain 41% of the variation in economic policy uncertainty. Separation of oil production shocks into US and non-US oil production shocks is found to result in the conclusion that supply-side oil shocks are as important for economic policy uncertainty as are oil demand-side shocks, a modification of the view in the literature. At the 60 month forecast horizon over 1985 to 2015, US oil supply shocks and non-US oil supply shocks explain 20.7% of the variation in economic policy uncertainty and oil-market specific demand shocks and aggregate demand shocks explain 20.3% of the variation of economic policy uncertainty.

The response of economic policy uncertainty is positive and statistically significant to shocks to US oil supply disruption. Shocks to US oil supply disruption causes significant rises in the forecast interquartile ranges of the US CPI and accounts for 21% of the overall variation of the CPI forecaster disagreement. Innovations to US oil supply disruption are associated with 16% of the variation of the economic forecast interquartile ranges about federal/state/local government expenditures. It is also found that significantly increased US oil production for several months is associated with a positive shock to economic policy uncertainty.

The paper is organized as follows. Section 2 describes data sources and presents the structural VAR model. Section 3 discusses empirical results about the dynamics of oil price shocks and economic policy uncertainty. Section 4 concludes.

2. Data and methodology

2.1. Data

We utilize monthly economic policy uncertainty and oil market data from January 1985 to December 2015. The oil supply proxy variables are given by the percent changes in non-US oil production ($\Delta prod_t^{nonUS}$) and in US oil production ($\Delta prod_t^{US}$) from the US Department of Energy. The global real economic activity proxy is the index of real economic activity (rea_t) constructed by Kilian (2009).[5] The real price of oil (rpo_t) is US refiner acquisition cost of imported crude oil drawn from the US Department of Energy and deflated by the US CPI from the Bureau of Labor Statistics.

The policy-related economic uncertainty index (pu_t) is developed by Baker et al. (2016).[6] The index is a weighted average of four underlying uncertainty components: broad news-based policy uncertainty that quantifies the newspaper coverage of the policy-related economic uncertainty, tax legislation expiration uncertainty that reflects the number of federal tax code provisions set to expire in the future years, and the economic forecast interquartile ranges about US CPI and about federal/state/local government expenditures. Newspaper coverage reflects search results for articles containing terms related to economic policy uncertainty. The number of federal tax code provisions set to terminate measures the level of uncertainty regarding the course the federal tax code will take in the future. Forecaster disagreement over federal and state/local government purchases measures uncertainty about future fiscal policy. Forecast disagreement over future inflation is a representation of uncertainty about future monetary policy. Baker et al.'s (2016) economic uncertainty index gauges economic policy uncertainty about public views and economic policy making.

We conduct Augmented Dicky–Fuller (ADF), Phillips–Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests for the stationarity of the oil and policy uncerainty variables.[7] The test results in Panel A of Table 1 show that oil supply and demand variables contain

[3] Oil shocks are connected with government activity and policy in a number of additional ways. Barro's (1979) tax-smoothing and Becker and Mulligan's (1997) inefficient-tax models predict an adjustment of taxes and government expenditure in response to wealth shocks. For oil exporting countries, El Anshasy and Bradley (2012) find that higher oil prices raises the size of government and for the US, Gelb (1988) finds that oil price shocks cause a rise in federal government purchases. Pieschacón (2012) shows that fiscal policy can affect the influence of oil price shocks on economic activity.

[4] Please see Antonakakis et al. (2014) and Kang and Ratti (2013a, 2013b).

[5] The data are available at Kilian's webpage: http://www-personal.umich.edu/~lkilian/paperlinks.html.

[6] The data can be found at http://www.policyuncertainty.com/.

[7] In the literature, the traditional tests for the stationarity include the work by Dickey and Fuller (1979), Elliot et al. (1996), Kwiatkowski et al. (1992), Ng and Perron (2001), Phillips and Perron (1988). The Phillips-Perron test has the same power properties as the ADF test. Because both tests lack power it is possible that the failure to reject the null in one case is simply a type II error. Employing two tests with the same power and size properties will not enhance the properties of either and it could be argued that the ADF Generalized Least Squares test might be more powerful. However, failure to reject the null in this one variable is not decisive for the model. Other tests such as ERS, KPSS and NP are then suggested in the investigation.