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# Causes and consequences of oil price shocks on the UK economy

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ABSTRACT

In this paper, we assess the impact and repercussions of oil price fluctuations on the UK economy. We use an empirical strategy which allows us to decompose oil price changes from the underlying source of the shock. Our results show that the consequences of oil price changes on UK macroeconomic aggregates depend on different types of oil shocks. While increases in aggregate and oil market-specific demand do not depress the UK economy in the short run, shortfalls in crude oil supply cause an immediate fall in GDP growth. We also find that domestic inflation increases following a rise in the real oil price. Our variance decomposition shows that oil shocks play a non-negligible role in terms of variation in the main UK macroeconomic aggregates. In particular, aggregate and specific oil demand substantially contribute to changes in GDP growth, inflation, nominal interest rate and unemployment rate. Our study provides evidence that the Bank of England responds to the underlying sources of oil price shocks rather than oil price changes themselves. In particular, unanticipated booms in aggregate and specific oil demand cause an increase in the nominal interest rate whereas the opposite occurs in the case of unexpected oil supply disruptions.

## 1. Introduction

Since the dramatic oil price spikes of the 1970's, and the consequent global recession, economists have analysed oil price fluctuations in order to understand their economic impact. In this regard, a large number of studies have investigated the macroeconomic effects of oil price shocks.[1]

Although these studies have found a negative correlation between oil price increases and economic performance, a strong divergence appeared in the analysis of the causes of oil price fluctuations. The assumption of the oil price as an exogenous driver to economic fundamentals, which did not distinguish between the different sources of oil price fluctuations, was shown inappropriate by Kilian (2009). In his study, Kilian (2009) suggested important evidences of a reverse causality from macroeconomic aggregates to oil prices and also showed that oil prices are driven by structural demand and supply shocks which have direct effects on the macroeconomy.

In this paper, we aim to analyse the impact of oil price changes on the UK economy. We use a structural Vector Autoregression (VAR) approach and adopt a two-stage method in order to identify and estimate our model. In the first stage, we assess the causes of oil price changes depending on the underlying source of the shock; that is, we investigate whether the oil price is driven by a supply or a demand disturbance. In the second stage, we examine the effects of the structural shocks estimated in stage 1 on a set of UK macroeconomic aggregates such as output growth, inflation, nominal interest rate and unemployment rate.

Our contribution with respect to previous economic literature is twofold. Firstly, we are able to assess the effects of different types of oil shocks on the UK economy. Using an impulse response analysis, we are able to show that unanticipated booms in oil demand have different effects than unexpected oil supply disruptions. Moreover, our variance decomposition analysis quantifies the contribution of these different types of oil shocks on the fluctuations in the main UK economic fundamentals. Secondly, our empirical model allows us to study the response of the Bank of England (BoE) to unexpected oil shocks. In particular, our findings show that the UK monetary policy is affected differently by changes in oil supply as well as variations in aggregate and specific oil demand. Interestingly, our results highlight the fact that the BoE responds to the underlying shocks in the oil market, whereas we find no evidence that the BoE responds directly to oil price shocks.

Our empirical strategy is in accordance with the approach of Kilian (2009), which endogenises the effects of oil price, and is fully consistent

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[1] See, for example, Hamilton (1983); Burbidge and Harrison (1984); Bernanke et al. (1997); Papapetrou (2001); Lee and Ni (2002); Barsky and Kilian (2004); Peersman (2005); Blanchard and Galí (2007); Kilian (2008); Peersman and Van Robays (2009); Mohaddes and Raissi (2013); Zhang and Yao (2016); Morana (2017).

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with the theoretical framework based on Dynamic Stochastic General Equilibrium (DSGE) models developed by Bodenstein et al. (2008), Nakov and Pescatori (2010), Bodenstein et al. (2011), Bodenstein and Guerrieri (2012), Bodenstein et al. (2012).[2] Our analysis also focuses on the demand side of the oil market. It is worth noting that the traditional emphasis on physical oil supply shocks in explaining oil price fluctuations is misplaced as provided by a large number of studies such as Barsky and Kilian (2002, 2008), Apergis and Miller (2009), Basher et al. (2012), Kilian and Murphy (2012, 2014), Kilian and Hicks (2013), Baumeister and Peersman (2013).

Most of the papers analysing the relationship between oil and the macroeconomy have focused on the United States. There have also been several cross-country studies.[3] More recently, economic literature has focused on the oil-macroeconomy relationship considering the complex framework of global economic interactions. For example, Cashin et al. (2014) have employed a Global VAR model (GVAR) to assess the effects of oil price shocks on a large number of countries. Esfahani et al. (2014) focused on nine major oil exporting countries and estimated the effects of oil revenue shocks on this set of countries. Mohaddes and Raissi (2017) have studied the consequences of the US shale oil boom for the global economy and, in particular, the Middle East and North Africa (MENA) region using a GVAR-Oil model. Mohaddes and Pesaran (2016) have analysed the economic impact of country specific oil supply shocks on real output, oil prices, interest rates, and real equity prices for 27 countries. In the same spirit, Mohaddes and Pesaran (2017) have used a GVAR approach to assess the effects of negative short-run oil price decreases on the US and the rest of the world economy. All these studies have a common point considering the direct effects of oil price shocks together with the indirect impact of oil price fluctuations through secondary and tertiary channels.

In contrast to the above literature, our paper focuses on the relationship between the UK macroeconomy and global oil price changes. We expect the United Kingdom to be a very interesting study case as it is one of the largest oil producers among the European countries. In particular, the recent Brexit vote could have profound implications since the European economy has not grown rapidly in recent years and a fracturing political system could affect negatively economic growth, putting pressure on oil demand.

Thus, we analyse how the effects of oil price fluctuations on the UK economy may depend on the nature of the underlying shock. Our structural VAR model distinguishes between oil price changes caused by exogenous disruptions in oil production, oil demand shocks driven by global real economic activity and oil market-specific demand shocks associated with the uncertainty about future supply. The sample of our analysis covers the period 1976–2014. In this regard, we estimate our VAR model with monthly data. Our empirical set up heavily relies on delay restrictions that are economically plausible only at monthly frequency. As far as the causes of oil price shocks are concerned, our results confirm the findings of Kilian (2009) for the sample 1976–2007, adding the explanation of oil price variations in recent years. We find that, since the mid-1970's, most large and persistent fluctuations in the real price of oil have been associated with the cumulative effects of oil demand rather than oil supply shocks.

Turning to the consequences of oil price shocks on the UK economy, we find that oil supply disruptions induce an immediate fall in domestic GDP growth and cause a sustained increase in domestic inflation. Our impulse response analysis shows that increases in aggregate demand and oil market-specific demand, initially, have a negligible effect on the UK output growth but in the long term they tend to depress it. In addition, both these shocks induce a rise in the CPI inflation. We also quantify the contribution of oil shocks in terms of fluctuations of the main UK macroeconomic aggregates. Our variance decomposition analysis indicates that oil shocks played an important role in the UK economy. Among oil shocks, oil market specific-demand is definitely the most important concerning the variation in the real GDP growth and the unemployment rate, whereas aggregate demand shocks play a significant role in determining changes in the inflation and nominal interest rate. Focusing on the UK monetary policy, we find that the nominal interest rate increases after both aggregate demand shocks and oil market-specific demand shocks occur, whereas negative shocks to the oil supply induce the Bank of England to reduce its policy interest rate.

The rest of the paper is structured as follows. In the next section we discuss the specification and identification of our empirical model. Section 3 discusses the results distinguishing between the causes of oil price changes and the effects of oil price fluctuations on the UK economy. Section 4 reports the robustness analysis. Section 5 concludes suggesting improvements for future researches.

## 2. The empirical framework

We estimate the causes and consequences of oil price shocks in two distinct stages. Firstly, we use a structural VAR (SVAR) framework to capture supply and demand conditions in the oil market. Accordingly, we apply the identifying assumptions on the relationships between the world variables in order to recover three structural shocks affecting oil prices: oil supply shocks, aggregate demand shocks and oil market-specific demand shocks (or precautionary demand shocks). In particular, oil supply shocks are shocks respondent to current availability of crude oil. Aggregate demand shocks affect the current demand for crude oil coming from changes in the global business cycle. Oil market-specific demand shocks are those driven by shifts in the precautionary demand for oil; they come from the uncertainty about shortfalls of expected supply relative to expected demand. The latter shock includes the holdings of oil inventories as insurance against oil supply disruptions.

In stage 2, we assess the impact of structural innovations, estimated in stage 1, on several UK macroeconomic aggregates such as real GDP growth, CPI inflation, the nominal interest rate and the unemployment rate. The use of two-stage procedure presents two advantages. Firstly, our approach enables us to keep the number of variables in our SVAR manageable given the computational requirements associated with estimating larger VARs. Secondly, separating the process of identifying structural shocks in the oil market removes the need to employ further identification restrictions on the UK macroeconomic aggregates.

### 2.1. Modelling the causes of oil price shocks: a world SVAR

#### 2.1.1. Data

We consider monthly data for the sample period 1976:1-2014:12.[4] In order to estimate the world structural VAR, we use the percentage change of global crude oil production ($\Delta prod_t$) obtained by the log differences of world crude oil production in millions per barrels pumped per day (averaged by month).[5]

The index of global real economic activity ($rea_t$) is a measure of the component of worldwide real economy activity which drives demand for industrial commodities in global markets. This index is based on dry cargo single voyage ocean freight rates. As argued by Kilian (2009), world economic activity is the most important determinant of the demand for transport services. Thus, increases in freight rates are indicators of strong cumulative global demand pressures.

[2] Using a DSGE model, Milani (2009) proposed an innovative approach in order to investigate the effects of oil prices on US macroeconomic aggregates. In particular, this author emphasized the changing effect that oil prices have on the formation of economic agents' expectations and the role of learning.

[3] See, for example, Berument et al. (2010); Baumeister et al. (2010); Peersman and Van Robays (2012); Vespignani (2015); Vespignani and Ratti (2016).

[4] We use the sample period 1974:1-1975:12 as training sample for our estimates.

[5] See Appendix A for a detailed description of data sources and the construction of the series used to estimate the world SVAR.