1. Introduction

Since the seminal work of Hamilton (1983) several studies have investigated the link between oil price shocks and either the macroeconomy,1 or financial markets.2 Yet no clear consensus has emerged as to whether such a link even existed. Our paper revisits this debate by replicating and extending the model proposed for the US by Sim and Zhou (2015, Journal of Banking and Finance) to 15 countries, whose classification as oil importing or exporting depends on their net position in crude oil trade.1 Their framework thus aims to differentiate the effects of oil prices on the US stock market conditional on the sign and the size of oil price shocks and stock market returns4 may lead to higher returns when the market is well performing and lower returns when markets perform poorly during high oil price shocks.

Using a structural vector autoregression (SVAR), Kilian (2009) and Kilian and Park (2009) identify three structural shocks to oil prices in the US; demand, supply and oil-specific demand. They find that precautionary demand shocks are the largest contributor to the relationship between oil price shocks and stock market returns. Sim and Zhou (2015) offer further insights into this relationship by using a quantile-on-quantile (QQ) approach. Stock markets, they argue, may react differently to small, large, positive, or negative oil price shocks (see Fig. 13 in the appendix). Their framework thus aims to differentiate the effects of oil prices on the US stock market conditional on the sign and the size of oil price shocks and the performance of the US stock market.

In this paper, we adapt the framework by Sim and Zhou (2015) to account for the impact of the US stock market on other countries, and apply the model to countries that are considered to be either oil importer, oil exporter or moderately oil dependent. Our results corroborate those of Sim and Zhou (2015) when considering large oil importing countries, in that large negative oil price shocks4 may lead to higher returns when the market is well performing and lower returns when markets perform poorly during high oil price shocks.

1 See e.g. Barsky and Kilian (2004), Hamilton (1996), Mork et al. (1994), Lee et al. (1995), and more recently Ratti and Vespignani (2016).
2 See e.g. Kling (1985), Jones and Kaul (1996), Chen et al. (1986), Sadorsky (1999), and more recently Broadstock and Filis (2014), Kang et al. (2015), Maghyereh et al. (2016), Balciar et al. (2017), and Zhang (2017).
3 Aloui et al. (2012) and Wang et al. (2013) adopted a similar classification.
4 With the exception of Japan where the negative oil price shock is small.
the period 1988:1–2007:12. However, when extending the study to more recent data (period 1988:1–2016:12), we find that China and India experience higher returns when markets perform well and there is a large positive oil price shock. Also, we find that large positive oil price shocks often lead to higher stock market returns when markets perform well for both oil exporting countries – Canada, Russia, Norway – and moderately oil dependent countries – such as Malaysia, Philippines and Thailand. Finally, in most cases, large negative oil price shocks depress further already poorly performing markets, as in Sim and Zhou (2015).

While much of the early literature on oil price shocks and stock market returns focus on the US, there has been an increased interest in developed countries in Europe and Asia, and developing countries across the world. In particular, Wang et al. (2013), and Cunado and de Gracia (2014) suggest that when considering other countries besides the US, the significance of the precautionary demand shocks is lower. Using a Vector Error Correction Model (VECM), Cunado and de Gracia (2014) analyze the impact oil price shocks have on stock market returns in 12 oil importing European countries. They find that the relationship between oil price shocks and stock market returns is negative, and that supply shocks have a greater impact than demand shocks.

Park and Ratti (2008) consider 13 European countries along with the US to conduct a multivariate vector autoregression (VAR) analysis on oil price shocks and stock market returns. They conclude that there is a statistically significant negative impact of oil price shocks on stock market returns in the same month or within 1 month.5 They also look at the asymmetric effects of stock returns on oil price shocks. They find some evidence for the US and Norway, but little evidence for any other oil importing European country.

Using a SVAR approach, Apergis and Miller (2009) analyse three types of oil price shocks on stock market returns from eight countries – Australia, Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States – and find that international stock market returns do not respond in a large way to oil market shocks. Using a similar methodology, Abhyankar et al. (2013) show that the Japanese stock market reacts negatively to oil price increases related to oil-market-specific demand shocks, and Lin et al. (2010) show that global oil demand and oil specific demand shocks have no significant impacts on China’s stock market returns.

Wang et al. (2013) consider the relationship between oil price shocks and stock market returns for a range of oil importing and oil exporting countries, using the SVAR methodology by Kilian (2009). They find that the magnitude, direction, and duration response of an oil price shock impact the stock market returns differently in oil importing countries compared with oil exporting countries. They further show that the nature of the price shock – whether it is driven by supply or demand – affects oil importing countries differently from oil exporting countries.

In their study, Fang and You (2014) analyse whether the stock market returns of the three large Newly Industrialised Economies’ (NIE), namely China, India and Russia, can be explained by fundamental oil demand and supply shocks, and find mixed results.

More recently, Bouoiyour and Selmi (2016) used a QQ approach to study G7 stock market responses to oil price shocks accounting for China’s slowdown. They find responses to be asymmetric and that markets in Germany, Italy, Canada and the United Kingdom are typically more responsive than those in France, Japan and the United States.

Basher and Sadorsky (2006) use an international multi-factor model to investigate the relationship between oil price shocks and stock market returns for 21 emerging stock markets. While they find strong evidence of such a relationship, their results are inconsistent and vary with the frequencies of data used. For daily and monthly data, they find that an increase in oil prices has a positive effect on stock market returns, while the same effect occurs for a decrease in oil prices using weekly and monthly data.

Aloui et al. (2012) consider emerging countries, which they separate into three groups – net oil exporting countries, net oil importing countries, and moderately oil dependent countries – depending on their net position in crude oil trade. Using the framework of Basher and Sadorsky (2006), they find that the sensitivity of stock market returns in relation to oil price shocks is asymmetric and particularly significant during periods of rising oil prices. They also find that the relationship between oil price shocks and stock returns during bearish periods is positive in moderately oil dependent countries and negative for oil exporting countries. No relationship is found however for oil importing countries during either bullish or bearish periods.

Güntner (2014) examines the relationship between structural oil price shocks and stock market returns in six OECD countries, comprising four oil importing countries – the United States, Japan, Germany, and France – and two oil exporting countries – Canada and Norway. Using the model developed by Kilian (2009), they find similar results to Kilian and Park (2009). In particular, they find that oil supply shocks have no significant impact of oil price shocks on stock returns, while aggregate demand oil shocks have a positive effect on stock returns, although more persistent for exporters and in particular Norway. They also show that precautionary demand oil shocks have a negative impact on stock returns for importing countries, a positive effect for Norway, but no effect for Canada.

The rest of the paper is organised as follow. Section 2 introduces the model by Sim and Zhou (2015), and the changes we made to extend its application to countries outside the US. Section 3 presents the data used in this study and our results. Section 5 concludes.

2. Model

Let \( \left( r_{o,j,t}, o_{i,t} \right)_{t=1}^{n} \) be a sample of \( n \) observations where \( r_{o,j,t} \) is the stock returns of country \( j \) at time \( t \) and \( o_{i,t} \) denotes the oil price shock at time \( t \) due to variations in precautionary demand.6 Consider the following quantile-on-quantile framework (similar to Sim and Zhou (2015)):

\[
    r_{o,j,t} = \beta^{\theta}_{j}(o_{i,t}) + \alpha^{\theta}_{j}r_{o,j,t-k} + \alpha^{\theta}_{j}r_{u,t-k} + \epsilon^{\theta}_{j,t},
\]

where \( \beta^{\theta}_{j}(\cdot) \) is a possible unknown function that links oil price shocks to the \( \theta \)-quantile of the stock returns of country \( j \), \( r_{u,t-k} \) is the US stock market returns at \( t - k \), and \( \epsilon^{\theta}_{j,t} \) is an error term that has zero \( \theta \)-quantile. Although model (1) is similar to that of Sim and Zhou (2015), focusing on countries other than the US requires controlling for the global influence of the US market in the equation. Indeed, it is highly likely that changes in the US market affect the stock returns in markets worldwide. Therefore the inclusion of \( r_{u,t-k} \) in the RHS of

5 Except for Norway which shows a positive relationship. They attribute this to Norway being a net oil exporter. Bjerland (2009) confirms this result for Norway showing that following a 10% increase in oil prices, stock returns increase immediately by 2–3% with the effect gradually dying off after 15 months.

6 Following Kilian (2009) and Kilian and Park (2009), \( o_{i,t} \) represents the oil price shocks arising from changes in oil precautionary demand filtered from the structural vector autoregressive(SVAR) model. In this study, we approximate \( o_{i,t} \) following the same steps as in Sim and Zhou (2015). The details of this estimation are omitted to shorten the exposition of the paper.
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