Do Oil Shocks and U.S. Economic Uncertainty Matter? A Global Stock Market Perspective

Dohyoung Kwon *

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Abstract

This paper examines interdependence between oil shocks and U.S. economic uncertainty and analyzes their effects on global stock markets within a structural VAR model over the period 1974–2018. I find that aggregate demand shocks cause a transitory rise of global stock returns, whereas precautionary oil demand and U.S. economic uncertainty shocks decline the returns. Especially, the oil demand shocks significantly increase the U.S. uncertainty, indicating that their direct impacts on global stock markets are amplified by its endogenous response. Variance decomposition analysis shows that the structural oil and U.S. macro uncertainty shocks explain 17% and 6% of the long-run variation in global stock returns, respectively. Those figures have more than doubled when the model is estimated on post 2000 data, suggesting that oil market fundamentals and U.S. economic uncertainty are an important determinant of fluctuations in global stock returns.

JEL Classification Numbers: G15; Q41; Q43

Keywords: Oil shocks; U.S. economic uncertainty; Stock returns; Structural VAR

*Dohyoung Kwon, Investment Policy Division, National Pension Research Institute, 180 Giji-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do 54870, South Korea (dohyoungkwon83@gmail.com). The views expressed here are solely the responsibility of the author and should not be interpreted as reflecting official positions of the National Pension Research Institute. All remaining errors are mine.

1 Introduction

What moves global stock markets? It is the well-established fact that changes in oil prices have direct impacts on stock market performance by influencing corporate cash flows and consumer demands (Jones and Kaul (1996); Sadorsky (1999); Kilian and Park (2009)).[1] In addition, economic uncertainty is known to be an important state variable affecting stock prices (Bansal and Yaron (2004); Bansal et al. (2014); Bali et al. (2017)). This paper investigates interdependence between oil shocks and U.S. economic uncertainty and their role in accounting for fluctuations in global stock returns. Moreover, I examine whether the impacts of these shocks on stock markets differ across countries. These results have crucial policy implications for global investors on portfolio strategies, as well as for policymakers who cope with these shocks.

Building on the influential work by Kilian (2009) and Kilian and Park (2009), I construct a structural VAR model that incorporates three-block structures of crude oil market, U.S. economic uncertainty, and global stock return data over the period 1974–2018. Using the three variables of world oil production, global economic activity measured by a world index of freight rates, and real oil prices, I extract the separate supply and demand-side sources of underlying oil price changes based on a recursive ordering restriction as in Kilian (2009) and Kilian and Park (2009). Then, I analyze the impulse response of global stock returns to each of the structural oil and U.S. economic uncertainty shocks and quantify their importance in explaining the long-term variation of the returns.

The response of global stock returns differs markedly depending on the underlying structural shocks. For example, oil supply shocks have statistically insignificant effects on global stock returns, whereas aggregate demand shocks cause a short-lived rise of the returns for the first several months, followed by a persistent drop. Both precautionary oil demand and U.S. economic uncertainty shocks decline global stock returns. In particular, I find that the oil demand shocks increase the U.S. economic uncertainty significantly, so that their direct effects on global equity returns are amplified by its endogenous response.

[1]Early papers, such as Jones and Kaul (1996) and Sadorsky (1999), show a stable negative relationship between oil shocks and stock returns, but Kilian and Park (2009) highlight that stock markets respond very differently depending on the underlying causes of the oil price change.

Variance decomposition analysis shows that the structural oil shocks and U.S. economic uncertainty account for 17% and 6% of long-term fluctuations in global stock returns, respectively. Almost all of that contribution made by oil shocks come from oil demand shocks, rather than oil supply shocks. More importantly, the role of oil shocks and U.S. macro uncertainty has increased substantially since 2000, explaining 40% and 39% of the long-run variation in the returns, respectively. In particular, precautionary oil demand shocks have become more important, which is closely associated with a large inflow of investment capital to commodity markets, the so-called "financialization" of commodity markets as described in Cheng and Xiong (2014) and Henderson et al. (2015). The increased importance of the U.S. uncertainty is related to the increased economic and financial integration of the U.S. economy with the rest of the world as highlighted by Kose et al. (2017). Overall, oil market fundamentals and U.S. economic uncertainty are an important determinant of global stock market movements.

Furthermore, I investigate whether the reaction of stock markets to structural oil and U.S. macro uncertainty shocks varies across countries. The key finding is that investors greatly benefit by constructing portfolios with more weights on stocks of net oil exporters such as Canada and Norway in response to oil demand shocks, because their positive impacts are larger and more persistent than those of net oil importers such as Japan and Germany. In addition, the different magnitude, duration, and even direction of individual stock markets in response to oil supply shocks suggest that a well-diversified portfolio can be obtainable. Lastly, an unexpected increase in U.S. economic uncertainty generally have negative impacts on all stock markets, but the effects on European stock markets are relatively greater than other major stock markets. This implies that investors need to construct relatively more defensive portfolios on European stock markets in response to the U.S. macro uncertainty shock.

This paper contributes to the literature that studies the dynamic relationship between oil shocks and stock returns by incorporating the endogenous response of U.S. economic uncertainty. Many existing papers, such as Park and Ratti (2008), Kilian and Park (2009), Wang et al. (2013), and Güntner (2014), examine the impacts of structural oil shocks on stock markets, but little attention has been paid to the endogenous role of U.S. economic uncertainty caused by oil shocks. Kang and Ratti (2013) and Kang and Ratti (2015) are closely related to my paper in that they consider the interrelation between oil shocks and economic policy uncertainty (EPU) developed by Baker et al. (2016) and analyze their impacts on stock returns. However, they focus only on the U.S. and Chinese stock markets, respectively, and use the EPU index that relies on the newspaper coverage frequency containing the term of uncertainty and items associated with economic policies. This paper employs the macroeconomic uncertainty index of Jurado et al. (2015), defined as the conditional volatility of the unforecastable component of a large number of economic indicators, which is markedly distinct from the EPU index, and shows the importance of using the uncertainty index in explaining variations in global stock returns.

The rest of the paper proceeds as follows. Section 2 describes the data and Section 3 discusses the empirical methodology of the structural VAR specification and identification. Section 4 presents the main results of this paper including the impulse response of world stock returns to the structural shocks and variance decomposition. Section 5 concludes.

2 Data

Data include a measure of the percent change in world oil production, an index of global real economic activity, the real price of crude oil, an indicator of U.S. macroeconomic uncertainty, and global real stock returns. All data are monthly and the sample period is 1974:1–2018:12.[2] World production of crude oil available from the Energy Information Administration (EIA) is used to construct its percent change. The index of global real economic activity is based on the equal-weighted dry cargo freight rates developed by Kilian (2009) reflecting across-the-board shifts in global demand for industrial commodities.[3] The real price of oil is measured as the U.S. refiner's acquisition cost for imported crude oil obtained from the EIA, deflated by the U.S. CPI and expressed in log-levels as in Kilian (2009) and Kilian and Park (2009).[4]

[2]The starting date of the sample period is determined by the availability of the real price of oil measured by the U.S. refiner's acquisition cost for imported crude oil.

[3]An increase in the index indicates a higher demand for transport services driven by global economic expansions, including emerging economies such as China and India. The data are available at Kilian's webpage: http://www-personal.umich.edu/~lkilian/paperlinks.html.

[4]One can use other measures of oil prices such as the West Texas Intermediate (WTI) or Brent, but they are available even later in 1983 and 1988, respectively. So, I employ the U.S. refiner's acquisition cost for

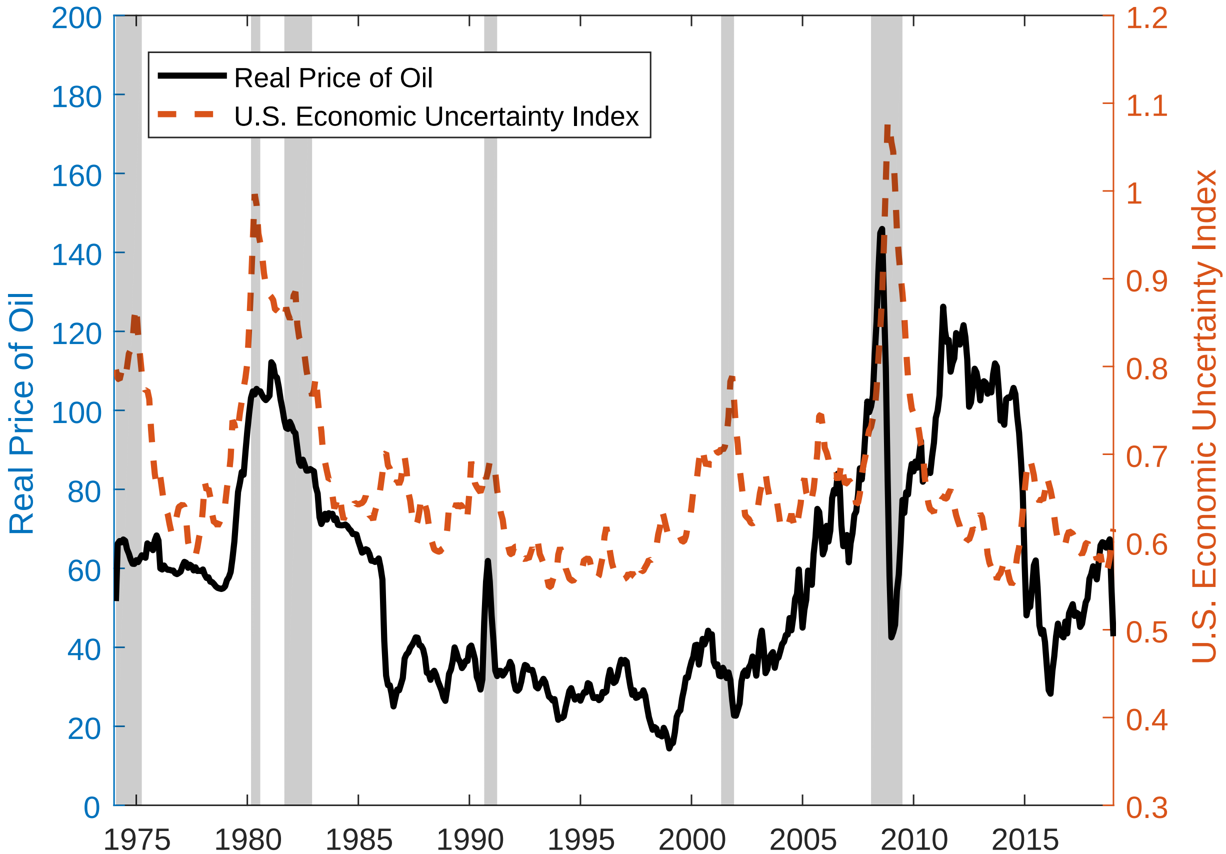

Figure 1: Real price of oil and U.S. economic uncertainty for 1974–2018: Shaded areas indicate the U.S. recession periods

For the measure of U.S. economic uncertainty, I rely on the factor-based estimate of economic uncertainty developed by Jurado et al. (2015). Using a rich set of time-series that represent broad categories of macroeconomic activity, they estimate the conditional volatility of the purely unforecastable component of the future value of each series and then aggregate individual conditional volatility into a macro uncertainty index.[5] Figure 1 presents the time-series of real price of oil and U.S. macroeconomic uncertainty between 1974:1 and 2018:12. Notice that oil price movements are closely associated with the U.S. uncertainty as Hamilton (2011) documents that ten out of the eleven postwar U.S. recessions had been preceded by

imported crude oil since it has much longer times series and also moves almost the same way with those oil prices.

[5]The one-month, three-month, and 12-month-ahead economic uncertainty indices are available at Ludvigson's webpage: https://www.sydneyludvigson.com/data-and-appendixes/. I employ the one-month-ahead uncertainty as a benchmark and find that main empirical results are robust to using different measures.

a rise in oil prices. That is, the dates of well-known events followed by the increase in U.S. economic uncertainty index mostly correspond with those of events that trigger the rise in oil prices, such as the 1978-81 OPEC II oil price shock, the 1990-91 Gulf War, and 2008-09 Global Financial Crisis.

As a proxy for global stock returns, I use the Morgan Stanley Capital International (MSCI) World price index to construct nominal stock returns, which are deflated by CPI inflation rates for G7 countries to obtain real stock returns.[6] For individual stock market returns, I employ a major index for each country collected from *Yahoo Finance*: S&P500 (U.S.), S&P/TSX (Canada), FTSE100 (U.K.), DAX (Germany), OSEAX (Norway), NIKKEI225 (Japan). Real stock returns in each country are similarly constructed by subtracting the respective country's CPI inflation rate from nominal stock returns.[7]

3 Methodology

3.1 VAR Specification

Building on the influential work by Kilian (2009), I develop a structural VAR model that incorporates three-block structures of crude oil markets, U.S. economic uncertainty, and global real stock returns. Let $y_t = (\Delta prod_t, rea_t, rpo_t, useu_t, \Delta stx_t)$ be a vector of endogenous variables, where $\Delta prod_t$ is the percentage change in world crude oil production, rea_t represents the index of global real economic activity, rpo_t denotes the real price of oil, $useu_t$ refers to a measure of U.S. macro uncertainty, and Δstx_t is the real rate of world stock returns. The structural representation of the VAR model can be written as follows:

$$A_0 y_t = \alpha_0 + \sum_{i=1}^{p} A_i y_{t-i} + \epsilon_t, \tag{1}$$

where α_0 is a vector of constant terms, A_i, i=0, $\cdots$, p, denotes a coefficient matrix, and ϵ_t refers to a vector of structural innovations.

[6]The MSCI World index is a free-float market capitalization weighted index of more than 1,600 securities from 24 developed markets and represents roughly 90% of world market capitalization.

[7]The cross-country inflation measured by CPI index can be easily obtained at OECD webpage: https://data.oecd.org/price/inflation-cpi.htm

Consistent with Kilian (2009), the model attributes fluctuations in oil prices to the three structural shocks in crude oil markets: shocks to the world supply of oil (ϵ_{1t}), innovations in aggregate demand for all industrial commodities associated with fluctuations in global real business cycle (ϵ_{2t}), and shocks to the oil-market specific demand (ϵ_{3t}) reflecting changes in precautionary demand caused by uncertainty about the availability of future oil production. Extending the work by Kilian (2009), I include the U.S. macroeconomic uncertainty (ϵ_{4t}) and world stock market shocks (ϵ_{5t}) in the second and third block of the VAR model, respectively. This specification allows us to analyze to what extent the impacts of oil price shocks on stock returns are magnified by the endogenous response of U.S. economic uncertainty.

Assuming that A_0 is invertible, the following reduced-form VAR representation can be obtained by multiplying both sides of (1) with A_0^{-1}:

$$y_t = \nu_0 + \sum_{i=1}^{p} B_i y_{t-i} + e_t, \tag{2}$$

where $\nu_0 = A_0^{-1}\alpha_0$ and $B_i = A_0^{-1}A_i$, i=1, $\cdots$, p, denote the intercept and slope coefficients, respectively, and e_t is the reduced-form disturbance that can be contemporaneously correlated. In accordance with Kilian (2009) and Kilian and Park (2009), the lag length in the VAR is set to be $p = 24$ in order to ensure sufficient length of propagation of oil shocks on stock markets.[8] This is also broadly consistent with Hamilton and Herrera (2004) and Ciner (2013) highlighting that long enough lags are important in structural models, because they allow for a potentially long delay in the effects of oil shocks and help remove serial correlations of residuals. The reduced-form VAR in (2) is consistently estimated by the least-squares method.

3.2 Identification

Following Kilian (2009) and Kilian and Park (2009), I impose the exclusion restrictions on A_0^{-1}, resulting in a recursively identified structural model such that the reduced-form errors

[8] In the Robustness Section, I will consider different values of lag length in the VAR model and show that the key empirical results remain unchanged.

e_t are a linear combination of the structural shocks ϵ_t, i.e. $e_t = A_0^{-1}\epsilon_t$:

$$e_t \equiv \begin{pmatrix} e_{1t}^{\Delta\text{prod}} \\ e_{2t}^{\text{rea}} \\ e_{3t}^{\text{rpo}} \\ e_{4t}^{\text{useu}} \\ e_{5t}^{\Delta\text{stx}} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{bmatrix} \times \begin{pmatrix} \epsilon_{1t}^{\Delta\text{prod}} \\ \epsilon_{2t}^{\text{rea}} \\ \epsilon_{3t}^{\text{rpo}} \\ \epsilon_{4t}^{\text{useu}} \\ \epsilon_{5t}^{\Delta\text{stx}} \end{pmatrix}. \tag{3}$$

The first block of identifying assumptions on A_0^{-1} is based on a vertical short-run supply and downward sloping demand curve in crude oil markets. In other words, oil production does not respond to oil demand innovations within a month because of the high adjustment cost of changing oil production. Global economic activity also does not respond to fluctuations in the real price of oil driven by the oil-market specific demand shock within the given month due to the sluggishness of aggregate economic reaction.

The second block of identifying restrictions on A_0^{-1} implies that U.S. economic uncertainty contemporaneously reacts to the three structural oil shocks, motivated by Bloom (2009) arguing that macroeconomic uncertainty dramatically jumps up after major economic and political shocks. In addition, treating oil price shocks as predetermined with respect to the economy is a standard assumption in an empirical model specification including Lee and Ni (2002) and Kilian and Vega (2011).[9]

The third block of the assumption on A_0^{-1} shows that consistent with Kang and Ratti (2013) and Kang and Ratti (2015), stock returns are ordered after structural oil and U.S. uncertainty shocks. It indicates that the direct impacts of oil shocks on the returns can be amplified by the endogenous response of the U.S. uncertainty.

4 Empirical Results

This section describes the dynamic reaction of world stock returns to structural oil and U.S. economic uncertainty shocks and quantifies their importance in explaining their long-

[9] Kilian and Vega (2011) conduct a formal test of the hypothesis of oil price predetermination and find no compelling evidence of feedback from U.S. macroeconomic variables to monthly changes in oil prices.

term fluctuations. Especially, I highlight the point that the direct effects of oil shocks on stock returns are amplified by the endogenous response of U.S. economic uncertainty. I also examine whether the reaction of stock returns varies across individual countries, which has important policy implications for portfolio adjustments of investors. Lastly, I checks the robustness of the main empirical results with respect to alternative model specification and identification assumptions, as well as to different data measures.

4.1 Responses of Global Stock Returns

Figure 2 illustrates the impulse response of world stock returns and U.S. economic uncertainty to a one-standard-deviation innovation in each of the structural shocks. All the three structural oil shocks have been normalized such that they tend to raise the real price of oil. The solid line represents the point estimates and the upper and lower dash lines refer to plus and minus one-standard-error bands computed using the recursive-design wild bootstrap with 2,000 replications proposed by Gonalves and Kilian (2004).

The first panel of Figure 2 shows that the reaction of global stock returns differs markedly depending on the underlying structural shocks. For instance, an unexpected disruption in world oil production has a statistically insignificant effect on global equity returns. In contrast, an unanticipated expansion in aggregate demand leads to a short-lived rise in world stock returns for the first few months, followed by a persistent decline subsequently. This is because as time elapses, the negative impact of oil price hikes that increase industrial costs and decline consumer demands gradually offsets the initial positive impact of the expansionary shock.[10] An unforeseen rise in oil-market specific demand causes a sustained drop in global stock returns, confirming that stock returns are primarily driven by the demand-side shock in the oil market. These results are broadly in line with the previous studies including Kilian and Park (2009) and Güntner (2014). Lastly, an unexpected increase in U.S. economic uncertainty results in a statistically significant and sizable fall in world stock returns, providing the empirical support of the findings by Bansal and Yaron (2004)

[10] As argued by Hamilton (2009), the initial increase of the stock returns can be attributed to a low short-run price elasticity of oil demand that raises revenues for oil-exporting countries with the increased oil price.

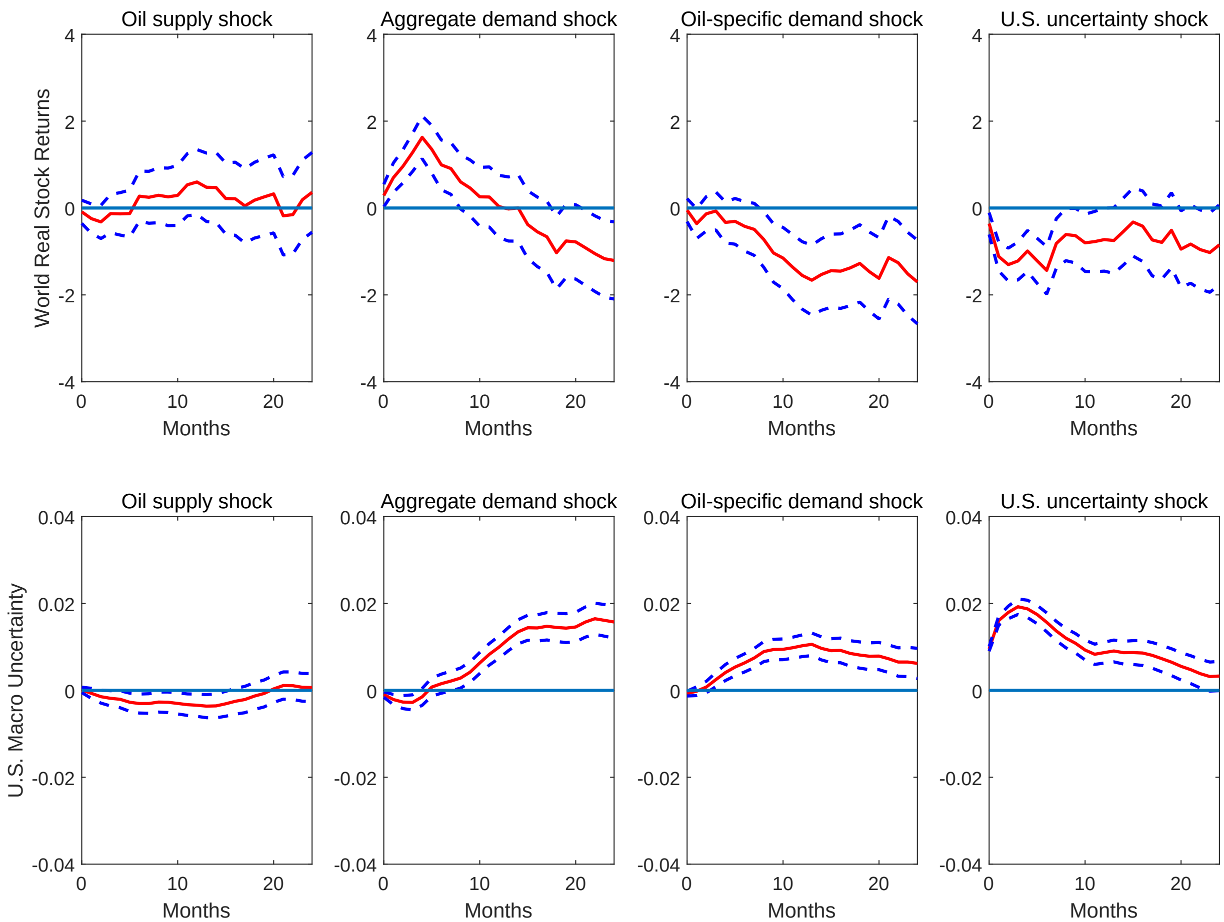

Figure 2: Impulse responses of world stock returns and U.S. economic uncertainty to one-standard-deviation structural shocks

and Bansal et al. (2014).

4.2 The role of U.S. Economic uncertainty

This subsection analyzes the transmission channel of U.S. macroeconomic uncertainty through which oil price shocks affect global stock markets. It is motivated by the previous papers, such as Elder and Serletis (2010), Jo (2014), and Gao et al. (2018), showing that higher volatility in oil prices increases economic uncertainty by postponing firm-level decisions about production and investment.

As plotted in the second panel of Figure 2, oil supply shocks have almost statistically insignificant impacts on U.S. economic uncertainty, whereas oil demand shocks significantly

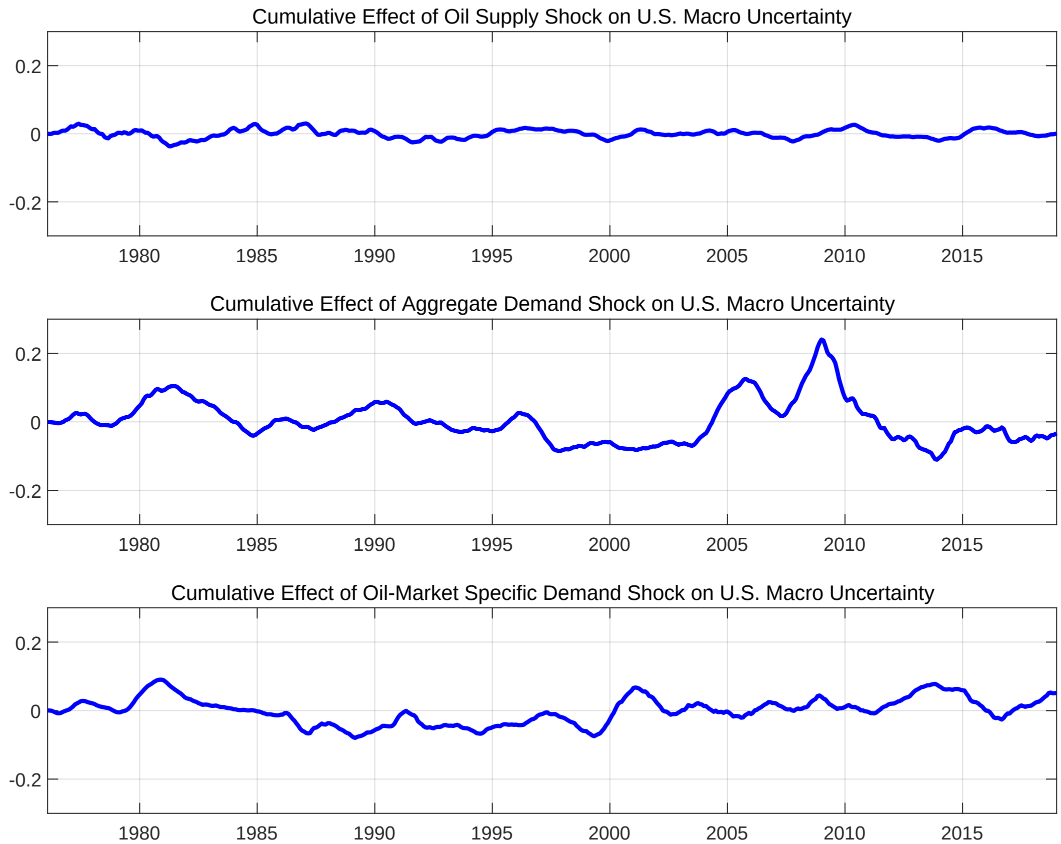

Figure 3: Historical Decomposition of Oil Supply and Demand Shocks to U.S. Economic Uncertainty for 1974–2018

increase the U.S. uncertainty, suggesting that their effects on world equity returns are intensified by its endogenous response. Aggregate demand shocks lead to a transient decline for the first few months, followed by a persistent rise afterwards. In contrast, oil-market specific demand shocks cause a relatively sharp increase in U.S. economic uncertainty for a short-period time, followed by a gradual decline after one year. These results are closely related to their different impacts on the real price of oil, as described in Kilian (2009). Specifically, aggregate demand shocks result in a delayed, but sustained rise in the real price of oil, whereas oil-market specific demand shocks trigger an immediate and substantial increase of the price.

Figure 3 presents the historical decomposition of the impacts of the three structural oil shocks on U.S. economic uncertainty over time. It indicates that oil demand shocks have historically been the main drivers of changes in U.S. macro uncertainty. For example, the buildup in U.S. economic uncertainty between 1999 and 2001 was primarily caused by oil-market specific demand shocks, while its sustained rise followed by the dramatic drop before and after the 2008-09 Global Financial Crisis was driven entirely by aggregate demand shocks. Overall, this finding confirms that the direct effects of oil demand shocks on international stock markets are amplified by the endogenous response of the U.S. uncertainty.[11]

4.3 Variance Decompositions

I compute the forecast-error variance decomposition to quantify the fraction of variations in U.S. economic uncertainty and world stock returns attributed to each of the structural shocks. Table 1 shows the results. For U.S. macro uncertainty, the short-run effect of oil shocks is relatively small, but their explanatory power increases significantly as forecasting horizons are lengthened. In the long-run, 68% of the variability in U.S. economic uncertainty is accounted for by the three structural oil shocks, suggesting that shocks in global oil markets are a critical determinant of the U.S. uncertainty. Especially, oil demand shocks are much more important than oil supply shocks: Aggregate demand and oil-market specific demand shocks explain 47% and 17% of the long-term fluctuation in U.S. economic uncertainty, respectively, whereas oil supply shocks explain only 2%.

For world equity returns, the short-run effects of aggregate demand and U.S. economic uncertainty shocks are relatively greater than the other structural oil shocks, explaining about 6% at the first 6 month, respectively. As the forecasting horizon increases, the explanatory power of aggregate demand and U.S. macro uncertainty drops a bit and then rebounds gradually in the medium term (3 years), while the contribution of oil-market specific demand shocks continues to increase over time. However, oil supply shocks have little effects on world stock returns throughout the whole forecasting horizons. In the long-run, oil shocks and U.S. economic uncertainty account for 17% and 6% of the variation in global

[11] Various transmission channels exist through which oil prices affect real economic activity and increase macroeconomic uncertainty. Typically, oil shocks have negative supply effects on oil-importing firms by increasing industrial costs, and also cause a dramatic reduction in consumer demand by declining disposable income. Extending the seminal work by Lee and Ni (2002), Jo et al. (2019) recently show that oil price shocks mainly influence the U.S. industrial activity through demand side effects, rather than supply side, by analyzing sectoral responses to oil shocks.

Table 1: Variance Decomposition of U.S. Economic Uncertainty and World Stock Returns

Horizon	Oil Supply Shock		Aggregate Demand Shock		Oil-market Specific Demand Shock		U.S. Economic Uncertainty Shock	
Panel A. U.S. Economic Uncertainty								
1	0.000	(0.02)	0.010	(0.60)	0.006	(0.50)	0.984	(44.93)
6	0.010	(0.39)	0.013	(0.61)	0.030	(0.97)	0.947	(21.45)
12	0.021	(0.54)	0.050	(1.22)	0.152	(1.98)	0.772	(8.71)
24	0.018	(0.51)	0.355	(3.18)	0.187	(2.14)	0.429	(4.15)
36	0.015	(0.40)	0.458	(3.60)	0.166	(1.91)	0.338	(3.34)
48	0.016	(0.40)	0.475	(3.69)	0.164	(1.88)	0.322	(3.20)
60	0.017	(0.44)	0.478	(3.72)	0.163	(1.87)	0.317	(3.18)
120	0.019	(0.46)	0.471	(3.65)	0.168	(1.88)	0.317	(3.20)
Panel B. World Real Stock Returns								
1	0.001	(0.05)	0.005	(0.39)	0.001	(0.02)	0.008	(0.56)
6	0.002	(0.11)	0.064	(1.34)	0.003	(0.18)	0.059	(1.34)
12	0.003	(0.14)	0.038	(0.94)	0.021	(0.53)	0.045	(1.01)
24	0.004	(0.10)	0.029	(0.74)	0.055	(0.74)	0.033	(0.62)
36	0.004	(0.09)	0.046	(0.74)	0.075	(0.84)	0.041	(0.59)
48	0.004	(0.09)	0.058	(0.73)	0.082	(0.85)	0.053	(0.64)
60	0.003	(0.07)	0.071	(0.76)	0.084	(0.84)	0.058	(0.65)
120	0.002	(0.04)	0.084	(0.68)	0.090	(0.74)	0.055	(0.58)

Note: The values in parentheses represent the absolute t-statistic when coefficients' standard errors are generated using a recursive-design wild bootstrap.

stock returns, respectively. In particular, almost all of that contribution made by oil shocks come from oil demand shocks, rather than oil supply shocks: Aggregate demand and oil-market specific demand shocks explain 8% and 9% of the long-term fluctuation in global stock returns, respectively.

4.4 Responses of Individual Stock Markets

I investigate whether there exist heterogeneous effects of structural oil shocks and U.S. economic uncertainty on stock markets across countries. This analysis provides global investors with important policy implications for appropriate portfolio adjustments depending on the nature of different structural shocks.

Figure 4 and 5 show that investors greatly benefit from constructing a portfolio with more weights on stocks of net oil-exporting countries in response to oil demand shocks. Consistent with Wang et al. (2013) and Güntner (2014), the positive impact of aggregate

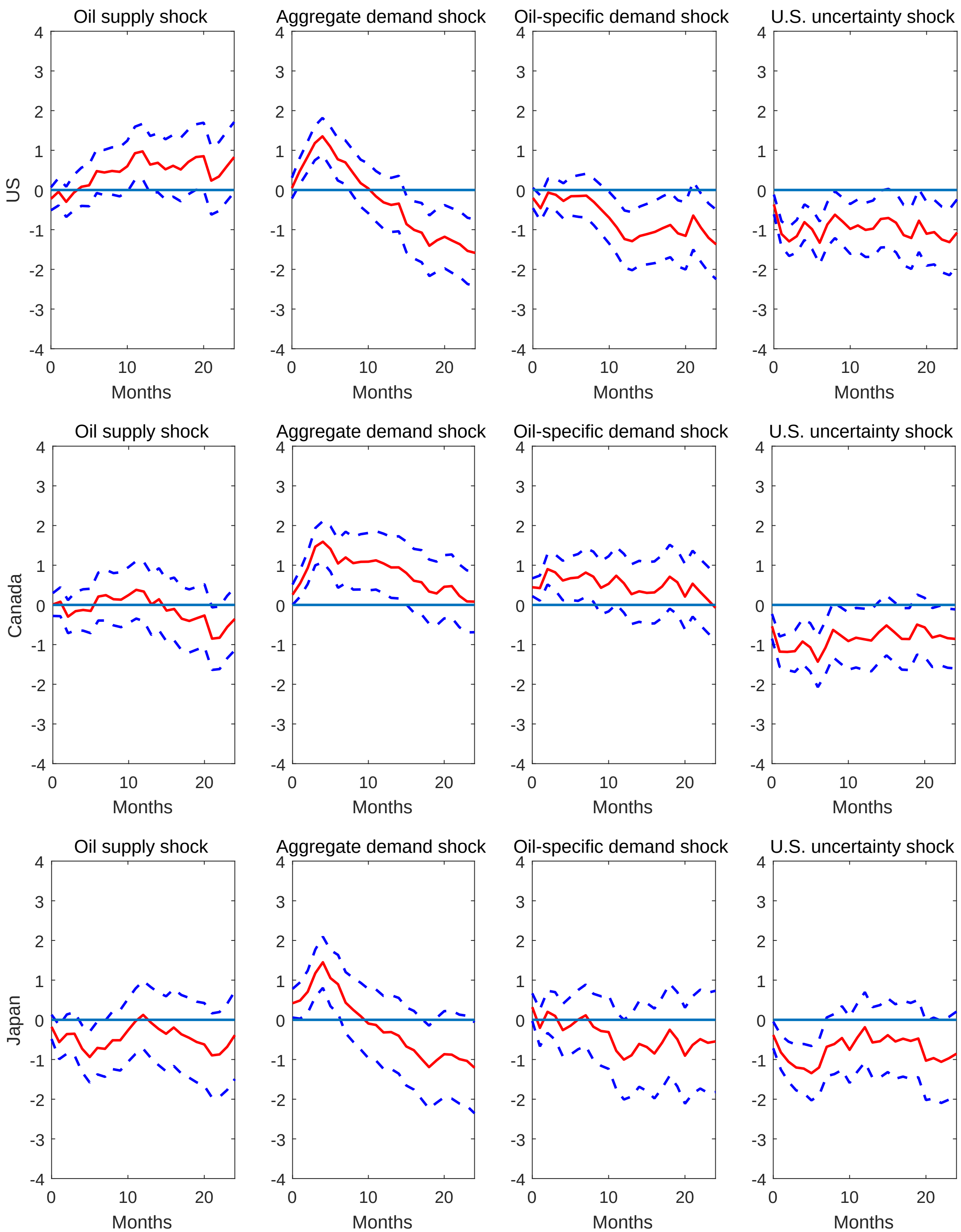

Figure 4: Cumulative Stock Return Responses to One-standard-deviation Structural Shocks for U.S., Canada, and Japan: Point Estimates with One-standard Error Bands

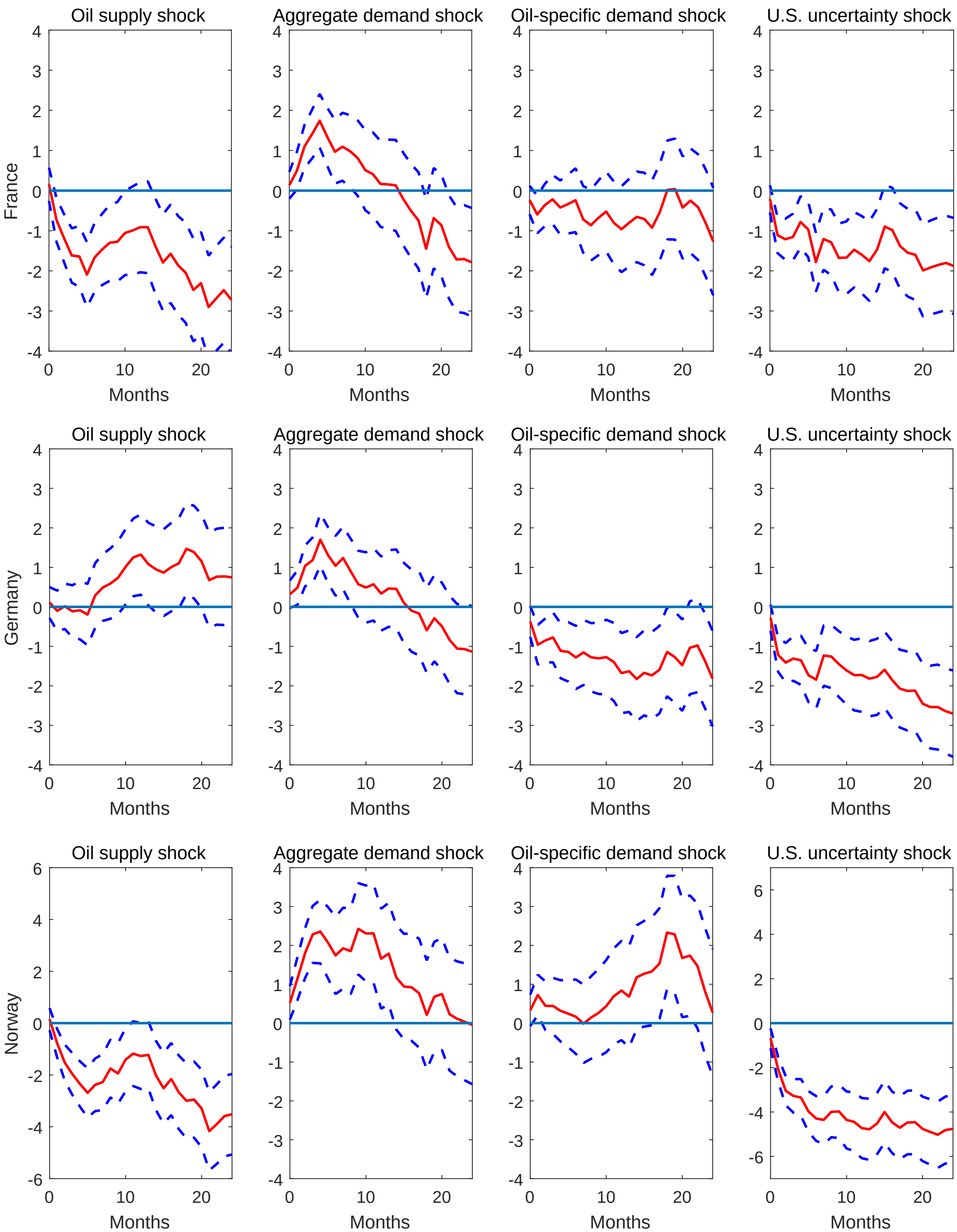

Figure 5: Cumulative Stock Return Responses to One-standard-deviation Structural Shocks for France, Germany, and Norway: Point Estimates with One-standard Error Bands

demand shocks on equity returns in net oil exporters such as Canada and Norway are larger and more persistent than those in net oil importers such as Japan and Germany. This is because higher oil prices driven by unexpected expansions in global real economic activity generate more income for net oil-exporting countries. In addition, oil-market specific demand shocks broadly have negative effects on stock returns in net oil-importing countries, whereas they cause a sustained rise of the returns in net oil-exporting countries.

Moreover, the magnitude and even direction of the stock return response to oil supply shocks differ across individual countries, suggesting that a well-diversified portfolio can be obtainable. Specifically, they lead to a substantial and persistent negative decline in stock markets in France and Norway, a relatively moderate drop in Canada and Japan, and a delayed increase in the U.S. and Germany. Hence, these results imply that mixing stocks in a variety of developed countries can effectively reduce the oil price risk caused by oil supply shocks through diversification.

Lastly, shocks to U.S. economic uncertainty generally have negative impacts on all developed stock markets, but the magnitudes vary across countries. For instance, the negative impacts of the U.S. uncertainty on European stock markets, such as France, Germany, and Norway, are greater than Canada and Japan. This indicates that investors need to construct relatively more defensive portfolio strategies on European stock markets in response to unanticipated shocks to U.S. macro uncertainty.

4.5 Robustness Checks

This section explores the robustness of forecast-error variance decomposition of global stock returns with respect to alternative model specification and identification assumptions, as well as to different data measures. First, I consider a shorter lag length set to be $p = 12$ in the model. Second, I examine an augmented model with an additional variable of the TED spread, which is commonly used as the proxy variable for global interest rate movements reflecting variations in global credit risks and capital flows that may not be fully captured in the benchmark model.[12] Third, I examine a different recursive ordering restriction in

[12] Following Basher et al. (2012), I order the TED spread after oil price and U.S. economic uncertainty variables and before world stock return variable.

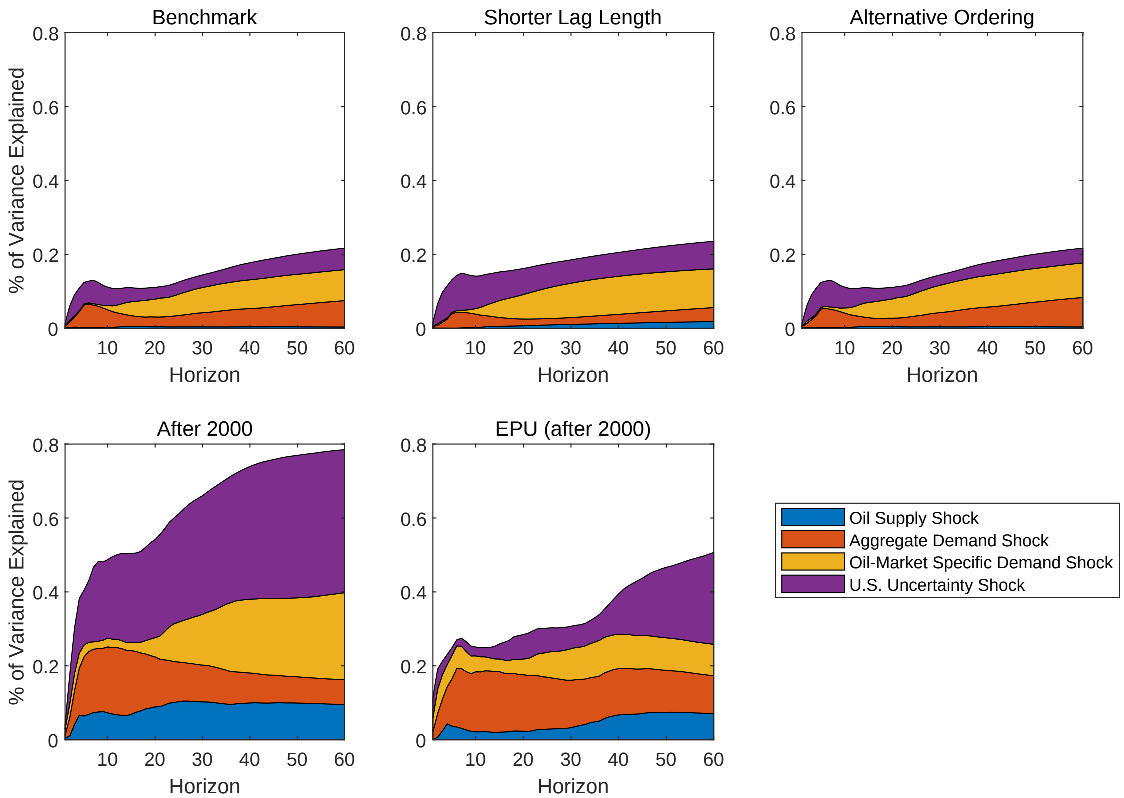

Figure 6: Sensitivity Analysis: Variance Decomposition of Global Stock Returns

the model, i.e. $y_t = (useu_t, \Delta prod_t, rea_t, rpo_t, \Delta stx_t)$. Under this alternative identification scheme, U.S. macro uncertainty has contemporaneous impacts on oil prices, but oil shocks are assumed not to affect the U.S. uncertainty instantaneously.[13] Fourth, I investigates whether the role of structural oil shocks and U.S. economic uncertainty has changed in recent years in explaining fluctuations in world stock returns. Lastly, I examine the sensitivity of different measures of the U.S uncertainty by using the EPU index developed by Baker et al. (2016).

As shown in Figure 6, the results are found to be robust with respect to changes in model specification and identification. With a shorter lag length in the model, the contribution of oil-market specific demand shock and U.S. economic uncertainty increases moderately in the medium and long run, while aggregate demand shocks gain a bit less importance. When the different ordering restriction is imposed, U.S. macro uncertainty and aggregate demand

[13]The assumption seems to be quite reasonable due to the fact that the U.S. has historically been a major consumer of oil, even though it has emerged as the largest producer of oil in recent years with the dramatic increase in shale oil production.

shocks become marginally less important, but there are no major changes in the relative importance of structural shocks. However, I find that the effects of structural oil shocks and U.S. economic uncertainty increase substantially after 2000, explaining 40% and 39% of the long-run variation in global stock returns, respectively. Consistent with Ewing et al. (2018), oil supply shocks also become more important, accounting for more than 9%. In particular, the contribution of oil-market specific demand shocks increases considerably, explaining more than 28%. Their increased importance is closely associated with the fact that commodity futures have become a popular asset class for investors since the early 2000s with a large inflow of investment capital to their markets, the so-called "financialization" of commodity markets as described in Cheng and Xiong (2014) and Henderson et al. (2015). Moreover, the U.S. economic uncertainty gains more importance due to the increased economic and financial integration of the U.S. economy with the rest of the world as highlighted by Kose et al. (2017). These results suggest that oil market fundamentals and U.S. economic uncertainty are an important determinant of global stock market movements. Lastly, notice that when the measure of the U.S. uncertainty is replaced by the EPU, the role of structural oil shocks and U.S. uncertainty declines compared with the results in the fourth experiment, indicating the importance of using the U.S. economic uncertainty index of Jurado et al. (2015).[14]

5 Conclusion

This paper examines the impacts of oil shocks and U.S. macro uncertainty on global stock markets. The key findings have important implications for portfolio strategies of investors. First, the reaction of world stock returns differs greatly depending on the underlying structural shocks. For instance, aggregate demand shocks cause a short-lived increase in world stock returns for the first several months, whereas oil-market specific demand and U.S. economic uncertainty shocks reduce the returns. Second, the heterogeneous effects of the structural oil and U.S. economic uncertainty shocks on individual stock markets suggest that a well-diversified portfolio can be obtainable. Third, variance decomposition analysis

[14]The last experiment is implemented after 2000 because the U.S. EPU data is not available until 1985, so that it needs to be compared with the fourth experiment in which the model is estimated on post 2000 data.

implies that the role of structural oil shocks and U.S. economic uncertainty has become more important since 2000, explaining 40% and 39% of long-run variations in world stock returns.

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