Revisiting the Impact of Oil Price Shocks on Macroeconomic Performance: An International Perspective*

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Abstract

Dramatic fluctuations in oil prices from time to time demand more research that can evaluate the impact of oil price shocks across the globe. Using a large-scale structural vector autoregression (SVAR) model that allows for an evolving parameter structure and that covers 60 oil-importing and -exporting economies, this paper disentangles the direct and indirect effects of oil price shocks on an economy. The results based on changes in oil prices and oil prices decomposed into aggregate demand, oil-specific demand and oil supply shocks show that in addition to the often measured direct impact, the indirect multiplier impact that works through the international transmission mechanism plays a crucial role in explaining the impact of oil price swings. The negative effects of a sharp rise in oil prices on oil importers are likely to be offset by the positive impact on oil exporters. Nevertheless, oil exporters may also suffer in the long run given a surge in oil prices.

JEL Classification: F41; F44; O19; Q43

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1 Introduction

The relationship between oil price shocks and macroeconomic performance has been a topic of interest since at least the first oil crisis in 1973. Recent dramatic fluctuations in oil price have rekindled interest in assessing the worldwide impact of oil price shocks. This is all the more interesting because, unlike the ensuing recessions caused by oil price hikes in the early 1970s, the impact of oil price fluctuations now appear to be subdued. This demands an investigation into the global impact of oil price fluctuations at a highly disaggregated level.

Given the steady increase in trade and financial integration, we expect the movements of oil price to affect the global economy through two channels. First, shocks in the crude oil market should have a *direct* impact on different economies. In this regard, it is useful to distinguish between net oil importers and net oil exporters. For the net oil importers, the lower oil prices lead directly to a drop in the oil cost and a rise in real income. At the firm level, the lower oil prices trigger a decline in production cost especially where oil or oil products are a major input in the production process. This further translates into lower goods and services prices. At the household level, lower oil prices lower the cost of living, leading to an increase in real incomes and a higher level of spending, hence greater growth for the economy. The magnitude of this lower oil price impact depends on the industry structure and the degree of oil dependence in each country. For the net oil-exporting countries, price falls in the crude oil market lead directly to a decline in their oil revenue. It further drags down government spending and other economic activities that rely highly on oil revenue. An exogenous oil price decline is therefore redistributive from an international perspective. At the global level, the windfall gains of oil importers are the losses of oil exporters. Overall, oil prices have different dynamic effects on different types of countries and therefore have a complex total impact on the global economy.

But the direct channel above is not the end of story. Oil price fluctuations also have an impact on the global economy through an *indirect* multiplier channel. Over the past thirty years, globalization and trade and financial integration across countries has led to the emergence of a common business cycle at the global and country group levels (e.g., Kose et al., 2003, 2008, 2012; Stock and Watson, 2005). Therefore, the redistributive global impact of oil shocks transmit across countries through these cross-country linkages. For example, a lower oil price boosts the growth of the US, which in turn, triggers an expansion of the demand for exports from Mexico, which is a net oil exporter. The indirect multiplier channel, along with the direct channel, provides a comprehensive pattern of the impact of oil price shocks at a global level. There is, however, not much research along these lines directly disentangling these two effects.

Conventional wisdom suggests that trade linkages and financial linkages are two main channels that generate the commonality of economic activities in the world. To link all the major economies and investigate dynamic interdependence among them, we implement a trade-linked structural vector-autoregressive (SVAR) model with realistic identification restrictions. More specifically, we utilize bilateral-export flows to construct a worldwide dynamic interdependence system, connecting national output growth across a large country set (60 economies), over a long time span (1985-2014).[1] The trade interdependencies are used to directly restrict parameter values in the SVAR. The global VAR model adopted by Dees et al. (2007) among others can be considered as a generalization of our method. Compared to the conventional global VAR model, we adopt a more realistic identification scheme but only focus on the GDP growth interactions across countries, which is of major interest of this paper.[2] Our country set contains both world major oil importers and exporters. We are particularly interested in the time period from 1985 to 2014 because this is the era when the remarkable globalization process takes place (Kose et al., 2012). The method, along with a comprehensive data set, allows us to construct a large-scale global dynamic interdependency system and explicitly disentangle the direct bilateral and indirect multiplier effects of interest in this paper.[3]

Our empirical section quantifies the dynamic profiles of direct and indirect impact of crude oil price fluctuations on growth performance of different types of economies. The results show that both the direct effect and indirect multiplier effect play important roles in explaining the impact of oil price swings on growth of the economies. Therefore, the overall effect of oil price movements on each economy depends not only on the country type, net oil exporter or importer, but also on the underlying international interdependency structure of the country and its network. Our results show that, through the cross-country indirect multiplier effect, the negative effects of an increase in oil prices on a net oil importer are likely to be offset by the increasing external demand of oil producers. Although the higher oil prices may benefit oil producers in the short run, they may also lose in the long run.

As the literature demonstrates, it is also important to account for the endogeneity of oil price changes and to differentiate between the effects of demand and supply shocks in energy markets when attempting to assess the macroeconomic impact of oil price shocks. We expect oil price fluctuations driven by demand and supply shocks to have distinct effects through the direct and indirect multiplier channels, which we cover in the second part of the study. We adopt the methodology introduced in Kilian (2009) and decompose the movements of oil prices into three structural shocks: (1) crude oil supply shocks (oil supply shocks), (2) shocks to the demand for all industrial commodities in the global market (aggregate demand shocks), and

[1] We use the trade linkage, instead of financial linkages, to construct our model due to the data limitation. Kubelec and Sá (2010) provide a pioneer work on constructing bilateral financial data, covering 18 major economies. However, their data set is still too narrow for a global analysis. However, Glick and Rose (1999) and Forbes (2002) both make the point that trade linkage is highly correlated with other cross-country linkages. Van Rijckeghem and Weder (2001) show high correlation between trade and financial linkages in a series of tests.

[2] Abeysinghe and Forbes (2005) provides the economic foundation for the identification of this modeling method. Meanwhile, we also experiment with both export and import share to construct our model, which follows the literature of global VAR. Our empirical results are in general robust to this alternative modeling strategy. Note also that bilateral exports capture the imports at the receiving end.

[3] Our econometric framework can be easily applied to investigate the direct and indirect macroeconomic impacts of price fluctuations in other international exchange commodities.

(3) demand shocks that are specific to the global crude oil markets (oil-market specific demand shocks). Our findings show substantial distinct macroeconomic impact of oil price shocks corresponding to different sources, confirming the importance of understanding the roots of oil price shifts. Notably, the negative impact of oil price increases elicited by aggregate demand shocks on major industrial countries can be largely canceled out by the booming global economy captured by the indirect multiplier channel. Precautionary oil shocks may give a boost to the major oil exporters at the beginning, but oil importers may suffer. In the long run, most countries, even the oil exporters, cannot escape from the negative oil impact operating through the indirect multiplier channel.

The findings of this study have clear implications for policymakers evaluating oil price impacts on different economies. For example, for a small open economy and net oil exporter, an increase in oil price is not necessarily beneficial in the long run. The higher oil revenue is likely to be canceled out through the channel of weak demand of its trading partners. Furthermore, not all oil price shocks are alike. The underlying source of oil price movement plays a crucial role in determining the direct and indirect impact of oil shocks. This further cautions the policy makers on the importance of understanding the roots of the shift in oil prices.

The rest of the paper is organized as follows. Section 2 reviews the existing literature and discusses how this paper complements the current research. Section 3 introduces our trade-linked SVAR model, which helps us to disentangle the direct and indirect effect of oil price movements. In this section, we also explain the data set and estimation strategy. Section 4 presents the empirical results based on the international transmission mechanism we trace out in this paper. Section 5 further decomposes the oil price and investigates the direct and indirect macroeconomic impact under different underlying sources of the oil price shift. Section 6 concludes.

2 Relation to the Literature

Our paper mainly relates to three strands of studies. The first strand is concerned with macroeconomic consequences of oil price shocks. Among the numerous research, the seminal work by Hamilton (1983) concludes that almost all recessions in the US have been preceded by a spike in oil prices, implying an essential role for oil price increases as one of the major causes of recessions. Blanchard and Gali (2007) use a structural VAR model to evaluate the macroeconomic effects of oil shocks and show that the effect of oil price shocks on output and inflation is more muted after 1984 than it was in the post-war period. Recent research along this line further shed lights on identifying oil supply and demand shocks (e.g. Hamilton, 2003; Kilian, 2008a,b, 2009; Peersman and Van Robays, 2012), investigating the nonlinear effects (e.g. Baumeister and Peersman, 2013; Zhang, 2008), and examining more disaggregate oil impacts on financial market, firm investment, household consumption, and etc.(e.g. Broadstock et al., 2012, 2016; Cheng et al., 2019; Stern and Enflo, 2013; Zsuzsanna et al., 2016; Zhang et al., 2017; Ji et al., 2018, 2019). One common feature of these studies is that they focus on one particular country or utilize a country-by-country analysis to investigate the oil impact on some country groups, and do not account for the interplay across the economies.

Our paper also relates to a second strand of research that investigates the international transmission mechanism and the world business cycle. Kose et al. (2003) employ a Bayesian dynamic latent factor model to study the common dynamic properties of business-cycle fluctuations in a 60-country sample, providing evidence of a world business cycle. Stock and Watson (2005) use a structural factor VAR to identify common international shocks. Kose et al. (2008) and Kose et al. (2012) further evaluate the evolution of this world business cycle as well as macroeconomic comovements within different regions or country groups. Abeysinghe and Forbes (2005) focus on the Asian financial crisis, studying the transmission mechanism through trade links. Canova et al. (2007) study the dynamics and cross-country interdependencies in G-7 countries. Dees et al. (2007) use a global VAR model to investigate the impact of external shocks on the euro area economy. Mumtaz and Surico (2009) examine the dynamic effects on the UK economy given an unanticipated shock in the rest of the world, by extending a Factor-Augmented VAR approach to the open economy. This literature stresses that globalization spurs rising production, trade, and financial integration across countries and generates a common business cycle at global and country-group levels. Therefore, understanding this international transmission of national structural shocks is crucial for academic discussion as well as for designing best policy responses to international developments.

Recent studies start to use a modelling approach which captures the complicated patterns of global economic interactions, taking into account not only the direct exposure of countries to the shocks but also the indirect effects through secondary or tertiary channels. Cashin et al. (2014) investigate the differential effects of oil demand and supply shocks on the global economy (using a multi-country model including 50 countries), and study the time profile of their macroeconomic effects across a wide range of countries. Mohaddes and Pesaran (2016) identify and investigate the global macroeconomic consequences of country-specific oil-supply shocks within a compact model of the global economy (including 34 countries). Mohaddes and Pesaran (2017) investigate whether the most recent oil price shocks are different than the ones observed in the past at the country and global levels in terms of GDP, inflation, interest rates and equity prices.

This paper connects first two strands of literature and complements the recent research by explicitly disentangling the direct impact of oil shocks on the world's major economies, and the indirect multiplier impact of oil shocks transmitted through international linkages. A search of the literature shows that only two published papers have investigated the topic along similar lines. Abeysinghe (2001) provides a leading work with a focus on the oil exporters in ASEAN and Korhonen and Ledyaeva (2010) pay particular attention to Russia. Our study advances these two papers by not only extending to a global analysis, but also by investigating the different types of oil shocks.

3 Decomposition of the Global Oil Price Impacts

3.1 An Open Economy Structural VAR

To identify both the direct and indirect impact of oil price movements, we need to link all the major economies and construct a worldwide dynamic interdependency system. Therefore, in this section, we first introduce a structural vector autoregression (SVAR) model with a realistic identification scheme to trace out the international transmission mechanism of national macroeconomic movements across the world. The large-scale SVAR method adopted in this paper builds on the work of Abeysinghe and Forbes (2005), and Abeysinghe and Yifan (2018). Abeysinghe and Forbes (2005) provides the economic foundation for the identification of this modeling method. This method simultaneously equates output supply and demand across trading partners, leading to the model:

$$(B_0 \cdot W_t)y_t = \lambda + (B_1 \cdot W_{t-1})y_{t-1} + ... + (B_p \cdot W_{t-p})y_{t-p} + \varepsilon_t, \tag{1}$$

where y_t is an (n×1) vector of GDP growth series, B are unknown (n×n) parameter matrices, and ε_t is an (n×1) vector of structural shocks. W_t is a known matrix of weights made up of bilateral export shares. The notation of '·' indicates the Hadamard product giving the element-wise product of two matrices. The diagonal terms of $B \cdot W$ measure persistence of domestic growth shocks, and the off-diagonal terms measure the degree of sensitivity to external growth shocks for each country. We denote the bilateral export share from country i to country j as w_{ijt} at time t.[4] For $n = 3$ and $p = 1$, the parameter matrices take the form:

$$B_0 = \begin{pmatrix} 1 & -\beta_{01} & -\beta_{01} \\ -\beta_{02} & 1 & -\beta_{02} \\ -\beta_{03} & -\beta_{03} & 1 \end{pmatrix}, B_1 = \begin{pmatrix} \phi_{11} & \beta_{11} & \beta_{11} \\ \beta_{12} & \phi_{22} & \beta_{12} \\ \beta_{13} & \beta_{13} & \phi_{33} \end{pmatrix}, W_t = \begin{pmatrix} 1 & w_{12t} & w_{13t} \\ w_{21t} & 1 & w_{23t} \\ w_{31t} & w_{32t} & 1 \end{pmatrix}.$$

Note that one important feature of this model is that the effective parameter matrices $B_p \cdot W_{t-p}$ change over time, which is essential to capture the time-varying nature of cross-country linkages and the vast movement of the economic landscape.[5]

The system in (1) can be easily extended to a structural VARX model to account for the impact of

[4] Bilateral export shares add up to unity such that $\sum_{j=1}^{n} w_{ijt} = 1, i \neq j$.

[5] Abeysinghe and Yifan (2018) show that this method can largely recover the dynamic properties of the world business cycle (Kose et al., 2003, 2012) and capture the transmission mechanism across countries.

exogenous variables. With oil prices or their extracted shock components, the structural VARX model can be written as follows:

$$(B_0 \cdot W_t)y_t = \lambda + (B_1 \cdot W_{t-1})y_{t-1} + ... + (B_p \cdot W_{t-p})y_{t-p} + \Gamma_0 X_t + ... + \Gamma_q X_{t-q} + \xi_t, \tag{2}$$

where X_t is an $(n \times 1)$ vector of oil price series or oil price shocks, q is the lag order of lag term and Γ's are diagonal matrices, measuring the sensitivity of the macroeconomic aggregates to oil price movements, and ξ_t is the structural shock.

After estimating the structural VARX model, we can derive the impulse responses of output growth with respect to changes in X_t from

$$y_t = \lambda^* + R(L)X_t + u_t, \tag{3}$$

where $R(L) = B^w(L)^{-1}\Gamma(L)$, $B^w(L) = (B_0 \cdot \ W_t) - (B_1 \cdot W_t)L - ... - (B_p \cdot W_t)L^p$, and $\Gamma(L) = \Gamma_0 + \Gamma_1 L + ... + \Gamma_q L^q$. For country i, the iith diagonal element of $R(L)$ provides the direct impact of oil prices on growth and the ij $(j = 1, 2, ..., n-1; i \neq j)$ off-diagonal terms provide the indirect oil impact through the $(n-1)$ trading partners. In other words, the direct effect is estimated by assuming there is no impact of oil shocks on foreign countries in the system. The indirect effect is estimated by assuming oil shocks only have impacts on an economy through the impacts on its trading partners.

The method we adopt has three appealing features: First, it can handle a large-scale VAR model without running into the curse of dimensionality. Second, it utilizes economic theory to develop a realistic identification scheme, without having to adopt purely statistical methods such as recursive identification schemes as is frequently done in the VARX literature. Third, it allows cross-country relationships to evolve over time and renders a changing parameter structure to the model. This is particularly important in assessing the impact before and after a crisis that usually requires a split-sample analysis which is often not possible due to reduced sample sizes.

3.2 Data

Although the structural model (2) requires only three sets of variables, GDP growth for each country (y_i), export shares linking each pair of counties (W) and a measure of oil price (o), it is not trivial to compile consistent time series data for the sample we consider. This section summarizes the key characteristics of this data set, and the Appendix describes the compilation process in detail.

The data set includes 60 economies with quarterly data for the period running from 1985 to 2014. The

Table 1: Country List

Industrial	Emerging	Other Developing Countries
Australia	Argentina	Bangladesh
Austria	Bahrain, Kingdom of	Cameroon
Canada	Brazil	Congo, Republic of
Denmark	Chile	Cote d'Ivoire
Finland	China, P.R.: Hong Kong	Cyprus
France	China, P.R.: Mainland	Ghana
Germany	Colombia	Guyana
Greece	Egypt	Iran, Islamic Republic of
Iceland	India	Kenya
Ireland	Indonesia	Malta
Italy	Korea, Republic of	Mozambique
Japan	Malaysia	Nigeria
Netherlands	Mexico	Pakistan
New Zealand	Morocco	Saudi Arabia
Norway	Peru	Senegal
Portugal	Philippines	Sri Lanka
Spain	Singapore	Tunisia
Sweden	Thailand	Uruguay
Switzerland	Turkey	Zambia
United Kingdom		Zimbabwe
United States		

Notes: Country classification is based on the IMF Database.

choice of the starting date reflects our desire to maximize the sample length while considering as many countries as possible.[6] The country set contains not only most of the industrial countries and emerging market economies, but also the major developing countries since they are highly involved in the globalization process. Table 1 reports the country set. In total, they accounted for 89 percent of world GDP in 2014.

The GDP growth is computed as $y_{it} = \Delta \ln(Y_{it})$, where Y_{it} is the seasonally adjusted real GDP of country i, at time t. For export shares we use the bilateral flows of merchandise exports between the countries. We calculate the export-share matrix (W_t) as a 12-quarter moving average of export shares to allow for the export-share matrix to vary smoothly over time. Although a constant W matrix would simplify the data requirement and model estimation, this is not realistic since trade patterns change significantly over the long time period under consideration.

For the oil price series, we use the US dollar spot price of Brent crude oil, which is denoted by O_t. We convert the original monthly data to the quarterly frequency by taking the average. The oil price series is expressed in terms of oil price inflation as $X_t = \Delta \ln(O_t)$. We also experiment with a number of alternative measures of oil prices, for example $x_{it} = \Delta \ln(O_t \cdot E_{it})$ and $x_{it} = \Delta \ln(O_t \cdot E_{it}/P_{it})$, where E_{it} is the exchange

[6] In addition, this is also the period when remarkable globalization takes place (Kose et al., 2012). Also, several research papers (e.g. Blanchard and Gali, 2007; Mork, 1989) report a structural break of oil price impact on macroeconomic performance around the mid 1980s. This is often attributed to the collapse of the OPEC cartel, the decrease of real wage rigidities, the decline of oil dependence and the start of the Great Moderation.

rate of country i against the US dollar and P_{it} is the CPI of country i, at time t. Since the changes in oil prices are so dominant that the above conversions do not have much effect on the variation in oil prices, preliminary estimates based on these measures show similar results.[7] To save space, we report the empirical results with the first measure.

4 Response Estimates in the Baseline Model

As a baseline case, in this section, we investigate the direct and indirect multiplier impacts of an oil price shock, and in Section 5, we will consider demand and supply shocks separately. It is useful to have such a baseline scenario for a comparison because the separation of oil price shocks into demand and supply components depends on the efficacy of the method used. However, we should notice that the baseline results mix the different types of oil price shocks, and may average out the results. After a preliminary analysis of residual autocorrelations, we set lag order $p = q = 4$ to govern the dynamics of the model in (2).[8] We adopt the ordinary least squares (OLS) method to estimate the model.

Note that the direct and indirect multiplier impact is subject to the time-varying trade share matrix W_t, which reflects the changing properties of the global economic landscape.[9] Since our focus is more on recent events we generate impulse responses based on the W matrix on 2014.[10] Although we cover 60 countries in the model, for the sake of brevity and to highlight the key results we present the results only for G-7, China, and the major oil exporters.

4.1 The G-7 Countries and China

Figure 1 summarizes the total impact of a one-standard-deviation (15.5%) increase in oil prices on the growth of the G-7 countries and China, together with 68% and 95% confidence intervals.[11] Figure 2 and Table 2 further decompose this total oil price impact into direct and indirect effects. The numbers reported are the cumulative effects. We represent the short-run effect as the sum of 4 quarters and the long-run effect as the sum of 20 quarters. After 20 quarters, the impulse responses turn virtually negligible. Figure 2 shows the total effect by the red solid line, the direct effect by the yellow dotted line, and the indirect effect by the purple dotted line. We do not report the confidence intervals in Figure 2 to avoid the clutter.

The following major observations emerge from these figures:

[7] The stylized facts discussed in the following section are also robust if we use alternative oil price measures, such as the PPI index for crude oil (used for example by Hamilton (1983) and Rotemberg and Woodford (Rotemberg and Woodford)) or the price of imported crude oil (e.g. Kilian (2009)).

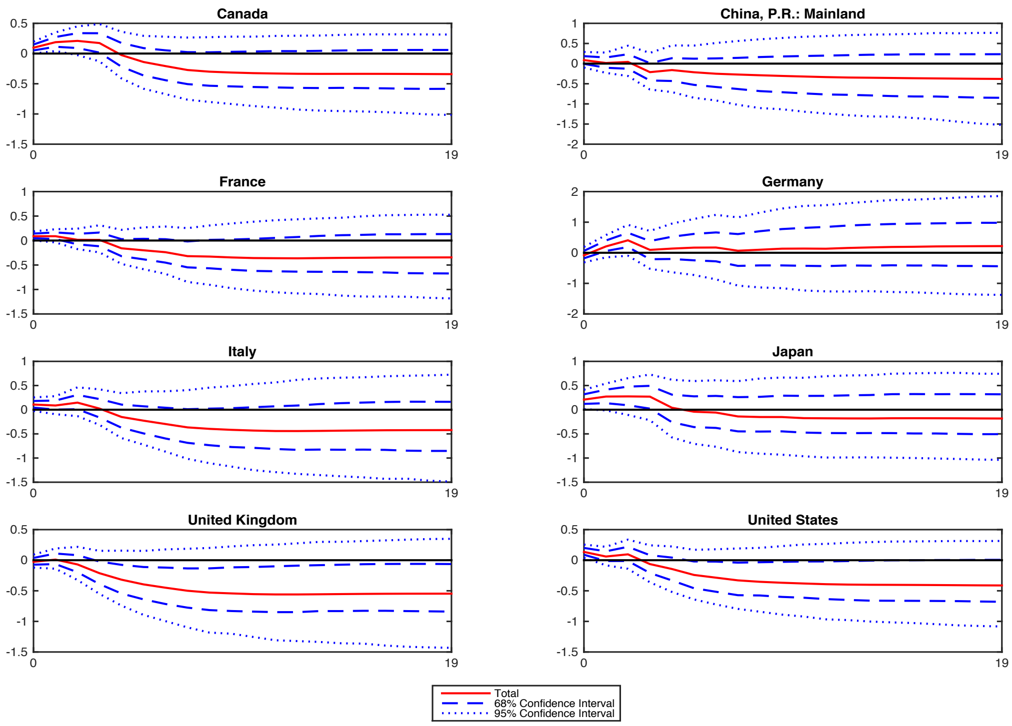
[8] Empirical results are robust to reasonable changes of lag orders.

[9] For example, the world economy today is more likely to be affected by the fluctuations of China's economy compared to thirty years ago.

[10] We rule out the seasonality and the possible structure changes by taking the moving average of 12 quarters.

[11] The confidence intervals are constructed by the standard residual-based recursive-design bootstrap with 1000 replications.

Figure 1. Total Impact of a One-standard-deviation (15.5%) Increase in Oil Prices on the G-7 Countries and China



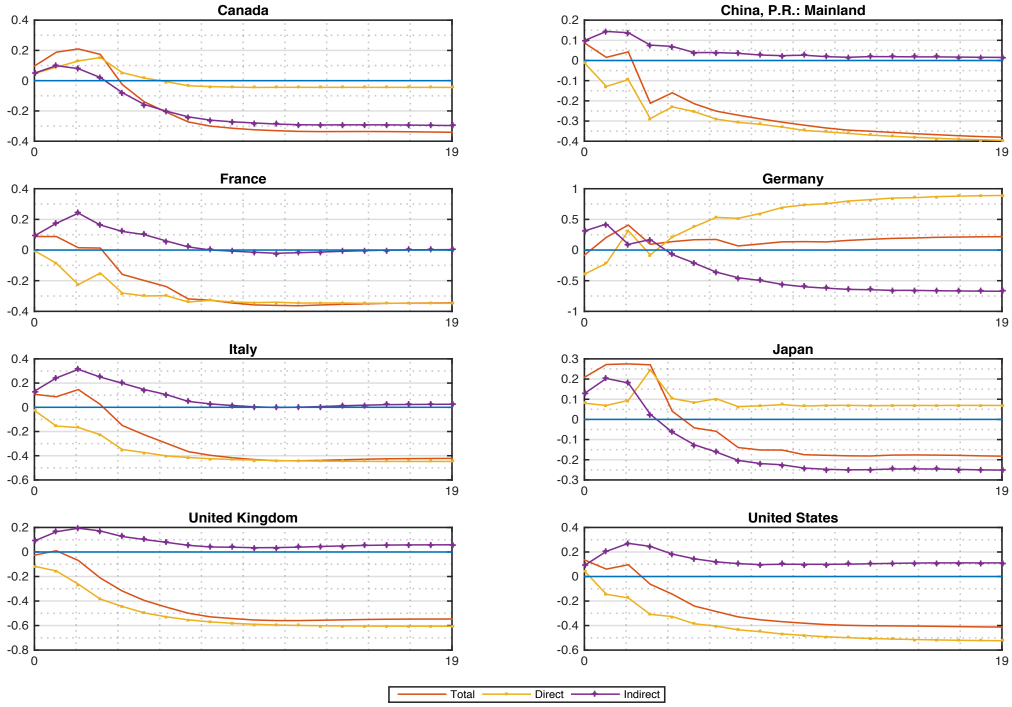
Notes:The plots show the cumulative total impact of a one-standard-deviation (15.5%) increase in oil prices on GDP growth for G-7 countries and China, together with 68% and 95% confidence intervals. Results are reported in percentage points.

1. As expected, the total oil price effect is, in general, negative in the long run. For example, in the long run, a one-standard-deviation increase in oil prices is likely to produce 0.41 percentage points of decline in the US GDP growth. China is the second-largest crude oil importer in the world today. As expected, the total impact of oil price increase on China's growth is also negative. In the long run, the magnitude of this impact is -0.38 percentage points.

2. The direct effect contributes to a large fraction of the total negative oil price impact. With the exception of Germany and Japan, the net oil importers face a negative direct impact from the oil price increase. Compared to the total effect, the negative impact of oil shocks operating through the direct channel is even more severe for the two largest economies, China and the US. This direct effect is stronger in the long run. Canada is a net oil exporter in the G-7 group. Our empirical findings show that, in the short run, the upward movement of oil prices does boost Canada's economy. In the long run, this direct impact is negative but negligible. In general, these findings stay in line with the status of net oil exporter of Canada. The UK is a net importer of non-oil energy. This results in the totally negative impact of oil shock for the UK.[12] The direct positive effect on Germany and Japan is puzzling. Nevertheless, this empirical regularity has been well acknowledged by others in the literature (e.g., Blanchard and Gali, 2007; Peersman and Van

[12]More details about this argument, see Peersman and Van Robays (2012).

Figure 2. Direct and Indirect Impact of a One-standard-deviation (15.5%) Increase in Oil Prices on the G-7 Countries and China



Notes:The plots show the cumulative direct, indirect and total impact of a one-standard-deviation (15.5%) increase in oil prices on GDP growth for the G-7 countries and China. Results are reported in percentage points.

Table 2. Impact of a One-standard deviation (15.5%) Increase in Oil Prices on the G-7 Countries and China

		Direct Impact	Indirect Multiplier Impact	Total Impact
Canada	Short Run	0.12	0.10	0.22
	Long Run	-0.04	-0.59	-0.62
China	Short Run	-0.05	0.05	0.00
	Long Run	-0.22	-0.08	-0.30
France	Short Run	-0.45	0.31	-0.14
	Long Run	-1.58	0.07	-1.51
Germany	Short Run	-0.22	0.46	0.24
	Long Run	-0.52	-0.36	-0.88
Italy	Short Run	-0.15	0.32	0.17
	Long Run	-0.36	-0.57	-0.94
Japan	Short Run	0.19	0.35	0.54
	Long Run	0.16	-0.23	-0.07
United Kingdom	Short Run	-0.28	0.24	-0.05
	Long Run	-0.70	-0.27	-0.97
United States	Short Run	-0.46	0.43	-0.03
	Long Run	-1.07	0.24	-0.83

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.

Robays, 2012). One argument in the literature to explain this positive direct effect is these countries' energy efficiency.[13]

3. The mixed pattern of indirect effects highlights the strength of these economies' trade linkages with each other and also with the net oil exporters outside the group. Because of the international transmission mechanism, for most of oil importers, the critical negative direct impact of an oil price increase can be offset to some extent by the indirect multiplier impact. For example, in the short run, the increase in external demand primarily coming from net oil exporters may provide a 0.25 percentage-point growth impact on the US economy. In the long run, this indirect impact reduces to 0.11 because of the global impact on the net oil exporters. This is evident in the case of Canada, which suffers a -0.30 indirect impact. This large indirect impact is not hard to understand. For example, the US is Canada's primary trading partner. The higher oil price first drags down the US growth and subsequently the Canadian economy as well. Similar to Canada, we document -0.67 and -0.25 percentage-point indirect long-run impact for Germany and Japan, respectively. This suggests that these two countries are sensitive to the world business cycle, and a rise in oil prices can largely drag down their economies through their external linkages. In short, it is evident that the indirect multiplier impact plays a critical role in generating the global impact of oil price shift.

4.2 Oil Exporters

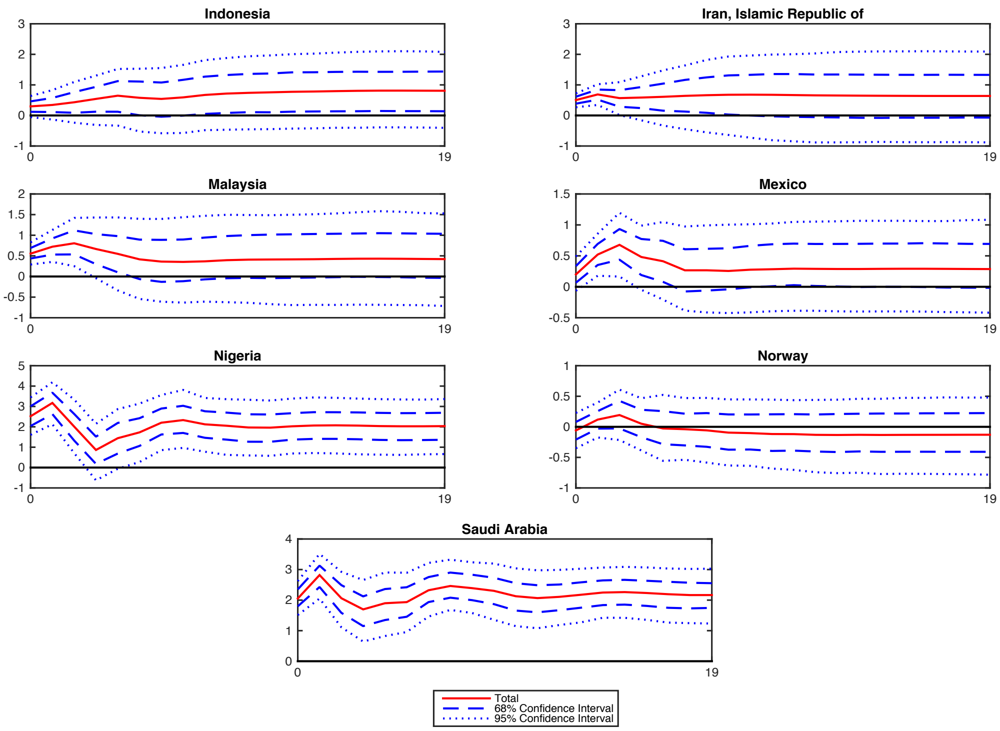
Figure 3 reports the total impact of a one-standard-deviation increase in oil prices on the major oil exporters in our sample. Figure 4 and Table 3 present corresponding direct and indirect impacts. The prominent observations can be summarized as follows.

1. In general, a rise in oil prices does benefit the oil exporters. In this regard, we can group these oil exporters into three types. The first type includes countries like Iran, Nigeria, and Saudi Arabia. The total impact of higher oil prices is huge for these countries. It reflects the fact that the growth of these countries significantly depends on oil revenues. The second type includes countries like Indonesia, Mexico, and Malaysia. The empirical results show that the total oil impacts on these countries are also positive, but the magnitude is muted compared to the first group. These countries share the features of small open economies, and their exports are more diversified compared to the countries in the first group. The third type includes Norway. The impulse response pattern of Norway is slightly different from the oil exporters analyzed above, but is very similar to Canada, another industrial country and a net oil exporter.

2. The total positive effect mainly comes from the direct channel. Except for Norway, we document positive direct impacts on the oil exporters. And even for Norway, we show a positive direct impact in the

[13] Energy efficiency may help us to understand the limited positive oil impact on Japan's economy, but it is still inadequate for Germany. Some other factors we are not able to account for in the model may govern this abnormal positive pattern.

Figure 3. Total Impact of a One-standard-deviation (15.5%) Increase in Oil Prices on Major Oil-Exporting Countries



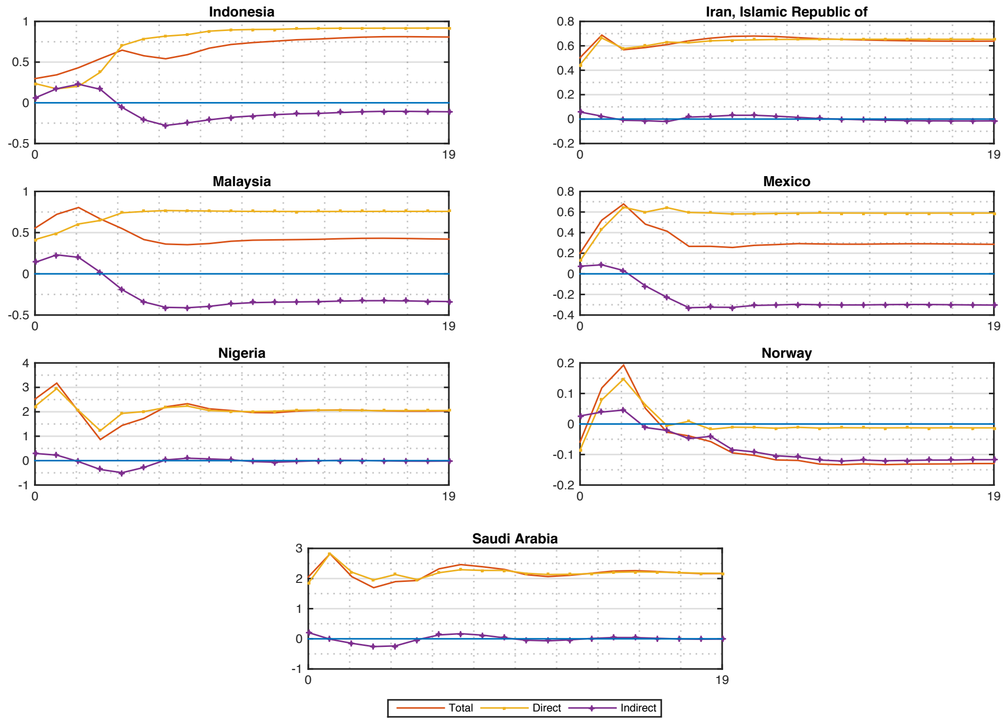
Notes:The plots show the cumulative total impact of a one-standard-deviation (15.5%) increase in oil prices on GDP growth for major oil-exporting countries, together with 68% and 95% confidence intervals. Results are reported in percentage points.

short run. In the long run, this direct impact is negative, but negligible. Compared to the impulse responses for the G-7 countries and China, the direct impacts for oil exporters are in general stronger and the responses are much faster.

3. Operating through the indirect multiplier channel, most of these countries experience an opposite oil impact in the short run, and half of these countries, like Indonesia, Malaysia, Mexico, and Norway, even suffer from this negative oil price impact in the long run. This provides an interesting observation that higher oil prices can hurt oil exporters as well. Combined with the empirical evidence in the previous section, we show that the overall effect of oil price movement on each economy depends not only on the country type, net oil exporter or importer, but also on the underlying external international interdependency structure of the country and its network.

4. These findings also offer a new perspective for understanding the resource curse (Sachs and Warner, 2001; Mehlum et al., 2006). If natural resources (in this case, oil) do contribute to the growth, why do not we see a positive correlation today between natural wealth and other kinds of economic wealth? There is no universally accepted theory of the curse of natural resources. However, we attempt to answer this question from an international perspective, showing that the international transmission mechanism may be a channel

Figure 4. Direct and Indirect Impact of a One-standard-deviation Increase (15.5%) in Oil Prices on Major Oil-Exporting Countries



Notes : The plots show the cumulative direct, indirect and total impact of one-standard-deviation (15.5%) increase in oil prices on GDP growth for major oil exporters. Results are reported in percentage points.

Table 3. Impact of a One-standard-deviation (15.5%) Increase in Oil Prices on Major Oil-Exporting Countries

		Direct Impact	Indirect Multiplier Impact	Total Impact
Indonisia	Short Run	1.26	-0.01	1.26
	Long Run	1.87	0.14	2.01
Iran	Short Run	0.61	0.06	0.67
	Long Run	1.01	0.00	1.01
Malaysia	Short Run	1.06	0.12	1.18
	Long Run	1.07	-0.12	0.95
Mexico	Short Run	0.41	0.07	0.48
	Long Run	0.45	-0.64	-0.18
Nigeria	Short Run	0.43	0.11	0.54
	Long Run	1.93	0.09	2.02
Norway	Short Run	-0.28	0.20	-0.08
	Long Run	-0.20	-0.42	-0.61
Russia	Short Run	1.15	0.26	1.41
	Long Run	1.19	-0.54	0.66
Saudi Arabia	Short Run	1.81	-0.33	1.49
	Long Run	1.73	0.06	1.79

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.

for explaining this phenomenon. If oil abundance elicits the export-led growth, it must be related to and affected by the external condition of the world economy. We document negative indirect oil price effects for some oil exporters, showing that the benefit of resource abundance may not be as large as we expected.[14]

5 The Differential Impact of Demand and Supply Shocks in the Global Oil Market

As the literature illustrates, it is also important to account for the endogeneity of oil prices and to differentiate between the effects of demand and supply shocks. For this, we follow the structural VAR method introduced in Kilian (2009) to quantify the impact of demand and supply shocks in the global crude oil market.[15] In this section, we modify the pervious research and assess the direct and indirect impact of these shocks on growth in the same set of countries examined in the previous section. This helps us compare the results.

One point deserves further discussion is the interpretation of the impact of oil price changes driven by the aggregate demand shock. Compared to the oil supply shock and the oil-specific demand shock, the aggregate demand shock is very difficult to interpret as there is no information where this aggregate demand shock originates, and depending on this the findings and conclusions could be very different. That is, it could be an increase in growth in China that raises oil prices, or it could be a global negative demand shock related to the financial crisis, or a rise in growth in oil-exporting countries. All these shocks would be categorised under the label aggregate demand shock, and therefore the impulse responses following this shocks cannot be given a sensible interpretation. Although our empirical results of aggregate demand shocks may suffer from the endogeneity problem, we still report them for comparison purposes in the following empirical section.

5.1 Decomposing Oil Price into Demand and Supply Shocks

Following Kilian (2009), the structural VAR model for decomposing oil prices includes monthly data for $z_t = (\Delta prod_t, rea_t, po_t)'$, where $\Delta prod_t$ is the percent change in global crude oil production, rea_t denotes an index of real economic activity constructed as in Kilian (2009), and po_t is the US dollar spot price of Brent crude oil. The rea_t and po_t series are expressed in logs. The sample period is 1980-2014. The structural

[14] We will further discuss this point of view in later sections, after decomposing the oil price. We show that negative indirect impacts can be more severe if oil price fluctuations are driven by precautionary demand shocks, which in fact are the major source of oil price movements.

[15] At the outset we have to note some possible drawbacks of the Kilian (2009) methodology. Many papers in the literature find that supply shocks mattered much more historically. The finding that supply shocks do not matter much may be quite specific to the Kilian (2009) methodology. Moreover, the impact of oil-specific shock emerges to be large in this methodology could be due to the fact that the oil-specific demand shock is derived as a residual that accounts for everything left out.

VAR representation is

$$A_0 z_t = \alpha + \sum_{i=1}^{24} A_i z_{t-i} + \varepsilon_t, \tag{4}$$

where ε_t denotes the vector of serially and mutually uncorrelated structural innovations. In this framework, we postulate that the movements of the oil prices are driven by three structural shocks: (1) crude oil supply shocks (oil supply shocks); (2) shocks to the demand for all industrial commodities in the global market (aggregate demand shocks); (3) demand shocks that are specific to the global crude oil market (oil-specific demand shocks).[16]

Following Kilian (2009), we assume that A_0^{-1} has a recursive structure such that the reduced-form errors e can be decomposed according to $e_t = A_0^{-1}\varepsilon_t$ or:[17]

$$e_t \equiv \begin{pmatrix} e_t^{\Delta prod} \\ e_t^{rea} \\ e_t^{po} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \varepsilon_t^{oil\ supply\ shock} \\ \varepsilon_t^{aggregate\ demand\ shock} \\ \varepsilon_t^{oil-specific\ demand\ shock} \end{pmatrix}.$$

The reduced-form VAR model is consistently estimated by the least-squares method. The resulting estimates are used to construct the structural VAR representation of the model.

Figure 5 reports the historical decomposition of oil prices based on the VAR model. The historical decomposed oil price series is constructed by

$$\hat{po}_{jt} = \sum_{i=0}^{t} \theta_{ji} \hat{\varepsilon}_{jt-i}, \tag{5}$$

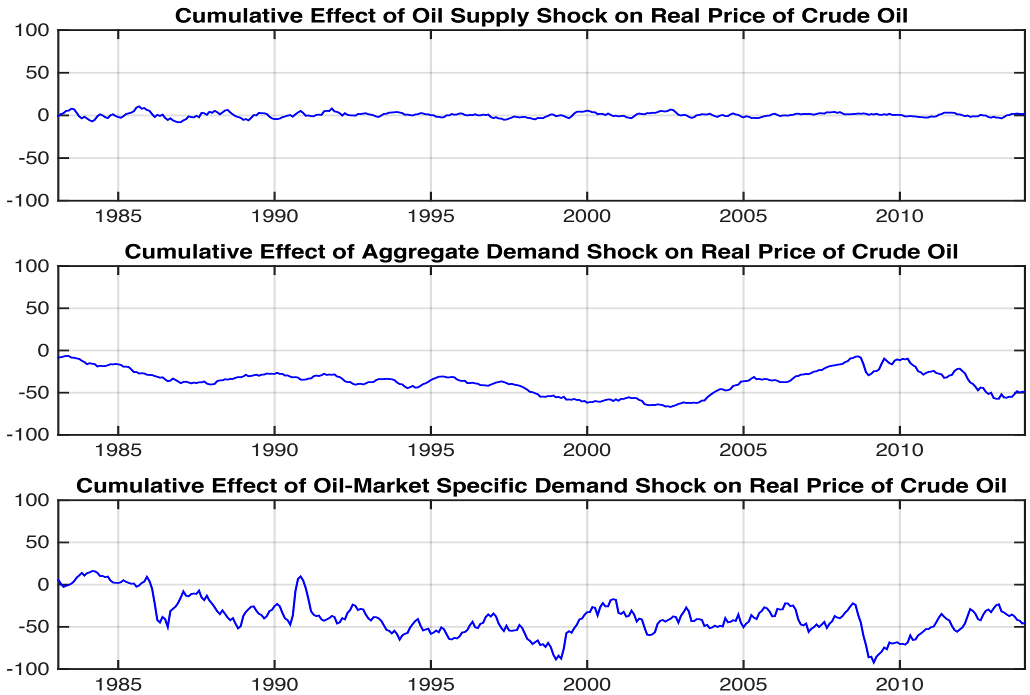
where θ_{ji} is the parameter governing the impulse response process estimated in the VAR model, and j refers to the three types of structural shocks.[18] Figure 5 allows us to assess the determinants of oil price movements in the timeline, and reveals some interesting stylized facts. For example, it indicates that oil supply shocks contribute a small fraction to the historical variation of oil prices over the sample period since 1980. The volatility of oil prices mainly comes from the two demand shocks. More specifically, the oil-specific demand shocks relate to sharp swings in the oil price series. This result reflects the nature that oil-specific demand shocks are associated with people's expectations about the future oil market, which can rapidly change based on market-related information such as exogenous political events.

[16] The aggregate demand shock is designed to capture shifts in the demand for international commodities (including crude oil) driven by the world business cycle and global developments. The oil-specific demand shock is designed to capture oil price change driven by higher precautionary demand, which is related to concerns about future oil supply shortage. For more details, see Kilian (2009).

[17] Kilian (2009) discusses the validity of this identification scheme.

[18] The spot oil price in each period is simply the sum of three decomposed oil price series constructed in this study.

Figure 5. Historical Decomposition of Oil Price, 1983:1-2013:12



Notes:Estimates are derived from the Kilian's model (2009).

5.2 Global Impact of Different Types of Oil Price Shocks

A question of considerable interest is how the oil price movements triggered by different structural shocks contribute to direct and indirect multiplier effects, and therefore constitute the total oil impact. To answer this question, we extract the quarterly series from the monthly decomposed series estimated in Equation (5). Quarterly values are the end period values of the monthly series. Again, in order to achieve the stationarity, these series have been de-trended by differencing if they contain a unit root. More specifically, we take the first difference for the oil price movements driven by aggregated demand shocks and oil specific demand shocks. As before, we use the trade share matrix on 2014 to focus on more recent outcomes.

Note that our paper differs from Kilian (2009) in how we choose the decomposed oil series for the analysis. To assess the effects of oil price disturbances on the US economy, Kilian directly relates the structural innovations ε_t in model (4) to US macroeconomic aggregates. For example, the impact on GDP is assessed by estimating:

$$y_t = \alpha_j + \sum_{i=0}^{p} \psi_{ji} \hat{o}^*_{jt-i} + u_{ij}, j = 1, 2, 3, \tag{6}$$

while

$$\hat{o}^*_{jt} = \frac{1}{3}\sum_{i=1}^{3}\hat{\varepsilon}_{jt-i}, \tag{7}$$

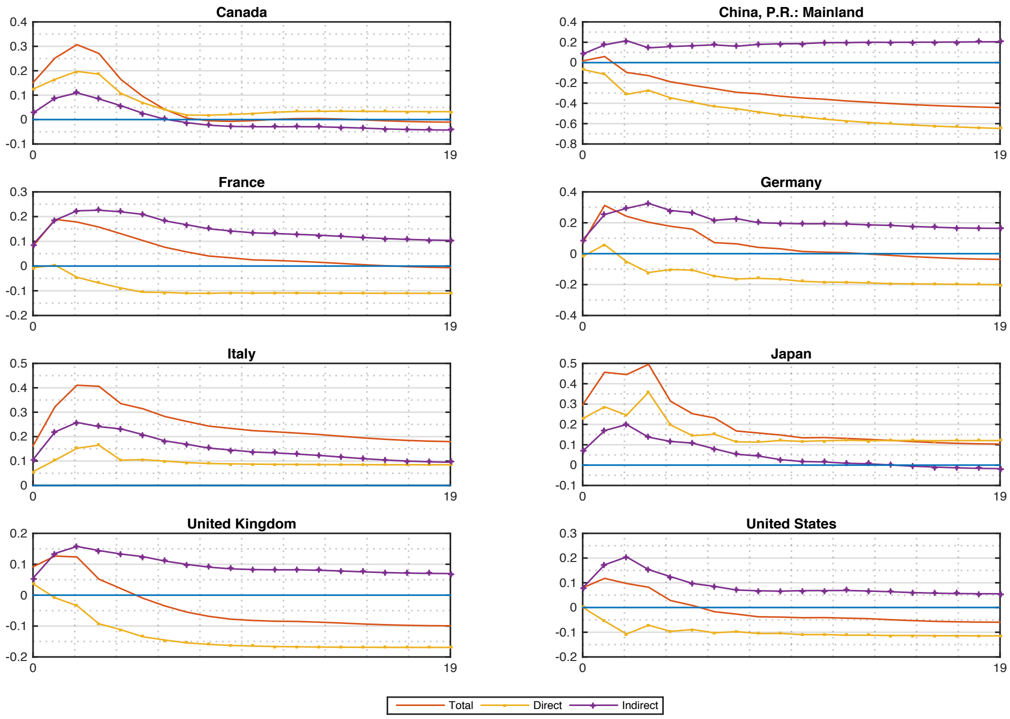
is the quarterly shocks constructed by averaging the monthly structural innovations, where j refers to three types of shocks. Although these structural innovations indeed govern the oil price fluctuations, directly linking them to the macroeconomic aggregates causes some difficulty of interpretation. For example, if we replace the oil price o_t with aggregate demand shocks in the structural VARX system (2), we are actually measuring the impact of a global boom, and not truly the demand component of oil prices. Comparison to Equation (5) clearly shows that the simple structural innovation measure fails to capture the dynamics delivered by the impulse response functions, θ_{ij}. Therefore, in our paper, we directly utilize the decomposed oil price series as in (5), instead of the structural innovations. It is more consistent with the research topic of investigating distinct macroeconomic impacts of oil price shocks originating from different sources. In the following discussions we present only the graphs of cumulative impulse responses. Tables are provided in the Appendix.

5.2.1 Global Impact of Oil Price Fluctuations Driven by Aggregate Demand Shocks

As in the baseline case, Figure 6 and Figure 7 present the results for the G-7 countries and China and for the major oil exporters, respectively. Several observations emerge from these results. First, higher oil prices driven by aggregate demand shocks are not necessary to trigger a recession for the oil importers. Oil price movements driven by aggregate demand shocks are associated with a booming world economy. Under this circumstance, the negative direct impact of higher oil prices is likely to be cancelled out by the indirect channel. Compared to the baseline model, we notice a substantial upward shift of the indirect impact curve. The oil importers experience a positive indirect impact in the short run. This positive impact is declining but remains positive for most countries. Through the international transmission mechanism, this development can, in turn, benefit the oil importers. The direct oil impact is also muted compared to the baseline model.

Second, the changing pattern of indirect multiplier impact is also the case for the oil exporters. We notice short-run positive indirect impacts for all the countries in the figure. For Indonesia and Malaysia, these positive impacts even persist in the long run. For the rest of the countries, the indirect impacts tend to be neutral in the long run. These empirical results are more interesting if we compare them with the baseline model. In the baseline model, we show that the indirect impact may significantly hinder the growth of open economies that are also oil net exporters, like Indonesia, Malaysia, and Mexico. However, given the price change driven by the demand shocks, these negative indirect impacts disappear. Considering the direct impact, most of these oil exporters experience a boom given an aggregate demand shock. The only exception

Figure 6. Direct and Indirect Impact of Oil Market Shocks on the G-7 Countries and China, Aggregate Demand Shocks



Notes:The plots show the cumulative direct, indirect and total impact of a one-standard-deviation increase in the aggregate demand component of oil price on GDP growth for the G-7 countries and China. Results are reported in percentage points.

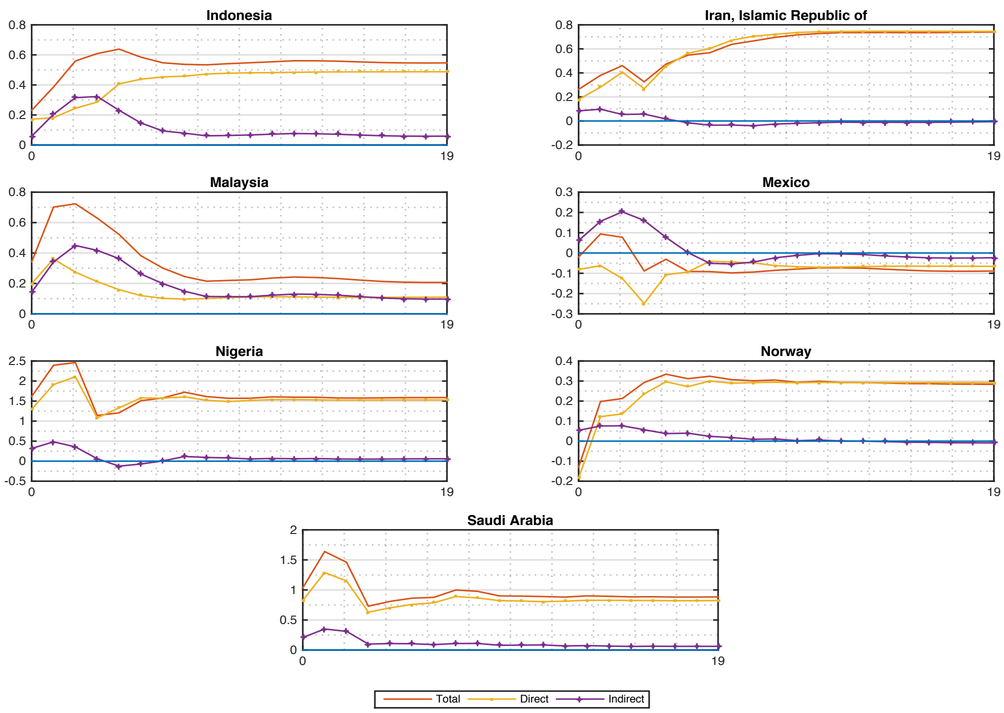
is Mexico. However, compared to the magnitude of the oil impact on other oil exporters, this negative impact is negligible.

5.2.2 Global Impact of Oil Price Fluctuations Driven by Precautionary Demand Shocks

Figure 8 and Figure 9 present the global impact of oil price fluctuations driven by precautionary demand shocks. We note several key observations from these figures. First, unlike the aggregate demand shocks, we see that the oil price movement driven by the precautionary demand shocks is associated with a severe contraction of the economies of the major oil importers. Compared to the baseline model, we document a substantial downward shift of the indirect impact curve. In this case, these negative indirect effects may reinforce the negative direct oil impact instead of offsetting it. The only two exceptions are China and the US. However, compared to the baseline model, the positive indirect effects for these two countries are both 0.04 percentage points, which is also of smaller magnitude. Altogether, we document that the higher oil prices driven by precautionary demand shocks trigger a severe contraction in oil importing economies.

Second, we document that higher oil prices driven by precautionary demand can hurt all the oil major exporters substantially. Although the higher oil prices driven by precautionary demand shocks still boost the

Figure 7. Direct and Indirect Impact of Oil Market Shock on Major Oil-Exporting Countries, Aggregate Demand Shocks



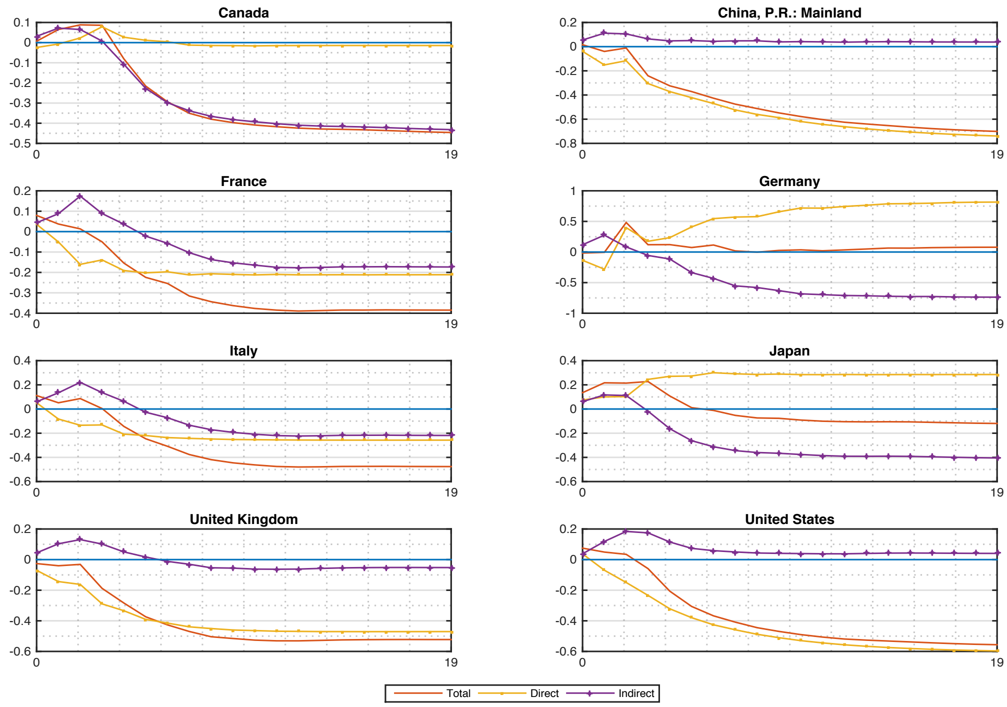
Notes : The plots show the cumulative direct, indirect and total impact of a one-standard-deviation increase in the aggregate demand component of oil price on GDP growth for major oil exporters. Results are reported in percentage points.

economies of net oil exporters, all of these major oil exporter also suffer from the indirect channel in the long run. For the largest oil exporter, Saudi Arabia, the direct impact boosts growth by 0.88 percentage points, and indirect impact accounts for a 0.43 percentage-point decline. For the small open economies of Indonesia and Malaysia, the direct impact accounts for 0.82 and 0.83 percentage-point growth respectively, and the indirect effect generates 0.23 and 0.53 percentage-point slumps, respectively. This result demonstrates higher oil prices are not always good news for oil exporters, and suggests that policy makers should be cautious and seek to understand the roots of substantial oil price movements. Besides, since the precautionary demand shock is one of the two major triggers of oil price movements, we note that windfall gains from oil abundance can be largely mitigated by the international transmission channel; this is even more so apparent for the small open oil exporters. Our findings provide a new perspective for explaining the resource curse.

5.2.3 Global Impact of Oil Price Fluctuations Driven by Supply Shocks

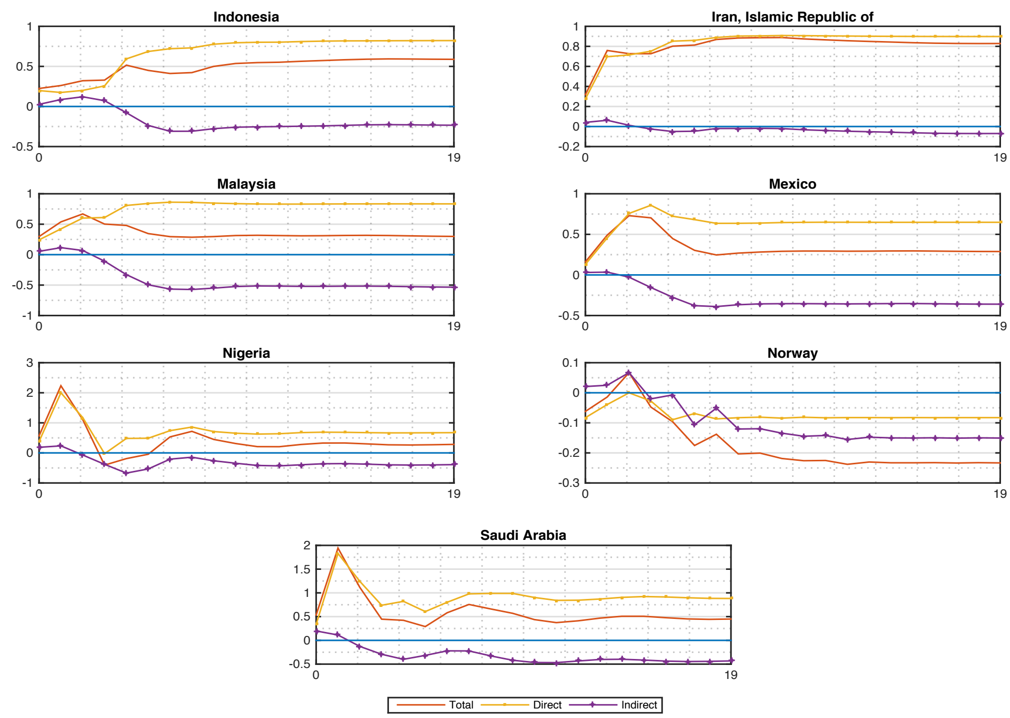
Figure 10 and Figure 11 display the global impact of oil price fluctuations driven by supply shocks. We can note the several observations from these figures. First, the indirect impact is more diversified compared to

Figure 8. Direct and Indirect Impact of Oil Market Shocks on the G-7 Countries and China, Precautionary Demand Shocks



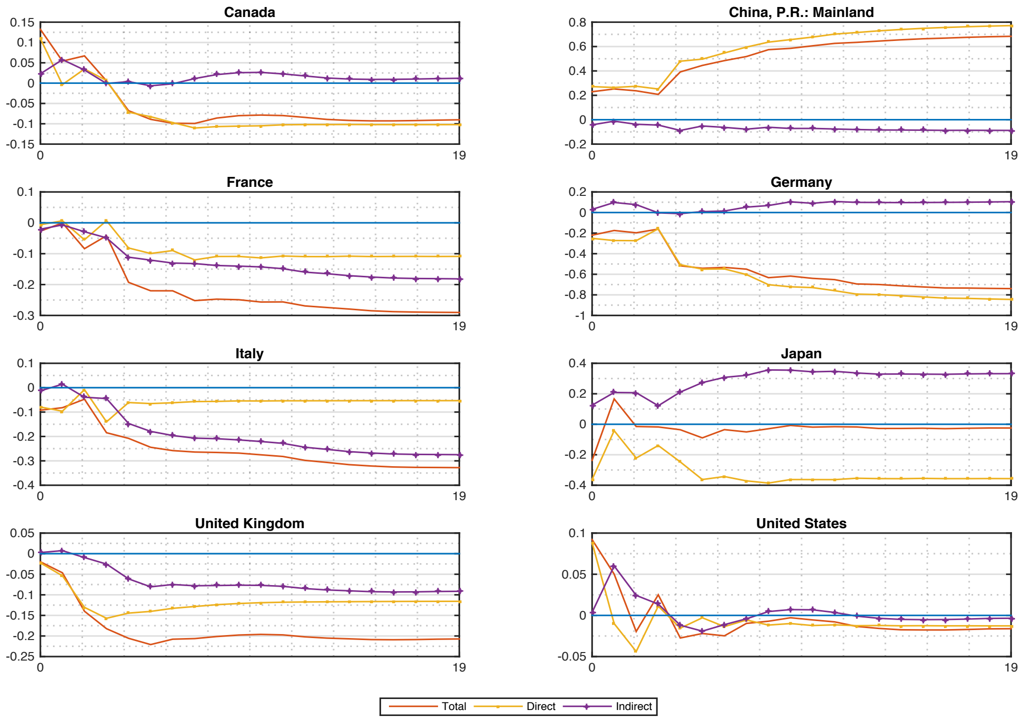
Notes: The plots show the cumulative direct, indirect and total impact of a one-standard-deviation increase in precautionary demand component of oil price on GDP growth for the G-7 countries and China. Results are reported in percentage points.

Figure 9. Direct and Indirect Impact of Oil Market Shock on Major Oil-Exporting Countries, Precautionary Demand Shocks



Notes : The plots show the cumulative direct, indirect and total impact of a one-standard-deviation increase in precautionary demand component of oil price on GDP growth for major oil exporters. Results are reported in percentage points.

Figure 10. Direct and Indirect Impact of Oil Market Shocks on the G-7 countries and China, Supply Shocks



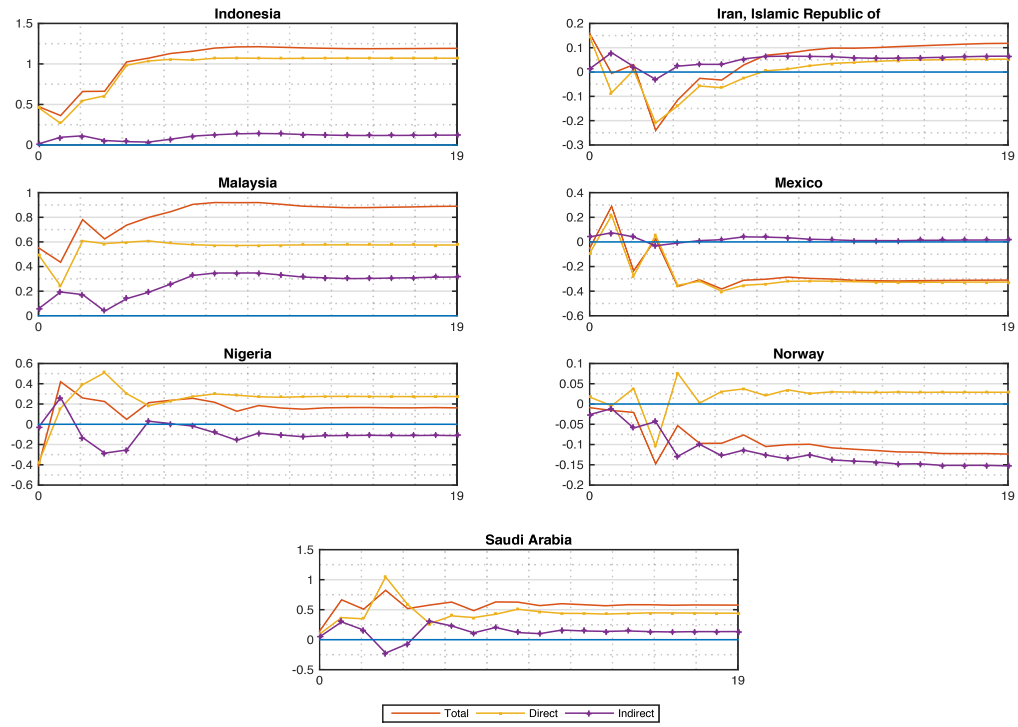
Notes:The plots show the cumulative direct, indirect and total impact of a one-standard-deviation increase in supply component of oil price on GDP growth for the G-7 countries and China. Results are reported in percentage points.

the previous two shocks.[19] For example, in the long run, the indirect impact for Japan is positive with a 0.33 percentage-point increase in growth. In contrast, for France, the indirect impact contributes to a 0.18 percentage-point contraction. But the indirect impact for the US tends to be neutral. The indirect impact is positive for Saudi Arabia in the long run, but negative for Nigeria.

Second, oil supply shocks also constitute diverging direct response patterns for the oil exporters. Supply shocks are normally associated with turmoil in oil-producing countries. As a result, the supply shocks should have complex impacts on these oil producers. On the one hand, the higher oil price boosts the oil revenue for the oil exporters that are not involved in the oil-production disruption. On the other hand, oil supply shock can also be regarded as an indicator of economic or political turmoil in certain countries. This complexity is reflected by the direct impact of oil supply shocks for different oil exporters in Figure 11. For the oil exporters in the Middle East, a rise in oil prices driven by oil supply shocks still boosts their economies in the long run, but the magnitude is much lower. For Mexico, its oil production increases slowly from 1985 and starts to decline from 2004. This fact is reflected by the negative direct impact of oil supply shocks on Mexico. For countries that are more likely to be immune to the oil-production disruption, like Indonesia, Malaysia, and

[19]In previous sections, we document the consistent upwards shifting pattern of indirect impact curve given the aggregate demand shocks and downward shifting pattern of indirect impact curve given the precautionary shocks.

Figure 11. Direct and Indirect Impact of Oil Market Shock on Major Oil-Exporting Countries, Supply Shocks



Notes : The plots show the cumulative direct, indirect and total impact of a one-standard-deviation increase in supply component of oil price on GDP growth for major oil exporters. Results are reported in percentage points.

Norway, oil supply shocks contribute to an even higher growth for these countries, compared to the baseline model.

Third, turning to oil importers, oil price movements driven by supply shocks are, in general, associated with a negative direct effect. One surprising direct impact is for China. We document the positive direct impact with the oil supply shocks. However, given China's heavy dependence on coal, as opposed to oil, for its energy consumption needs and the composition of its export basket, this result might not be surprising after all. Moreover, oil supply disruptions lead to increases in the international price of coal, which may also benefit China's economy directly.

6 Conclusion

The fluctuations of oil prices may affect each country mainly through two channels: the direct channel and indirect multiplier channel. The indirect channel becomes increasingly important as the global economy integrates more and more. In this paper, we disentangle these direct and indirect oil price impacts based on a large-scale structural VAR model by linking all the major economies through a time-varying trade matrix. The paper provides estimates of dynamic impact of oil price fluctuations on growth in different types of economies during the 1985-2014 period.

The empirical evidence show that the indirect multiplier channel plays a crucial role in explaining the global impact of oil price movement. On the one hand, the negative effects of rising oil prices on net oil importers are likely to be offset by the increasing external demand of oil producers. On the other hand, higher oil prices may immediately benefit the oil producers but harm their economies in long run. In an era of increasing international connections, our empirical results highlight the importance of identifying both the direct and indirect multiplier impacts in the investigation of macroeconomic implications of oil price shocks. This study further highlights potential pitfalls of country-by-country analysis and even small-scale VAR models in accessing the macroeconomic impact of international commodities, like oil.

As the literature demonstrates, it is also important to account for the endogeneity of energy prices and to differentiate between the effects of demand and supply shocks in energy markets when one attempts to assess the macroeconomic impact of oil shocks. The oil price fluctuation driven by supply shocks and demand shocks is expected to have distinct impacts through the direct and indirect multiplier channels, which are of particular interest in this study. Therefore, we adapt the methodology introduced in Kilian (2009) and further decompose the movements of oil prices into three structural shocks: (1) crude oil supply shocks (oil supply shocks); (2) shocks to the demand for all industrial commodities in global markets (aggregate demand shocks); (3) demand shocks that are specific to the global crude oil markets (oil-market specific demand shocks). Our findings document substantial distinct macroeconomic impacts of oil shocks emanating from different sources, confirming the importance of understanding the roots of oil price shift. Particularly, the negative impact of oil price increase elicited by the aggregate demand shocks on major industrial countries can be largely compensated by the booming global economy captured by the indirect effects. However, the precautionary demand oil shocks boost the major oil exporters at the beginning, but generate a severe contraction in oil-importing countries. In the long run, most of countries, even the oil exporters, cannot escape from the negative indirect impact of oil shocks.

The findings of this study have clear implications for policymakers when evaluating oil price impacts on different economies. We argue that in addition to country type (oil dependency), net oil exporter or importer, that are often discussed in the literature, the underlying external interdependency structure (global macroeconomic network) of an economy is also a critical factor to take into account. This cautions the policymakers, especially those from small open oil-exporters, to carefully evaluate macroeconomic impacts of oil shocks. Our arguments are in line with the facts that OPEC increased supply when the oil prices were considered to be too high.

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Appendix A. Data Sources

Quarterly real GDP series are primarily from the IMFs International Financial Statistics (IFS) data base with 2010 as the base year. When quarterly series are not available we extract the annual series for interpolation. If recent annual series are not available, we extend the IFS series using the growth rates derived from the World Banks World Development Indicators (WDI).

Where quarterly data are not available, we first use the existing data from the Singapore Centre for Applied and Policy Economics (SCAPE) at the National University of Singapore. In that data set, some major Asian quarterly GDP series are carefully interpolated using the Chow-Lin related series technique (for further details, see Abeysinghe and Rajaguru, 2004). We use the same technique to interpolate other GDP series based on quarterly export series. After collecting or interpolating the quarterly data, seasonal adjustment is performed with R (seasonal package), which uses the US Census X-13ARIMA-SEATS program (for more details, see US Census Bureau, 2015).

The bilateral export (FOB) series are from the IMF Direction of Trade Statistics (DOTS); quarterly series are in 2010 constant US dollars. In the DOTS dataset, there are several missing components (Singapore to Indonesia, 1982Q1-2002Q4; Chile to Nigeria, 1982Q1-1991Q1; Ghana to Chile, 1982Q1-1986Q1; Zambia-Mexico 1982Q1-1983Q4). For Singapore to Indonesia we use the corresponding import data of Indonesia from Singapore (Import, CIF). For the other missing series, we assign zero values because of the relatively weak trade linkage between these countries. This is corroborated by the recently available data for these countries. After generating the weight matrix, we take twelve quarter moving average to smoothen export shares.

The oil price data is crude oil series from the IMF primary commodity price data set. The oil series is the monthly nominal price in US dollars. We convert frequency of the oil series from monthly to quarterly by taking the end of the period value.

Appendix B. Tables for Section 5

Table A.1. Impact of Oil Price Movement on the G-7 Countries and China, Aggregate Demand Shocks

		Direct Impact	Indirect Multiplier Impact	Total Impact
Canada	Short Run	0.19	0.08	0.27
	Long Run	0.03	-0.04	-0.01
China	Short Run	-0.27	0.14	-0.13
	Long Run	-0.65	0.21	-0.44
France	Short Run	-0.07	0.23	0.16
	Long Run	-0.11	0.10	-0.01
Germany	Short Run	-0.12	0.33	0.20
	Long Run	-0.20	0.16	-0.04
Italy	Short Run	0.17	0.24	0.41
	Long Run	0.08	0.10	0.18
Japan	Short Run	0.36	0.14	0.50
	Long Run	0.12	-0.02	0.10
United Kingdom	Short Run	-0.09	0.14	0.05
	Long Run	-0.17	0.07	-0.10
United States	Short Run	-0.07	0.15	0.08
	Long Run	-0.11	0.06	-0.06

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.

Table A.2. Impact of Oil Price Movement on Major Oil Exporters, Aggregate Demand Shocks

		Direct Impact	Indirect Multiplier Impact	Total Impact
Indonisia	Short Run	0.29	0.32	0.61
	Long Run	0.49	0.06	0.55
Iran	Short Run	0.27	0.06	0.33
	Long Run	0.75	-0.01	0.74
Malaysia	Short Run	0.21	0.42	0.63
	Long Run	0.11	0.10	0.21
Mexico	Short Run	-0.25	0.16	-0.09
	Long Run	-0.07	-0.02	-0.09
Nigeria	Short Run	1.08	0.06	1.14
	Long Run	1.53	0.06	1.59
Norway	Short Run	0.24	0.06	0.29
	Long Run	0.29	-0.01	0.28
Saudi Arabia	Short Run	0.63	0.10	0.73
	Long Run	0.82	0.06	0.88

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.

Table A.3. Impact of Oil Price Movement on the G-7 Countries and China, Percautionary Demand Shocks

		Direct Impact	Indirect Multiplier Impact	Total Impact
Canada	Short Run	0.08	0.01	0.09
	Long Run	-0.01	-0.43	-0.45
China	Short Run	-0.30	0.06	-0.24
	Long Run	-0.74	0.04	-0.70
France	Short Run	-0.14	0.09	-0.05
	Long Run	-0.21	-0.17	-0.38
Germany	Short Run	0.18	-0.06	0.12
	Long Run	0.82	-0.74	0.08
Italy	Short Run	-0.13	0.14	0.00
	Long Run	-0.26	-0.22	-0.48
Japan	Short Run	0.25	-0.02	0.23
	Long Run	0.29	-0.40	-0.12
United Kingdom	Short Run	-0.29	0.10	-0.19
	Long Run	-0.47	-0.05	-0.52
United States	Short Run	-0.23	0.17	-0.06
	Long Run	-0.60	0.04	-0.56

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.

Table A.4. Impact of Oil Price Movement on Major Oil Exporters, Percautionary Demand Shocks

		Direct Impact	Indirect Multiplier Impact	Total Impact
Indonisia	Short Run	0.26	0.07	0.33
	Long Run	0.82	-0.23	0.59
Iran	Short Run	0.75	-0.03	0.73
	Long Run	0.90	-0.07	0.83
Malaysia	Short Run	0.61	-0.11	0.50
	Long Run	0.83	-0.53	0.30
Mexico	Short Run	0.86	-0.15	0.70
	Long Run	0.65	-0.36	0.29
Nigeria	Short Run	-0.03	-0.38	-0.41
	Long Run	0.67	-0.39	0.28
Norway	Short Run	-0.03	-0.02	-0.05
	Long Run	-0.08	-0.15	-0.23
Saudi Arabia	Short Run	0.74	-0.29	0.45
	Long Run	0.88	-0.43	0.45

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.

Table A.5. Impact of Oil Price Movement on the G-7 Countries and China, Supply Shocks

		Direct Impact	Indirect Multiplier Impact	Total Impact
Canada	Short Run	0.01	0.00	0.01
	Long Run	-0.10	0.01	-0.09
China	Short Run	0.25	-0.04	0.21
	Long Run	0.77	-0.09	0.68
France	Short Run	0.01	-0.05	-0.04
	Long Run	-0.11	-0.18	-0.29
Germany	Short Run	-0.16	0.00	-0.16
	Long Run	-0.84	0.11	-0.74
Italy	Short Run	-0.14	-0.04	-0.18
	Long Run	-0.05	-0.27	-0.33
Japan	Short Run	-0.14	0.12	-0.02
	Long Run	-0.36	0.33	-0.02
United Kingdom	Short Run	-0.16	-0.03	-0.18
	Long Run	-0.12	-0.09	-0.21
United States	Short Run	0.01	0.01	0.03
	Long Run	-0.01	0.00	-0.02

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.

Table A.6. Impact of Oil Price Movement on Major Oil Exporters, Supply Shocks

		Direct Impact	Indirect Multiplier Impact	Total Impact
Bahrain	Short Run	-0.14	0.07	-0.08
	Long Run	-0.05	0.08	0.04
Indonisia	Short Run	0.61	0.06	0.66
	Long Run	1.07	0.12	1.19
Iran	Short Run	-0.21	-0.03	-0.24
	Long Run	0.05	0.07	0.12
Malaysia	Short Run	0.59	0.04	0.62
	Long Run	0.58	0.31	0.89
Mexico	Short Run	0.05	-0.03	0.02
	Long Run	-0.33	0.02	-0.31
Nigeria	Short Run	0.51	-0.28	0.22
	Long Run	0.27	-0.11	0.16
Norway	Short Run	-0.10	-0.04	-0.15
	Long Run	0.03	-0.15	-0.12
Saudi Arabia	Short Run	1.04	-0.22	0.82
	Long Run	0.44	0.14	0.58

Notes: The table shows the cumulative effect. Short run refers to four quarters and long run to 20 quarters. Results are reported in percentage points.