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Oil price shocks and global imbalances: Lessons from a model with trade and financial interdependencies*

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Abstract

The aim of this paper is to investigate oil price shocks' effects and their associated transmission channels on global imbalances. To this end, we rely on a Global VAR approach that allows us to account for trade and financial interdependencies between countries. Considering a sample of 30 oil-exporting and importing economies over the 1980-2011 period, we show that the nature of the shock—demand-driven or supply-driven—matters in understanding the effects of oil price shocks on global imbalances. In addition, we evidence that the main adjustment mechanism to oil shocks is based on the trade channel, the valuation channel being at play only on the short run.

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1 Introduction

In a context of increasing scarcity of fossil fuels, and more particularly oil, the relationship between energy prices and current-account imbalances has become a key issue in the economic literature (IMF, 2011). Since the late 1990s, this theme has increasingly prevailed in the extensive study of global imbalances' persistence, as well as in the analysis of the recent financial crisis.[1] Changes in energy prices impact worldwide current-account imbalances and, consequently, countries' net foreign asset positions, since an increase in energy prices can be considered as a transfer of wealth from importing to exporting countries. More specifically, considering the energy price-current account imbalances relationship, two main transmission channels can be highlighted. The first one refers to the trade channel that focuses on the dynamics of energy exports and imports for exporting and importing countries. Two related elements are of particular importance here: (i) the propensity of energy-importing countries to import due to increased revenues, and (ii) the geographical distribution of their international trade. The second channel is related to international capital flows linked to the increase in energy prices; these flows being important since many producing countries have a limited propensity to import. This channel can be apprehended by relying on intergenerational considerations: in a sustainable development perspective and with exhaustible energy resources, countries need to save part of their current earnings to shift resources toward future generations.

Within this context, the aim of this paper is to provide a detailed investigation of oil price shocks' effects and their associated transmission channels on global imbalances. Regarding previous literature, the IMF (2006) evidences that while oil price shocks have a short-lived impact on current accounts, they exert a significant effect on net foreign asset positions. In addition, oil importers suffer from slower growth and real exchange rate depreciation, while oil exporters experience higher growth and real appreciation. As equity prices fall in oil-importing countries, a significant valuation channel is identified. Kilian et al. (2009) investigate the effects of oil-supply driven and oil-demand driven shocks on external accounts of oil-importing and oil-exporting countries throughout the 1975-2006 period. By using a vector autoregressive (VAR) framework, they focus on the role of the non-oil trade balance in offsetting oil trade changes and on the effects of shocks (trade channel) on the value of gross foreign assets and liabilities (valuation channel). They show that (i) the source of the shocks matters insofar as oil-supply and oil-demand shocks have different effects on external accounts[2], and (ii) trade and valuation channels exert a significant influence on the global adjustment process. Focusing on foreign trade as a key channel of transmission of oil shocks,

[1] See, among others, IMF (2006, 2011), and Caballero et al. (2008).

[2] For instance, Kilian et al. (2009) show that oil-supply shocks have a relatively small and short-lived impact on oil trade balance, while oil-demand shocks lead to large and persistent oil trade deficits in oil-importing countries.

Korhonen and Ledyaeva (2010) estimate a system of simultaneous equations capturing the interlinkages among the GDP growth rates of different countries through the trade matrix. Their approach is based on the following intuition: (i) for net oil importers, higher oil prices constitute a negative supply shock that slowdowns growth, reducing the initial positive effect for net oil exporters, but (ii) at the same time, a higher growth in oil-exporting economies may lead to larger exports from oil importers. The specificity of their approach is that responses of growth rates are allowed to vary over time as the trading pattern changes. Considering the case of Russia from 1995 to 2006, Korhonen and Ledyaeva (2010) find that the direct positive effect of higher oil prices is dampened by the negative indirect effect that rests on the slower growth in its main trading partners. Cashin et al. (2013) analyze the macroeconomic consequences of oil price fluctuations across different countries over the 1979-2011 period, through the estimation of a global VAR model with a set of sign restrictions on the generalized impulse responses. They show that supply- and demand-driven shocks have specific impacts on macroeconomic variables, and that oil importers and exporters react differently.

This paper falls into this strand of the literature by focusing on the effects of oil price shocks on global imbalances, with particular attention paid to their transmission channels. To this end, we consider a panel of 30 countries over the 1980-2011 period. Our sample of countries accounts for more than 85 percent of the world GDP in 2011, and is composed by 18 oil importers (their share of world oil imports amounts to 75 percent throughout the studied period) and 12 oil exporters (covering 60 percent of world oil exports).[3] Our main contributions are the following. First, from a methodological viewpoint, we rely on the global VAR (GVAR) approach introduced by Pesaran et al. (2004) which allows us to account for trade and financial interdependencies between countries—which is a key condition to correctly analyze global imbalances. Second, while most of previous studies consider only oil-importing countries[4], we also include oil exporters in our sample of economies. Third, acknowledging that oil price shocks may have different effects over time[5], we consider various types of structural shocks following Kilian (2009)'s identification scheme:[6] (i) supply shocks on crude oil, (ii) aggregate demand shocks, identified by demand shocks affecting all industrial commodity markets, and (iii) demand shocks specific to the oil market. Fourth, and compared to Cashin et al. (2013) which is the closest study to ours, we pay particular attention to the adjustment channel, distinguishing between trade channel and valuation effects. Our findings show that the nature of the shock matters in understanding the effects of oil price shocks on global imbalances. In addition, we evidence that the main adjustment mechanism to oil

[3]Source: BP Statistical Review of World Energy.

[4]See, for instance, Kilian (2008), Blanchard and Gali (2010) and Peersman and Van Robays (2012); the main exceptions being Cashin et al. (2013) and Esfahani et al. (2014).

[5]See e.g. Hamilton (2008) and Kilian (2008).

[6]Relying on a VAR specification, Kilian (2009) shows that, unlike the two other types of shocks, pure supply shocks in the oil market have a short-term impact on crude oil prices, and therefore a limited effect on macroeconomic variables. See also Apergis and Miller (2009) and Hahn and Mestre (2011).

shocks is based on the trade channel, the valuation channel being at play only on the short run.

The rest of this paper is organized as follows. Section 2 briefly describes the GVAR approach. Section 3 presents the data and outlines our estimation methodology. Results and related comments are reported in Section 4, while Section 5 concludes the paper.

2 The Global VAR framework

Consider a set of $N+1$ countries/regions indexed by $i = 0, 1, 2, ..., N$, with country 0 denoting the reference one.[7] The GVAR model consists in a collection of individual VARX models for each country that are linked together via a "linkage matrix". For the ease of exposition, and without loss of generality, consider $VARX(1,1)$ specifications (see Pesaran et al., 2004, and Dees et al., 2007 for a generalization).[8] Those individual VARX models, that account for common global variables, are given by:

$$x_{i,t} = a_{i,0} + a_{i,1}t + \Phi_i x_{i,t-1} + \Sigma_{j=0}^{1} \Psi_{i,j} x_{i,t-j}^{*} + \Sigma_{j=0}^{1} \tau_{i,j} d_{t-j} + \varepsilon_{i,t} \quad (1)$$

for $t = 1, 2, ..., T$ and $i = 0, 1, 2, ..., N$. $x_{i,t}$ is a $(k_i \times 1)$ vector containing country-specific domestic variables, $x_{i,t}^{*}$ is a $(k_i^{*} \times 1)$ vector of country-specific foreign variables, and d_t is a m-dimensional vector of observed common global variables assumed to be weakly exogenous to the global economy. Φ_i, $\Psi_{i,j}$, and $\tau_{i,j}$ are of dimension $(k_i \times k_i)$, $(k_i \times k_i^{*})$ and $(k_i \times m)$ respectively. The vectors of fixed intercepts and of deterministic time trend coefficients are both $(k_i \times 1)$. $\varepsilon_{i,t}$ is a $(k_i \times 1)$ vector of idiosyncratic country-specific shocks and is assumed to be serially uncorrelated with zero mean and non-singular covariance matrix:

$$\varepsilon_{i,t} \sim i.i.d(0, \Sigma_{ii}) \quad (2)$$

The foreign variables specific to country i, $x_{i,t}^{*}$, are constructed as a weighted sum of the corresponding variables of the other countries. To this end, we use trade weights, reflecting the specific geographical trade composition of each economy.[9] We thus have:

$$x_{i,t}^{*} = \sum_{j=1}^{N} w_{ij} x_{j,t} \quad (3)$$

where $w_{i,j}$ stands for the share of country j in the total trade of country i (measured in U.S. dollars), $i \neq j$. We have:

[7] The United States and the Gulf region are alternatively regarded as the reference country/region.

[8] In our empirical analysis, we use the Akaike information criterion to select the lag orders corresponding to both domestic and foreign variables, allowing lags up to four. Tables for the selected lag orders, as well as the results regarding the number of cointegrating relationships based on the trace test are available upon request to the authors.

[9] The choice of trade weights rests on the fact that bilateral trade has a strong influence on inter-country business cycle linkages (see, among others, Forbes and Chinn, 2004; Imbs, 2004; and Baxter and Kouparitsas, 2005).

$$\sum_{j=1}^{N} w_{ij} = 1 \tag{4}$$

for all $i, j = 1, ..., N$ and $w_{ii} = 0$ for all $i = 1, ..., N$. The weights we consider here rely on the average geographic distribution of imports and exports of goods and services over the 1980-2011 period.[10]

Regarding the estimation strategy, we follow the procedure suggested by Pesaran et al. (2004) and Dees et al. (2007). We first check that foreign and common global variables are weakly exogenous to ensure that Equation (1) can be independently estimated on a country-by-country basis.[11] We then stack the country-specific domestic and foreign variables, to study the dynamics for all the variables and all the considered countries simultaneously. More specifically, Equation (1) is rewritten as follows:

$$A_i z_{i,t} = a_{i,0} + a_{i,1} t + B_i z_{i,t-1} + \tau_{i,0} d_t + \tau_{i,1} d_{t-1} + \varepsilon_{i,t} \tag{5}$$

where $z_{i,t} = (x'_{i,t}, x^{*'}_{i,t})'$, $A_i = (I, -\Psi_{i,0})$ and $B_i = (\Phi_i, \Psi_{i,1})$. A_i and B_i are of dimension $k_i \times (k_i + k^*_i)$, and the rank of $(A_i - B_i)$ gives the number of long-run relationships that exist among $x_{i,t}$ and $x^*_{i,t}$.

In a last step, we combine the country-specific models into an overall representation. To this aim, we collect all country-specific variables in a $(k \times 1)$ vector $x_t = (x'_{0,t}, x'_{1,t}, ..., x'_{N,t})'$ with $k = \Sigma_{i=0}^{N} k_i$. Country-specific variables in terms of x_t are then given by:

$$z_{i,t} = W_i x_t \tag{6}$$

for $i = 0, 1, 2, ..., N$, where W_i is a $(k_i + k^*_i) \times k$ matrix of fixed constants defined in terms of country-specific weights w_{ij}. Then, stacking all country-specific equations, we get:

$$\Gamma x_t = a_0 + a_1 t + C x_{t-1} + \tau_0 d_t + \tau_1 d_{t-1} + \epsilon_t \tag{7}$$

where $a_0 = \begin{bmatrix} a_{0,0} \\ a_{1,0} \\ \vdots \\ a_{N,0} \end{bmatrix}$, $a_1 = \begin{bmatrix} a_{0,1} \\ a_{1,1} \\ \vdots \\ a_{N,1} \end{bmatrix}$, $\epsilon_t = \begin{bmatrix} \epsilon_{0,t} \\ \epsilon_{1,t} \\ \vdots \\ \epsilon_{N,t} \end{bmatrix}$, $\Gamma = \begin{bmatrix} A_0 W_0 \\ A_1 W_1 \\ \vdots \\ A_N W_N \end{bmatrix}$, $C = \begin{bmatrix} B_0 W_0 \\ B_1 W_1 \\ \vdots \\ B_N W_N \end{bmatrix}$,

[10] See Section 3.

[11] This assumption is needed due to the high number of parameters that exceeds the number of available observations. Results are available upon request to the authors.

and $\tau_0 = \begin{bmatrix} \tau_{0,0} \\ \tau_{1,0} \\ \vdots \\ \tau_{N,0} \end{bmatrix}, \tau_1 = \begin{bmatrix} \tau_{0,1} \\ \tau_{1,1} \\ \vdots \\ \tau_{N,1} \end{bmatrix}$.

Assuming that the $(k \times k)$ matrix Γ is non-singular, we can deduce the GVAR model in its reduced form and solve it recursively so as to predict the future values of x_t:

$$x_t = \Gamma^{-1}(a_0 + a_1 t + C x_{t-1} + \tau_0 d_t + \tau_1 d_{t-1} + \epsilon_t) \quad (8)$$

3 Estimation methodology

3.1 Sample of countries

We consider quarterly data over the 1980Q1-2011Q1 period for the 30 following countries: Algeria, Argentina, Australia, Bahrain, Brazil, Canada, Chile, China, the Euro area, India, Indonesia, Japan, Korea, Kuwait, Malaysia, Mexico, New Zealand, Nigeria, Norway, Oman, the Philippines, Qatar, Saudi Arabia, Singapore, South Africa, Turkey, the United Arab Emirates, the United Kingdom, the United States, and Venezuela. To account for potentially different impacts of oil supply/demand shocks, we split our sample in two sub-groups of countries depending on whether they are oil importers or oil exporters. To make the empirical analysis more tractable, we also group our countries in four regions, namely Latin America, Emerging Asia, the Gulf region and Rest of the World[12] (see Table 1). The Euro area is considered as an economy as a whole, and is constructed as a weighted average of Germany, France, Italy, Spain and the Netherlands, using country-specific average purchasing power parity GDP weights[13] over the 2006-2008 period. A similar methodology is used for the construction of the four other regions, namely Latin America, Emerging Asia, the Gulf region, and ROW.

3.2 Individual country-specific models

We consider four country-specific variables, namely real GDP $(y_{i,t})$, real exchange rates $(rer_{i,t})$, equity prices $(ep_{i,t})$ and current accounts $(ca_{i,t})$.[14] The country-specific vector of domestic variables $x_{i,t}$ is thus given by:

$$x_{i,t} = (y_{i,t}, rer_{i,t}, ep_{i,t}, ca_{i,t})' \quad (9)$$

$y_{i,t}$ is given by the ratio of nominal GDP to consumer price index (CPI), expressed in logarithm and in constant US dollars. $rer_{i,t}$ denotes the logarithm of the real effective exchange

[12] Denoted ROW hereafter.
[13] Country-specific weights are extracted from the World Development Indicators' database (World Bank).
[14] Data sources are given in Appendix A.

Table 1: Countries and regions in the GVAR model

Oil importers		**Oil exporters**	
Latin America		Algeria	
Emerging Asia		Canada	
China		**Gulf region**	
Euro area		Indonesia	
India		Mexico	
Japan		Nigeria	
Rest of the world		United Kingdom	
United States		Venezuela	
		Norway	
Latin America	**Emerging Asia**	**Gulf region**	**Rest of the World**
Argentina	Korea	Bahrain	Australia
Brazil	Malaysia	Kuwait	New Zealand
Chile	Philippines	Oman	Turkey
	Singapore	Qatar	South Africa
		Saudi Arabia	
		UAE	

rate of each country i at time t; real effective exchange rates being based on relative CPI. Equity price series $ep_{i,t}$ are calculated as the ratio of the nominal equity price index to CPI, and are expressed in logarithm. Current account data are expressed in US dollars and equal to 100 in 2005 base year.[15]

The foreign-specific variables are constructed from the domestic ones using average trade weights over the 1980-2011 period. Those weights are based on the sum of imports and exports, and are extracted from the Direction of Trade Statistics database.[16] Having defined four regions, the regional trade share is also constructed so that $w_{ii} = 0$, where i denotes either a country or a region, the i^{th} row summing to one for all i. The vector $x^*_{i,t}$ of country-specific foreign variables is thus given by:

$$x^*_{i,t} = \left(y^*_{i,t}, rer^*_{i,t}, ep^*_{i,t}, ca^*_{i,t}\right)' \tag{10}$$

Finally, in addition to these four country-specific variables, our VARX models include two common global variables, namely the oil price and oil production. As previously mentioned,

[15] Note that current-account series for Mexico, the Philippines, Argentina and Brazil have been seasonally adjusted by the reg-ARIMA procedure (regression models with ARIMA errors, in which the mean function of the time series is described by a linear combination of regressors, and the covariance structure of the series is that of an ARIMA process). For the sake of completeness, we have also used the TRAMO-SEATS procedure, leading to similar results.

[16] The weighting matrix is given in Appendix F.

we consider two reference countries/regions, the U.S. and the Gulf region. Following Pesaran et al. (2004) and Dees et al. (2007) among others, we include the oil price as an endogenous variable in the U.S. model:

$$x_{us,t} = (y_{us,t}, rer_{us,t}, ep_{us,t}, ca_{us,t}, poil_t)' \tag{11}$$

where *poil* stands for the oil price index (in logarithm).
Turning to the Gulf region model, oil production is included as an endogenous variable (see Cashin et al., 2013):

$$x_{gulf,t} = (y_{gulf,t}, rer_{gulf,t}, ep_{gulf,t}, ca_{gulf,t}, qoil_t)' \tag{12}$$

where *qoil* denotes the world oil production (in logarithm).

The foreign counterparts of these vectors of variables for the U.S and Gulf region models are respectively given by:

$$x^*_{us,t} = (y^*_{us,t}, rer^*_{us,t}, ep^*_{us,t}, ca^*_{us,t}, poil_t)' \tag{13}$$

and

$$x^*_{gulf,t} = (y^*_{gulf,t}, rer^*_{gulf,t}, ep^*_{gulf,t}, ca^*_{gulf,t}, qoil_t)' \tag{14}$$

Table 2 summarizes the endogenous and foreign variables included in the country-specific models.

3.3 Oil supply/demand shock identification

To account for the different types of shocks, we need to discriminate between oil supply-driven and oil demand-driven shocks. To this aim, we impose sign restrictions on oil price, oil production and real GDP for both oil-exporting and oil-importing countries/regions. We rely on structural vector autoregressive (SVAR) models to identify oil-demand and oil-supply shocks (see among others Peersman and Van Robays, 2009; Baumeister and Peersman, 2010; and Baumeister et al., 2010). The idea underlying sign restrictions is that structural shocks can be identified by checking whether the signs of the corresponding impulse responses are in line with economic theory.

According to Fry and Pagan (2007), the sign restrictions' approach suffers from two drawbacks: it does not wedge a unique structural model, and any sign restriction identification procedure is likely to be imperfect. More precisely, the authors provide an analytical example based on a simple two equations-demand/supply model in which sign restrictions are not able

Table 2: Domestic and foreign variables included in the country-specific models

	Emerging Asia		Gulf region		Latin America	
Variables	Endogenous	Foreign	Endogenous	Foreign	Endogenous	Foreign
Real GDP	$y_{i,t}$	$y^*_{i,t}$	$y_{gulf,t}$	$y^*_{gulf,t}$	$y_{i,t}$	$y^*_{i,t}$
Equity price	$ep_{i,t}$	$ep^*_{i,t}$	-	$ep^*_{gulf,t}$	$ep_{i,t}$	$ep^*_{i,t}$
Current account	$ca_{i,t}$	$ca^*_{i,t}$	$ca_{gulf,t}$	$ca^*_{gulf,t}$	$ca_{i,t}$	$ca^*_{i,t}$
Exchange rate	$rer_{i,t}$	-	$rer_{gulf,t}$	-	$rer_{i,t}$	-
Oil price	-	$poil_t$	-	$poil_t$	-	$poil_t$
Oil production	-	$qoil_t$	$qoil_t$	-	-	$qoil_t$
	China		Euro area		United States	
Variables	Endogenous	Foreign	Endogenous	Foreign	Endogenous	Foreign
Real GDP	$y_{i,t}$	$y^*_{i,t}$	$y_{i,t}$	$y^*_{i,t}$	$y_{us,t}$	$y^*_{us,t}$
Equity price	-	$ep^*_{i,t}$	$ep_{i,t}$	$ep^*_{i,t}$	$ep_{us,t}$	$ep^*_{us,t}$
Current account	$ca_{i,t}$	$ca^*_{i,t}$	$ca_{i,t}$	$ca^*_{i,t}$	$ca_{us,t}$	$ca^*_{us,t}$
Exchange rate	$rer_{i,t}$	-	$rer_{i,t}$	-	$rer_{us,t}$	-
Oil price	-	$poil_t$	-	$poil_t$	$poil_t$	-
Oil production	-	$qoil_t$	-	$qoil_t$	-	$qoil_t$

to catch the correct sign of the impulse responses due to the very weak information embodied in the restrictions. On the contrary, Paustian (2007) argues that sign restrictions are able to pin down the correct sign of the impulse responses generated by a dynamic stochastic general equilibrium (DSGE) model provided that a fairly large number of sign restrictions is imposed.

Regarding the criticisms addressed to the sign restriction approach, our empirical analysis is in line with Chudik and Fidora (2011) who stress the benefits that can be derived from the global dimension of the GVAR for the identification of shocks, by adding a large number of sign restrictions. The global dimension indeed allows shifting from a weak information situation to a highly informative situation.[17] More specifically, to distinguish between the different shocks' effects, we have to separate equations determining oil-demand and oil-supply shocks, justifying the need for an oil production equation and an oil price one for the identification of both disturbances.

Oil supply-driven shocks are then associated with a rise in oil prices, a fall in oil production, and no global economic activity expansion (see Table 3). Conversely, oil demand-driven shocks are associated with a positive co-movement between oil prices and oil production. The oil-demand shock we consider here is a shock caused by an increase in global economic activity,

[17]See Chudik and Fidora (2011) for further details.

leading us to expect the GDP growth of both oil importers and exporters to be positively associated to this shock.

Table 3: : Sign restrictions on impulse responses in the GVAR model

	Sign restrictions	
	Oil-supply shock	Oil-demand shock
Oil price	+	+
Oil production	−	+
$GDP_{oil\sim importers}$	−	+
$GDP_{oil\sim exporters}$		+

4 Empirical results

Considering that the current balance is defined as the sum of merchandise trade balance, service trade balance and income balance, we successively analyze the responses of real GDP, real effective exchange rates, real equity prices, and current-account balances to oil price shocks. The response of the current-account balance to oil shocks indeed results from the interaction of different transmission channels: (i) the trade channel proxied by economic activity in both net oil importers and exporters (real GDP); (ii) the inflation channel embodied by the real effective exchange rate; and (iii) the valuation effect represented by the equity price. As stressed above, two oil shocks—supply-driven and demand-driven shocks—are distinguished in order to investigate whether supply-driven (demand-driven) oil price shocks have a stronger influence than demand-driven (supply-driven) shocks on global imbalances. Impulse-response functions derived from the estimation of our GVAR model are reported in Appendices B and D for oil-exporting countries, and in Appendices C and E for oil importers.

4.1 Responses of real GDP

Consider first the case of oil-importing countries. As positive oil price shocks deteriorate terms of trade in those economies, they are accompanied by a transfer of wealth to oil-exporting countries. As a result, the domestic absorption in the former may contract over time. Overall, the two oil price shocks (supply-driven and demand-driven) do not have a strong and negative impact on real GDP (Appendices C and E). More specifically, except for the United States (supply-driven shock) and the Euro area (demand-driven shock), real GDP increases in the aftermath of the shocks. These results are in line with Rasmussen and Roitman (2011) who find that large oil price shocks[18] do not have a widespread negative effect on economic

[18]They define large oil price shocks as episodes in which oil prices have reached three-year rise.

activity in net oil-importing countries. Similarly, using a multiregion dynamic general equilibrium model, the IMF (2011) suggests that a decline in the average growth rate of world oil production does not lead to severe long-term output effects.

Regarding specifically the U.S. case, the supply-driven oil price shock has a negative—but short-lived—influence on real GDP (Appendix C). Such a result is expected insofar as the identification of our GVAR model is based on negative relationships between the supply-driven shock and global economic activity (see the sign restrictions in Table 3). In addition, a negative response of real GDP may result from the heavily dependence of some oil importers on energy consumption (Peersman and Van Robays, 2012). However, the geographical composition of trade and the leading influence of oil prices on other commodity prices should also be accounted for, as trade links may indeed explain the positive response of real GDP to supply-driven shocks in China, Emerging Asia, and Japan. As stressed by the IMF (2011) and Cashin et al. (2013), Asian economies benefit from the increased exports to net oil-exporting countries—as confirmed by the trade matrix (see Appendix F) showing that these economies have close trade relations with many net oil exporters.[19] This effect is strengthened by the positive impact of the driven-supply shock in the ROW and Latin American economies. Indeed, in these two sets of countries, the oil supply-driven shock leads to an increase in real GDP, and such a response rests on the positive co-movement of non-energy commodity prices with energy prices—agricultural products and/or fuel and mining products accounting for a significant share of total exports in countries belonging to these regions.[20]

Considering now the impact of the oil demand-driven shock—explained by an expansion in global economic activity—our findings show that, as expected, real GDP increases in the aftermath of the shock in all importing countries but the Euro area for which the effect lasts after one year (Appendices C and E). Interestingly, the time profile comparison of the two shocks evidences that the positive impact of the supply-driven shock is shorter than that of the demand-driven shock. This finding qualifies our overall result that the two shocks have a qualitatively similar influence on real GDP. Specifically, if these shocks tend to exert a positive impact on real GDP in a multilateral framework, the shorter-lived effects of the supply-driven shock support the view that the increase in oil prices explained by a contraction in oil production negatively affects global economic activity.

Turning now to oil exporters, the response of real GDP to oil price shocks in those countries depends on numerous factors. Some of them refer to supply conditions such as investment in the energy sector and the strategy of production diversification. Those supply conditions are closely related to the policies adopted by domestic authorities, but also to the development

[19] Recall that Appendix F exhibits trade weights based on both exports and imports. However, our findings do not differ if we consider only weights based on exports. Results are available upon request to the authors.

[20] And for Turkey, to a lesser extent.

level of the financial system. While the former refers to the use of additional income from higher oil prices—mainly through fiscal policy—the latter concerns the ability to allocate savings efficiently. In addition, as stressed by the Dutch disease literature[21], an increase in oil prices may lead to real exchange rate appreciation, implying distortions in resource allocation. However, as suggested by Berument et al. (2010), a real appreciation decreases the prices of imported intermediary products that stimulates production. Finally, the response of real GDP to oil price shocks partly mirrors the reaction of net oil-importing countries.

As evidenced in Appendices B and D, the two oil shocks have different influences on real GDP in net oil exporters. While the supply-driven shock is not necessarily followed by a rise in real GDP, economic activity tends to increase in the aftermath of the demand-driven shock. More specifically, regarding supply-driven shocks, real GDP rises in Algeria and Mexico—with long-lasting effects observed in these countries—Nigeria, and to a lesser extent Canada. These countries share two common distinguishing features. First, throughout much of the studied period, their oil production rose. Second, they experience a common increase in their oil trade balance surplus over time.[22] Conversely, Appendix B displays a negative response of real GDP in the Gulf region, Indonesia, the United Kingdom, and Venezuela. Regarding the Gulf region, in addition to its high levels of macroeconomic volatility (Arezki and Nabli, 2012), our findings may be explained by the presence of productive inefficiencies in this area. The negative response of the real GDP in Indonesia and the United Kingdom rests on two main factors: the declining trend in oil production (since 1990 and 1999, respectively), and a shifting position from net oil exporters to net oil importers (since 2003 and 2004, respectively). Venezuela has been experiencing a declining trend in its oil production since 1998, resulting from institutional deficiencies (corruption, fiscal greed...) and insufficient investment in the energy sector. In other words, Venezuela is affected by the resource curse.[23]

When significant, the oil demand-driven shock leads to an increase in real GDP in all countries except for Norway—the negative response is significant only at the impact—the United Kingdom after two years, and Indonesia after three years. Whatever the type of shock, Norway seems thus particularly immune from oil price changes. However, this country is the largest oil exporter in the world—the average ratio of oil exports to total exports amounting to 55.3 percent over the studied period—and oil and natural gas sectors provide the government with around 30 percent of its revenue. In fact, our results are in line with the literature that stresses the role of fiscal policy in this country. For instance, Pieschacón (2012), by using a VAR model to evaluate the effects of oil price changes in some macroeconomic variables in Mexico and Norway, shows that the lack of significant response for the latter contrary to the former is due to the transfer of the totality of its oil cash flow to the Government Pension

[21] See e.g. Corden and Neary (1982).
[22] For Mexico, we can observe a reduction in the oil trade balance surplus since 2006.
[23] On the resource curse, see Gylfason (2011) and van der Ploeg (2011).

Fund-Global. Indeed, such a framework allows Norway to conduct a countercyclical fiscal policy (see also Gylfason, 2011).

4.2 Responses of real exchange rates

A rise in the real oil price represents negative (positive) terms of trade and income shocks for net oil importers (net exporters). As a result, since the real exchange rate adjustment ensures current-account sustainability, general equilibrium models predict the real exchange rate to depreciate (appreciate) in net importing (net exporting) countries.[24] For instance, in net oil importers, a real exchange rate depreciation allows the improvement of the non-oil trade balance that compensates for the degradation of the oil trade balance. Broadly speaking, our results contradict these theoretical predictions. On the one hand, we generally find that the real exchange rate in net oil importers tends to appreciate whatever the type of the underlying shock (Appendices C and E), emphasizing the inflationary consequences of the oil shock.[25] On the other hand, for net oil exporters, there is no clear link between oil price shocks and real exchange rate, whatever the exchange-rate regime adopted by those countries. It should be noticed that the demand-driven shock tends to be accompanied by more frequent real appreciation episodes while the opposite is observed for the supply-driven shock, suggesting that inflationary pressures are stronger when the oil price increase is due to a rise in global economic activity. The strongest appreciation is observed (i) on the short run for Venezuela, confirming that this country is faced with important difficulties to stabilize the economy in the aftermath of oil price shocks, and (ii) on the long run in the Gulf region, suggesting that the peg to the U.S. dollar constraints the ability of authorities to contain inflationary pressures due to oil shocks.

While Cashin et al. (2013) find that real exchange rate appreciates in oil exporters, our results are in line with Buetzer et al. (2012) and Dauvin (2014). Using a fixed effects pooled panel model for a sample of 12 advanced and 32 emerging economies over the 1980-2011 period, Buetzer et al. (2012) show that there is no evidence of systematic appreciation of net oil exporters relative to net importers, emphasizing the role played by the accumulation of foreign exchange reserves. In a similar way, Dauvin (2014) estimates panel smooth transition regression models for 10 energy-exporting and 23 commodity-exporting countries over the 1980-2011 period. She does not identify a clear relationship between positive terms of trade shocks and the real exchange rate appreciation for oil-exporting countries (except for Venezuela).

[24] See, among others, Elekdag et al. (2008), Bodenstein et al. (2011), and IMF (2011).

[25] Note that the supply-driven shock does not affect the real exchange rate in the Euro area, in line with Dees et al. (2007) and Cashin et al. (2013).

4.3 Responses of real equity prices

Changes in net foreign asset positions are part of the external adjustment in the aftermath of positive oil price shocks (Kilian et al., 2009). More specifically, the valuation channel rests on the following mechanism: as net oil exporters (importers) diversify their portfolio by holding assets from oil-importing (exporting) economies, a change in equity returns due to oil price shocks has an influence on the global adjustment process. Changes in asset values are an expected consequence of oil price shocks. Indeed, as oil price shocks are equivalent to a transfer of wealth from net oil importers to net oil exporters, we must observe a negative (positive) impact on equity returns in the former (the latter). As a result, lower (higher) equity prices in oil-importing (exporting) countries play as a wealth transfer in the opposite way. In other words, the valuation channel implies a transfer of some of the increased wealth that accompanies oil price shocks from net oil exporters to net importers. We analyze the valuation channel by considering the response of real equity prices in net oil importers and exporters to supply-driven and demand-driven shocks.[26]

Considering first the case of net oil importers (Appendices C and E), the short-term impact of the supply-driven shock is negative (except in Japan at the impact) while we find the opposite for demand shocks. Such a result supports our previous finding concerning the responses of real GDP. More specifically, as oil demand shocks are driven by an increase in global economic activity, we can expect a positive response of real equity prices. Turning to the case of oil exporters, oil supply-driven and demand-driven shocks exhibit similar responses of real equity prices (Appendices B and D).

On the whole, our findings qualify the previous literature on the role of the valuation effect in the global adjustment process.[27] On the one hand, results suggest that responses of real equity prices in net oil importers differ according to the underlying oil shock. Clearly, in the case of a shock driven by a rise in global economic activity, there is no wealth transfer from net oil exporters to importers. On the other hand, real equity price responses are relatively short-lived.

4.4 Responses of current-account balances

As shown in Appendices C and E, both shocks tend to be followed by an increase in current-account deficits in net oil-importing economies, with however some interesting specificities. First, the sizes of the responses are larger for supply-driven shocks relative to demand-driven ones. Second, the former has a higher influence on current-account imbalances than the latter.

[26] Due to data availability constraints, the number of studied countries in the group of net oil exporters is limited.

[27] Recall that related empirical studies report mixed results on this question. For instance, the study released by the IMF (2006) gives insignificant responses of real equity prices to oil shocks, while Kilian et al. (2009) find partially significant responses of net foreign asset positions in both net oil importers and exporters.

These two results suggest that oil-supply shocks contribute more to the increase in current-account imbalances than oil-demand shocks. Third, the supply-driven shocks' effects are closely related to the degree of energy dependence. More specifically, as shown in Appendix C, heavily dependent economies experiment especially strong responses of their current account to oil shocks (Japan, China, and the United States).[28] This relationship is attenuated for oil-demand shocks, suggesting that the trade channel tends to smooth the reaction of the current account in those cases.

Regarding net oil exporters, both shocks increase current-account surpluses, as expected (Appendices B and D). In fact, current-account responses of net oil exporters mirror those of oil importers. Indeed, our results show that supply-driven shocks are accompanied by higher surplus than demand-driven disturbances.[29] Interestingly, we find a similar result for net oil-importing countries, but in the direction of current-account deficits.

5 Conclusion

This paper investigates the respective effects of oil supply-driven and oil demand-driven shocks on global imbalances, as well as their transmission channels. To this end, we adopt a Global VAR approach that allows us to account for trade and financial interdependencies between countries. Three key findings emerge from our analysis. First, we evidence that the impact of oil shocks on global imbalances depends on the source of those shocks. Demand-driven shocks have a weak impact on current-account imbalances, a result that may be explained by the importance of the trade channel when the rise in oil price comes from an increase in global economic activity. Second, contrary to general equilibrium models, the real exchange rate does not play a key role in the global adjustment process. Third, while we identify a significant valuation channel, it is short-lived, and the trade channel—mostly explained by trade interdependencies between countries—represents the main adjustment mechanism to oil shocks.

Our findings have important implications since they show that the nature of the transmission of oil price shocks depends on the type of the shock. Furthermore, in addition to short-term valuation effects, the dynamics of energy exports and imports plays a key role in explaining global imbalances. On the whole, fully understanding the effects of oil shocks on global balances requires to consider both the trade channel and international capital flows. One promising extension would be to account for time-changing effects of oil price shocks using time-varying parameters GVAR models; this is left for future research.

[28] Peersman and van Robays (2012) find the same result for the responses of real GDP.

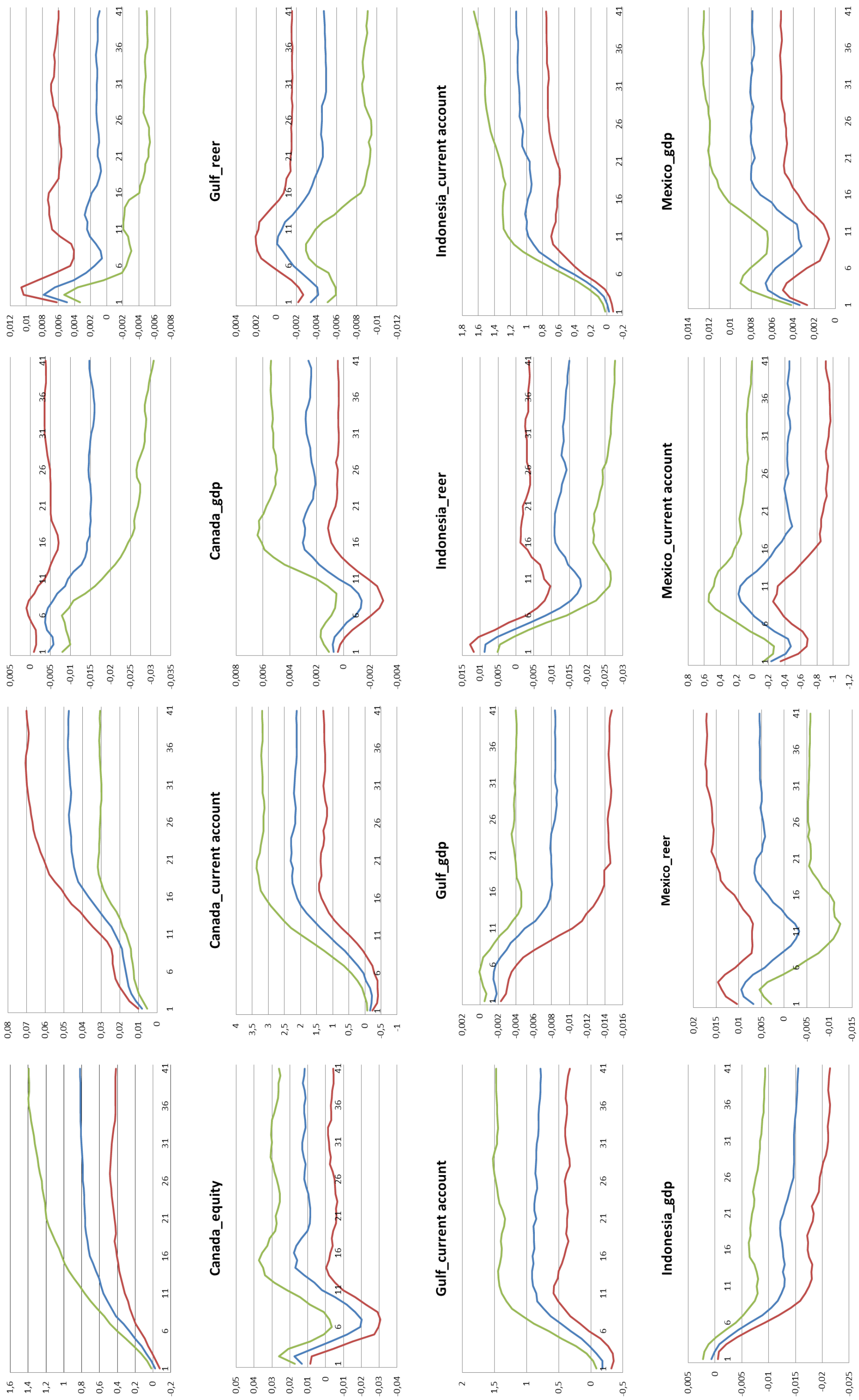
[29] The Gulf region is an exception, as the demand-driven shock exhibits a stronger response at all horizons. Responses to demand-driven shock are statistically insignificant in Nigeria and Venezuela, a result that can be explained by the dramatic inefficiencies that characterized those countries, as stressed above.

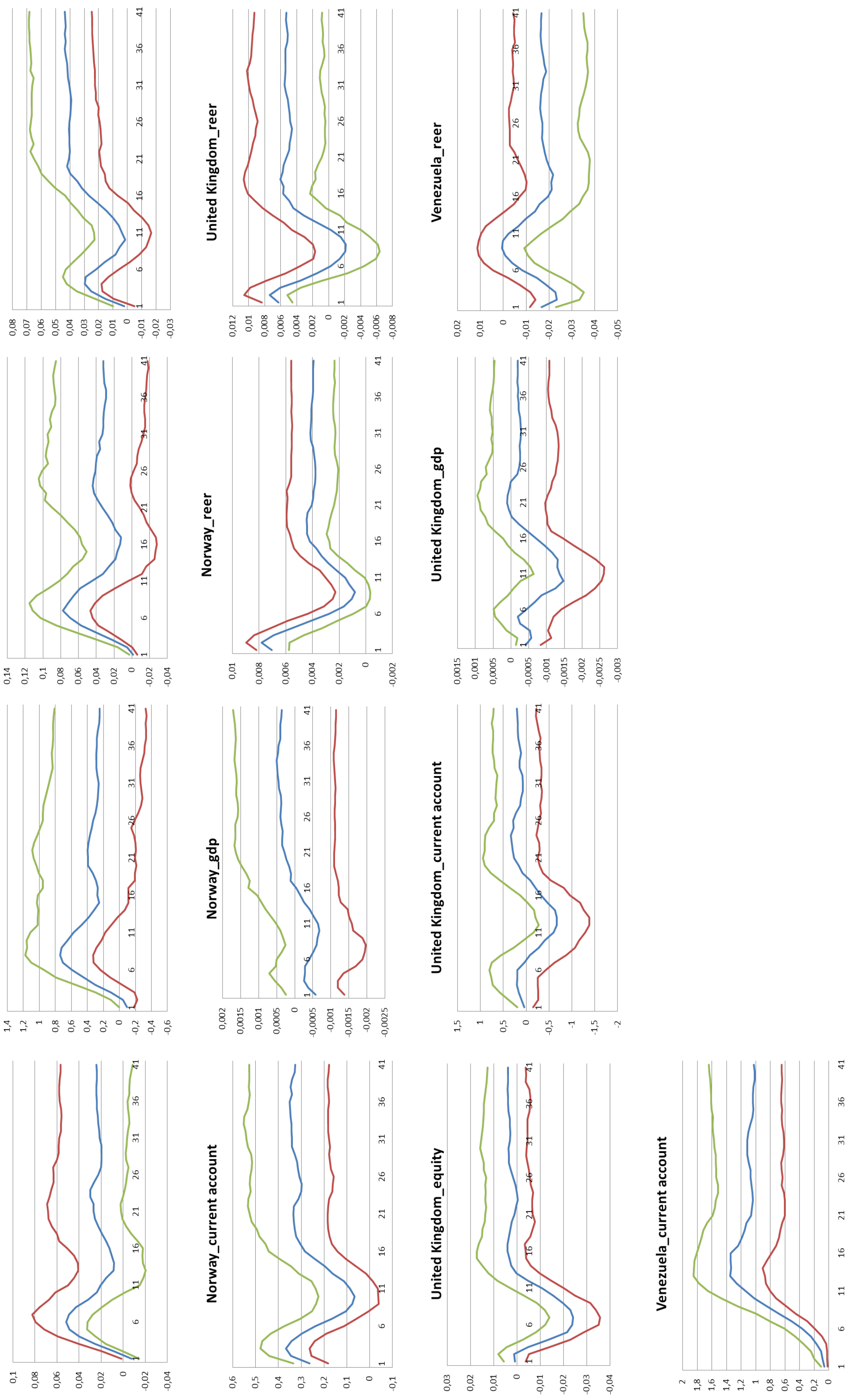
Appendix A - Data sources

Countries	Real GDP	CPI	Real exchange rate	Equity price	Current account	Oil price	Oil production
Algeria	IFS+WEO	IFS	IFS	Bloomberg	WEO	psw	Datastream
Argentina	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
Australia	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
Bahrain	IFS+WEO	IFS	IFS	Bloomberg	WEO	psw	Datastream
Brazil	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
Canada	IFS	IFS	IFS	Bloomberg	IFS+WDI	psw	Datastream
Chile	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
China	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Euro zone	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
India	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Indonesia	IFS	IFS	IFS	Bloomberg	WEO+IFS+WDI	psw	Datastream
Japan	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Korea	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
Kuwait	IFS+WEO	IFS	IFS	Bloomberg	WEO	psw	Datastream
Malaysia	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Mexico	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
New Zealand	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Nigeria	IFS+WEO	IFS	IFS	Bloomberg	WEO	psw	Datastream
Norway	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Oman	IFS+WEO	WEO	IFS	Bloomberg	WEO	psw	Datastream
Philippines	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
Qatar	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Saudi Arabia	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
Singapore	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
South Africa	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
Turkey	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream
United Arab Emirates	IFS	WEO	IFS	Bloomberg	WEO	psw	Datastream
United Kingdom	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
United States	IFS	IFS	IFS	Bloomberg	IFS	psw	Datastream
Venezuela	IFS	IFS	IFS	Bloomberg	WEO	psw	Datastream

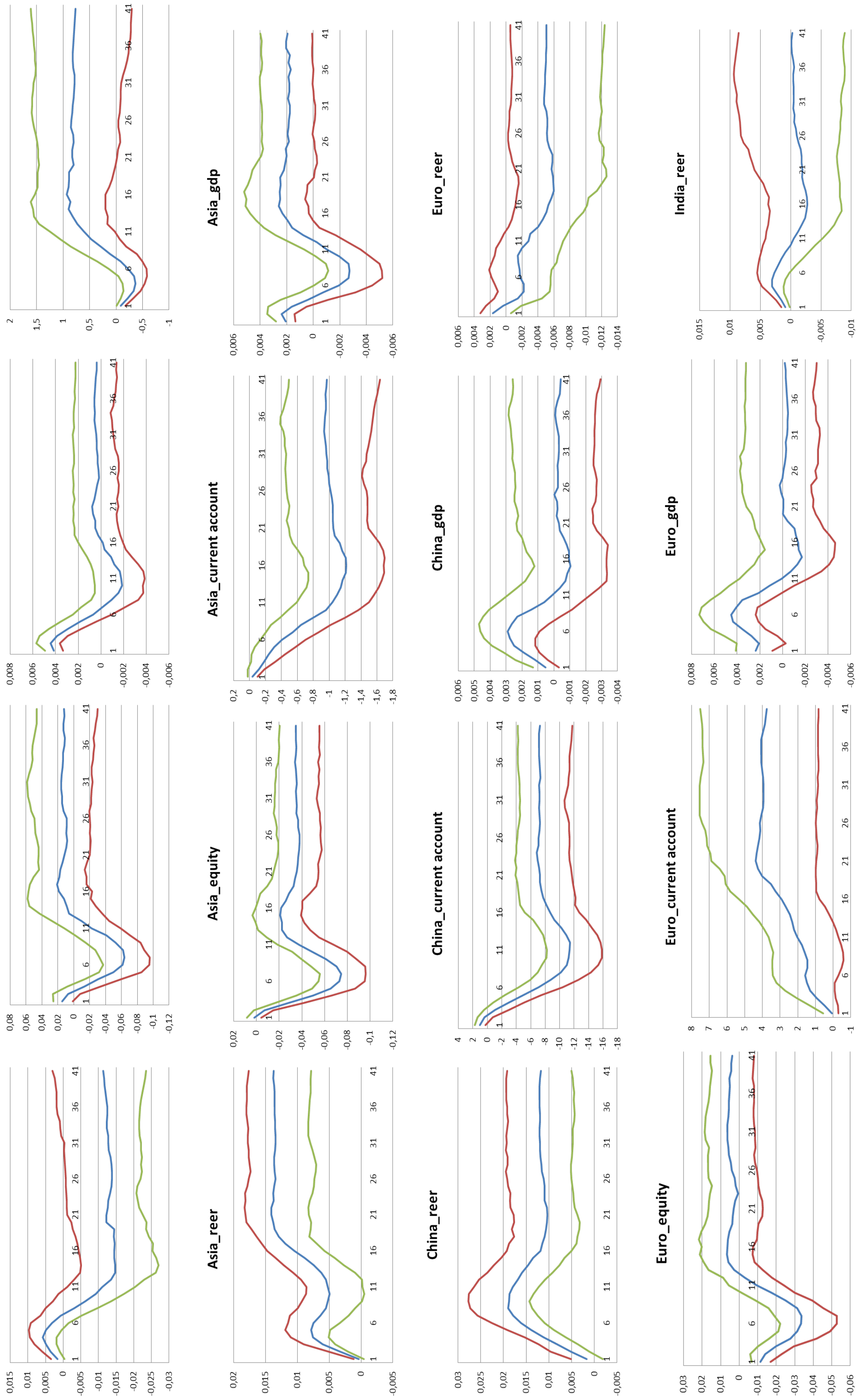
Note: psw refers to the on line database available on the Pesaran's web page:
https://sites.google.com/site/gvarmodelling/

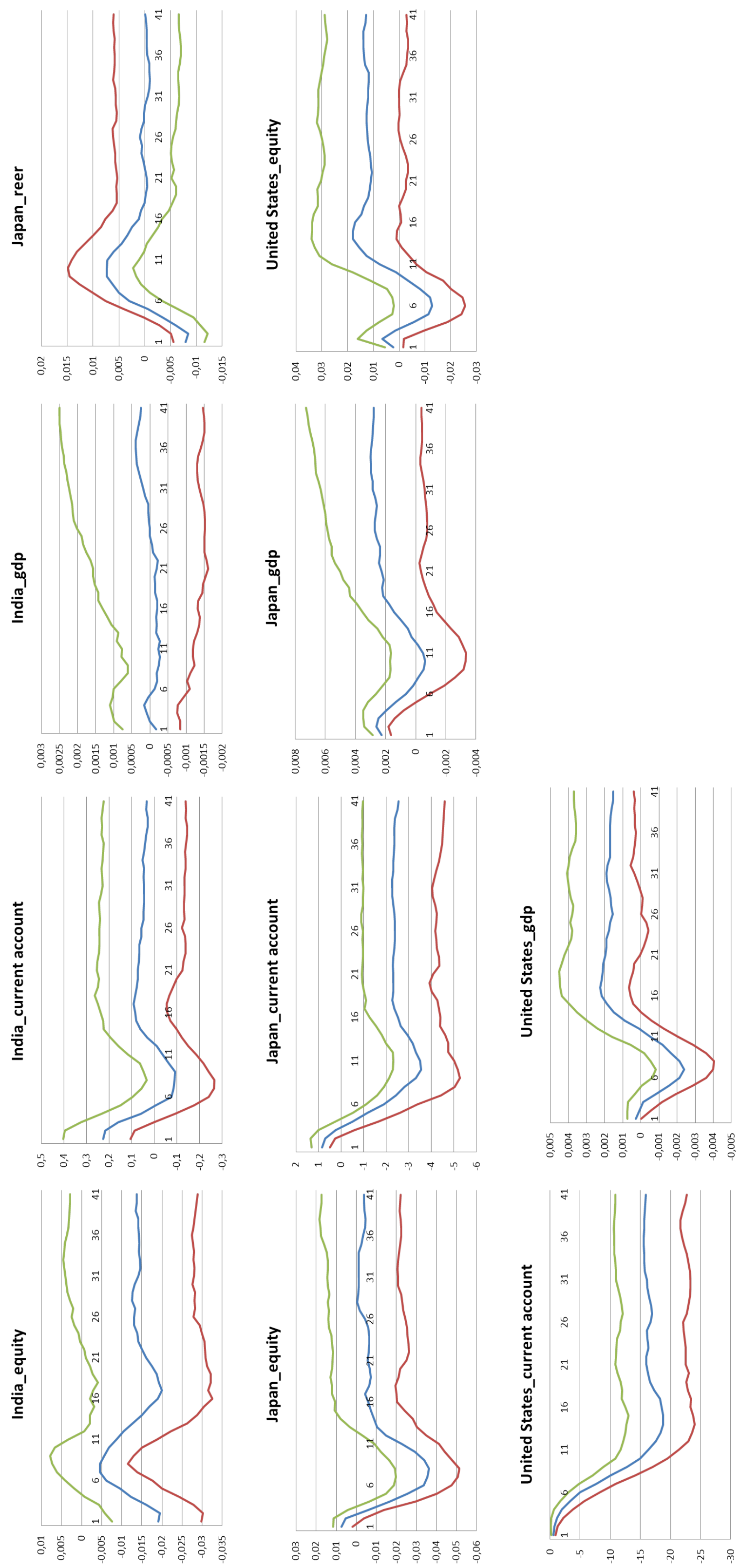
Appendix B: Oil-supply shocks: exporting countries



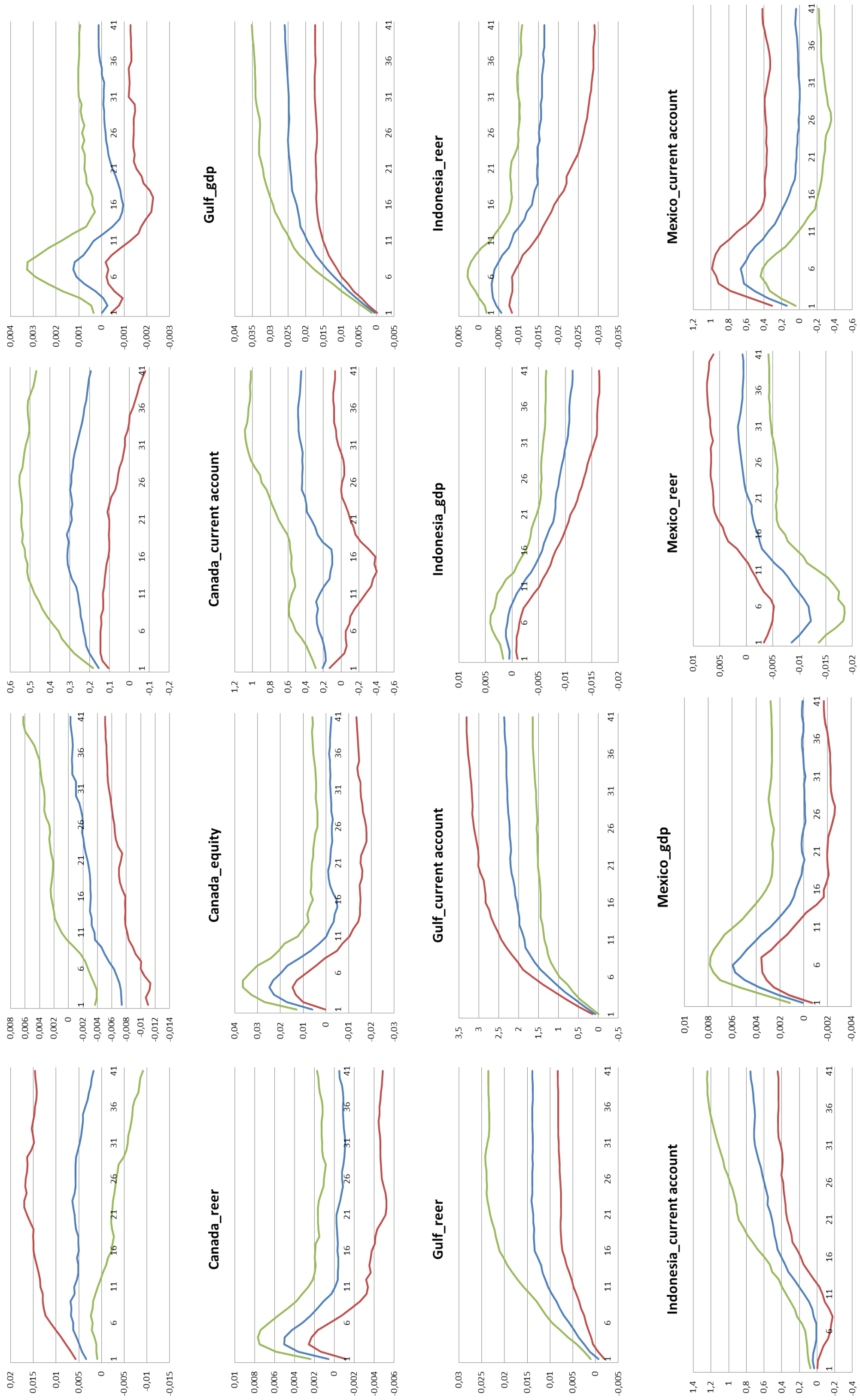

Nigeria_reer
Nigeria_current account
Nigeria_gdp
Norway_equity
Norway_current account
Norway_gdp
Norway_reer
United Kingdom_reer
United Kingdom_equity
United Kingdom_current account
United Kingdom_gdp
Venezuela_reer
Venezuela_current account

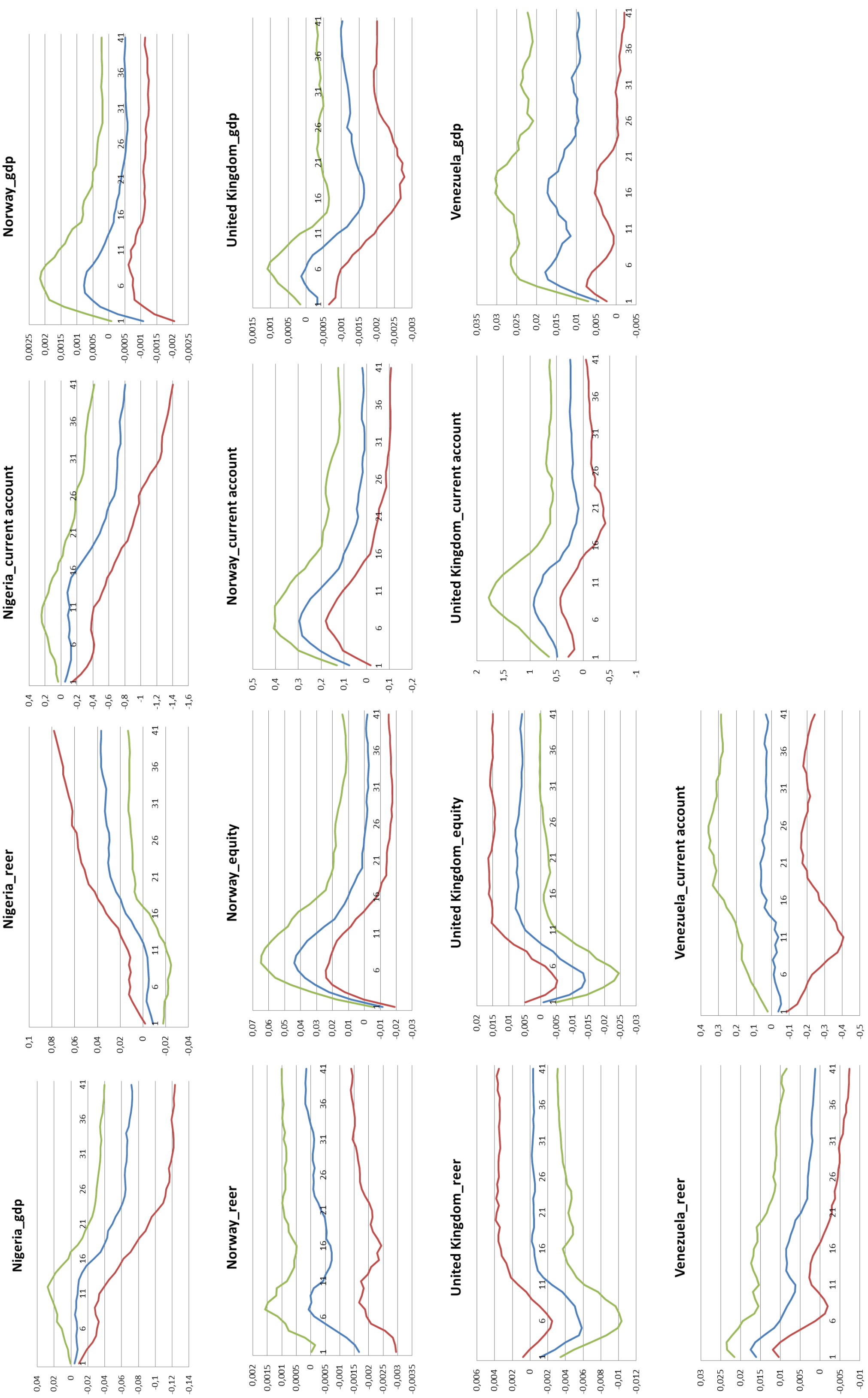
Appendix C: Oil-supply shocks: importing countries



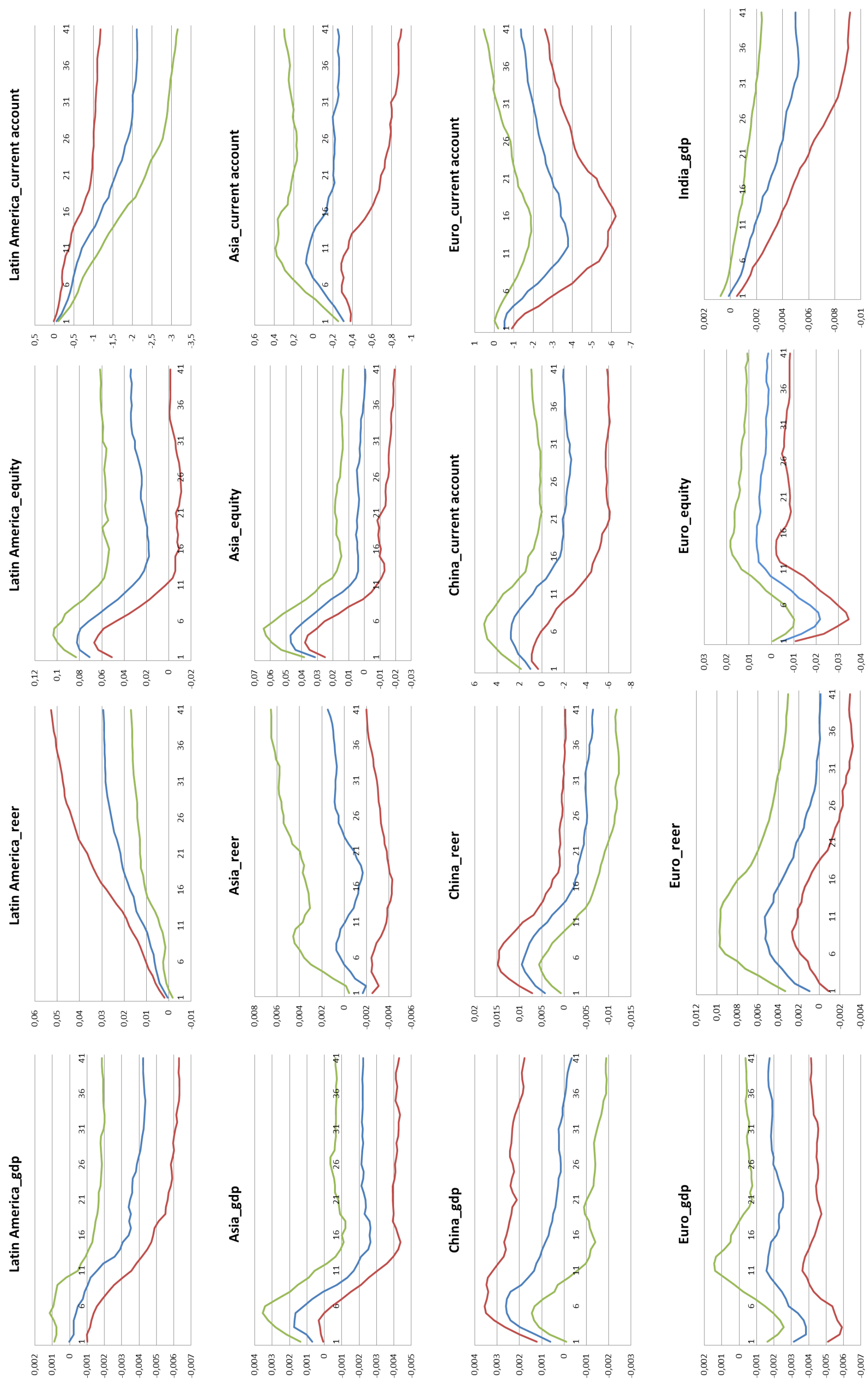

Japan_reer
India_gdp
India_current account
India_equity
United States_equity
Japan_gdp
Japan_current account
Japan_equity
United States_gdp
United States_current account

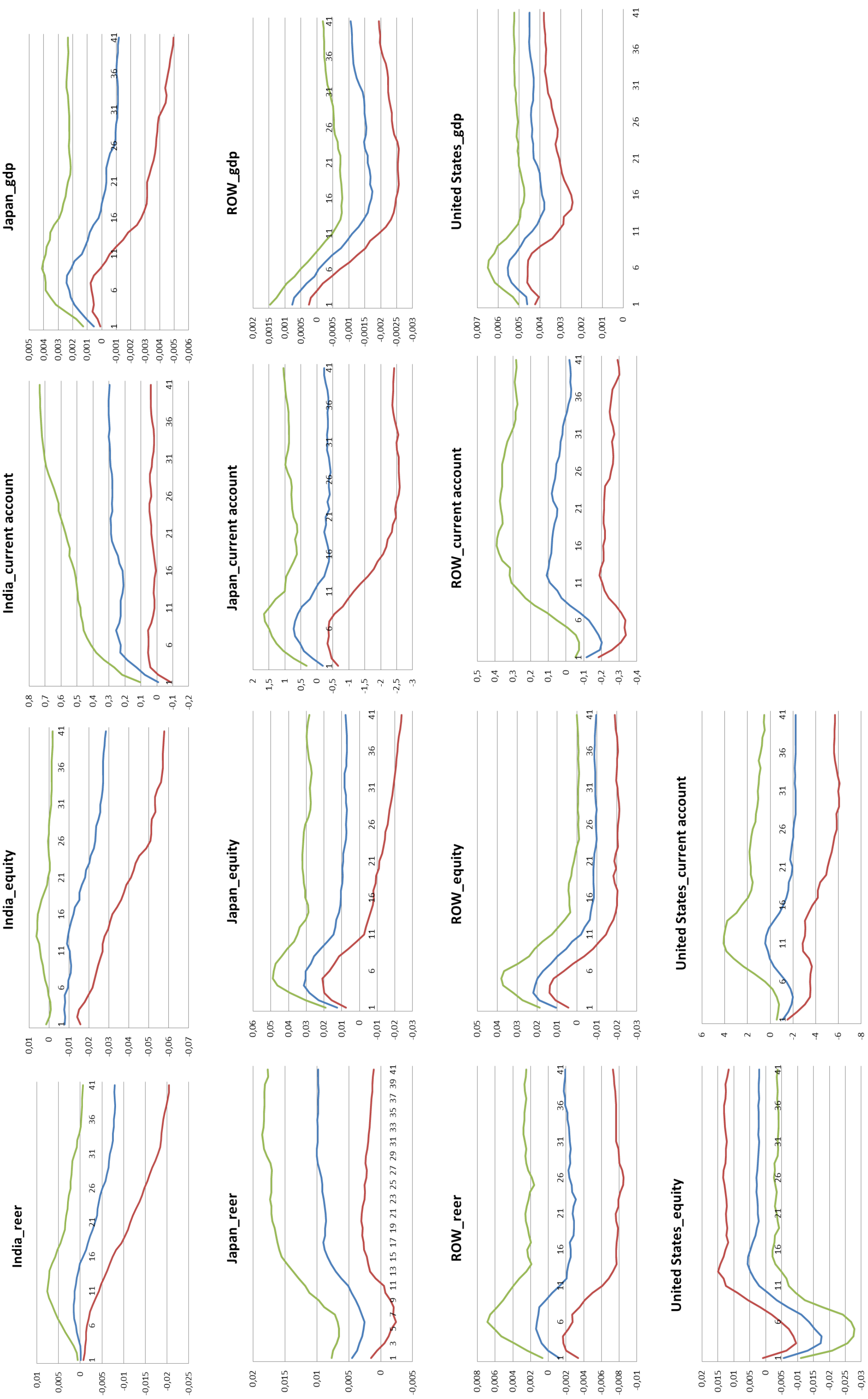
Appendix D: Oil-demand shocks: exporting countries




Nigeria_gdp
Nigeria_reer
Nigeria_current account
Norway_gdp
Norway_reer
Norway_equity
Norway_current account
United Kingdom_gdp
United Kingdom_reer
United Kingdom_equity
United Kingdom_current account
Venezuela_gdp
Venezuela_reer
Venezuela_current account

Appendix E: Oil-demand shocks: importing countries




India_reer
India_equity
India_current account
Japan_gdp
Japan_reer
Japan_equity
Japan_current account
ROW_gdp
ROW_reer
ROW_equity
ROW_current account
United States_gdp
United States_equity
United States_current account

Appendix F

Table 4: Weighting matrix (average of weights for the 1980-2011 period)

	Latin America	Emerging Asia	Gulf region	ROW	China	Euro area	India	Japan	USA	Algeria	Canada	Indonesia	Mexico	Nigeria	UK	Venezuela	Norway
Latin America	0.000	0.063	0.010	0.040	0.144	0.310	0.020	0.059	0.212	0.011	0.020	0.008	0.034	0.021	0.022	0.020	0.005
Emerging Asia	0.010	0.000	0.045	0.084	0.165	0.186	0.041	0.139	0.189	0.002	0.008	0.092	0.005	0.001	0.028	0.002	0.002
Gulf region	0.008	0.178	0.000	0.071	0.094	0.202	0.114	0.203	0.072	0.000	0.004	0.010	0.000	0.002	0.040	0.000	0.001
ROW	0.016	0.119	0.030	0.000	0.120	0.329	0.040	0.126	0.128	0.005	0.011	0.018	0.004	0.004	0.048	0.001	0.002
China	0.025	0.126	0.023	0.051	0.000	0.278	0.026	0.116	0.259	0.003	0.021	0.015	0.013	0.005	0.035	0.003	0.003
Euro area	0.040	0.066	0.027	0.104	0.138	0.000	0.025	0.056	0.202	0.017	0.023	0.009	0.015	0.010	0.205	0.005	0.061
India	0.020	0.106	0.141	0.124	0.110	0.227	0.000	0.031	0.122	0.004	0.011	0.024	0.006	0.027	0.037	0.005	0.005
Japan	0.019	0.145	0.078	0.105	0.211	0.149	0.009	0.000	0.192	0.001	0.019	0.033	0.012	0.002	0.021	0.001	0.003
USA	0.030	0.067	0.010	0.041	0.140	0.214	0.014	0.074	0.000	0.007	0.200	0.007	0.124	0.013	0.038	0.019	0.001
Algeria	0.041	0.011	0.002	0.043	0.036	0.528	0.018	0.016	0.212	0.000	0.057	0.004	0.004	0.000	0.026	0.000	0.001
Canada	0.010	0.019	0.002	0.012	0.058	0.101	0.005	0.030	0.684	0.008	0.000	0.002	0.027	0.001	0.028	0.003	0.010
Indonesia	0.031	0.222	0.023	0.267	0.125	0.114	0.015	0.050	0.081	0.001	0.014	0.000	0.001	0.044	0.007	0.005	0.001
Mexico	0.027	0.042	0.000	0.006	0.063	0.092	0.004	0.035	0.686	0.001	0.028	0.002	0.000	0.001	0.007	0.006	0.001
Nigeria	0.076	0.030	0.009	0.034	0.054	0.294	0.084	0.019	0.350	0.000	0.008	0.005	0.003	0.000	0.031	0.001	0.002
UK	0.009	0.020	0.015	0.046	0.048	0.549	0.012	0.022	0.220	0.002	0.017	0.003	0.000	0.003	0.000	0.002	0.034
Venezuela	0.083	0.029	0.000	0.006	0.054	0.139	0.027	0.013	0.591	0.000	0.011	0.001	0.029	0.001	0.014	0.000	0.000
Norway	0.007	0.015	0.002	0.008	0.026	0.678	0.003	0.013	0.047	0.000	0.026	0.001	0.001	0.001	0.174	0.000	0.000

Source: Direction of Trade Statistics database.

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