

Financial liquidity, geopolitics, and oil prices

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Abstract

This paper aims simultaneously to study the global dynamic relationship of oil prices, financial liquidity, and geopolitical risk, on the one hand, and the economic performance of oil-dependent economies on the other. Global and country-specific dynamics are studied together in a Global Vector Autoregression (GVAR) model that allows different lag structures for different variables in different countries. Impulse response functions from the estimated model suggest that new waves of high oil prices are unlikely, despite the likely continuation of high global financial liquidity and heightened geopolitical risk, which had driven earlier episodes of very high oil prices. With oil remaining at modest to low prices by recent historical standards, we study the prospects for economic growth in oil-dependent economies through dramatic increases in domestic investment, as planned under Visions 2030 of a number of Arab economies, and conclude that success is unlikely.

Keywords: Geopolitics, Global Liquidity, Oil Prices, MENA Region, Arab Spring, Global VAR
JEL code: C32, E17, F44, F47, O53, Q43

1. Introduction

Arab economies are undergoing or about to undergo a painful transition period necessitated by fundamental transformations in oil markets, large revenue windfalls from which had shaped these economies over several decades. The effect of petrodollars has been pronounced, not only in shaping their primary recipients, which are the major oil-exporting countries with relatively small populations, but also their labor-exporting

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neighbors. Economies of the latter have largely been shaped by workers' remittances from oil-exporting countries, as well as the investment patterns (mostly in real estate) favored in these countries, which are the primary source of their foreign investment.

In recent years, countries in the region have finally come to accept the dawning of a post-petrodollar world, as the OPEC cartel lost market-supply power to shale production from the United States, and forecasted oil demand continues to decline with technological advances and environmental regulations, especially in the transportation and power generation sectors. Thus, a number of Arab countries have begun to construct medium to long-term economic plans that emphasize diversification to wean their economies away from direct and indirect dependence on crude-oil sales revenues. Most notable among these is the highly publicized Vision 2030 of Saudi Arabia (the largest Arab economy), and its earlier namesake sibling in Egypt (the largest Arab country by population).¹

Both visions rely on the forecast success of massive infrastructure and other investment programs to transform regional economies, provide job opportunities for their alarmingly-fast-growing labor forces, and enhance their prospects in an increasingly competitive global economy. The massive capital needs of those investment programs are envisioned to be met through privatization (including an initial public offering for Saudi Aramco, which may be the largest in history), foreign direct investment, or both.

Success or failure in the design and implementation of these optimistically transformative economic visions is of critical importance, not only for the Middle East and North Africa region, but also for the entire world, because, as some have put it, only partly in jest: "What happens in the Middle East does not stay in the Middle East." The econometric methodology that we use in this paper takes this notion seriously. Global and domestic variables interact in significant and often complicated ways that we need to understand empirically. In turn, because, as Shakespeare put it, "what's past is prologue," it is necessary to use the best available empirical methods to extract maximal information from available historical data. This allows us to examine various scenarios that shed

¹The Egyptian Vision was unveiled during the ramp-up to a major investor conference in March 2015; c.f. <http://www.mof.gov.eg/MOFGallerySource/English/Strategy.pdf>. The Saudi Vision was unveiled in a highly publicised announcement in April 2016, c.f. <http://vision2030.gov.sa/en>, but heavily based on an earlier document published by McKinsey Global Institute in December 2015, c.f. <http://www.mckinsey.com/global-themes/employment-and-growth/moving-saudi-arabias-economy-beyond-oil>.

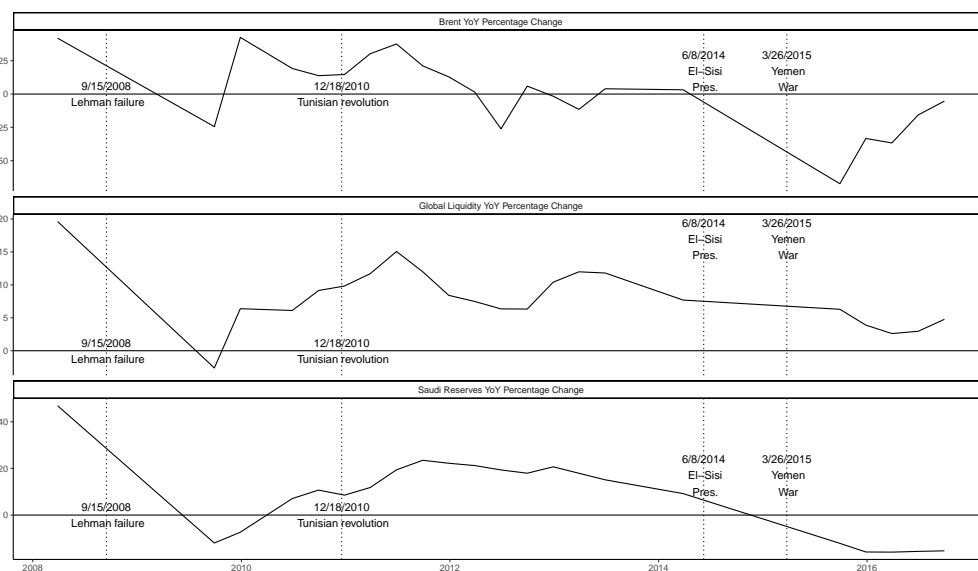
light on the potential success or failure of the region's economic attempts to adjust to a post-petrodollar world. In this regard, our estimated long-term domestic, regional, and global economic relationships serve as context and *de facto* constraints.

We investigate the interactions of three main variables at both global and domestic levels, using a large quarterly dataset that we compiled to cover seventy countries over the period from the first quarter of 1979 to the second quarter of 2017. The main global variables in our model are oil prices, financial liquidity, and geopolitical risk, which we complement with domestic data on gross domestic product (GDP), investment (measured as gross capital formation), international reserves, and geopolitical risk at the country level. To the best of our knowledge, this is the first paper to consider all three global variables simultaneously, and we do so using a Global Vector Autoregression (GVAR) framework that allows us to investigate the aggregate effects of collective economic fluctuations at the domestic level, and vice versa. In this regard, Mohaddes and Pesaran (2016) and some earlier papers cited therein have shown the usefulness of the GVAR framework in identifying possibly very different impacts of country specific fluctuations on global variables, and vice versa.

The reason for considering simultaneously oil prices, financial liquidity, and geopolitical risk should be clear to those who have studied any of these three variables in global and Middle East economics contexts. For example, the advent of the petrodollar age in the period 1973–79 would not have been possible were it not for the simultaneous occurrence of (i) transformation in the international financial system to a high-liquidity Dollar-based post-Bretton-Woods regime, and (ii) the geopolitical catalysts of the Vietnam War (the cost of which forced the United States to unpeg the Dollar from gold in 1971), the Arab-Israeli War of October 1973, and the Iranian Revolution of 1979. In turn, the recycling of petrodollars from oil exporting countries with limited absorptive economic capacities contributed to global financial liquidity and the ensuing sovereign debt crises of the 1980s. A similar pattern occurred during the later wave of petrodollars starting in 2003, and contributed to the financial crisis in 2007–8, as discussed extensively in El-Gamal and Jaffe (2009). The latter considered the roles of petrodollars and Middle East geopolitics in endogenizing financial cycles, as Barsky and Kilian (2004) had endogenized energy price fluctuations, and following the logic of financial crisis cycles explained in the seminal works of Kindleberger and Aliber (2005) and Minsky (1982).

It should be clear that recent geopolitical events within our sample period, from 1979 to 2017, cannot be separated from global financial conditions and oil prices. The first Iraq War, and the ensuing meteoric rise of Islamist terrorist groups, would not have been as likely were it not for low oil prices starting in the mid-1980s. In his letter to King Fahd of Saudi Arabia, and later in a message to his supporters, Ossama bin Laden highlighted this connection by calling the precipitous decline of oil prices from near \$100 per barrel to \$9 the greatest theft in history (Lawrence, 2005, p. 272). Conversely, the phenomenal increase in oil prices starting in 2003 would not have been as likely were it not for the second Iraq War that year, as well as a global financial liquidity surge facilitated in part by petrodollars. Acknowledging the latter connection, albeit in the opposite direction, the Bank for International Settlements (BIS) concluded in its February 2015 review of global liquidity that “recent changes in production and consumption are not enough by themselves to explain the extent and timing of the drop in oil prices. One should consider the nature of crude oil as a financial asset” (http://www.bis.org/statistics/gli/gli_feb15.pdf, page 1).

Figure 1: Percentage Changes in Saudi Reserves, Global Liquidity, and Oil Price



Finally, the advent of Arab Spring uprisings, especially starting in Tunisia and Egypt, which were considered exemplary economic success stories between 2005 and 2010, may

not have materialized were it not for economic frustrations in the aftermath of the 2007–8 financial crisis that resulted from excessive global financial liquidity (the catastrophically embarrassing misstatement by the International Monetary Fund in the 2010 Egypt Article IV consultation that the country was resilient to the financial crisis notwithstanding; c.f. <http://www.imf.org/external/np/ms/2010/021610.htm>). In turn, the heightened geopolitical risk in the aftermath of those Arab uprisings contributed, together with the financial liquidity considerations raised by BIS in 2015, to keeping oil prices high despite a glut in the physical market. This is illustrated in Figure 1, which shows year-on-year annual percentage change in two of our three global variables of interest (global liquidity and oil prices): Following the financial crisis, oil prices recovered and then rose significantly upon the advent of the Arab Spring in late 2010, despite a continued physical-market glut. Prices fell back only after the geopolitical status quo ante was restored in mid 2014 (when Egyptian President El-Sisi took office), and only partially, as the Yemen war preserved part of the geopolitical risk premium.

Figure 1 also illustrates the significant growth in Saudi Arabia's reserves during the period of Arab Spring turbulence and political uncertainty (December 2010 to June 2014), which coincided, characteristically, with growing global liquidity. The combination of low oil revenues and increased costs of the Yemen war and other military spending has caused Saudi Arabia and other major oil exporters to reverse their contributions to global financial liquidity, at a time when the Federal Reserve has begun to reverse its policy of quantitative easing. Thus, it is clear that one cannot understand the domestic and regional prospects of Middle East economies without understanding the joint interactions of oil prices, financial liquidity, and geopolitical risk. Moreover, as we have already suggested in this introduction, causality runs in both directions for all bivariate and trivariate combinations of those variables. Our GVAR framework allows us to investigate the domestic and global simultaneous and lagged effects of those interactions.

Because the United States (U.S.) has the largest economy, financial sector, and military, and also because of its resumed role as one of the largest oil producers, thanks to advances in shale oil extraction, we use the U.S. as the reference country for all three variables at the global level. In other words, we assume that the U.S. is the only country that can unilaterally influence each of our three global variables of interest, while the remaining sixty-nine countries are affected by those global variables but can only influence them

collectively. This is discussed in greater and more technical detail in Section 4, which covers econometric methodology. We summarize some of the notable recent contributions in the literature to understanding the causal mechanisms underlying our *GVAR* analysis in Section 2. We describe the data and highlight the stylized facts motivating our analysis in Section 3. The main empirical results are summarized in Section 5.

2. Literature on Interactions of Oil Prices, Financial Liquidity, and Geopolitics

The largest extant literature on links between global financial conditions and oil markets has focused on the traditional causal links from oil supply shocks to economic activity and financial markets (Bernanke, 1983; Hamilton, 2003; Kilian, 2008, 2009; Jo, 2014, for example). In this regard, Miller and Ratti (2009) have suggested that the previously strong link between stock market and oil market bubbles broke down in the 2000s. Likewise, Alsalman (2016) has found no effect of oil-price uncertainty on US financial market returns in recent years, although sectoral stocks were, in fact, differentially affected by directional movements in oil prices. Likewise, Arouri et al. (2012) had found differentially significant effects of oil-price fluctuation on sectoral stock returns in European markets.

The reverse link, from economic activity and financial market conditions, especially speculative behavior by investors, to oil prices, has also been extensively studied, for example, in Kilian and Murphy (2014); Askari and Krichene (2008); Chevillon and Riffart (2009); Coleman (2012); Cifarelli and Paladino (2010); and Ratti and Vespignani (2013), although the feedback mechanism from oil prices through contributions to global financial liquidity was not a focal point of this research. A series of papers using money supply as a proxy for global financial liquidity (Belke, Bordon and Hendricks, 2010; Belke, Orth and Setzer, 2010; Belke et al., 2012), including the use of *GVAR* methodology in the last paper, point to this link from liquidity to inflation in commodity and asset prices, as documented historically in Kindleberger and Aliber (2005).

We seek to contribute to this literature by including geopolitical risk factors in the analysis of interactions between oil prices and global financial liquidity. Although our modeling methodology is reduced form, the theoretical and empirical literatures on potential causal mechanisms from oil prices to geopolitical risk, and vice versa, inform our analysis. In this regard, although research by Ross (2006) and Cotet and Tsui (2013), for example, shows that oil dependence of an economy does not necessarily cause political violence,

it does make the state an attractive target for extralegal activity, which, combined with state weakness, may indeed result in increased geopolitical risk. In this direction, studies by Dube and Vargas (2013) and Miguel et al. (2004), for example, have shown, respectively, how low commodity prices have intensified civil conflict in Columbia, and how commodity-price-driven negative growth shocks have led to increased civil conflict in sub-Saharan Africa.

Finally, there is a growing literature investigating the causal direction from intensified geopolitical risk to oil prices, although Blomberg et al. (2009) have found that the declining market power of OPEC in recent years has reduced the magnitudes of resulting geopolitical risk premia in oil prices. Nonetheless, as Lee (2016) has argued, major oil producers, especially in the Middle East, which is the focus of our attention, remain particularly attractive targets for terrorists, because significant economic harm can result from a major disruption of oil production and/or transport from the region. Thus, Noguera-Santaella (2016) found a strong positive effect of geopolitical strife (measured by event analysis using a limited list of 32 major events culminating in the Arab Spring period) on oil prices, although, as already noted in the above cited studies, the effect has become less pronounced in recent years. We aim to contribute also to this literature by incorporating in our analysis the secondary effects of geopolitical risk on oil prices, through the financial-liquidity channel, as well as using a more continuous measure of global geopolitical risk levels.

3. Data and preliminary analysis

For the country-specific component of our analysis, we use quarterly data from the first quarter of 1979 to the second quarter of 201 for the 70 countries listed alphabetically in Table 2. The bulk of this data is obtained through DataStream. For countries wherein GDP data were not available, we used industrial production as a proxy for GDP. For investment in each country, we used gross capital formation series. International reserves are the official reported figures for each country. To construct the weighting matrix described in Section 4, we used official bilateral trade data.

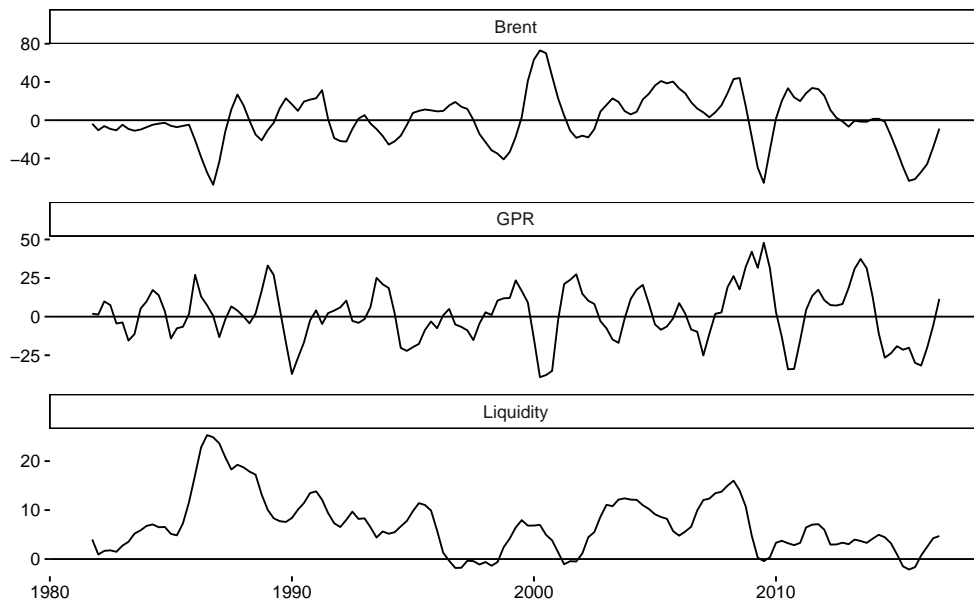
For the three main global variables in our analysis: Brent price of crude oil (in USD per Barrel) was the obvious first choice. For our measure of global financial liquidity, instead

of following the literature cited in Section 2, which has generally used money supply measure M2 as a proxy for financial liquidity, we decided to follow the logic championed by the BIS, c.f. Caruana (2014), and used the BIS series (Bank for International Settlements, March 2017) for credit from all sectors to the private non-financial sector as our measure of global financial liquidity. For our measure of global geopolitical risk, we used the index constructed by Caldara and Iacoviello (2016). Where available, we also used the country-level geopolitical risk index for various countries. The other domestic variables used to estimate country-level models were GDP (or industrial production as a proxy thereof) and gross capital formation. We estimated the global and country-level models simultaneously using the Global Vector Autoregression (GVAR) model described in Section 4.

As a first investigation toward the general expected results, we check two simple correlations. The first correlation between global financial liquidity and Brent prices is expected to be positive, with causation working in both directions (high financial liquidity contributes to speculation on commodity prices, including oil, and petrodollar recycling flows contribute to high financial liquidity). In fact, the sample correlation between quarterly year-on-year percentage changes in Brent and global liquidity is 0.17, which is significant at the 5% level. The second total correlation between Brent prices and global political risk is less obvious, because causation works in opposite ways for the two directions (low oil prices may result in higher global political risk, but higher political risk would result in higher oil prices). The total sample correlation between quarterly year-on-year percentage changes in Brent prices and our global political risk index is -0.18, which is also significant at the 5% level.

Figure 2 illustrates the comovements of the three main global series by showing four-quarter moving averages (smoothing) of the annual percentage change (year-on-year) for the series. The contemporaneous negative correlation between oil price changes and geopolitical risk index changes is quite strongly evident. In the meantime, lagged effects that may have contributed to the mutual perpetuation in the bivariate cycle require investigation through the richer autoregression model. In the meantime, we can note that the contemporaneous positive correlation between oil prices and global liquidity becomes much more pronounced in the later part of our sample, when the effects of speculative investment in commodities became more pronounced.

Figure 2: Four-Quarter Moving Averages of Annual Percentage Changes in Oil Prices, Geopolitical Risk Index, and Global Financial Liquidity Index



Needless to say, a deeper understanding of the comovements of our three global variables, and their interactions with various domestic variables of interest, will only be obtained once we review the results of our GVAR model estimation in Section 5. In the meantime, as an intermediate check on our hypothesis, we report in Table 1 the Wald statistics for Granger causality tests of various directions of causation between the three variables using a simple Vector Autoregression model on Hodrick-Prescott-filtered data for the three variables. Except for the Granger-causal effect of lagged liquidity on geopolitical risk, the lagged effects of each of our variables on the other two is statistical significant.

Table 1: Granger causality test

Equation	Oil price	Liquidity	Geo. Risks
Oil price	-	23.000***	48.000***
Liquidity	5.627***	-	2.584**
Geo. Risks	4.168***	0.354	-
All	4.040***	24.000***	85.000***

4. Econometric Model

Our approach is similar to Cashin et al. (2014), which uses a similar GVAR framework with cross-country sign restrictions for studying differential effects of supply and demand oil shocks on global financial conditions and real economies. Modeling international transmission of shocks is a challenging task in empirical research. The key challenge arises in identifying cross-country interdependencies. The extant literature offers different modeling techniques, classified variously as panel-data models, country-specific VAR models, large-scale macroeconomic models, factor models, and global models. Unfortunately, single-equation models require elaborate treatment of endogeneity problems. Moreover, while panel-VAR models may account for endogeneity, they do not capture differences in dynamics across countries. Likewise, although factor models can control for all common factors between countries, they include important cross-country interdependencies from policy and trade spillover effects in the residuals, thus failing to explain them (Samake and Yang, 2014). Finally, econometric treatments via country-specific VAR and large-scale macroeconomic models require the estimation of large numbers of parameters which is not feasible for most developing countries due to data limitations. The same limitation applies to a number of global models, such as NiGEM (Barrell et al., 2001), Multimod III (Laxton, 1998), and MSG2 (McKibbin, 1993), which suffer from large numbers of equations and intensive computational demand. For example, the NiGEM model contains over 3000 equations and requires the use of sophisticated solution software (Dennis and Lopez, 2004).

In contrast, our *GVAR* model does not suffer from the aforementioned limitations, and, thus, allows us with relative ease to study the propagation mechanisms of shocks to oil prices, financial liquidity, and geopolitics: Compared to other global models, the *GVAR* model is compact and flexible. It limits significantly the number of variables for each individual country, and thus does not require specialized software. In the meantime, it allows for combining countries into regions, and for treating each region as an individual economy. Thus, it can be used to investigate cross-country and cross-regional interdependencies (Samake and Yang, 2014). In addition, it is an atheoretical reduced form model that relies mainly on cointegrating relationships among the variables. Moreover, in contrast to factor models, the *GVAR* approach explicitly allows for cross-country interdependencies in three ways: a) it models country-specific dynamics explicitly by combining individual country equations that include domestic and foreign variables; b)

it allows for non-zero pairwise correlations in residuals between countries and equations, thus capturing some dependence structures in idiosyncratic shocks; and c) it allows for incorporating common global shocks such as oil prices (Eickmeier and Ng, 2011). Finally, unlike panel VAR models, the GVAR model allows for incorporating contemporaneous endogenous variables while keeping dimensionality manageable.

GVAR models are built by combining multiple small open economies, which may be impacted differently by the global economy, together with reference countries, each of which plays a significant role for a specific global variable. Country specific models are constructed such that they include domestic variables, cross-section averages of foreign variables, and global variables. The foreign and global variables are treated as weakly exogenous in individual country models, and thus they affect individual countries. However, the weak exogeneity assumption, if correct, allows for a short-run feedback from a given small country to the global economy, while restricting such feedback in the long run. While each global variable is treated exogenously in all other country models, it is treated as endogenous in the model of the reference country for that variable. Thus, GVAR contribution to reduction of the curse of dimensionality is the estimation of models on a country basis. The estimated coefficients from individual country models are thus stacked and solved in one big system. Therefore, a GVAR model is essentially a massive VAR system that includes a set of VARX models, where X denotes the set of foreign variables that are assumed to be weakly exogenous, thus providing a useful framework for studying the international transmission of shocks.

In our GVAR model, the reference country for all global variables is the U.S., given its sizable impact in the world economy. Endogenous variables in individual country models are real GDP, investment, and international reserves. Exogenous variables in country-specific models are the weighted cross-section averages of the aforementioned variables in all other countries in the system. Toward that end, we construct a weight matrix based on average bilateral trade links from 2009 to 2011. The global variables, which are treated as weakly exogenous in all country specific models except the U.S. (our reference country), are oil prices, geopolitical risks index, and global liquidity index. Regions are constructed in the aggregate model based on a weighted averages of country models, for which we use a matrix of each country's GDP contribution relative to the GDP of the whole region. After estimating country specific VARX models, we stack

these models using the bilateral trade weight matrix. Thus, our model, which directly incorporates many observable macroeconomic and financial market variables, allows us to investigate scenarios for variables of interest and their response to different types of shocks. The remainder of this section provides a formal presentation of our *GVAR* model.

4.1. Country specific models

Consider $N + 1$ countries in the global economy, indexed by $i = 0, 1, 2, \dots, N$, where $N = 69$ and country $i = 0$ serves as a reference country. For each country i , we estimate a $VARX^*(p_i, q_i)$ model, where p_i and q_i are the lag orders of the domestic and foreign variables, respectively:

$$\mathbf{x}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1}t + \Phi_i \mathbf{x}_{i,t-1} + \dots + \Phi_{ip_i} \mathbf{x}_{i,t-p_i} + \Lambda_{i0} \mathbf{x}_{it}^* + \Lambda_{i1} \mathbf{x}_{i,t-1}^* + \dots + \Lambda_{iq_i} \mathbf{x}_{i,t-q_i}^* + \mathbf{u}_{it} \quad (1)$$

where $t = 1, 2, \dots, T$, \mathbf{x}_{it} is a $k_i \times 1$ vector of domestic variables for country i , at time t , \mathbf{x}_{it}^* is a $k_i^* \times 1$ vector of country i specific foreign variables, \mathbf{a}_{i0} is a $k_i \times 1$ vector of fixed intercept coefficients, \mathbf{a}_{i1} is a $k_i \times 1$ vector of coefficients of the deterministic time trend, Φ_i is a $k_i \times k_i$ matrix of coefficients associated with lagged domestic variables, and Λ_{i0} and Λ_{i1} are $k_i \times k_i^*$ matrices of coefficients related to contemporaneous and lagged foreign variables, respectively. The error term \mathbf{u}_{it} is a $k_i \times 1$ vector of idiosyncratic, serially uncorrelated, country specific shocks, assumed to be i.i.d., with mean zero and covariance matrix Σ_{ij} .² Country-specific foreign variables are constructed as cross-sectional averages of the domestic variables using fixed weights w_{ij} that are calculated based on bilateral trade between countries i and j over the years 2009-2011:

$$\mathbf{x}_{it}^* = \sum_{j=0}^N w_{ij} \mathbf{x}_{jt} \quad (2)$$

where $j = 0, 1, \dots, N$, $w_{ii} = 0$, and $\sum_{j=0}^N w_{ij} = 1$. \mathbf{x}_{it}^* is a vector of foreign variables for country i in time t and \mathbf{x}_{jt} is a vector of their endogenous counterparts in the global system excluding country i . w_{ij} denotes the j^{th} element of the trade-weight matrix of country i with country j , see Table 7. In addition to these foreign variables, constructed as the sums of weighted contributions of the $N - 1$ other countries, the model also contains unweighted oil prices (*poil*), as well as *GPR* and *Lq* as global variables, which are assumed to be weakly exogenous for all countries in the system other than the U.S. Thus, the resulting

²Note that this *GVAR* model allows for non-zero contemporaneous correlation of shocks across countries.

GVAR model is effectively a VAR(p) model that includes global endogenous variables.

This GVAR model allows for interdependence between countries and/or regions through three separate but interrelated channels: (i) direct correlation of domestic variables \mathbf{x}_{it} with foreign variables \mathbf{x}_{it}^* and with their lagged values; (ii) correlation of country-specific domestic variables \mathbf{x}_{it} with common global exogenous variables (such as oil prices) and their related lagged values; and (iii) contemporaneous correlation of idiosyncratic shocks to country i with shocks to country j .

By combining individual $VARX^*(p_i, q_i)$ models into a GVAR(p) system via the weight matrix, we may now study international ties of real and financial variables.³ To explicitly account for long-run relationships in the country-specific VARX models in Eq. 1, this study considers the error correction representation VECMX of these models. According to Dees et al. (2010), the long-run restrictions can be imposed by identifying the cointegrating vectors of the country specific VECMXs.

Let \mathbf{z}_{it} be a $(k_i + k_i^*)$ vector of the domestic and foreign variables; $\mathbf{z}_{it} = (\mathbf{x}_{it}', \mathbf{x}_{it}^{*'})'$, the model may thus be re-written as a vector error-correcting model VECMX:

$$\Delta \mathbf{x}_{it} = -\Pi \mathbf{z}_{i,t-1} + \Lambda_{i0} \Delta \mathbf{x}_{it}^* + \sum_{i=1}^{p-1} \Psi_i \Delta \mathbf{z}_{it} + \mathbf{c}_{i0} + \mathbf{c}_{i1}t + \mathbf{v}_{it} \quad (3)$$

where, $\Delta \mathbf{x}_t^* = \sum_{i=1}^{p-1} \Gamma_{i^*i} \Delta \mathbf{z}_{i,t-1} + \mathbf{a}_{x^*0} + \mathbf{u}_{x^*t}$. When there are r cointegrating relations among \mathbf{z}_{it} , then $\Pi = \alpha_i \beta_i$, and by substituting in equation 3:

$$\Delta \mathbf{x}_{it} = -\alpha_i \beta_i \mathbf{z}_{i,t-1} + \Lambda_{i0} \Delta \mathbf{x}_{it}^* + \sum_{i=1}^{p-1} \Psi_i \Delta \mathbf{z}_{i,t-1} + \mathbf{c}_{i0} + \mathbf{c}_{i1}t + \mathbf{v}_{it} \quad (4)$$

where α_i is a $(k_i \times r_i)$ matrix of rank r_i , $\beta_i(k_i + k_i^*) \times r_i$ matrix of rank r_i . By partitioning β_i as $\beta_i = (\beta_{ix}', \beta_{ix^*}')'$ conformable to \mathbf{z}_{it} , the r_i error correction terms defined by equation 3 can be written thus:

$$\beta_i'(\mathbf{z}_{it} - \gamma_i t) = \beta_{ix}' \mathbf{x}_{it} + \beta_{ix^*}' \mathbf{x}_{it}^* - (\beta_i' \gamma_i) t$$

This allows for the possibility of cointegration both within endogenous and exogenous

³Note that the GVAR order (p) is the highest lag order in the individual country model, and the lag orders for the endogenous and exogenous variables need not to be the same. In this regard, individual country lag orders are selected separately, and explicitly allowed to vary across countries.

variables in the same country model, and, consequently, across the endogenous variables among different countries. For estimation, the country-specific foreign variables are treated as 'long-run forcing' weakly exogenous with respect to the parameters of the conditional model. The individual country models are estimated separately conditional on the country foreign variables using reduced rank regression and taking into account the possibility of cointegration both within the endogenous variables and across the endogenous and the exogenous variables. Therefore, we obtain the number of cointegrating relations (r_i), the speed of adjustment coefficients (α_i), and the cointegrating vectors (β_i) for each country model. Conditional on a given estimate of β_i , the remaining parameters of the $VARX^*(p_i, q_i)$ model are consistently estimated by OLS regressions of the following equations:

$$\Delta \mathbf{x}_{it} = \mathbf{c}_{i0} + \delta_i ECM_{i,t-1} + \mathbf{\Lambda}_{i0} \Delta \mathbf{x}_{it}^* + \mathbf{\Gamma}_i \Delta \mathbf{z}_{i,t-1} + \mathbf{u}_{it} \quad (5)$$

Afterwards, a test of the cointegrating rank is conducted, and the estimation of the above VECM in equation 3 is carried out to maximize likelihood subject to: a) appropriate restrictions on c_{i0} and c_{i1} , the rank of $\Pi = r$, and k general long-run restrictions.

4.2. Building the global model

GVAR's main contribution to avoid the curse of dimensionality stems from the country-level estimation described above. However, it remains very powerful because the full system model is estimated allowing all variables to be endogenous at the global level. Recalling our stacked notation $\mathbf{z}_{it} = (\mathbf{x}'_{it}, \mathbf{x}'_{it}^*)'$, Eq. 1 may be re-written compactly:

$$\mathbf{A}_{i0} \mathbf{z}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1} t + \sum_{j=1}^p \mathbf{A}_{ij} \mathbf{z}_{i,t-j} + \mathbf{u}_{it} \quad (6)$$

where

$$\mathbf{A}_{i0} = (\mathbf{I}_{k_i}, \mathbf{\Lambda}_{i0}), \mathbf{A}_{ij} = (\mathbf{\Phi}_{ij}, \mathbf{\Lambda}_{ij})$$

for $j = 1, \dots, p$.

To combine the country-specific $VARX^*(p_i, q_i)$ models into a *Global VAR* model, we begin by collecting the $k \times 1$ vector of endogenous global variables, where $k = \sum_{i=0}^N k_i$, $\mathbf{x}_t = (\mathbf{x}'_{0t}, \dots, \mathbf{x}'_{Nt})'$. Next, using the link matrices $\mathbf{W}_i(k_i + k_i^*) \times k$ based on the trade weights w_{ij} , we exploit the following identity:

$$\mathbf{z}_t = \mathbf{W}_i \mathbf{x}_t \quad (7)$$

Using the above identity in equation 7, it follows that:

$$\mathbf{A}_{i0} \mathbf{W}_i \mathbf{x}_t = \mathbf{a}_{i0} + \mathbf{a}_{i1} t + \sum_{j=1}^p \mathbf{A}_{ij} \mathbf{W}_i \mathbf{x}_{t-j} + \mathbf{u}_t, \quad (8)$$

for $i = 0, 1, 2, \dots, N$.

Now, it is clear that we can stack the country-specific $VARX^*(p_i, q_i)$ models in equation 8 as follows:

$$\mathbf{H}_0 \mathbf{x}_t = \mathbf{a}_0 + \mathbf{a}_1 t + \sum_{j=1}^p \mathbf{H}_j \mathbf{x}_{t-j} + \mathbf{u}_t, \quad (9)$$

where

$$\mathbf{H}_0 = \begin{pmatrix} \mathbf{A}_{00} \mathbf{W}_0 \\ \mathbf{A}_{01} \mathbf{W}_1 \\ \vdots \\ \mathbf{A}_{N0} \mathbf{W}_N \end{pmatrix}, \quad \mathbf{H}_j = \begin{pmatrix} \mathbf{A}_{0j} \mathbf{W}_0 \\ \mathbf{A}_{1j} \mathbf{W}_1 \\ \vdots \\ \mathbf{A}_{Nj} \mathbf{W}_N \end{pmatrix}, \quad \mathbf{a}_0 = \begin{pmatrix} \mathbf{a}_{00} \\ \mathbf{a}_{10} \\ \vdots \\ \mathbf{a}_{N0} \end{pmatrix}, \quad \mathbf{a}_1 = \begin{pmatrix} \mathbf{a}_{01} \\ \mathbf{a}_{11} \\ \vdots \\ \mathbf{a}_{N1} \end{pmatrix}, \quad \mathbf{u}_t = \begin{pmatrix} \mathbf{u}_{0t} \\ \mathbf{u}_{1t} \\ \vdots \\ \mathbf{u}_{Nt} \end{pmatrix}$$

Lastly, since \mathbf{H}_0 is a known non-singular matrix that depends on the trade weights and parameter estimates, the reduced form GVAR model is obtained by pre-multiplying equation 9 by \mathbf{H}_0^{-1} :

$$\mathbf{x}_t = \mathbf{b}_0 + \mathbf{b}_1 t + \sum_{j=1}^p \mathbf{G}_j \mathbf{x}_{t-j} + \varepsilon_t \quad (10)$$

where

$\mathbf{G}_j = \mathbf{H}_0^{-1} \mathbf{H}_j$, $j = 1, \dots, p$ are an $k \times k$ matrix of GVAR coefficients, $\mathbf{b}_0 = \mathbf{H}_0^{-1} \mathbf{a}_0$, $\mathbf{b}_1 = \mathbf{H}_0^{-1} \mathbf{a}_1$, $\varepsilon_t = \mathbf{H}_0^{-1} \mathbf{u}_t$.

Note that all GVAR parameters \mathbf{G}_j are obtained for the country-specific models $VARX^*(p_i, q_i)$ and the transformation using the link matrices \mathbf{W}_i . The GVAR equation 10 can be solved recursively and later used to examine the effects of various shocks. Note also that there

are no restrictions placed on the covariance matrix $\Sigma_\varepsilon = \mathbf{E}(\varepsilon_t, \varepsilon_t')$.⁴ An infinite-order global vector moving average (GVMA) is derived from the GVAR model in Eq. 10 above, which allows us to investigate the dynamic features of the model through impulse response functions, and the like. This GVMA is written in the following form:

$$\mathbf{x}_t = \sum_{j=0}^{\infty} \mathbf{B}_j \varepsilon_{t-j} \quad (11)$$

where the \mathbf{B}_j s are evaluated recursively as

$$\mathbf{B}_j = \mathbf{G}_1 \mathbf{B}_{j-1} + \mathbf{G}_2 \mathbf{B}_{j-2} + \dots + \mathbf{G}_{p-1} \mathbf{B}_{j-p+1} \quad (12)$$

$j = 1, 2, \dots, \mathbf{B}_0 = \mathbf{I}_k, \mathbf{B}_j = 0$ for $j < 0$.

Section 5 provides a summary of the results of unit root and cointegration tests, estimations, and impulse response functions obtained using the methods described above.

5. Empirical Results

In order to capture possible unobserved common factors, the global component of our GVAR model includes the cross-country averages of all endogenous variables. Moreover, in order to estimate equation 1, our GVAR model assumes that the country-specific foreign and global variables are weakly exogenous and $I(1)$ (integrated of order one), and that the parameters of the individual models are stable over time. To justify these model specifications and assumptions, as well as to determine the lag orders for various model components, we conducted a battery of diagnostic hypothesis tests.

In subsection 5.1, we provide a brief summary of these tests results. The preliminary tests for model specification include unit root tests for all variables, tests for lag order of the various models, and cointegration tests. After-estimation diagnostic tests include tests of residual serial correlation in VECMX models, as well as tests of weak exogeneity of foreign and global variables in our various country-level models. The most insightful empirical results of our estimated GVAR are summarized in two sections, 5.2 and 5.3, respectively, for global variables and country-level variables in Middle-East and

⁴Note that, for simplicity, the GVAR solution discussed above, so far, is based on the $\text{VARX}^*(p_i, q_i)$ representation rather than the VECMX model. However, this should not affect the logic behind the GVAR estimation in any way given that a VAR model defined for cointegrated non-stationary data has an equivalent VECM representation, and converting one to the other should cause no problems.

North Africa (MENA) countries. The latter are of particular interest because they are simultaneously major contributors to global political risk, possessors of economies that are particularly sensitive to oil prices, and sometimes contributors to global financial liquidity through petrodollar recycling. The reported results in both subsections take the form of impulse response functions to shocks in each of our three global variables (oil, liquidity and geopolitical risks).

5.1. Diagnostic tests

Table 6 lists the results of Augmented Dickey Fuller (ADF) unit root tests for our three global variables, which justify the assumption that those variables are integrated of order one. Country-specific ADF tests for each country's domestic and foreign variables, respectively, are reported in Tables 8 and 9. With very few exceptions (e.g. for investment in a handful of countries, where the order of integration may be higher), the I(1) assumption is also justified for virtually all country-variable pairs in our model.

Table 10 lists the results of our various country-level test for the order of the VARX models and the number of cointegrating relationships therein, based on the maximum eigenvalue and trace statistics at the 5% significance level. All country-specific models are estimated to have either one or two cointegrating relationships.

Table 11 lists the various F-statistics (indicating significance at the 5% level) by country and variable for tests of residual-serial-correlation in VECMX models. We fail to reject the null hypothesis of no serial correlation for almost all country and variable pairs.

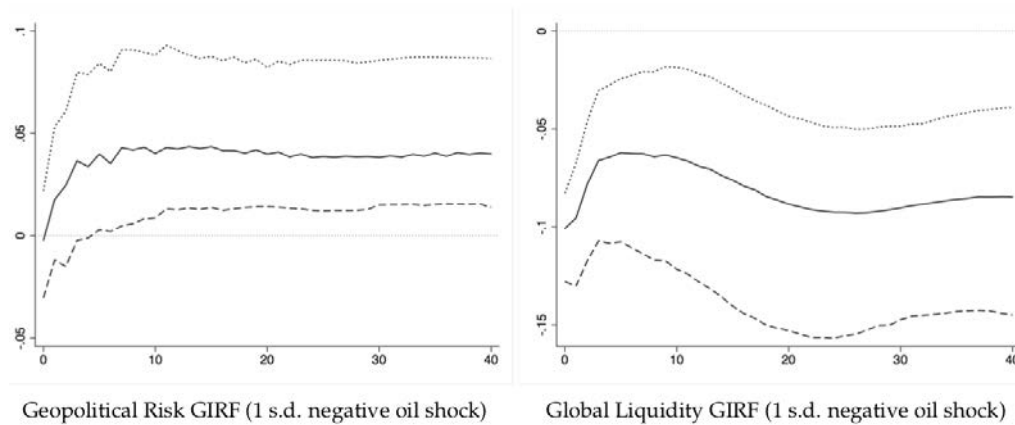
Table 12 lists the results of F tests of the weak exogeneity of foreign and global variables in each country-level model. This exogeneity is an essential assumption for the validity of our GVAR model, because it precludes any long-term feedback effects from the endogenous variables to the foreign or global variables. The formal tests of weak exogeneity were conducted by testing the joint significance of estimated error-correction terms in auxiliary regressions wherein foreign and global variables are included in the various country-variable auxiliary regressions as if they were endogenous. Almost all the F tests for these various country-variable regressions fail to reject the null hypothesis of $R^2 = 0$ in the corresponding auxiliary regression.

Finally, Figure 15 shows the persistence profiles of our estimated model, showing high speeds of convergence to long-term equilibrium relationships, thus confirming the validity of our estimated cointegrating vectors (Pesaran and Shin, 1996). In this regard, eigenvalues of the constructed GVAR were forced to lie on or within the unit circle, to ensure model convergence, but the estimated rate of convergence was not restricted. The resulting estimates of persistence profiles shows convergence to the long-term relationships within two to three years, which is quite fast, thus suggesting that our model specification is valid for the set of modeled variables.

5.2. Dynamic analysis: Global shocks and responses

Throughout the remainder of this section, we shall report results of our estimated GVAR(2) model graphically as plotted generalized impulse response functions (GIRFs) for various shocks and response variables. Each graph includes the median GIRF and its 95% confidence interval from 2000 replications of the bootstrapped model. In this subsection, we begin by studying shocks to each of our three global variables and the resulting GIRFs for each of the other global variables.

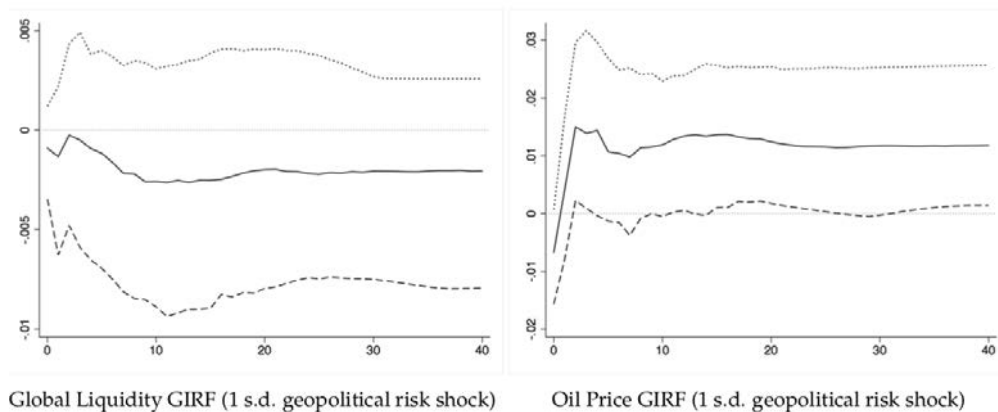
Figure 3: Impulse = One s.d. Negative Shock to Oil Price



The pair of GIRF graphs for the impacts on global liquidity and geopolitical risk from a one standard deviation negative shock in oil prices are shown in Fig. 3. The left panel shows that, starting one year after the shock, geopolitical risk increases significantly, around 4%, and persists in response to a one s.d. negative oil price shocks. This confirms

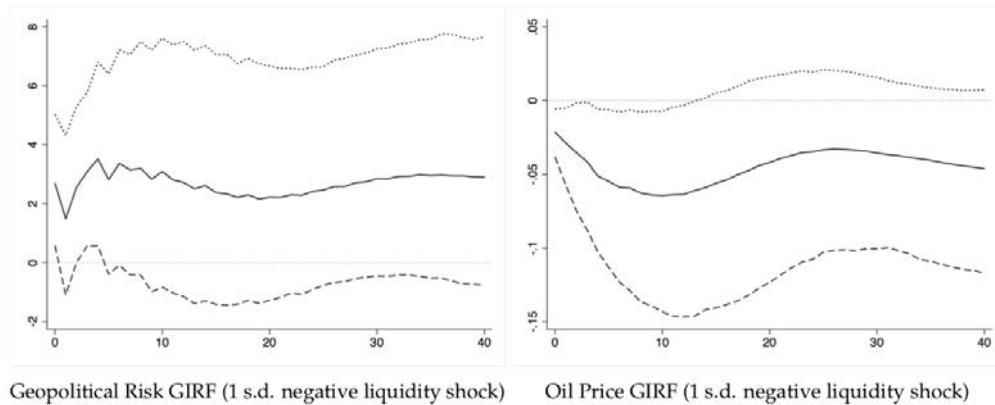
our prior hypothesis that periods of low oil prices contribute to increased geopolitical strife. In the meantime, the right panel shows that global liquidity declines significantly (in the order of 10%), both immediately and persistently, in response to a one s.d. negative oil price shock. This also confirms our prior hypothesis that decline in oil prices reduces or reverses petrodollar flows to the international financial system, thus resulting in reduced global financial liquidity.

Figure 4: Impulse = One s.d. Positive Shock to Geopolitical Risk Index



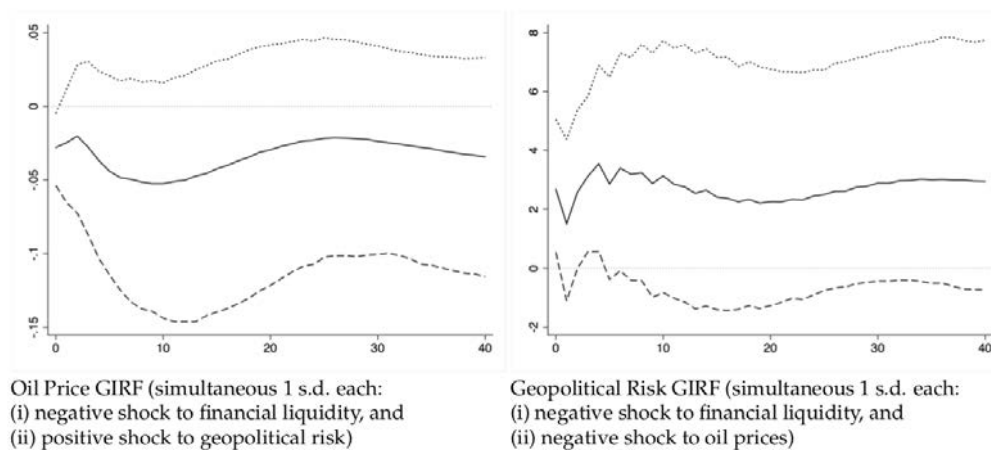
The pair of GIRFs for the impacts on global liquidity and oil prices from a one standard deviation positive shock in global geopolitical risk are shown in Fig. 4. The left panel shows a persistently negative (approximately 0.2%) but statistically insignificant decline in global liquidity, which is consistent with our Section 2 result of insignificant Wald test statistic for the Granger-causal impact of geopolitical risk on global liquidity. The right panel shows a persistently positive (approximately 1.5%) and statistically significant response of oil prices to a one s.d. positive shock in geopolitical risk. This is consistent with the second part of our motivational hypothesis on oil price and geopolitical risk cycles: lower oil prices trigger higher geopolitical risk (as we have seen in the left panel of 3), and the latter leads to later increases in oil prices, perpetuating the endogenous cycle discussed in El-Gamal and Jaffe (2009). We consider responses to simultaneous shocks later in this subsection, after we consider GIRFs to global financial liquidity shocks.

Figure 5: Impulse = One s.d. Negative Shock to Global Financial Liquidity



The pair of GIRFs for the impacts on geopolitical risk and oil prices from a one s.d. negative shock in global financial liquidity are shown in Fig. 5. The left panel shows that geopolitical risk index responds positively and persistently (at approximately 2.5%), albeit mostly statistically insignificantly, to the negative liquidity shock. The right panel shows that oil prices are likely to drop persistently (by approximately 5%) in response to the negative shock in global financial liquidity. The impulse response in oil prices is statistically significant for approximately 3 years, during which it appears that the investment-commodity-class and/or speculative-trade channel from global financial liquidity to oil prices is hampered by the stipulated negative liquidity shock.

Figure 6: Global Variable Responses to Select Combined Shocks

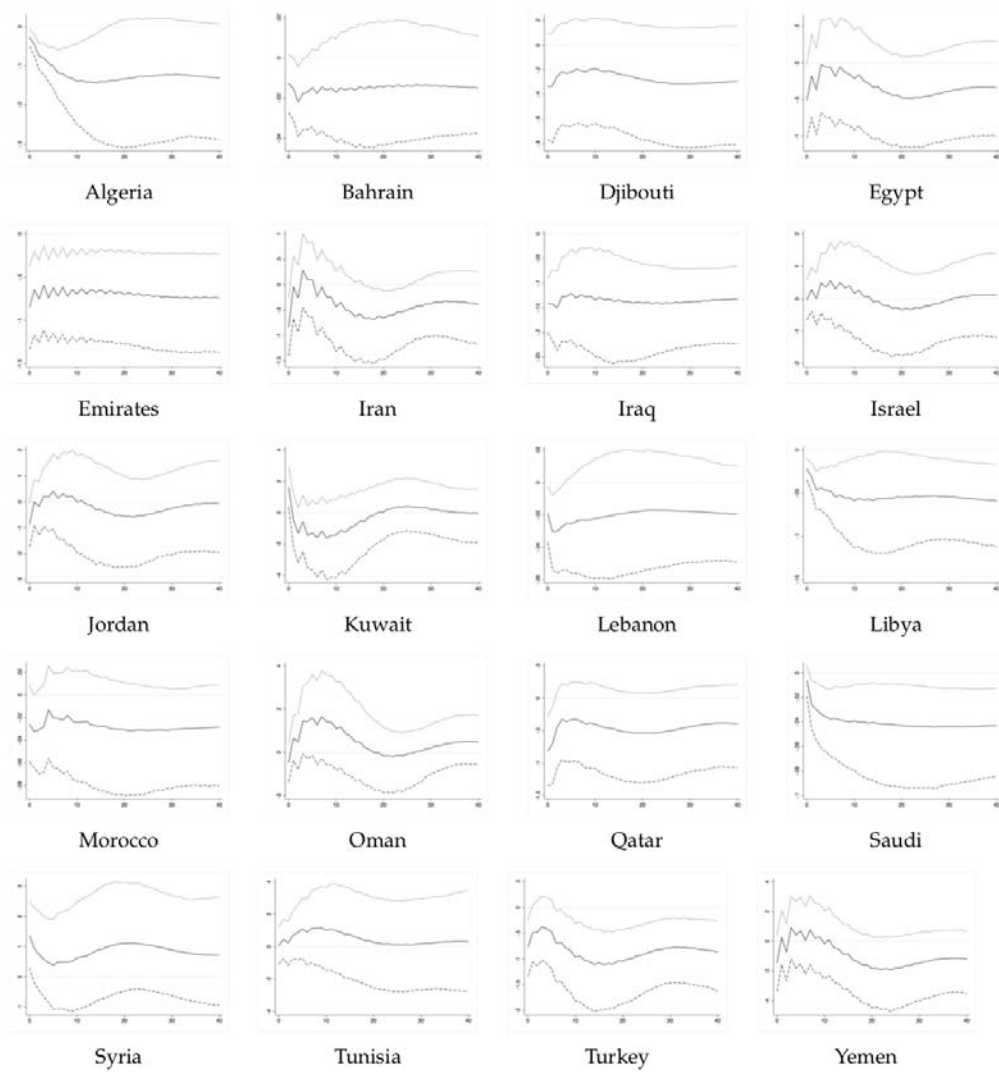


Before turning our focus to MENA-country-level impacts of global shocks, we consider the impacts of likely combined shocks of two global variables on the third. In light of our earlier results and the prior hypotheses that they confirmed, we consider two particular scenarios that are of current interest at the time of writing:

1. The first current scenario that we consider is one of simultaneous negative shock to global financial liquidity (as petrodollar recycling has reversed to finance the deficits of Saudi Arabia and other major oil exporters, and central bankers are contemplating monetary tightening, including the taper or reversal of quantitative easing) and heightened geopolitical risk (ongoing war in Yemen, confrontations between Kurds and Arabs in Iraq, etc.). The two effects work in opposite directions for oil prices: heightened geopolitical risk may boost oil prices mildly (right panel of Figure 4), while reduced financial liquidity impacts oil negatively (right panel of Figure 5). The left panel of Figure 6 shows that the combined effect is mildly negative on oil prices. In other words, the current conditions are not conducive to significant oil price recovery.
2. We also consider the effect of the second scenario of simultaneous negative shocks to financial liquidity and oil prices. For this scenario, the right panel of Figure 6 warns that the response will continue to be manifested in heightened geopolitical risk.

The sobering conclusion of the GIRF analysis to individual and simultaneous shocks that resemble the current environment is that we should expect continuation of the current forecast of low oil prices, declining financial liquidity, and medium-level heightening of geopolitical risk. Of course, were a major shock to geopolitical risk to materialize, it may have a strong positive effect on oil prices and financial liquidity through the petrodollar recycling channel. Ominously, if oil prices were to drop significantly from their current levels, this may trigger that surge in geopolitical risk which may plant the seeds for higher oil prices in a later period. In the meantime, a major financial liquidity shock due to significant monetary tightening, either preemptively to enhance monetary policy effectiveness during the next global recession, or in response to a potential uptick in inflation, is unlikely to have a significant effect on geopolitical risk and oil prices. In this regard, financial liquidity merely serves as a procyclical accelerator for oil price movements during periods of high prices (e.g. during the decade 2003–2013), as well as low prices (e.g. in the current period), through the commodity-investment-class and/or speculative trading channels.

Figure 7: MENA Country GDP GIRF to 1 S.D. Negative Oil Prices Shock



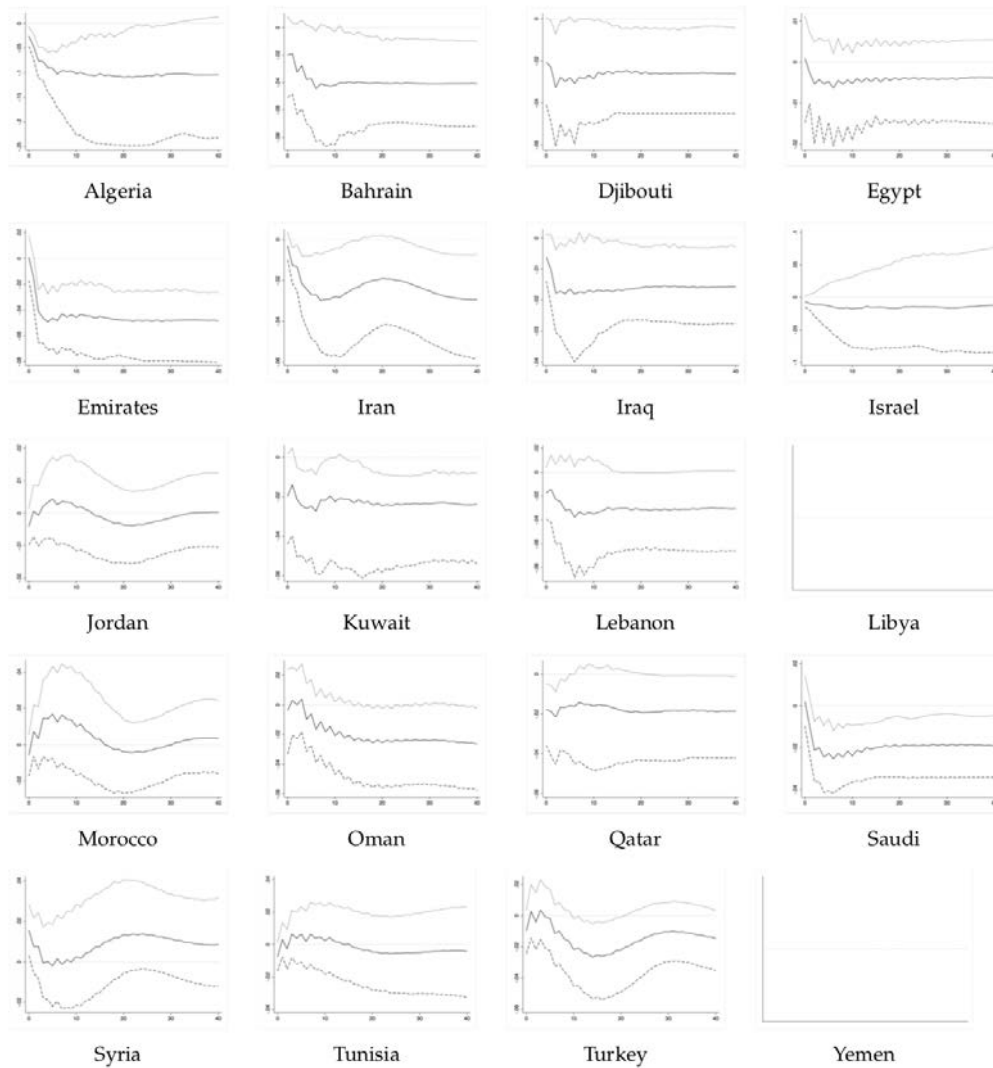
5.3. Dynamic Analysis: MENA-Country-Specific Responses

We now focus primarily on the MENA region, which is particularly sensitive to oil prices, both for oil exporting countries and their labor exporting neighbors, a major epicenter of geopolitical risk factors, and an occasional contributor to financial liquidity changes due to petrodollar recycling and its reversal.⁵ As we have done in the previous section, we report results graphically in the form of median GIRFs and 95% confidence bands

⁵Oil exporting countries in the MENA region are Algeria, Libya, Iraq, Saudi Arabia, Kuwait, Yemen, Oman, Bahrain, Qatar, Emirates.

generated through 2000 bootstrapping simulations from the GVAR(2) model.

Figure 8: MENA Country Investment GIRF to 1 S.D. Negative Oil Prices Shock



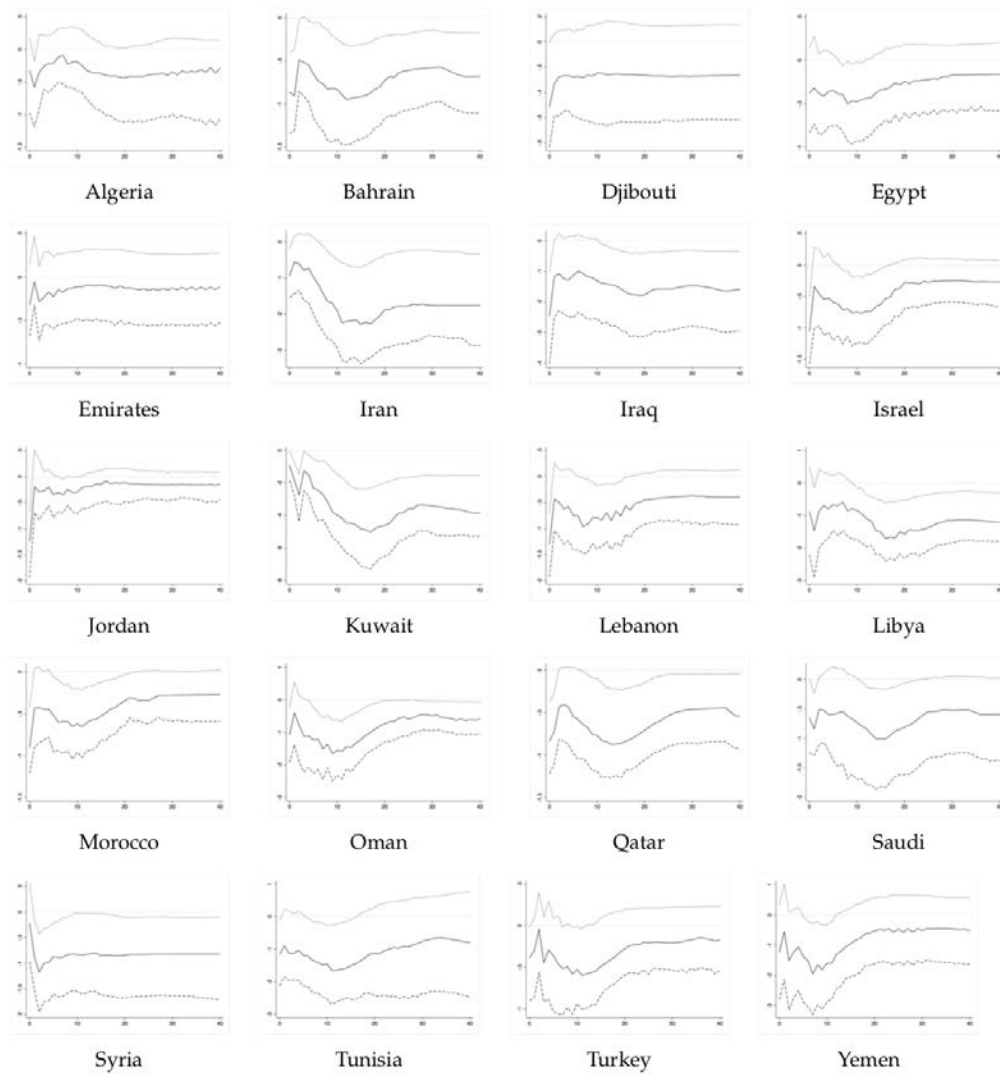
MENA country GDP GIRFs to a one s.d. negative oil price shock are shown in Figure 7. Median GDP GIRFs to oil price drops are generally negative for most countries in the region, as we would expect. Moreover, the negative impact is persistent and statistically significant in countries that depend significantly on oil exports, namely, Algeria, United Arab Emirates, Iraq, Libya, and Saudi Arabia. Interestingly, the long-term GIRF is also negative and statistically significant for Turkey, which has relied on petrodollar flows

to grow both its export and international investment markets. Comparing GIRFs for all countries, as shown in Figure 7, we note that the dramatic direct effects of negative oil shocks on the GDPs of Iraq and Saudi Arabia are also observed for Brazil and Chile (which is dependent on exports of other commodities), and the indirect effects on Turkey's GDP is somewhat similar to that of Thailand, which was, likewise, one of the major recipients of petrodollar-funded investments.

Figure 8 shows that investment GIRFs to a negative shock in oil prices are much more uniformly persistent and statistically significant for oil exporters. The median GIRF for other MENA countries is also negative but not significant. This reflects the procyclical nature of investment in MENA oil exporters, as investment programs serve to enhance absorptive (or wealth sharing) capacity during boom years and their suspension helps to ameliorate fiscal deficit problems during lean years. Figure 17 shows that investment in some other non-oil-exporting countries outside MENA, e.g. Italy, are also impacted significantly by negative oil shocks. Moreover, the impacts on oil exporters outside MENA seem to vary by the degree of diversification of the economy. Thus, the negative impact on investment is significant in Chile (which relies heavily on commodity exports), but not in Brazil.

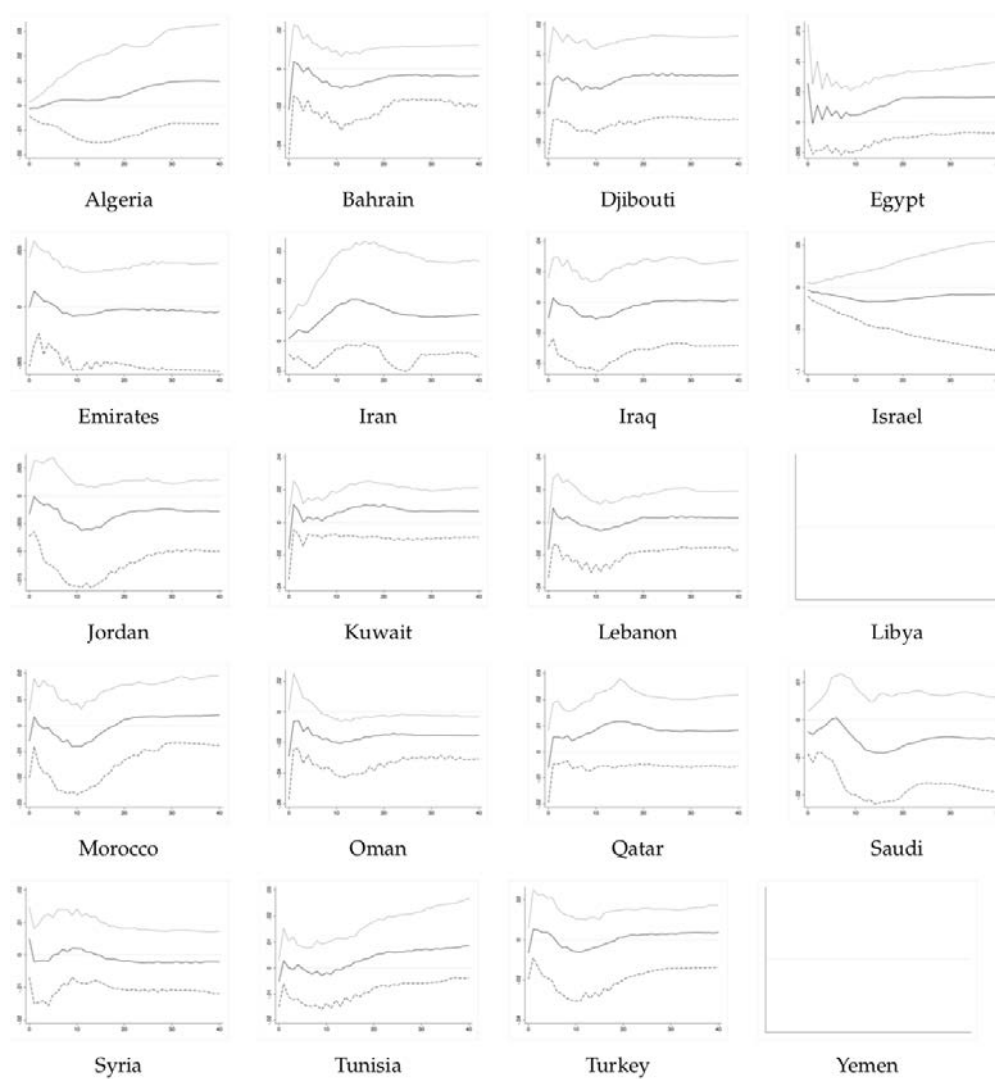
We report the GDP and investment GIRFs to a one s.d. increase in geopolitical risk, respectively, in Figures 9 and 10. Not surprisingly, an increase in geopolitical risk is associated with negative effects on GDP in most countries, and the effect is statistically significant at least for the short-to medium term of 2 to 3 years. In the meantime, with the exception of Oman, we do not observe the same negative and significant impact of geopolitical risk on investment. Outside of MENA, there are a number of other countries whose GDP GIRFs to geopolitical risk shocks are negative and statistically significant, including Australia, Canada, Ecuador, New Zealand, U.S. and U.K., as shown in Figure 18. Consistent with the evidence for MENA, Figure 19 shows that investment is much more resilient to geopolitical risk shocks, and is not affected in the same manner as GDP.

Figure 9: MENA Country GDP GIRF to 1 S.D. Geopolitical Risk Shock



The GIRFs reported in Fig. 10 show that investments in the MENA countries are expected to drop as a result of a positive shock to geopolitical risks. For example investment is likely to drop by 0.2% in Bahrain, 0.03% in Jordan, 0.16% in Kuwait, 0.17% in Lebanon, 0.3% in Oman, 0.06% in Qatar, and by in 0.05% in Tunisia. Although investment drops are likely to be the case in other MENA countries as well, the plotted GIRFs in Fig. 10 suggest that such response may not be statistically significant in many of the MENA countries.

Figure 10: MENA Country Investment GIRF to 1 S.D. Geopolitical Risk Shock



Figures 11 and 12 show, respectively, the GIRFs of GDP and investment to a negative shock to global liquidity. Although we estimate that a negative liquidity shock would have short-lived negative effects on GDP in Saudi Arabia, Egypt, and Turkey (the first a major provider of global liquidity through petrodollar recycling, and the latter two recipients of significant portions of petrodollar investment and spending), most MENA countries' GDPs do not react significantly negatively to negative financial liquidity shocks. The main notable exception is Bahrain, whose GDP declines very significantly as a consequence of a negative financial liquidity shock, in large part because of its specialization in petrodollar recycling as a financial hub.

GIRFs in Figure 20 show a similar pattern of only brief or no significant effect of a negative financial liquidity shock on most countries' GDPs. In this regard, Bahrain's GDP-dependence on financial liquidity is the obvious anomaly throughout our sample. Investment in MENA countries is generally not affected significantly by a negative liquidity shock, with the exceptions of short-lived effects in Morocco and Turkey. Likewise, Figure 21 shows that the effect of a negative liquidity shock is minimal and short lived in most countries outside MENA, with the notable exception of Luxembourg, whose role as an international financial center makes its investment significantly dependent on financial liquidity, like Bahrain's GDP.

Figure 11: MENA Country GDP GIRF to 1 S.D. Negative Financial Liquidity Shock

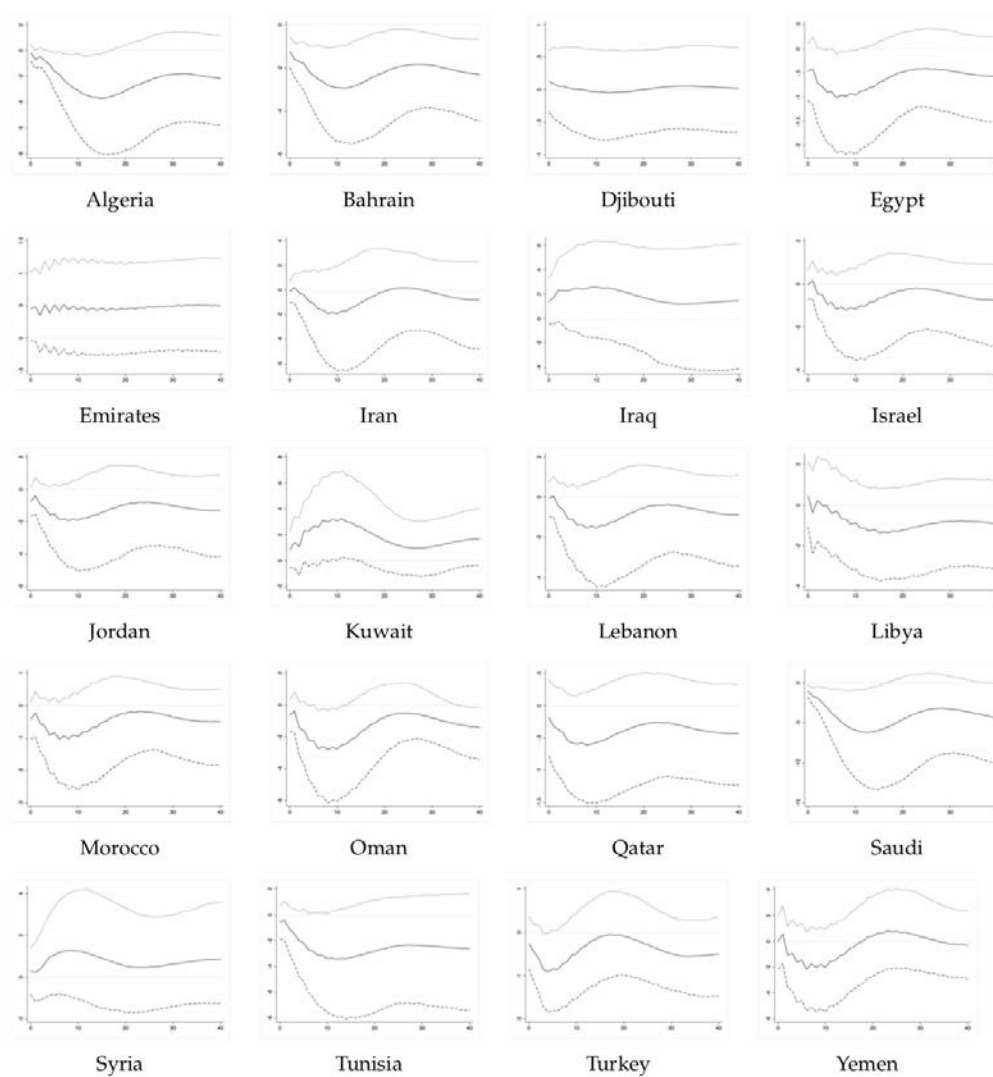
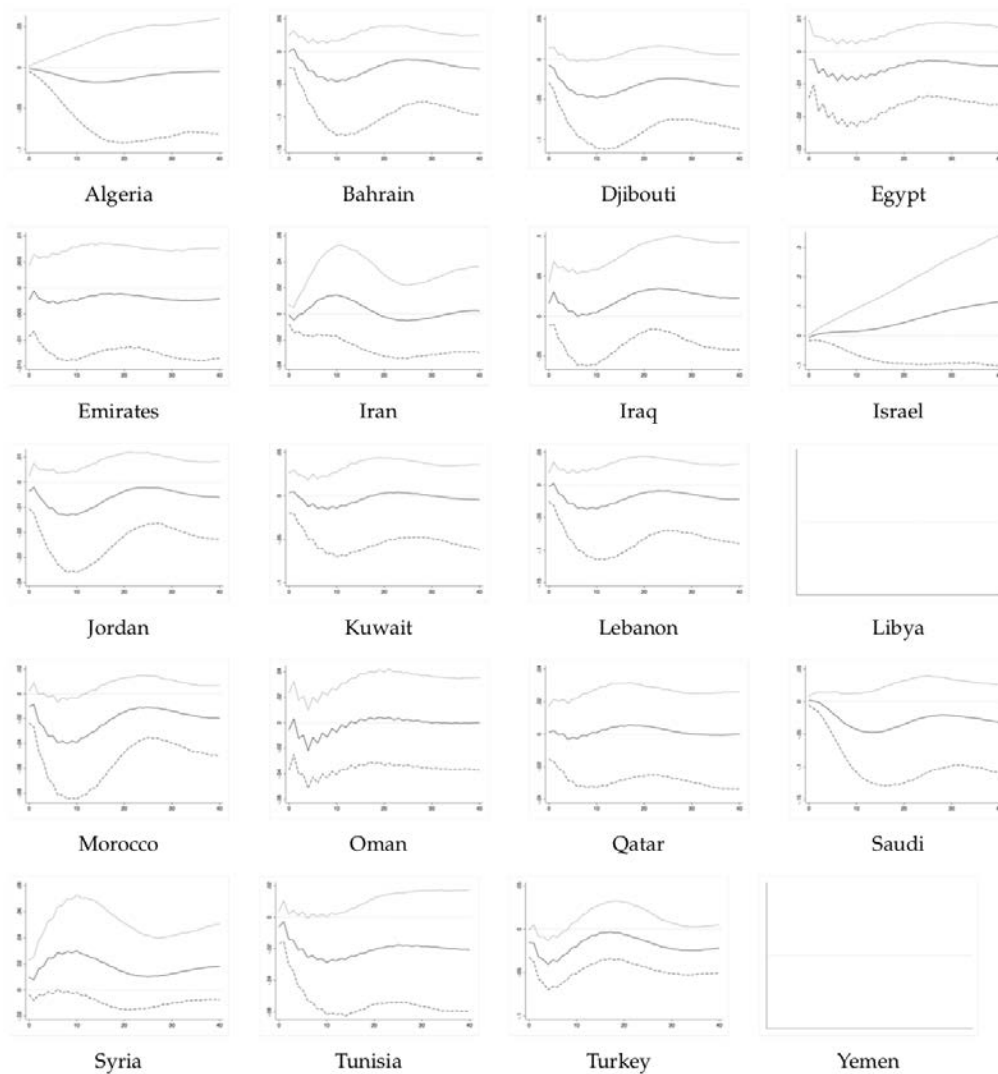


Figure 12: MENA Country Investment GIRF to 1 S.D. Negative Financial Liquidity Shock



Before we close this section, we consider the current historical episode and its potential effects on Saudi investment and GDP. As we have seen in Figure 7, Saudi GDP was the most negatively affected by negative oil price shocks. In the meantime, we have seen in the left panel of Figure 3 and the right panel of Figure 4, respectively, that low oil prices lead to heightened geopolitical risk, and the latter, in turn, leads to higher oil prices. Indeed, this was evident in our motivational Figure 1: The decline in oil prices following the financial crisis contributed to the revolutionary wave, including the Arab Spring, which, in turn, added a very significant geopolitical risk premium to oil prices. Once the

Arab Spring revolts ended, oil prices fell dramatically, but that contributed to success of Houthi rebels in Yemen, and the ensuing war, which has contributed to a partial rebound in oil prices.

The Kingdom of Saudi Arabia is embarking on a remarkably ambitious program to reconfigure its economy away from dependence on oil, in what is known as Vision 2030 and the shorter-term Transformation Program. The program requires a massive infusion of investment spending to build the non-oil sector of the Saudi economy, but this requires fast swimming against the natural tide of the economy. In fact, Figure 13 shows that even with geopolitical risk shocks, the lower oil prices are still predicted to cause contraction in Saudi GDP and reduction in its investment. Indeed, data until the time of writing show a contracting GDP in the Saudi non-oil sector, which has been historically derivative of the oil sector. Further, Figure 14 shows that the resulting decline in Saudi investment is likely to cause further significant decline in Saudi GDP.

Needless to say, our econometric estimates are driven by patterns in historical data, while the bold Saudi Vision promises a dramatic break with historical norms. Nonetheless, the estimated GIRFs contain valuable information on private sector investment and economic activity responses to low oil prices, and this information suggests that the envisioned plan's chances of success are not promising.

Figure 13: Simultaneous Negative Shock to Oil Price and Positive Shock to Geopolitical Risk

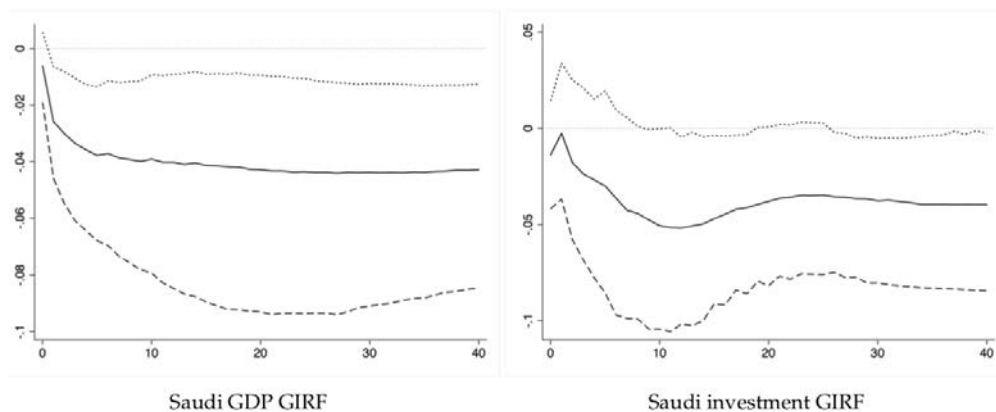
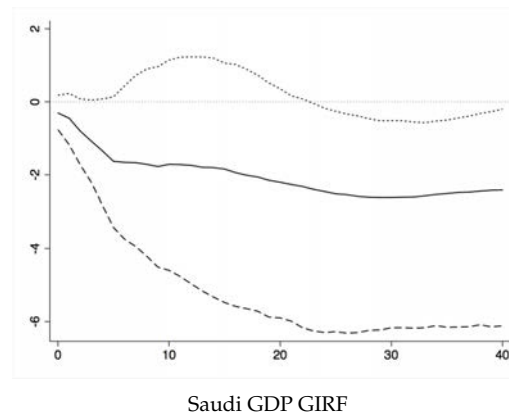


Figure 14: A negative shock to Saudi investment and GDP response



6. Conclusion

The simple VAR-based Granger-causality test conducted in Section 3 confirmed our hypothesis that the triad of oil prices, geopolitical risk, and financial liquidity are closely linked in a self-perpetuating cycle. Our GVAR model in Section 5 took the U.S. to be the only country that can unilaterally influence those three global variables, but the large number of countries in our sample were allowed collectively to influence those variables. Generalized impulse response functions from the GVAR model confirm our hypothesis that a negative shock to oil prices results in higher geopolitical risk and lower global financial liquidity, as petrodollar recycling decelerates or reverses direction. The GIRFs also show that a positive shock to geopolitical risk results in higher oil prices. Thus, we reconfirm the perpetuation of the cycle of low oil prices (e.g. in the late 1980s) leading to geopolitical strife (e.g. first Iraq War), which, in turn, leads to higher oil prices. We also confirm the catalytic role of financial liquidity in accelerating oil price bubbles and crashes, as petrodollar recycling fuels speculative demand for all commodities, including oil.

The full power of our GVAR analysis is exhibited in its ability to study the effects of global variables on individual countries, and the collective effects of country effects on global variables. In this regard, we focused our attention on the most likely scenario given global variable dynamics, which is a prolonged period of relatively moderate oil prices, geopolitical risk, and financial liquidity, with a slight probability of financial tightening to give central banks room for maneuver when the next global recession

arrives. Under this scenario, we found that countries heavily dependent on oil exports, like Saudi Arabia, are unlikely to succeed in generating significant economic growth in other sectors to compensate for contraction in their oil sectors.

The conclusions of our empirical analysis are at once sobering and cautionary. In the absence of any major global shocks, the current conditions of moderate oil prices, moderate geopolitical risk, and moderate to high financial liquidity are likely to persist, and call for accommodation of the long-term realities of slower global growth, reduced security, and lower standards of living in oil-exporting countries. A heightening of geopolitical risk, which may be caused by direct intervention or reaction to the inevitable lower standards of living in MENA countries, may propel another phase of the cycle of higher oil prices, acceleration through financial liquidity, and a brief reduction in geopolitical risk. However, reversion to the long-term “new normal” is likely to follow soon, and to be more painful than the last phase. Wise management and lowered expectations may be the most advisable social and economic policies to manage a soft landing following the past half-century of petrodollars, financial crises, and wars.

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Table 2: Country List

Algeria	El Salvador	Kuwait	Saudi Arabia
Argentina	Estonia	Latvia	Singapore
Australia	Finland	Lebanon	Slovakia
Austria	France	Libya	Slovenia
Bahrain	Germany	Luxembourg	South Africa
Belgium	Greece	Malaysia	South Korea
Brazil	Hong Kong	Malta	Spain
Canada	Hungary	Mexico	Sweden
Chile	Iceland	Morocco	Switzerland
China	India	Netherlands	Syria
Colombia	Indonesia	New Zealand	Thailand
Croatia	Iran	Norway	Tunisia
Czech	Iraq	Oman	Turkey
Denmark	Ireland	Philippines	UK
Djibouti	Israel	Poland	US
Ecuador	Italy	Portugal	Yemen
Egypt	Japan	Qatar	
Emirates	Jordan	Russia	

Table 5: Descriptive Statistics of Global Variables

	Mean	Median	Maximum	Minimum	Std. dev.
Oil price	3.49	3.37	4.80	2.45	0.65
Goepolitical Risk	87.07	74.16	463.78	28.99	57.53
Global Liquidity Index	46067.02	36669.82	102763.54	7563.67	30445.80

Table 6: Unit Root Tests for the Global Variables

	Oil			GPR			Lq		
	trend	no trend	DOil	trend	no trend	DGPR	trend	no trend	DLq
Critical Value	-3.24	-2.55	-2.55	-3.24	-2.55	-2.55	-3.24	-2.55	-2.55
Statistic	-1.99	-1.34	-6.72**	-2.82	-2.82	-7**	-1.08	1.45	-8.52**

[illegible]

Table 8: Unit Root Tests for Domestic Variables

	Y			I			Rs			Gis		
	trend	no trend	DYs	trend	no trend	DIs	trend	no trend	DRss	trend	no trend	DGis
alg	-0.94	-1.4	-3.84**	-1.78	-2.54	-0.71	-0.83	-0.25	-8.01**	0	0	0
arg	-1.75	-1.19	-7.44**	-2.94	-1.91	-4.45**	-1.65	-1.46	-5.97**	-3.29**	-2.64	-12.1**
aus	-6.56**	0.91	-8.56**	-1.88	0.43	-9.82**	-2.35	0.97	-8.92**	0	0	0
aus	-2.8	-0.92	-10.13**	-2.41	-0.42	-5.47**	-1.44	-0.85	-9.95**	0	0	0
bah	-4.49**	-3.28**	-7.53**	-1.68	-0.56	-12.28**	-2.44	-0.39	-4.91**	0	0	0
bel	-1.96	0.09	-10.72**	-2.2	-0.59	-6.16**	-2.28	-1.16	-6.5**	0	0	0
bra	-1.22	-1.57	-10.9**	-2.45	-0.94	-5.73**	-2.29	-0.14	-8.63**	-3.71**	-3.42**	-9.94**
can	-1.71	0.86	-9.89**	-0.48	-1.43	-1.06	-2.35	0.28	-10.17**	0	0	0
chl	-0.91	-0.83	-8.95**	-1.59	-1.38	-7.19**	-4.48**	-1.06	-9.25**	0	0	0
chn	2.06	4.44**	-4.61**	0.8	0.57	-5.79**	-2.67	1.07	-6.44**	-5.08**	-5.08**	-9.47**
col	-2.89	-0.12	-9.8**	-2.25	-0.79	-4.36**	-3.19	-0.9	-4.12**	-3.1	-3.1	-13.56**
cro	-2.32	-2.31	-4**	0	0	0	-1.68	-0.77	-8.22**	0	0	0
cze	-0.74	-0.29	-7.8**	0	0	0	-1.91	-0.77	-7.47**	0	0	0
den	-1.55	-0.31	-8.92**	-1.94	0.37	-5.85**	-4.18**	0.64	-7.37**	0	0	0
dji	-2.63	-2.43	-6.27**	-3.27**	-2.66	-6.73**	-2.35	-2.34	-8.6**	0	0	0
ecu	-4.31**	-0.74	-11.45**	-1.5	-1.92	-2.23	-2.89	-1.6	-6.5**	0	0	0
egy	-0.43	-0.96	-8.84**	-1.1	-0.99	-6.43**	-1.01	-0.26	-8.31**	0	0	0
emi	-2.31	-2.08	-5.39**	-2	-0.91	-7.87**	-1.62	0.73	-9.29**	0	0	0
els	-2.4	-1.17	-6.24**	-0.35	0.1	-6.75**	-4.43**	0.68	-8.15**	0	0	0
est	0	0	0	0	0	0	-2.66	-0.47	-10.4**	0	0	0
fin	-1.95	-0.65	-6.32**	-2.74	-1.53	-6.83**	-2.21	-1.05	-8**	0	0	0
fra	-1.79	-1.54	-8.28**	-1.17	2.05	-12.64**	-4.24**	-1.83	-8.68**	0	0	0
ger	-3.63**	-0.93	-8.84**	-2.44	-0.56	-5.46**	-2.01	-1.85	-11.56**	0	0	0
gre	-2.26	-2.2	-4.83**	-2.39	-2.08	-3.45**	-1.67	-1.7	-9.58**	0	0	0
hon	-2.18	-2.2	-3.88**	-1.69	0.42	-10.44**	-1.92	-1.01	-11.33**	0	0	0
hun	-1.94	-0.61	-4.91**	-1.49	-1.59	-4.62**	-1.92	-0.66	-10.33**	0	0	0
ice	0	0	0	-2.91	-1.5	-5.75**	-0.48	1.77	-4.18**	0	0	0
ind	-1.08	0.42	-11.35**	-1.19	0.52	-7.62**	-0.86	-1.12	-5.65**	-4.48**	-4.24**	-9.52**
ind	-2.15	-0.91	-9.92**	-1.35	-0.23	-5.94**	-1.09	-1.6	-1.45	-3.03	-2.98	-11.4**
irn	-2.58	-2.15	-8.04**	-2.58	-1.91	-5.17**	-0.8	-1.28	-11.66**	0	0	0
irq	-1.92	-1.71	-8.42**	-3.47**	-3.45**	-6.56**	-2.76	-2.97	-8.1**	0	0	0
ire	-3.14	0.5	-6**	-1.78	-0.26	-8.51**	-0.3	-0.96	-5.59**	0	0	0
isr	-3.45**	0.41	-8.79**	-0.18	-0.03	-1.14	-2.15	0	-9.18**	-4.33**	-4.35**	-9.65**
ita	-1.67	-1.66	-8.68**	-0.08	2.06	-12.01**	-1.32	0.17	-3.4**	0	0	0
jap	-1.53	-1.14	-7.78**	-0.92	-0.18	-8.11**	1.45	-0.87	-1.73	0	0	0
jor	-2.02	0.62	-16.28**	-2.92	-1.16	-5.64**	-2.19	-0.59	-11.08**	0	0	0
kuw	-4.1**	-1.87	-13.17**	-1.64	-0.25	-10.07**	-1.63	-1.92	-2.66	0	0	0
lat	0	0	0	0	0	0	-2.36	0.37	-4.44**	0	0	0
leb	-2.91	-1.23	-9.59**	-3.16	-1.75	-8.76**	-1.88	0.46	-7.64**	0	0	0
lib	-3.79**	-3.77**	-8.12**	0	0	0	-1.73	-0.06	-5.8**	0	0	0
lux	-2.61	-0.23	-7.72**	-3.43**	0.23	-9.55**	-2.84	-0.41	-10.67**	0	0	0
mal	-3.21	0.13	-10.55**	-1.5	-0.02	-6.91**	-1.73	0.12	-8.15**	-5.86**	-5.84**	-9.74**
mal	0	0	0	-1.94	2.29	-10.25**	-2.28	-2.21	-9.07**	0	0	0
mex	-2.99	-0.26	-10.33**	-3.35**	-1.17	-6.85**	-5.32**	-0.32	-7.85**	-2.36	-1.94	-10.51**
mor	-1.94	1.18	-9.97**	-2.23	-0.12	-5.53**	-1.3	-0.19	-14.17**	0	0	0
net	-3.28**	-0.03	-10.72**	-2.36	-0.67	-7.02**	-1.67	-1.63	-8.06**	0	0	0
nez	-3.84**	-3.79**	-9.03**	-3.76**	0.38	-6.77**	-1.88	0.62	-10.97**	0	0	0
nor	-0.96	0	-12.59**	-1.87	-0.01	-5.77**	-2.15	1	-10.44**	0	0	0
oma	-0.56	0.43	-11.94**	-1.97	-0.14	-9.33**	-2.26	0.88	-11.56**	0	0	0
phi	-1.17	-0.78	-5.6**	-1.74	-1.52	-3.29**	-2.08	-0.57	-11.1**	-1.92	-1.92	-10.86**
pol	-0.64	-0.81	-5.52**	0	0	0	-1.63	-1.08	-6.74**	0	0	0
por	-1.05	-0.23	-11.48**	-1.65	1.33	-5.56**	-1.26	-1.04	-8.36**	0	0	0
qat	-2.36	-1.3	-8.41**	-3.66**	-1.43	-5.27**	-1.16	0.69	-8.54**	0	0	0
rus	0	0	0	-1.84	-1.19	-2.36	-2.5	-0.48	-7.82**	-3.57**	-3.59**	-13.05**
sau	-2.46	-2.2	-8.79**	-1.15	-1.8	-3.79**	-1.18	-0.4	-7.67**	-4.43**	-4.34**	-10.19**
sin	-1.06	0.65	-6.92**	-1.79	0.7	-12.37**	-0.83	2.05	-11.16**	0	0	0
slk	0	0	0	0	0	0	-1.48	-0.55	-8.66**	0	0	0
sln	0	0	0	0	0	0	-1.98	-0.8	-8.7**	0	0	0
saf	-3.26**	-0.89	-8.5**	-1.76	-0.95	-4.67**	-1.89	-0.57	-7.28**	-2.55	-2.16	-12.22**
sko	-1.81	0.75	-10.88**	-1.11	1.59	-10.91**	-1.92	0.39	-7.21**	-4.46**	-4.47**	-11.87**
spa	-1.54	-1.28	-8.03**	-1.72	-0.62	-4.74**	-1.83	-1.58	-6.47**	0	0	0
swe	-2.17	-1.02	-5.98**	-2.22	-1.49	-3.15	-1.85	0.61	-11.06**	0	0	0
swi	-4.91**	-4.98**	-6.01**	-2.46	-0.26	-5.43**	-1.76	-0.19	-3.96**	0	0	0
syr	-0.49	-0.13	-7.81**	-2.37	-2.22	-4.85**	-5.6**	-4.98**	-6.57**	0	0	0
tha	-1.96	-1.5	-8.61**	-2.13	-0.8	-5.73**	-1.48	0.63	-5.14**	-3.85**	-3.83**	-12.26**
tun	-2.57	-2.59	-9.92**	-1.35	0.19	-9.37**	-2.31	-1.02	-3.77**	0	0	0
tur	-2.19	0.83	-6.15**	-2.87	0.14	-7.09**	-2.31	0.46	-9.43**	-3.51**	-3.43**	-10.15**
uk	-1.49	-1.08	-8.51**	-2.49	-0.24	-9.2**	-1.78	-0.09	-7.68**	0	0	0
us	-2.2	0	-9.53**	-0.54	1.25	-13.17**	-1.71	0.37	-6.57**	0	0	0
yem	0.2	-0.26	-12.34**	0	0	0	-2.23	-1.13	-11.66**	0	0	0

Table 9: Unit Root Tests for Country-Specific Foreign Variables

	Ys			Is			Rss			Gis		
	trend	no trend	DYs	trend	no trend	DIs	trend	no trend	DRss	trend	no trend	DGis
alg	-2.42	-0.24	-9.82**	-1.06	1.17	-12.03**	-1.88	1.38	-8.81**	-3.76**	-3.76**	-10.55**
arg	-1.33	-0.11	-9.45**	-1.2	-0.02	-5.87**	-1.8	0.9	-8.34**	-3.59**	-3.42**	-11.44**
aus	-1.22	1.17	-7.42**	-0.27	1.17	-9.48**	0.77	0.15	-5.64**	-5.55**	-5.51**	-9.41**
aus	-3.23	-0.52	-9.06**	-0.58	0.6	-7.87**	-2.62	0.82	-7.32**	-4.81**	-4.81**	-10.04**
bah	-2.23	-0.98	-5.66**	-0.27	-0.14	-4.04**	-1.18	-0.42	-4.34**	-4.63**	-4.62**	-9.65**
bel	-2.97	-0.4	-9.2**	-1.19	1.32	-11.88**	-2.34	0.93	-9.36**	-4.68**	-4.64**	-9.79**
bra	-1.62	0.76	-7.06**	0.04	0.8	-8.72**	-1.23	1.14	-5.26**	-3.72**	-3.49**	-11.04**
can	-2.52	0.13	-9.71**	-0.09	1.55	-10.3**	-1.75	0.88	-9.91**	-3.75**	-3.77**	-9.64**
chl	-1.39	0.98	-7.43**	-0.03	1.09	-9.79**	-0.42	1.17	-8.73**	-5.64**	-3.76**	-9.57**
chn	-3.66**	-0.25	-5.85**	-0.95	0.98	-11.17**	-2.24	-0.22	-11.21**	-3.65**	-3.64**	-11.1**
col	-2.89	0.24	-10.24**	-0.13	1.2	-12.11**	-1.96	1.17	-10.72**	-3.75**	-3.72**	-10.98**
cro	-2.65	-0.86	-9.12**	-0.69	1.29	-12.28**	-2.09	0.47	-7.2**	-3.8**	-3.82**	-9.57**
cze	-3.09	-0.59	-7.1**	-0.84	0.5	-5.83**	-1.98	0.35	-5.7**	-3.86**	-3.86**	-9.67**
den	-2.97	-0.41	-9.16**	-1.67	0.04	-5.49**	-2.25	1.19	-7.88**	-4.98**	-4.97**	-10.23**
dji	-0.9	-0.73	-11.23**	-2.28	-0.07	-6.04**	-1.74	0.17	-9.77**	-3.67**	-3.43**	-9.87**
ecu	-2.57	-0.09	-9.34**	-0.47	0.81	-10.78**	-2.01	0.99	-10.28**	-3.54**	-3.54**	-10.05**
egy	-1.97	-0.32	-9.64**	-1	0.97	-10.65**	-3.73**	0.6	-6.43**	-4.72**	-4.72**	-9.22**
emi	-4.83**	0.02	-10.72**	-1.63	0.97	-10.54**	-1.34	-0.38	-11.4**	-5.21**	-5.13**	-10.87**
els	-2.26	-0.02	-9.5**	-0.48	1.21	-10.22**	-1.62	0.77	-9.9**	-3.38**	-3.29**	-6.71**
est	-2.3	-0.49	-6.34**	-0.99	-0.4	-4.34**	-2.64	0.8	-7.14**	-3.64**	-3.66**	-12.68**
fin	-3.31**	0	-9.45**	-0.61	-0.39	-4.04**	-2.03	0.79	-7.02**	-3.85**	-3.87**	-9.82**
fra	-3.16	-0.33	-9.8**	-0.97	0.92	-11.27**	-2.06	1.46	-6.9**	-4.95**	-4.95**	-10.21**
ger	-3.06	-0.11	-10**	-0.34	1.15	-11.35**	-2.14	1.15	-7.91**	-4.93**	-4.92**	-10.18**
gre	-3.11	-0.17	-9.36**	-0.64	1.54	-11.4**	-2.32	1.64	-8.47**	-3.57**	-3.54**	-10.03**
hon	1.46	3.65**	-7.97**	0.61	0.82	-7.49**	-1.76	0.98	-6.6**	-5.13**	-5.12**	-9.45**
hun	-3.19	-0.52	-9.29**	-0.69	1.04	-10.84**	-1.91	0.72	-5.85**	-3.84**	-3.86**	-9.72**
ice	-2.58	-0.23	-9.99**	-1.42	0.53	-10.96**	-1.78	0.25	-8.37**	-3.82**	-3.84**	-9.85**
ind	-3.29**	0.34	-6.47**	-0.17	1.25	-4.96**	-2.2	0.86	-10.49**	-5.25**	-5.21**	-9.49**
ind	-3.42**	1.22	-10.04**	-0.59	1.08	-10.69**	-0.25	0.57	-7.63**	-3.69**	-3.7**	-11.01**
irn	-1.46	1.08	-7.45**	-0.47	1.27	-10.1**	0.35	0.74	-7.68**	-5.1**	-5.03**	-10.26**
irq	-3.01	0.82	-9.99**	-0.38	1.39	-11.61**	-1.25	1.12	-9.7**	-5.33**	-5.19**	-10.47**
ire	-2.89	-0.22	-9.65**	-1.59	0.93	-11.32**	-2.04	0.93	-9.45**	-5.12**	-5.13**	-9.24**
isr	-3.85**	0.23	-11.37**	-0.56	1.15	-11.76**	-2.28	0.48	-11.28**	-4.86**	-4.81**	-10.19**
ita	-3.01	-0.3	-9.71**	-0.74	1.13	-11.14**	-2.04	0.76	-7.09**	-3.63**	-3.64**	-10.12**
jap	-0.74	1.23	-6.92**	-0.12	0.99	-9.76**	-2.5	1.01	-11.12**	-5.88**	-5.88**	-9.79**
kor	-1.55	-0.73	-4.47**	-2.39	-0.34	-7.38**	-1.54	-1.02	-4.48**	-4.6**	-4.6**	-9.34**
kuw	-3.87**	1.11	-9.88**	-0.75	1.47	-11.33**	1.41	-0.13	-5.19**	-6.07**	-5.96**	-10.98**
lat	-2.3	-0.43	-9.6**	-1.21	-0.83	-2.99	-2.18	0.3	-9.61**	-3.6**	-3.62**	-12.83**
leb	-2.9	-0.8	-6.39**	-1.24	-0.21	-4.14**	-4.1**	-0.31	-6.22**	-4.05**	-3.59**	-12.06**
lib	-2.6	-0.7	-9.98**	-0.31	1.89	-12.84**	-1.8	1.37	-5.45**	-4.98**	-4.96**	-9.22**
lux	-3.18	-0.6	-9.06**	-1.66	0.89	-11.14**	-2.24	0.98	-6.9**	-4.66**	-4.67**	-9.72**
mal	-1.55	1.3	-6.33**	-0.44	1.05	-10.66**	-2.35	0.29	-9.3**	-5.52**	-5.5**	-9.52**
mal	-3.43**	-0.16	-5.48**	-1.08	1.41	-12.45**	-2.12	0.27	-11.39**	-3.73**	-3.75**	-9.44**
mex	-2.37	0.06	-9.62**	-0.42	1.2	-10.27**	-1.72	0.77	-6.88**	-3.39**	-3.24**	-10.99**
mor	-2.15	-0.56	-9.17**	-0.99	1.29	-11.83**	-2.16	0.86	-8.7**	-4.7**	-4.53**	-9.8**
net	-3.44**	-0.48	-9.39**	-1.45	0.84	-11**	-2.48	0.99	-7.13**	-3.62**	-3.63**	-10.19**
nez	-2.23	1.25	-11.69**	-0.18	0.92	-10.37**	-2.16	0.9	-8.89**	-5.41**	-5.41**	-9.58**
nor	-2.69	-0.4	-9.34**	-1.92	0.65	-6.03**	-2.12	0.86	-6.93**	-3.72**	-3.73**	-9.46**
oma	-2.17	1.08	-7.27**	0.03	1.11	-9.15**	-0.45	-0.01	-4.68**	-5.67**	-5.63**	-10.99**
phi	-3.84**	0.86	-6.43**	-0.55	1.25	-11.12**	-2.66	0.03	-10.52**	-6.08**	-6.09**	-9.83**
pol	-3.53**	-0.6	-9**	-0.67	0.49	-5.7**	-2.9	0.66	-8.03**	-3.76**	-3.78**	-9.64**
por	-2.01	-0.79	-8.64**	-1.41	0.71	-11.06**	-1.77	0.64	-7.93**	-3.62**	-3.63**	-11.03**
qat	-4.58**	0.56	-7.51**	-1.25	1.26	-11.09**	1.39	-0.32	-4.44**	-4.12**	-4.1**	-11.35**
rus	-3.3**	0.12	-9.34**	-0.94	0.98	-11.38**	-2.06	1.42	-8.23**	-3.69**	-3.71**	-9.26**
sau	-2.18	1.22	-10.59**	-0.4	1.37	-11.29**	1.28	0.22	-6.21**	-5.71**	-5.6**	-10.95**
sin	-3.46**	0.41	-6.33**	-0.91	0.75	-9.09**	-2.53	-0.71	-9.59**	-5.35**	-5.35**	-9.62**
slk	-2.04	-0.41	-9.07**	-0.63	0.09	-4.97**	-2.15	0.03	-7.92**	-3.78**	-3.79**	-9.75**
sln	-2.74	-0.77	-8.92**	-0.58	0.65	-7.94**	-2.17	0.73	-7.8**	-3.76**	-3.77**	-9.57**
saf	-3.12	0.96	-11.04**	0	1.27	-10.25**	-1.69	0.72	-8.43**	-5.17**	-5.14**	-9.2**
sko	-0.37	1.51	-7.33**	0.32	0.82	-8.43**	-2	0.79	-10.36**	-5.02**	-5.01**	-9.39**
spa	-2.58	-0.5	-9.61**	-0.98	1.35	-12.13**	-2.26	1.39	-9.16**	-3.62**	-3.64**	-10.51**
swe	-2.87	-0.15	-10.87**	-1.34	0.94	-11.22**	-2.52	1.14	-7.44**	-4.83**	-4.79**	-10**
swi	-3.65**	-0.35	-10.04**	-0.74	1.28	-11.83**	-2.25	1.13	-10.88**	-5.08**	-5.07**	-10.39**
syri	-2.17	-1.08	-4.6**	-2.89	-0.98	-7.69**	-2.51	-1.16	-9.09**	-4.49**	-4.43**	-9.58**
tha	-3.12	0.92	-7.03**	-0.71	0.8	-9.82**	-2.32	-0.04	-9.24**	-5.05**	-5.03**	-9.46**
tun	-2.17	-1.41	-8.35**	-1.06	1.77	-12.4**	-1.84	1.2	-6.65**	-4.8**	-4.78**	-9.59**
tur	-2.62	-0.81	-7.98**	-0.5	1.17	-9.97**	-1.98	0.62	-9.88**	-4.56**	-4.56**	-9.59**
uk	-3.34**	-0.02	-10.19**	-1.3	0.91	-11**	-2.13	1.53	-10.1**	-4.81**	-4.74**	-10**
us	-2.35	0.81	-10.29**	-0.8	0.04	-5.43**	-2.72	1.04	-10.33**	-3.57**	-3.58**	-9.93**
yem	-0.25	0.9	-6.65**	-0.2	0.94	-6.68**	-0.23	0.86	-6.31**	-4.95**	-4.87**	-10.78**

Table 10: Lags and Number of Cointegration Relations

Country	p	q	cointeg.	Country	p	q	cointeg.	Country	p	q	cointeg.
alg	2	1	1	hon	2	1	1	oma	1	1	1
arg	2	1	1	hun	2	1	1	phi	2	1	1
aus	2	1	1	ice	1	1	1	pol	2	1	1
aus	1	1	1	ind	1	1	2	por	1	1	1
bah	2	1	1	ind	2	1	1	qat	1	1	1
bel	1	1	1	irn	1	1	1	rus	2	1	1
bra	2	1	1	irq	2	1	1	sau	2	1	1
can	2	1	1	ire	2	1	1	sin	2	1	1
chl	2	1	1	isr	1	1	1	slk	1	1	1
chn	2	1	1	ita	1	1	1	sln	1	1	1
col	1	1	1	jap	1	1	1	saf	2	1	2
cro	2	1	1	jor	2	1	1	sko	1	1	1
cze	1	1	1	kuw	2	1	1	spa	2	1	1
den	2	1	1	lat	1	1	1	swe	2	1	1
dji	1	1	1	leb	2	1	1	swi	2	1	2
ecu	1	1	1	lib	2	1	1	syr	1	1	1
egy	2	1	1	lux	1	1	1	tha	2	1	2
emi	2	1	1	mal	2	1	1	tun	1	1	1
els	2	1	2	mal	1	1	1	tur	2	1	1
est	2	1	1	mex	2	1	1	uk	1	1	1
fin	1	1	1	mor	2	1	1	us	2	1	2
fra	2	1	1	net	1	1	1	yem	2	1	1
ger	2	1	1	nez	2	1	1				
gre	2	1	1	nor	2	1	1				

Table 11: F-statistics for the serial correlation tests

Cou.	Y	I	Rs	Gi	Cou.	Y	I	Rs	Gi	Cou.	Y	I	Rs	Gi
alg	2.09	1.91	2.09		hon	8.79**	2.05	0.17		oma	2.31	1.07	0.9	
arg	1.68	1.26	0.4	0.53	hun	2.08	3.44**	2.39		phi	9.2**	2.14	1.18	0.17
aus	0.54	0.97	0.76		ice	0	3.23**	1.03		pol	2.35	0	1.03	
aus	2.25	3.6**	0.87		ind	2.39	2.24	0.22	2.29	por	0.67	6.56**	1.25	
bah	0.96	1.45	3.73**		ind	0.32	2.18	0.85	1.57	qat	0.98	2.19	1.24	
bel	2.34	2.31	1.43		irn	1.07	2.11	1.39		rus	0	9.51**	2.32	1.29
bra	0.56	2.33	2.15	1.47	irq	2.36	0.19	0.85		sau	2.29	2.17	0.28	0.88
can	2.31	2.35	1.5		ire	2.09	2.17	2.06		sin	1.68	2.41	1.33	
chl	1.78	0.92	6.59**		isr	2.83**	0.71	1.48	1.55	slk	0	0	0.18	
chn	8.72**	2.43	0.64	2.09	ita	2.31	2.38	0.98		sln	0	0	0.76	
col	6.64**	2.08	2.03	1.36	jap	1.41	1.32	1.95		saf	3.82**	0.27	1.73	2.35
cro	7.27**	0	0.36		jor	12.31**	0.89	2.45**		sko	1.24	0.9	0.73	2.14
cze	1.22	0	2.74**		kuw	11.5**	0.94	0.88		spa	2.33	0.17	0.65	
den	2.14	7.03**	2.44		lat	0	0	0.2		swe	3.4**	10.77**	1.34	
dji	2.01	5.88**	0.02		leb	1.93	0.73	0.32		swi	3.68**	0.36	3.08**	
ecu	1.94	0.9	2.07		lib	2.14	0	2.03		syr	0.74	1.6	0.42	
egy	1.39	2.19	2.15		lux	1.32	2.23	0.32		tha	0.92	2.12	0.6	1.94
emi	0.28	2.06	0.92		mal	1.8	1.82	0.34	1.84	tun	1.7	2.39	2.27	
els	2.29	1.6	0.72		mal	0	2.18	0.35		tur	2.05	1.56	0.22	0.56
est	0	0	3.7**		mex	2.13	1.47	0.53	1.13	uk	1.71	0.78	1.43	
fin	10.51**	0.99	1.91		mor	2.29	9.06**	1.1		us	1.03	0.47	1.23	
fra	0.72	2.38	0.7		net	1.23	0.34	1.46		yem	1.24	0	1	
ger	1.2	2.39	2.07		nez	2.08	1.84	0.14						
gre	2.7**	1.53	1.86		nor	0.71	1.89	1.05						

Table 12: Tests for Weak Exogeneity

Cou.	Ys	Is	Rss	Gis	Oil	GPR	Lq	Cou.	Ys	Is	Rss	Gis	Oil	GPR	Lq
alg	0.92	0.15	0.20	0.01	1.02	3.07	0.61	kuw	0.27	0.10	1.41	2.22	0.22	0.80	0.71
arg	1.14	1.45	1.19	0.30	0.95	1.45	0.50	lat	0.00	0.00	0.00	0.00	0.00	0.00	0.00
aus	3.44	0.52	0.01	3.69	2.39	0.12	3.62	leb	0.00	0.00	0.00	0.00	0.00	0.00	0.00
aus	0.52	0.34	0.01	0.12	0.02	0.57	0.51	lib	0.08	0.71	0.23	0.91	0.86	0.92	0.34
bah	2.93	0.49	3.33	0.60	2.45	0.19	3.67	lux	0.81	1.27	1.09	0.03	1.18	0.78	3.80
bel	0.00	2.52	0.24	0.36	0.00	0.02	1.57	mal	0.00	0.14	0.03	0.00	10.28**	4.06**	0.74
bra	0.04	0.70	0.44	0.29	0.24	0.02	1.30	mal	0.03	0.62	0.11	0.47	0.02	0.01	1.10
can	3.04	3.02	0.38	3.07	1.21	0.23	1.62	mex	0.30	0.00	0.04	0.67	2.81	0.49	0.34
chl	0.72	0.40	0.09	0.93	3.28	0.06	1.88	mor	2.06	1.20	0.01	0.00	1.52	0.31	0.11
chn	2.36	2.04	1.99	6.5**	1.58	0.03	0.08	net	0.03	0.28	1.77	0.31	6.76**	0.21	4.95**
col	0.23	0.71	1.09	3.05	0.38	1.27	0.21	nez	0.62	0.00	0.13	0.35	2.03	0.23	0.02
cro	1.38	0.73	2.66	1.82	1.69	0.00	3.16	nor	0.00	0.00	0.00	0.00	0.00	0.00	0.00
cze	0.40	3.55	0.00	0.01	0.01	4.3**	0.20	oma	5.37**	2.25	0.47	0.97	1.28	0.06	1.57
den	0.81	1.31	0.30	0.02	3.37	0.26	1.78	phi	0.37	4.08**	0.64	0.00	1.13	0.49	4.34**
dji	0.00	0.00	0.00	0.00	0.00	0.00	0.00	pol	0.62	1.45	0.30	1.50	1.11	2.62	0.18
ecu	0.23	0.58	0.73	0.10	4.92**	0.03	0.71	por	0.00	0.00	0.00	0.00	0.00	0.00	0.00
egy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	qat	0.17	2.31	0.56	0.00	1.59	0.76	2.43
emi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	rus	1.87	0.45	0.09	1.23	1.91	0.00	1.07
els	0.85	1.34	0.50	0.80	0.39	1.52	0.76	sau	0.45	0.09	0.36	0.38	0.00	0.52	0.31
est	0.00	0.00	0.00	0.00	0.00	0.00	0.00	sin	0.00	0.00	0.00	0.00	0.00	0.00	0.00
fin	1.41	0.21	0.06	0.30	0.02	0.38	1.41	slk	0.00	0.00	0.00	0.00	0.00	0.00	0.00
fra	1.87	0.71	4.43**	1.11	0.01	2.91	0.38	sln	0.34	1.02	0.22	0.08	0.01	0.00	0.81
ger	0.05	0.87	0.65	0.58	0.39	0.54	3.05	saf	1.76	0.97	0.18	1.23	0.97	1.05	1.32
gre	0.00	1.20	0.07	0.00	0.56	0.14	2.59	sko	0.05	0.16	2.82	0.60	0.27	1.91	0.80
hon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	spa	0.00	0.17	0.46	0.19	0.01	2.01	0.45
hun	0.50	0.25	0.01	1.98	0.00	0.38	0.15	swe	1.88	4.91**	0.50	2.69	6.21**	0.94	0.05
ice	0.00	0.00	0.00	0.00	0.00	0.00	0.00	swi	3.23**	1.45	0.37	3.55**	1.22	0.12	0.77
ind	0.20	1.00	1.84	2.75	0.26	0.55	0.20	syr	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ind	0.40	2.07	0.47	0.00	0.87	0.00	0.24	tha	0.38	0.92	2.17	0.22	1.83	1.97	0.33
irn	0.00	0.16	0.30	4.68**	0.02	0.17	0.24	tun	3.35	0.40	10.49**	1.71	0.16	0.93	1.42
irq	0.00	0.00	0.00	0.00	0.00	0.00	0.00	tur	0.03	0.27	1.36	1.93	3.02	0.09	2.27
ire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	uk	0.00	0.00	0.00	0.00	0.00	0.00	0.00
isr	0.12	0.04	0.07	0.37	0.84	4.79**	0.94	us	0.04	0.45	0.31	2.18	0.68	0.00	0.00
ita	4.6**	0.94	0.01	0.28	0.01	0.03	0.02	yem	0.00	0.00	0.00	0.00	0.00	0.00	0.00
jap	0.68	0.83	1.69	0.03	2.28	0.99	1.47								
jor	0.81	0.64	2.20	0.34	0.06	1.73	1.85								

Figure 15: Persistence Profile of the Effect of System-Wide Shocks

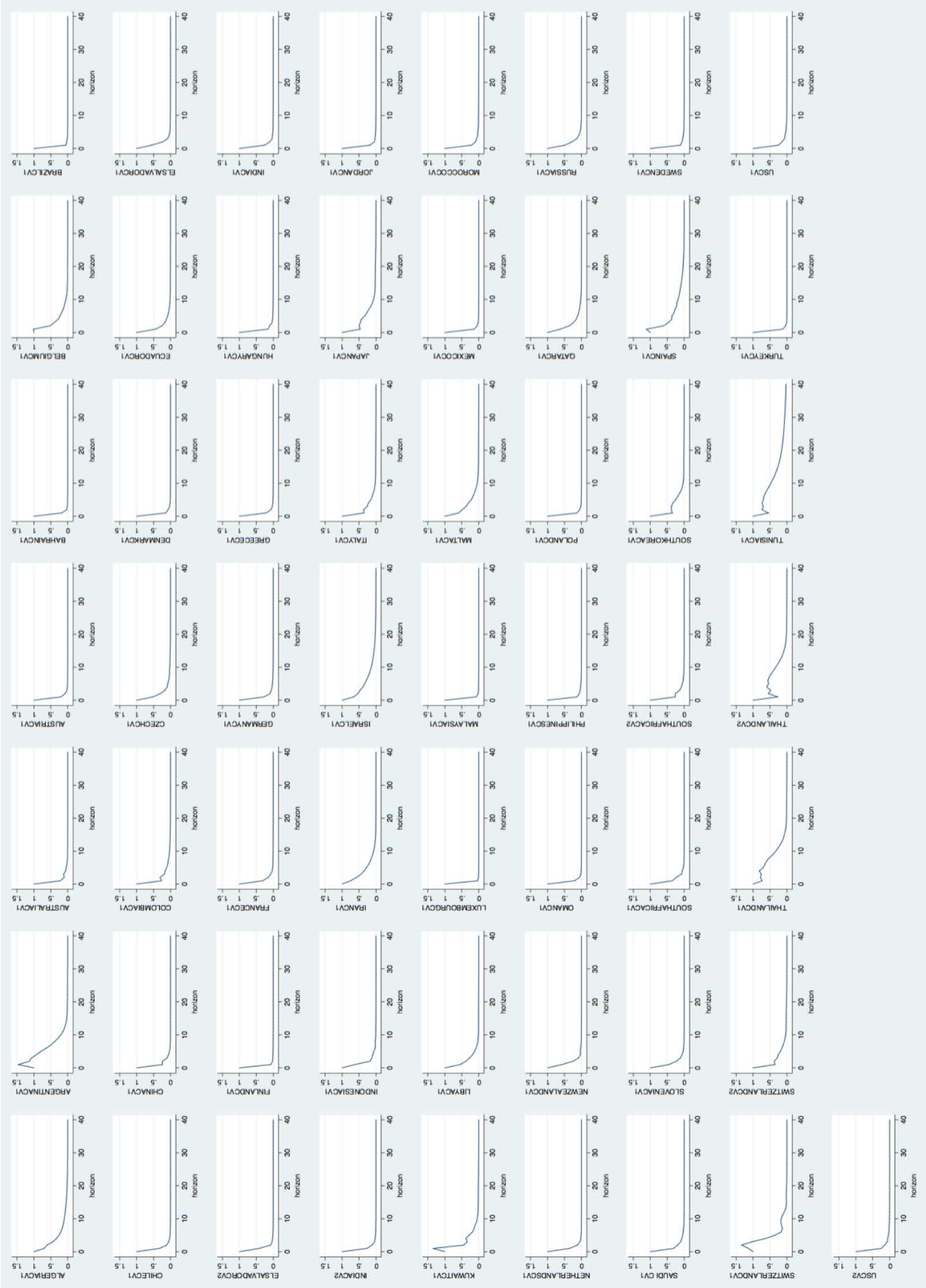


Figure 16: Country GDP GIRFs to Negative Oil Price Shock

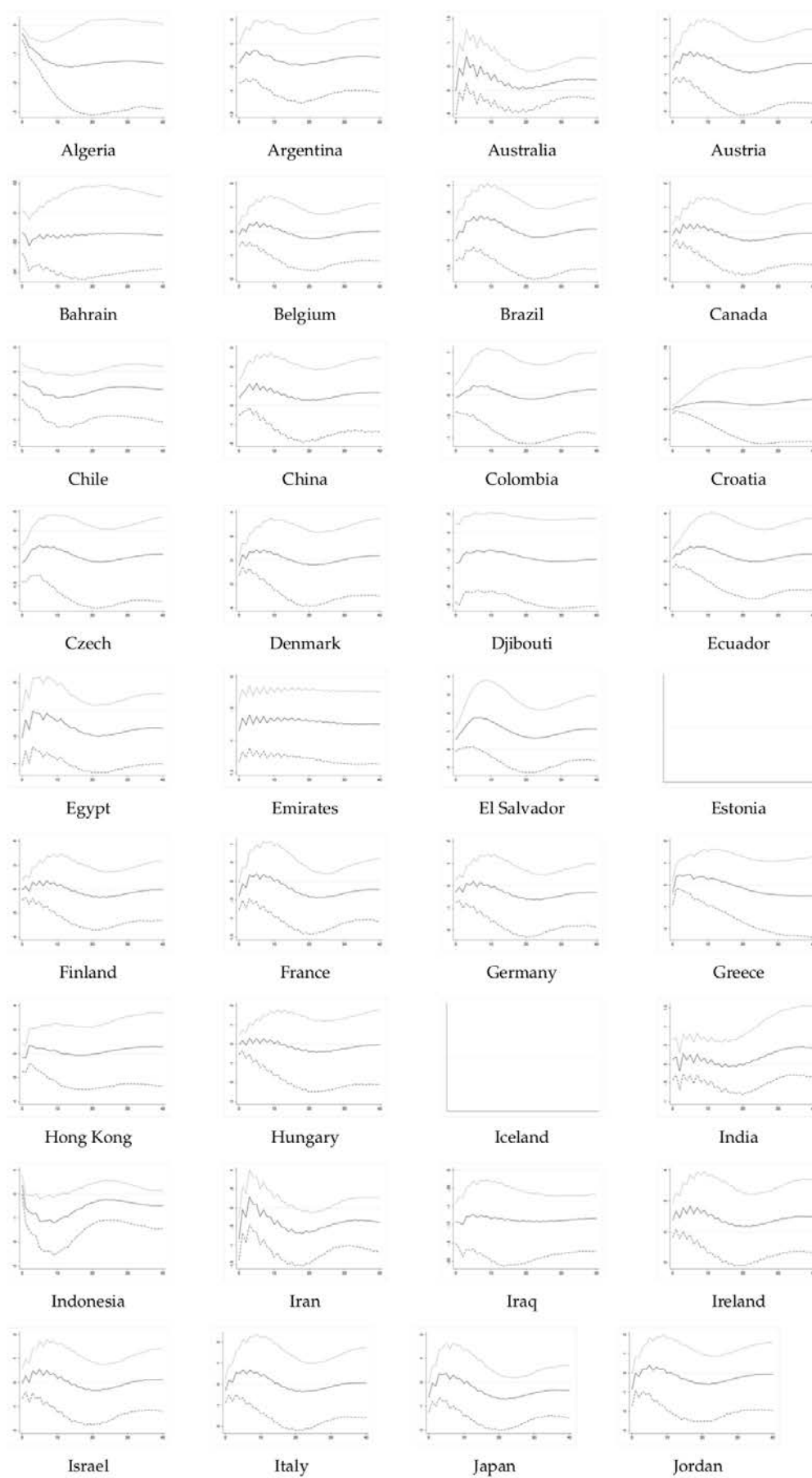


Figure 16: Country GDP GIRFs to Negative Oil Price Shock

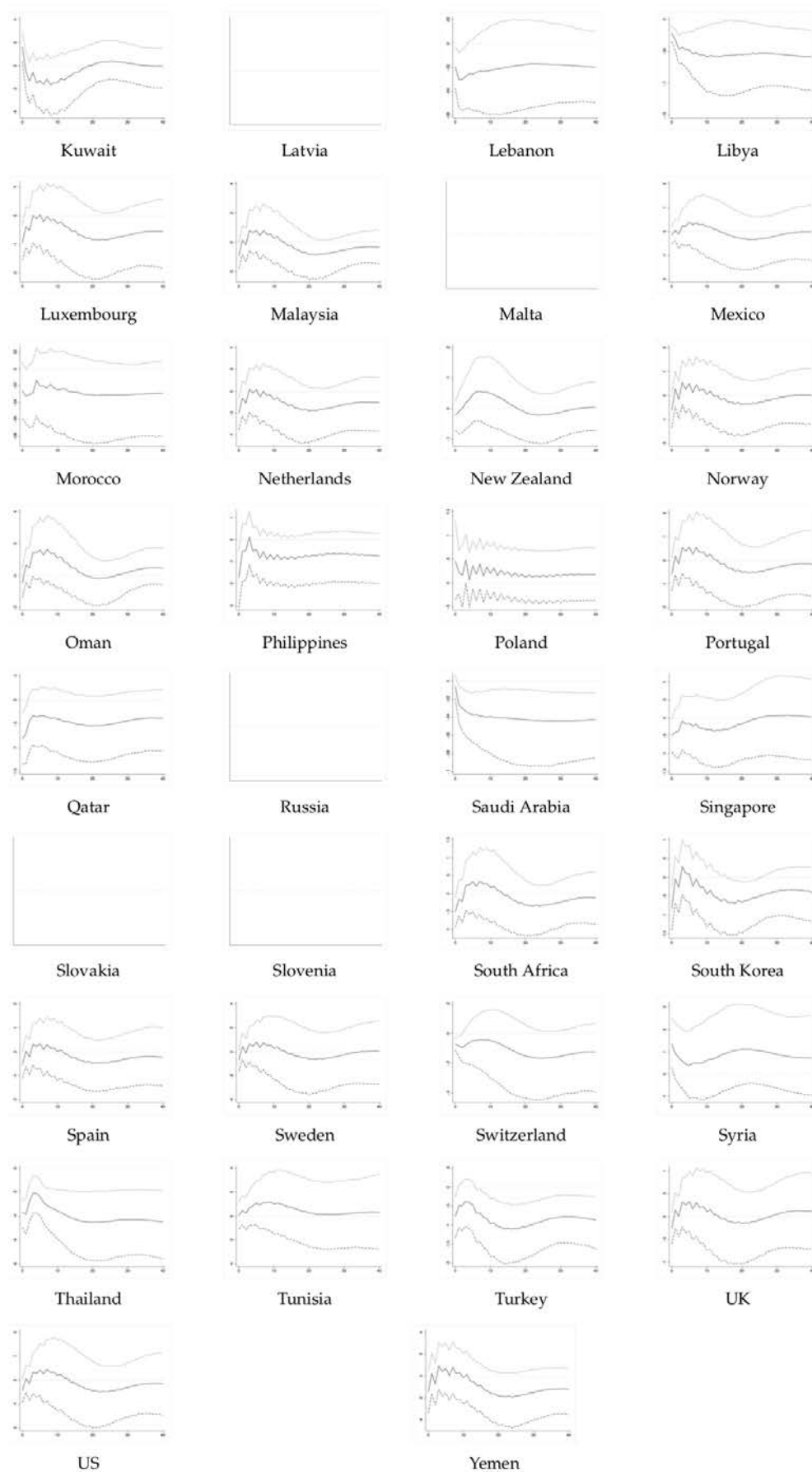


Figure 17: Country Investment GIRFs to Negative Oil Price Shock

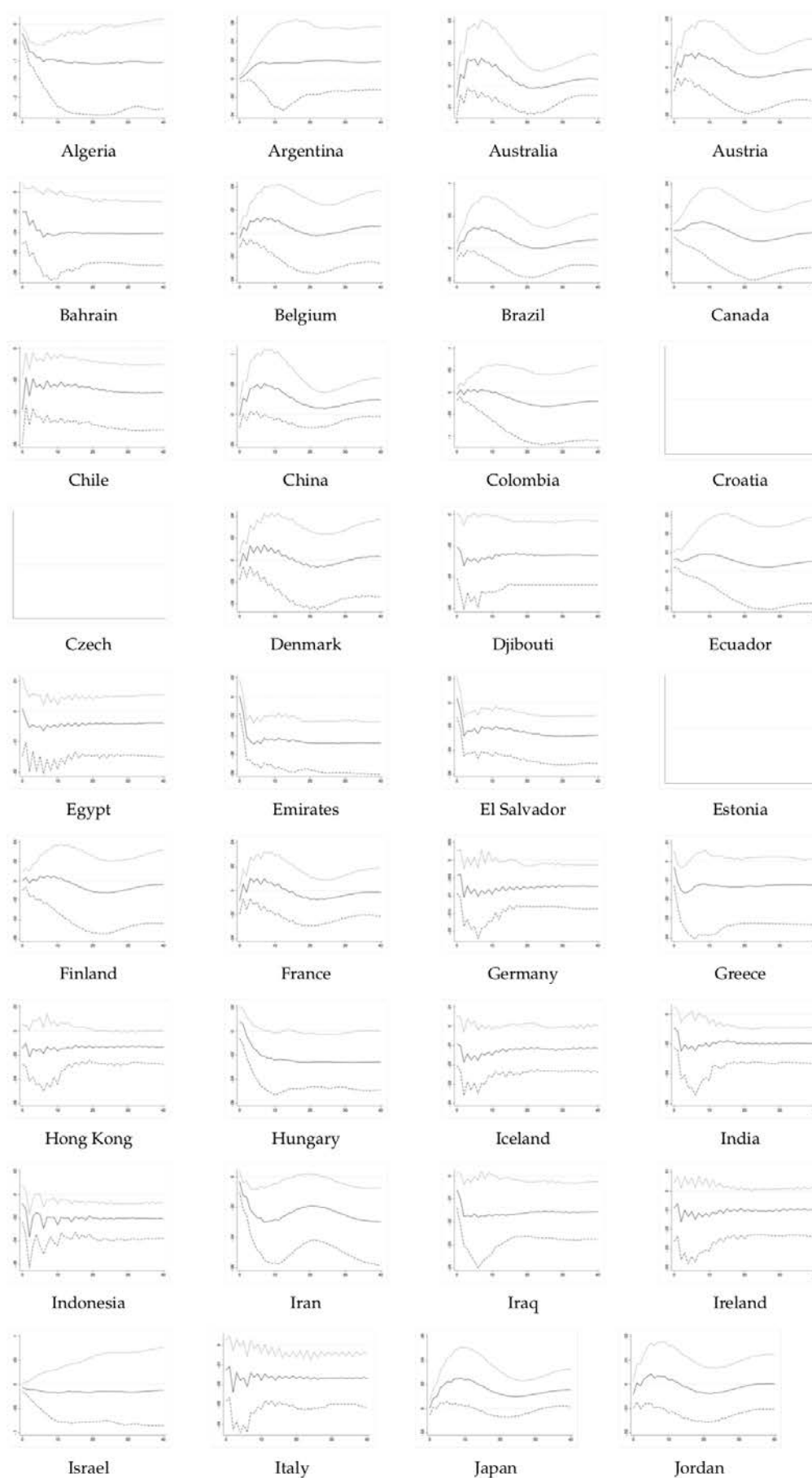


Figure 17: Country Investment GIRFs to Negative Oil Price Shock



Figure 18: Country GDP GIRFs to Positive Geopolitical Risk Shock

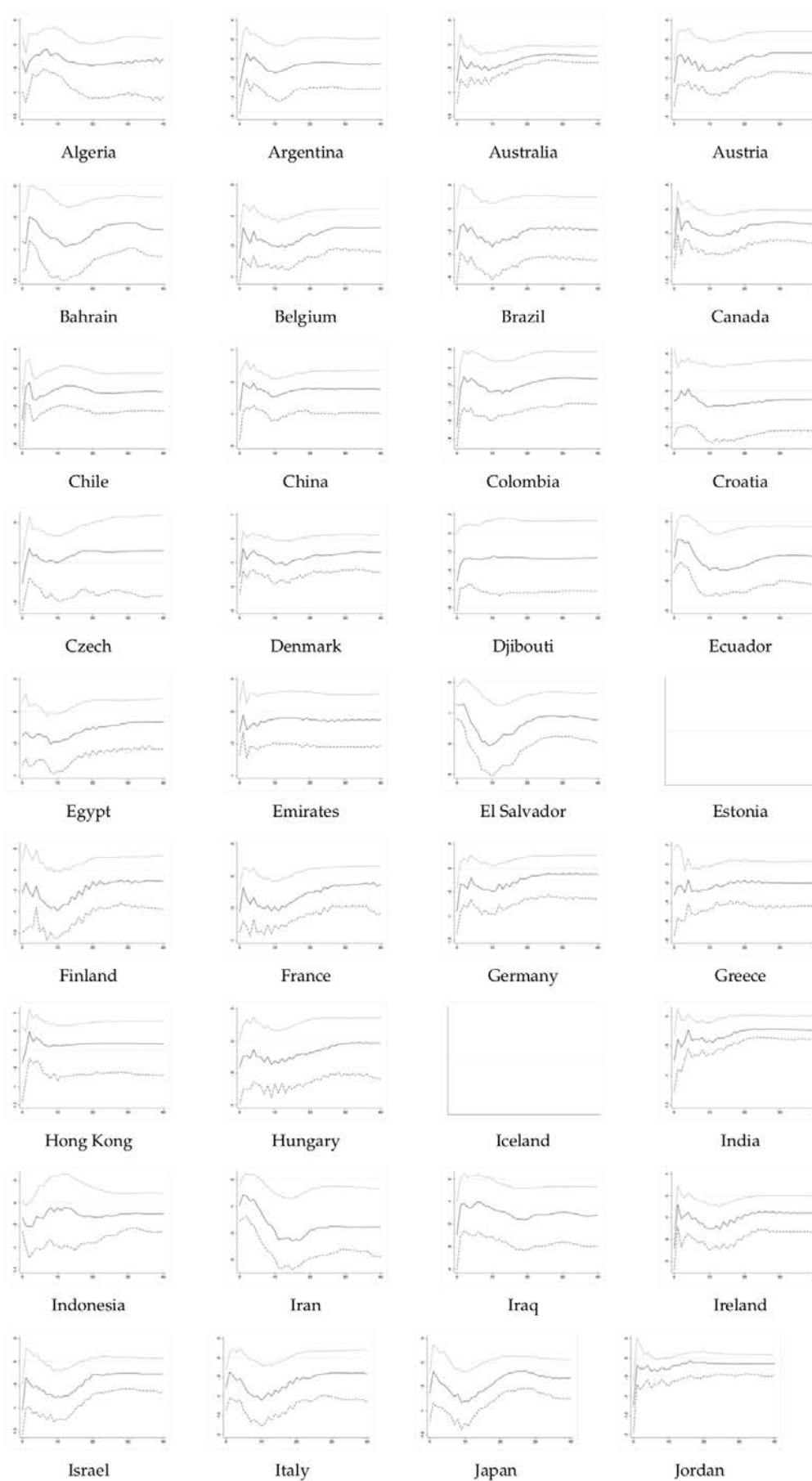


Figure 18: Country GDP GIRFs to Positive Geopolitical Risk Shock



Figure 19: Country Investment GIRFs to Positive Geopolitical Risk Shock

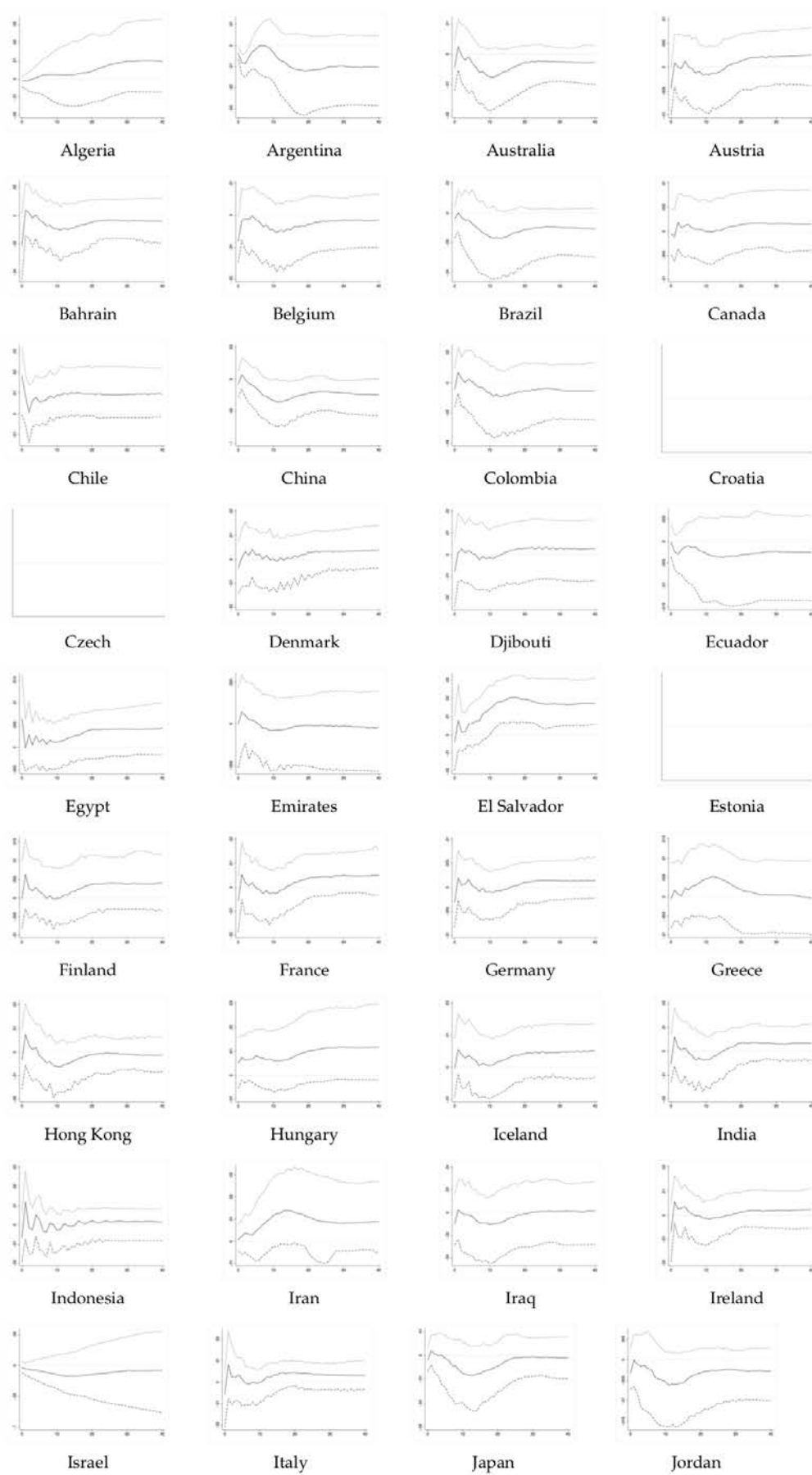


Figure 19: Country Investment GIRFs to Positive Geopolitical Risk Shock



Figure 20: Country GDP GIRFs to Negative Liquidity Shock

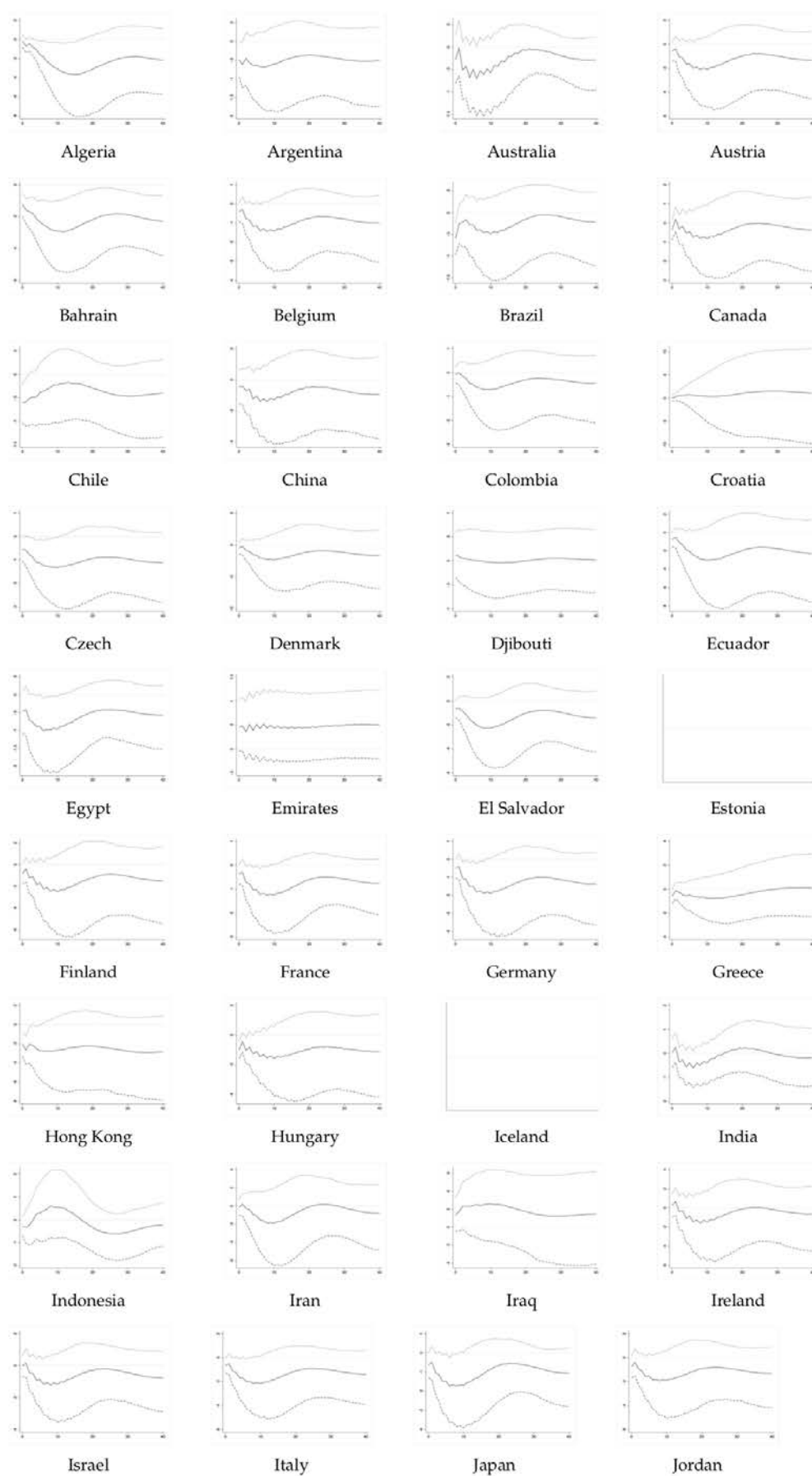


Figure 20: Country GDP GIRFs to Negative Liquidity Shock

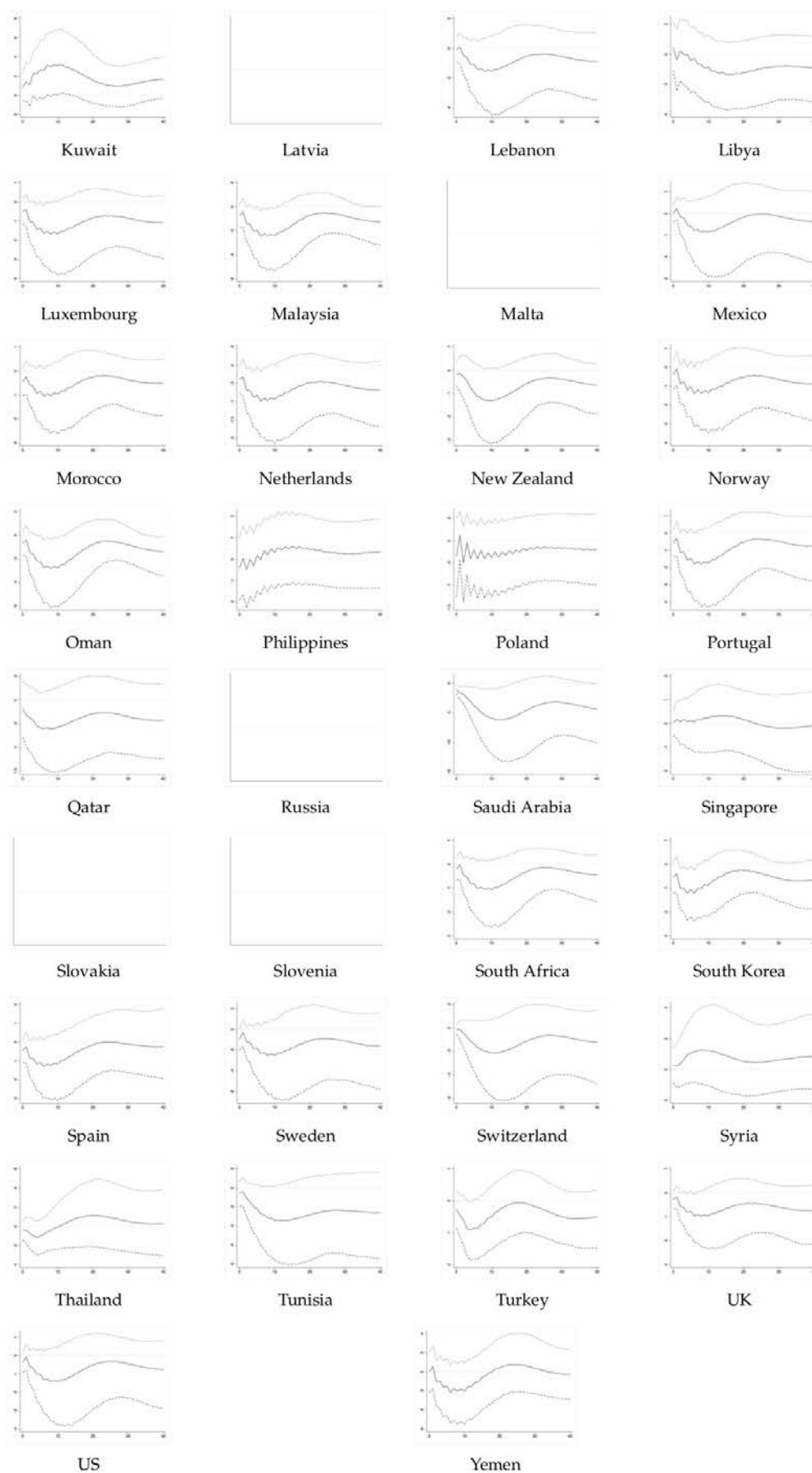


Figure 21: Country Investment GIRFs to Negative Liquidity Shock

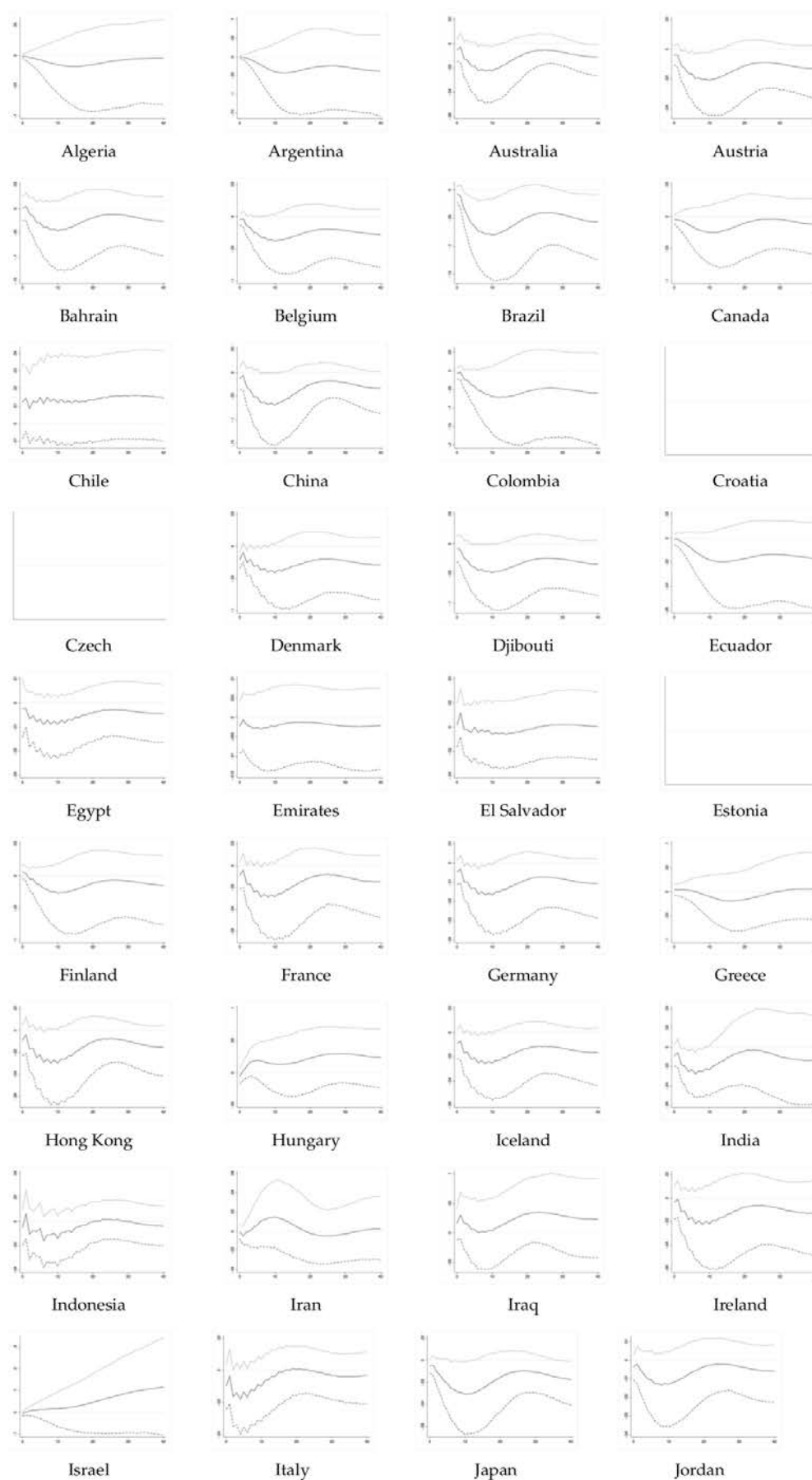


Figure 21: Country Investment GIRFs to Negative Liquidity Shock

