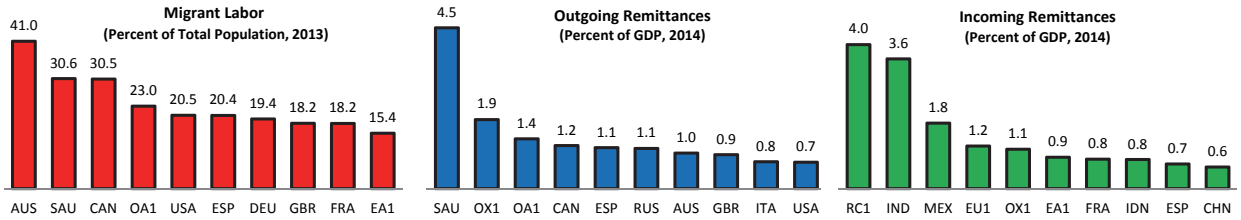
Online Appendices (Not for Publication)

Appendix 1: Regional Remittance Trends

This section provides a description of the regional migrant labor stocks and the remittance flows summarized using the regional compositions of FSGM's modules.[1] The intent is to provide an introduction to the regions and FSGM modules in which remittance channels may play a major role in dynamics. Figures, 15-22 summarize the top regions in the FSGM modules that have the highest stock of migrant labor as a percent of the total population, outgoing remittances to GDP, and income remittances to GDP.

Gulf Cooperation Council (GCC) members remit some of the highest shares of GDP in 2013: 4.5 percent in Saudi Arabia and 6.1 percent in other GCC economies (GCX region), see Figure **??**. Approximately half of GCC remittances are sent to South Asia: India, Bangladesh, Nepal and Pakistan. For example, Pakistan, with remittances at 6 percent of GDP, receives some 60 percent of its remittances from GCC countries. The other half is sent to other countries in the Middle East and North Africa (MENA) region, mostly Egypt and Libya. Outflows of remittances from the GCC have doubled in recent years, although the persistent decline in oil prices could eventually erode these increases. Moreover, nationalization policies in Saudi Arabia have slowed remittance flows in recent years, reducing the number of migrant workers to Saudi Arabia.

Figure 1. Remittance and Migrant Labor in G20MOD

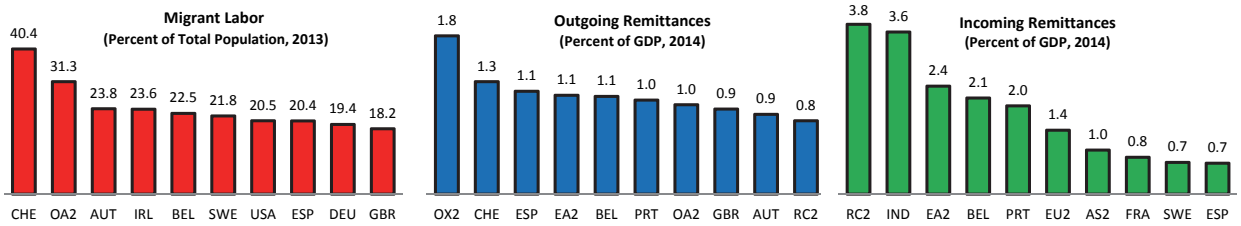


Region codes are as follows: EA1, Other Euro Area; EU1, Other European Union; OA1, Other Advanced Economies; OX1, Other Oil Exporters (mostly OPEC); RC1, Remaining Countries

In G20MOD and EUROMOD, receipts of remittances are largest in the remaining regions followed by India, close to 4 percent of GDP in both modules (Figures **??** and **??**). The majority of these remittances originate from the GCC countries. Even though many advanced economies have foreign labor share as a percent of the population above fifteen percent, outgoing remittance flows

[1]There are 63 unique countries and 27 unique regions modeled among the nine modules. Using International Organization for Standardization (ISO) country codes, the unique countries are AGO, ARG, AUS, AUT, BEL, BGD, BGR, BOL, BRA, CAN, CHE, CHL, CHN, COL, CRI, CZE, DEU, DOM, ECU, ESP, FIN, FRA, GBR, GHA, GRC, GTM, HKG, HRV, HUN, IDN, IND, IRL, ITA, JPN, KHM, KOR, LKA, MEX, MNG, MYS, NGA, NLD, NZL, PAN, PER, PHL, POL, PRY, ROM, RUS, SAU, SGP, SRB, SWE, THA, TTO, TUR, UKR, URY, USA, VNM, ZAF, and ZMB. The unique regions are ASEAN, Caucasus and Central Asia Oil Exporters, Caucasus and Central Asia Oil Importers, Central America, Central Asia and Caucasus Oil Exporters, Central Asia and Caucasus Oil Importers, Central Europe 3, Core Euro Area, Eastern Africa, Eastern and Southeastern Europe, Emerging Asia, Emerging Euro Area, Euro Area, Euro Area Periphery, European Union, Fragile Africa, Gulf Cooperation Council (GCC) Oil Exporters excluding Saudi Arabia, Latin America, Low Income Africa, Middle East and North Africa Oil Importers, Middle Income Africa, Newly Industrialized Asia excluding China and India, OPEC, Pacific Island Countries, Sub-Saharan Africa Oil Exporters, Sub-Saharan Africa Oil Importers, and the other West African Economic and Monetary Union (WAEMU).

Figure 2. Remittances and Migrant Labor in EUROMOD

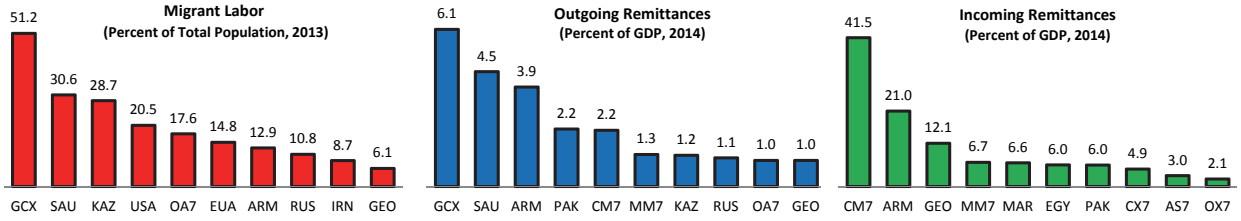


Region codes are as follows: AS2, Newly Industrialized Asia excluding China and India; EA2, Other Euro Area; EU2, Other European Union; OA2, Other Advanced Economies; OX2, Oil Exporters (mostly OPEC, Russia); RC2, Remaining Countries

are very small. Thus, the GCC to South Asia flows are expected to have the largest international spillovers from remittances in both G20MOD and EUROMOD.

Remittance dynamics are expected to constitute a large proportion of international spillover channels in MCDMOD which models many of the Middle East and Central Asia economies. As shown in Figure **??**, seven regions in MCDMOD have remittance shares greater than or equal to 6 percent of GDP. However, the GCC is not necessarily the largest source of remittances for many economies.

Figure 3. Remittances and Migrant Labor in MCDMOD

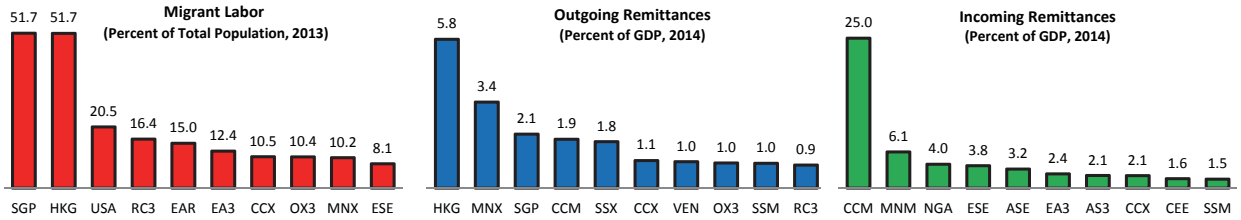


Region codes are as follows: AS7, Emerging Asia; CM7, Central Asia and Caucasus Oil Importers; CX7, Central Asia and Caucasus Oil Exporters; EUA, Euro Area; EU7, Other European Union; GCX, Other GCC Oil Exporters; LAT, Latin America; MN7, Other Middle East and North Africa Oil Importers; OA7, Other Advanced Economies; OX7, Other Oil Exporters; RC7, Remaining Countries

Eastern and Southern Europe as well as Central Asia rely heavily on remittances from Russia and Western Europe. In MCDMOD, the largest recipients of remittances are those dependent on flows from Russia. For example, the Caucasus and Central Asia Oil Importers (CM7) region has remittance inflows of 41.5 percent of GDP, followed by Armenia (21 percent), and Georgia (12.1 percent). In EMERGMOD (Figure **??**), remittances flows to the Central Asia and Caucasus Oil Importers (CCM) are very high at 25 percent of GDP, mostly coming from Russia. Moreover, in EEUMOD (Figure **??**), Ukraine is highly dependent on remittances from Russia, with remittances constituting 5.4 percent of GDP.

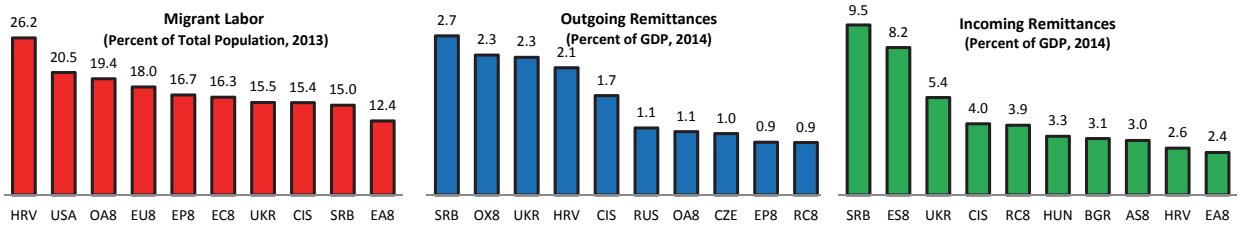
Remittance flows from Europe are particularly large for Northern Africa, and Eastern and Southern Europe. North Africa receives over half of its remittances from Europe, whereas a third is from the GCC. In MCDMOD, European flows are high in comparison to the other Middle East

Figure 4. Remittances and Migrant Labor in EMERGMOD



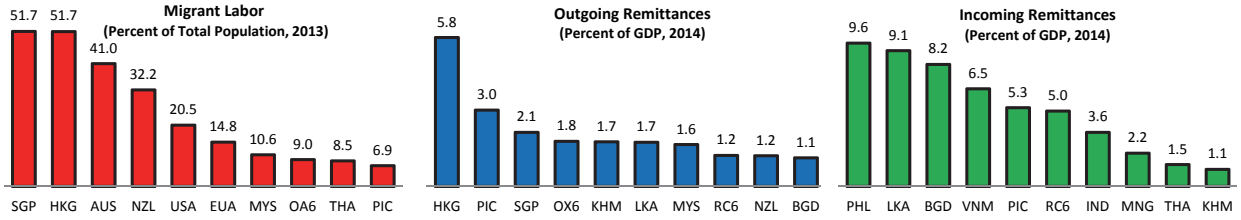
Region codes are as follows: ASE, ASEAN-3 (MYS,PHL,THA); AS3, Rest of Emerging and Newly Industrialized Asia (including IND, IDN, KOR); CCM, Caucasus and Central Asia Oil Importers; CCX, Caucasus and Central Asia Oil Exporters; CEE, Central Europe 3; EA3, Emerging Euro Area; ESE, Eastern and Southeastern Europe; MNM, Middle East and North Africa Oil Importers; MNX, Middle East and North Africa Oil Exporters; OX3, Other Oil Exporters (mainly NOR, RUS); SSM, Sub-Saharan Africa Oil Importers; SSX, Sub-Saharan Africa Oil Exporters; RC3, Remaining Countries

Figure 5. Remittances and Migrant Labor in EEUMOD



Region codes are as follows: AS8, Emerging Asia; CIS, CIS excluding Russia; EA8, Emerging Euro Area; EC8, Core Euro Area; EP8, Euro Area Periphery; ES8, Eastern and Southeastern Europe; EU8, Other European Union; LAT, Latin America; OA8, Other Advanced Economies; OX8, Oil Exporters; RC8, Remaining Countries

Figure 6. Remittances and Migrant Labor in APDMOD



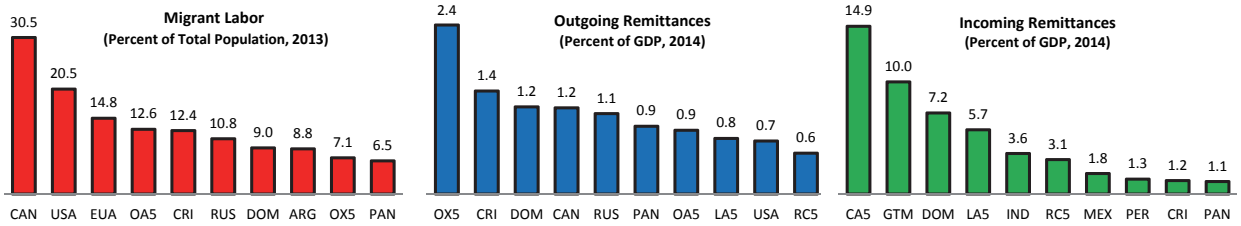
Region codes are as follows: EUA, Euro Area; LAT, Latin America; OA6, Other Advanced Economies; OX6, Oil Exporters; PIC, Pacific Island Countries; RC6, Remaining Countries

and North Africa Oil Importers (MM7) and Morocco, at 6.7 and 6.6 percent of GDP, respectively. In EEUMOD, Southeastern Europe and Serbia have high shares of remittances at 8.2 and 9.5 percent of GDP, respectively. This is reflected in EMERGMOD which includes may of the countries in EEUMOD and MCDMOD. In EMERGMOD, remittances to GDP are 3.8 percent of GDP in

Eastern and Southeastern Europe (ESE) and 6.1 percent of GDP in the Middle East and North Africa Oil Importers region (MNM), making these regions susceptible to remittance outflows from Europe.

The importance of remittances to East Asia and the Pacific regions is notable in APDMOD, as remittances are larger than or equal to 5 percent of GDP in six of its regions. At 9.6 percent of GDP, the Philippines is the region's largest recipient of remittances as a percent of GDP, coming primarily from the U.S., Euro Area, Canada, and Singapore. This is followed by Sri Lanka (9.1 percent), Bangladesh (8.2 percent), Vietnam (6.5 percent), and the smaller Pacific Islands (PIC) at 5.3 percent. The source of remittances across these economies is quite diversified, such as for the above-mentioned example of the Philippines.

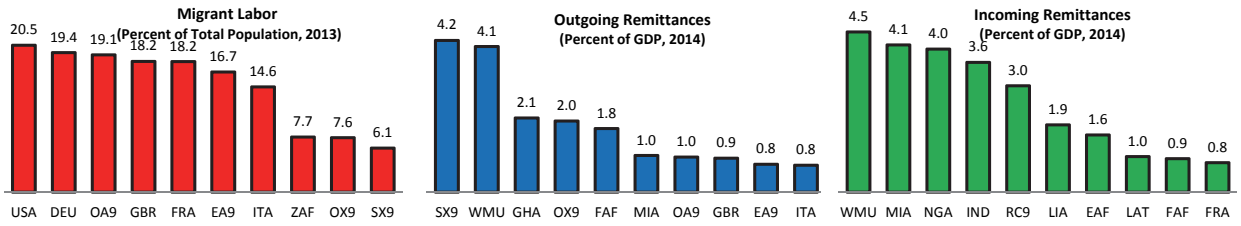
Figure 7. Remittances and Migrant Labor in WHDMOD



Region codes are as follows: CA5, Other Central America (SLV,HND,NIC); EUA, Euro Area; LA5, Other Latin America; OX5, Oil Exporters; RC5, Remaining Countries

Many of the Latin American and Caribbean economies are reliant on regional remittance flows. The United States accounts for over half of the flows, which are concentrated in the Caribbean and Central America. In WHDMOD (Figure **??**), the United States' largest recipients are Mexico (1.8 percent of GDP), Other Central America (CA5) (14.9 percent of GDP), the Dominican Republic (7.2 percent of GDP), Guatemala (10 percent of GDP), and Other Latin America (LA5) (5.7 percent of GDP). Spain hosts over one-tenth of all migrants from Latin America, although as a percent of GDP, remittances from Spain are only important in the Other Latin America region (LA5) which has total incoming remittances at 5.7 percent of GDP.

Figure 8. Remittances and Migrant Labor in AFRMOD



Region codes are as follows: EA9, Other Euro Area; EAF, Eastern Africa; FAF, Fragile Africa; LAT, Latin America; LIA, Low Income Africa; MIA, Middle Income Africa; OA9, Other Advanced Economies; OX9 , Other Oil Exporters; SX9, Sub-Saharan Africa Oil Exporters; WMU, West African Economic and Monetary Union, WAEMU; RC9, Remaining Countries

In Sub-Saharan Africa, the importance of remittances varies greatly depending on the country.

In AFRMOD (Figure **??**), the largest recipients of remittances are the West African Economic and Monetary Union (WMU), Middle Income Africa (MIA), and Nigeria, all close to 4 percent of GDP. Nigeria accounts for around two-thirds of total remittance inflows to the region. Of these flows, most originate in Western Europe, notably France, with a third coming from the United States.

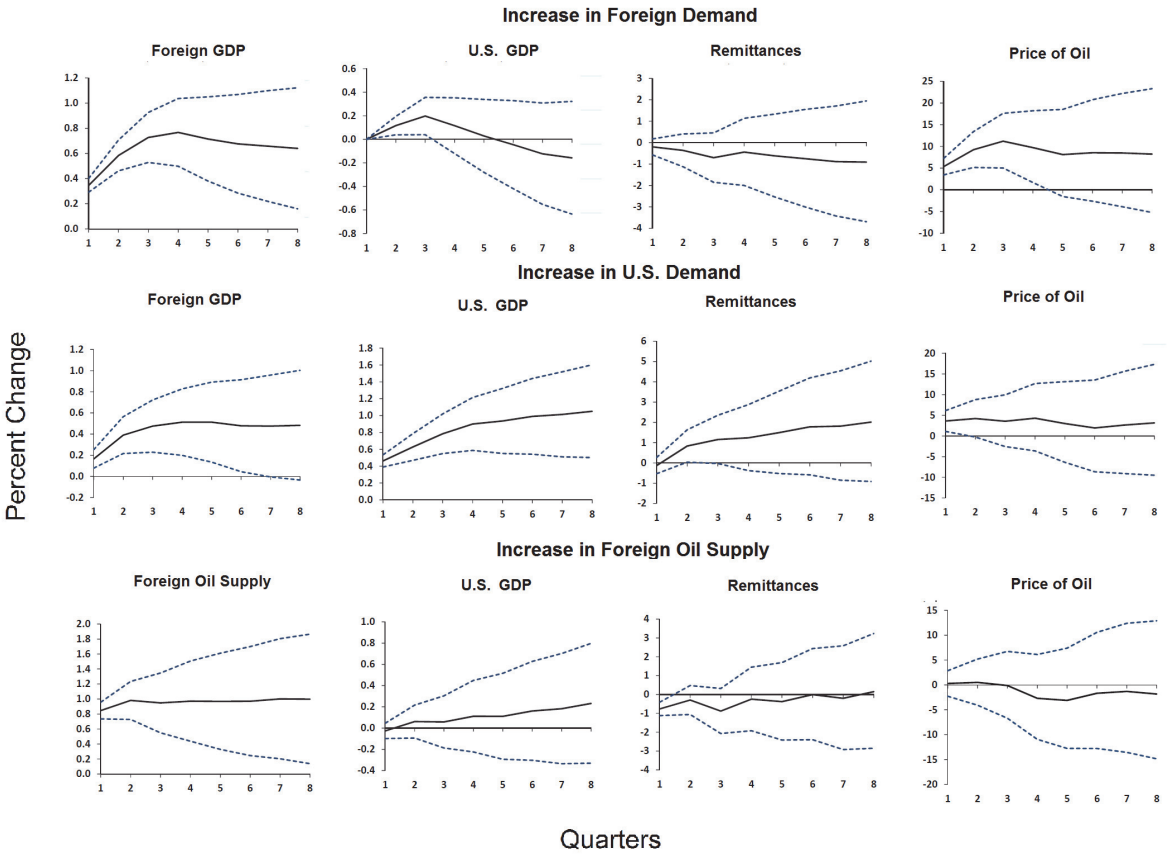
Overall, MCDMOD is the FSGM module where remittances channels drive the dynamics in the most regions. The GCC, Europe, and Russia are the primary sources for these regions. Many of these regions are represented in EMERGMOD, and EEUMOD, suggesting that remittances are also important to these modules. A handful of regions in WHDMOD have high dependence on remittances, mainly from the United States. Again, several regions in APDMOD have high share of remittances, although the source of these remittances tends to be diversified. Overall, G20MOD and EUROMOD will have little of their dynamics influenced by remittances. The main link in these models is from oil exporters to the remaining country and Asian regions.

Appendix 2: Additional SVAR Results

The United States

Figure **??** illustrates the IRFs of structural shocks in the SVAR estimated for the United States. The IRFs are normalized so that the shock is one percent on average in the first year. The model is estimated using quarterly data from 1994q1 to 2015q2. The assumption of a SOE is unlikely for the United States so the structure is modified to allow for shocks to U.S. real GDP to have a contemporaneous effect on foreign real GDP but not vice versa. Further the lags of U.S. GDP are not restricted to zero in any equations. Although the ordering affects the contemporaneous response of U.S. and foreign real GDP to each other's demand shocks, the response of remittances is robust across specifications. A demand shock that increases foreign real GDP by one percent on

Figure 9. SVAR: Remittance Outflows in the United States



average in the first year results in a significant fifteen percent increase in the real price of oil on average in the first. Oil supply does not significantly rise, but home real GDP increases significantly by 0.2 percent on average in the first year. There is a slight insignificant fall in U.S. remittance outflows.

A demand shock that increases U.S. real GDP by one percent on average in the first year results in an increase in U.S. remittance outflows of one percent on average in the first year and two percent on average in the second year. There is significant upward pressure in the first year on the price of oil by five and half percent on average and foreign real GDP increases significantly by half a

percent.

The shock which increases foreign oil supply by one percent in the first year results in a decline in the real price of oil by half a percent on average in the first year and two percent on average in the second year. U.S. and foreign real GDP increase slightly but insignificantly.

The Euro Area

Figure 10. SVAR: Remittance Outflows in the Euro Area

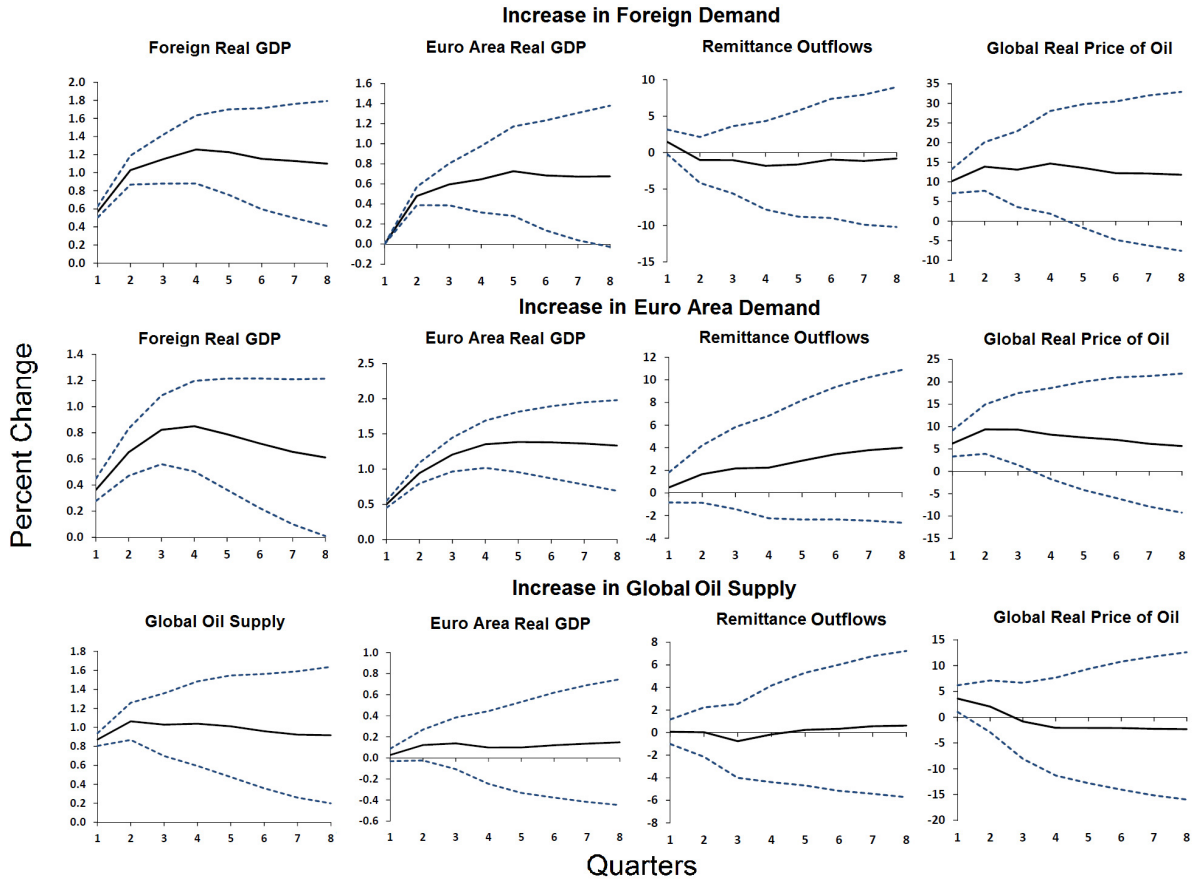


Figure **??** illustrates the IRFs of the SVAR estimated for the euro area. The IRFs are normalized so that the shock is one percent on average in the first year. The model is estimated using quarterly data from 2000q1 to 2015q2. As with the U.S., the assumption of a SOE is unlikely for the euro area so the structure is modified to allow for shocks to euro area real GDP to have a contemporaneous effect on foreign real GDP but not vice versa. Further, the lags of euro area real GDP are not restricted to zero in any equations. Similar to the estimates of the United States, the ordering of home and foreign GDP affects the contemporaneous real GDP responses but not the response of remittances. Since the euro area produces only a small amount of crude oil, the SVAR is estimated using global oil supply. Hence, the only oil supply shock is that of global oil supply.

A demand shock which increases foreign real GDP by one percent on average in the first year significantly increases the real price of oil by approximately 13 percent on average in the first year.

Euro area real GDP increases significantly by 0.4 percent on average in the first year. Remittances fall by close to 0.6 percent on average in the first year.

A demand shock which increases euro area real GDP by one percent on average in the first year results in a significant 8.3 percent increase in the real price of oil and a 1.6 and 2.6 percent increase in remittances on average in the first and second year, respectively. Foreign real GDP significantly increases by close to 0.7 percent on average in the first year.

A shock that increases global oil supply by one percent on average in the first year is unable to identify a significant fall in oil prices in the first year, but results in a decline in the real oil price by 2.3 percent on average in the second year. Euro area real GDP increases on average slightly in both years. Remittances increase by 0.6 percent on average in the second year. Overall, the estimates suggest a slightly less responsive remittances outflow in the euro area relative to the United States.

Annualized SVAR Elasticities

The following tables summarize the SVAR impulse responses by averaging the responses in the first and second years as elasticities. These are the same IRFs presented in the graphs in the previous sections. The results for a SVAR estimated using global data is also presented in Table 1. In the global SVAR, the structural shocks to the global market of crude oil are consistent with the impulse response of the SVARs estimated for each economy and with the findings of Kilian (2009).

Table 1. Annualized Global SVAR Elasticities

First Year			
Impu./Resp.	SUPOIL	GDP	POIL
SUPOIL	1.00*	0.05	-2.22
GDP	0.45*	1.00*	12.94*
POIL	0.01	-0.003	1.00*
Second Year			
Impu./Resp.	SUPOIL	GDP	POIL
SUPOIL	1.00*	0.06	-6.00
GDP	0.56*	1.00*	9.00
POIL	0.01	-0.02	1.00*

Annual averages. Sample period: 1994q1 - 2015q2. * represents significance at the 32 percent significance level. SUPOIL is global oil supply, GDP is global real GDP, and POIL is the real price of crude oil. Rows are shocks, columns are responses.

Table 2. Annualized SVAR Elasticities for Russia

First Year						
Impu./Resp.	SUPOILF	SUPOILH	GDPF	POIL	GDPH	PAY
SUPOILF	1.00*	-0.15	0.03	-2.00	-0.60*	-2.41
SUPOILH	0.00	1.00*	0.04	0.94	0.49*	1.89
GDPF	0.54*	0.01	1.00*	12.25*	1.56*	4.81
POIL	0.01	0.00	0.00	1.00*	0.04*	0.16
GDPH	0.00	0.02	0.00	0.07	1.00*	3.34
PAY	0.00	0.000	0.000	0.000	0.00	1.00*
Second Year						
Impu./Resp.	SUPOILF	SUPOILH	GDPF	POIL	GDPH	PAY
SUPOILF	1.00*	-0.30	0.01	-5.86	-1.46*	-6.97
SUPOILH	0.06	1.00*	0.07	1.54	0.74*	4.64*
GDPF	0.66*	-0.34	1.00*	8.16	1.88*	7.08
POIL	0.000	0.02	-0.02	1.00*	0.03	0.02
GDPH	0.01	-0.11	-0.01	-0.10	1.00*	4.47
PAY	0.00	-0.001	0.00	0.000	0.00	1.00*

Annual averages. Sample period: 1995q1 - 2015q2. * represents significance at the 32 percent significance level. SUPOILH is domestic oil supply, SUPOILF is foreign oil supply, GDPH is domestic real GDP, GDPF is foreign real GDP, POIL is real price of crude oil, PAY are real remittance outflows. Rows are shocks, columns are responses.

Table 3. Annualized SVAR Elasticities for Saudi Arabia

First Year						
Impu./Resp.	SUPOILF	SUPOILH	GDPF	POIL	GDPH	PAY
SUPOILF	1.00*	1.37*	0.05	-3.47	0.18	-1.42
SUPOILH	0.00	1.00*	0.00	0.80	0.20*	0.06
GDPF	0.37*	1.33*	1.00*	12.81*	1.00*	-2.55
POIL	0.00	0.06*	-0.003	1.00*	0.04	0.09
GDPH	0.00	0.02	0.00	0.01	1.00*	1.19
PAY	0.00	0.00	0.00	0.00	0.07*	1.00*
Second Year						
Impu./Resp.	SUPOILF	SUPOILH	GDPF	POIL	GDPH	PAY
SUPOILF	1.00*	1.33	0.09	-7.10	0.00	-2.45
SUPOILH	0.02	1.00*	-0.05	0.07	0.19	0.12
GDPF	0.35	2.18*	1.00*	8.92	1.24	-2.90
POIL	0.00	0.11	-0.02	1.00*	0.05	0.15
GDPH	0.00	-0.02	0.00	0.01	1.00*	1.16
PAY	0.00	0.00	0.00	0.00	0.09	1.00

Annual averages. Sample period: 1995q1 - 2015q2. * represents significance at the 32 percent significance level. SUPOILH is domestic oil supply, SUPOILF is foreign oil supply, GDPH is domestic real GDP, GDPF is foreign real GDP, POIL is real price of crude oil, PAY are real remittance outflows. Rows are shocks, columns are responses.

Table 4. Annualized SVAR Elasticities for the Euro Area

First Year					
Impu./Resp.	SUPOIL	GDPH	GDPF	POIL	PAY
SUPOIL	1.00*	0.10	0.08	0.69	-0.20
GDPH	-0.02	1.00*	0.67*	8.28*	1.64
GDPF	0.77*	0.43*	1.00*	12.96*	-0.59
POIL	-0.01	-0.02*	-0.02*	1.00*	0.16
PAY	0.00	0.00	0.00	0.002	1.00*
Second Year					
Impu./Resp.	SUPOIL	GDPH	GDPF	POIL	PAY
SUPOIL	1.00*	0.13	-0.01	-2.30	0.46
GDPH	-0.19	1.00*	0.51*	4.84	2.57
GDPF	0.97*	0.60*	1.00*	10.79	-0.98
POIL	-0.01	-0.08*	-0.05*	1.00*	0.01
PAY	-0.01	0.01	0.00	0.00	1.00*

Annual averages. Sample period: 2000q1 - 2015q2. * represents significance at the 32 percent significance level. SUPOIL is global oil supply, GDPH is domestic real GDP, GDPF is foreign real GDP, POIL is real price of crude oil, PAY are real remittance outflows. Rows are shocks, columns are responses.

Table 5. Annualized SVAR Elasticities for the United States

First Year						
Impu./Resp.	SUPOILH	SUPOILF	GDPH	GDPF	POIL	PAY
SUPOILH	1.00*	0.02	0.005	-0.01	-0.58	-0.16
SUPOILF	-0.41*	1.00*	0.05	0.02	-0.28	-0.69
GDPH	-0.49*	0.47*	1.00*	0.52*	5.22*	1.17
GDPF	-0.41	0.26*	0.17*	1.00*	14.67*	-0.77
POIL	-0.02	0.01	-0.01	-0.003	1.00*	-0.04
PAY	0.02	-0.04*	-0.12*	-0.02*	0.30	1.00*
Second Year						
Impu./Resp.	SUPOILH	SUPOILF	GDPH	GDPF	POIL	PAY
SUPOILH	1.00*	0.01	0.003	-0.02	-1.93	-0.09
SUPOILF	-0.82	1.00*	0.19	-0.03	-1.89	-0.17
GDPH	-1.28*	0.60*	1.00*	0.47*	2.22	1.79
GDPF	-0.10	0.17	-0.10	1.00*	12.46*	-0.97
POIL	-0.02	0.02	-0.02	-0.01	1.00*	-0.07
PAY	0.34	-0.15	-0.30*	-0.05	0.73	1.00

Annual averages. Sample period: 1994q1 - 2015q2. * represents significance at the 32 percent significance level. SUPOILH is domestic oil supply, SUPOILF is foreign oil supply, GDPH is domestic real GDP, GDPF is foreign real GDP, POIL is real price of crude oil, PAY are real remittance outflows. Rows are shocks, columns are responses.