WP/17/287

IMF Working Paper

Oil Price Shocks and Economic Growth in Oil-Exporting Countries: Does the Size of Government Matter?

by Amir Sadeghi

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

INTERNATIONAL MONETARY FUND

© 2017 International Monetary Fund WP/17/287

IMF Working Paper

Middle East and Central Asia Department

Oil Price Shocks and Economic Growth in Oil-Exporting Countries,

Does the Size of Government Matter? *

Prepared by Amir Sadeghi

Authorized for distribution by Catriona Purfield

December 2017

IMF Working Papers **describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

Abstract

This paper examines the impact of government size on how output and government expenditure respond to oil price shocks in 28 oil-exporting countries between 1990 and 2016. Results suggest that if the size of government (measured by government expenditure-to-(non-oil) GDP ratio) is larger, non-oil output growth, in response to a positive oil price shock, tends to be greater and output volatility higher. Furthermore, I find that an unexpected increase in oil price leads to expansion in government expenditure and the expansion is larger, the larger is the government. This paper provides empirical evidence for direct correlation between government size and macroecnomic stability in oil-exporting countries. The findings imply that fiscal consolidation and economic diversification help to narrow down economic exposure to exogenous oil price shocks and reduce volatility in non-oil output.

JEL Classification Numbers: E6, H3, H5, O4, O5, Q3

Keywords: Oil Price Shock, Government Expenditure, Growth, Oil-Exporting Countries

Author’s E-Mail Address: asadeghi@imf.org

---

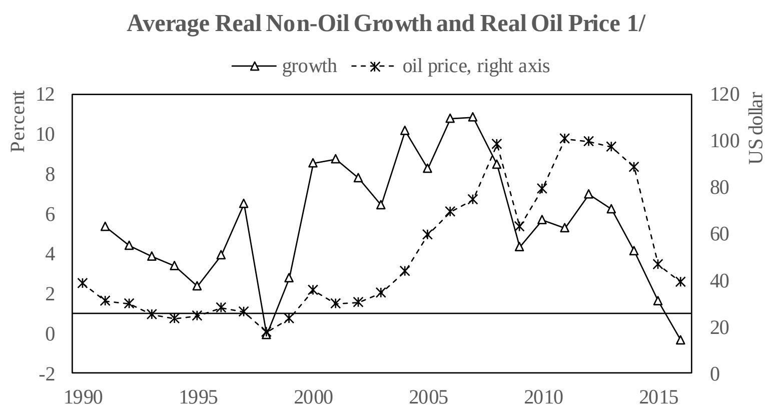
* I am grateful to Michael Bradley, Hamid Davoodi, Catriona Purfield, Hossein Samiei, Martin Sommer, and Robert Vigfusson as well as seminar participants at the IMF MCD Discussion Forum for constructive comments and suggestions. I am also thankful for the editorial assistance of Maria Orihuela-Quintanilla.

CONTENT PAGE

I. Introduction

Changes in global oil prices have significant consequences for economic growth in oil-exporting countries (Figure 1).[1] Due to its growth implications, oil exporters have always been concerned about changes in oil prices and even more so when changes are demand-driven, i.e. decline in oil prices is due to a global economy slowdown and technology advancements that reduce oil importers' dependence on oil imports. Recent studies show that shocks have become more demand driven, leaving supply disturbances as a temporary and insignificant driver of oil prices, and the breakeven price of oil from once too-expensive-to-explore fields, such as shale and arctic, has dropped significantly (Blanchard and Galí, 2007; Kilian, 2009; Cashin et al., 2014). Furthermore, medium-and long-term forecast no sign of improvement in oil prices in the foreseeable future.[2]

Figure 1. Oil Price Developments and Non-Oil Growth in the Sample Oil-Exporting Countries, 1990–2016.



Source: IMF WEO, Haver Analytics, and Author's calculations.

Note: 1/ Oil Price is simple average of three spot prices: Brent, West Texas Intermediate, and the Dubai Fateh, US$ per barrel deflated by U.S. CPI.

Currently low oil prices, relative to the levels seen in 2000s, and the not-so-promising oil price outlook beg for a long-term plan, to preserve economic stability and protect growth in oil exporting countries. In this context, it is critical for oil-exporting countries to understand how exogenous oil price shocks affect their economies and how they can use policy instruments to not only protect their economies from adverse shocks in the short run, but also create a diversified, private-sector driven, oil-independent economy in the long run.

---

[1] For a list of the sample oil-exporting countries, please see Appendix I.

[2] The WEO five-year oil price projections are around $60 per barrel (IMF, 2017). In the long run, international agreements, such as the Paris climate accord, and technological advancements that shift energy consumption away from fossil fuel, e.g., electric cars, indicate that the age of oil consumption is beginning to end.

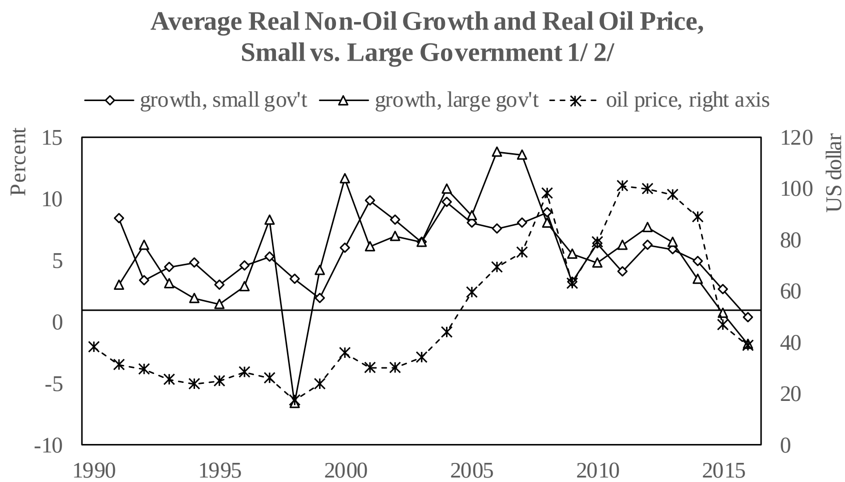
Studies show that fiscal policy is the main transmission mechanism of oil price shocks in oil-exporting countries (Husain et al., 2008; El Anshasy & Bradley, 2012) and countercyclical policies can insulate the economy from oil price shocks (Pieschacon, 2012). They show that fiscal policy in developing, oil-exporting countries is usually procyclical (Ilzetzki and Vegh, 2008; Villafouerte and Lopez-Murphy, 2010; Arezki and Ismail, 2010) and fiscal positions usually deteriorate during oil price booms (or improve when oil prices decline) owing to expansions (contractions) in government expenditure (Villafouerte and Lopez-Murphy, 2010). None of the studies that focus on oil-exporting countries, however, has addressed the key question explored in this paper: *how does the size of government, as a measure of economic exposure to oil price shocks, affect the way oil price shocks impact non-oil output in oil-exporting countries?*

This is a key question that goes beyond showing that fiscal policy is the channel through which oil price shocks affect output and that fiscal policy is procyclical in oil-exporting countries. Under the assumption that different oil-exporting countries have different degrees of exposure to oil price shocks, which can potentially change from year to year for each country, this study attempts to provide a quantitative measure of output and government spending response to oil price shocks conditional on the degree of economic exposure to oil price shocks, which is measured by government size in this paper.

Government expenditure is one of the key fiscal policy instruments available to oil-exporting governments. In most oil-exporting countries, oil income accrues to government revenues, which is either saved in a sovereign fund, when oil prices are historically high, e.g., during 2000s before the global financial crisis, or used to finance government expenses. Therefore, there is a direct connection between oil prices and government expenditure in oil-exporting countries. However, because governments, in oil-exporting countries, finance part of their expenditure by tax income, it is incorrect to assume that larger government expenditure means higher reliability on oil income, and consequently higher exposure to oil price shocks. To ensure that government size is a good representative of the degree of exposure to oil price shocks, I take the ratio of government expenditure to (non-oil) GDP. Scaling government expenditure by non-oil GDP allows for cross-country comparisons and rules out any instances that could weaken the connection between oil income (oil prices) and government expenditure. For example, if we assume that government expenditure is large, but it is financed mostly by tax income, it means that non-oil sector is also large, and so the ratio of government expenditure to non-oil GDP cannot be large.

To see if data support the idea that government size can change the way non-oil output responds to changes in the oil price, I depict non-oil growth vs. real oil price in Figure 2. Instead of calculating average non-oil growth for the full sample (Figure 1), the sample is divided into two sub-samples: (i) country-year observations that are smaller than the sample mean of (total) expenditure-to-output ratio (small government), and (ii) those that are larger than the sample mean (large government), and calculate a growth series for each sub-sample. Figure 2 suggests that the average non-oil growth for the large-government sub-sample responds stronger to oil price shocks.

Figure 2. Oil Price Developments and Non-Oil Growth in the Sample Oil-Exporting Countries, 1990–2016, Small vs. Large Governments



Source: IMF WEO, Haver Analytics, and Author's calculations.

Note: 1/ Oil Price is simple average of three spot prices: Brent, West Texas Intermediate, and the Dubai Fateh, US$ per barrel deflated by U.S. CPI.
2/ The sample is divided into a *small government* subsample (total expenditure, as a share of non-oil output, is smaller than the sample mean) and a *large government* subsample (total expenditure, as a share of non-oil output, is larger than the sample mean).

To examine the impact of oil price shocks on output, a recursive interacted panel vector autoregression is estimated and responses vary with the size of government expenditure, scaled by non-oil GDP. The results suggest that if government is large, non-oil growth, in response to a positive oil price shock, tends to be greater and output volatility higher. Furthermore, an unexpected increase in oil prices causes an expansion in government expenditure and its impact is bigger on capital than current expenditure, although non-oil growth is higher if the shock passes through current expenditure.

The remainder of the paper is organized as follows: Section two introduces the empirical model and explains the identification issues. The estimation procedure is described in section three. Section four reports the results and section five concludes the paper.

II. THE EMPIRICAL MODEL

I use a trivariate deterministically-varying coefficient vector autoregression model of real oil price index (o), real government expenditure (g) – total, current, and capital, and real non-oil output (y), all in log form and linearly detrended.[3] The structural model is

$$\begin{aligned}
o_{i,t} &= v_{i,1} + \sum_{l=1}^{p} b_{11,l} o_{i,t-l} + \omega_{i,t}^{o} \\
g_{i,t} &= v_{i,2} + \sum_{l=0}^{p} b_{21,l} o_{i,t-l} + \sum_{l=1}^{p} b_{22,l} g_{i,t-l} + \sum_{l=1}^{p} b_{23,l} y_{i,t-l} + \omega_{i,t}^{g} \qquad (1) \\
y_{i,t} &= v_{i,3} + \sum_{l=0}^{p} b_{31,l} o_{i,t-l} + \sum_{l=0}^{p} b_{32,l} g_{i,t-l} + \sum_{l=1}^{p} b_{33,l} y_{i,t-l} + \omega_{i,t}^{y}
\end{aligned}$$

$i = 1 \dots N$ (countries), $t = 1 \dots T$ (years), and $\omega_{i,t}^{o}$, $\omega_{i,t}^{g}$, and $\omega_{i,t}^{y}$ are the structural shocks which are mutually and serially uncorrelated.

Under the assumption of exogenous oil prices,[4] I can identify the oil price shocks.

To analyze impulse responses across the distribution of spending-to-output ratio for all countries and years in the sample, the paper could proceed in two ways: (i) split the sample into two sub-samples, where one sub-sample includes only the left side of the distribution of government size (small government) and the other sub-sample includes the right side of the distribution (large government), and a VAR model is estimated separately for each sub-sample; or (ii) take the ratio of government expenditure to non-oil GDP and interact it with all the right-hand side variables in a vector autoregression model (also known as interacted panel vector autoregression or ipvar). I take the second approach because it allows the use of the full sample and more degrees of freedom. Using the pooled sample also results in an identical oil price coefficient, and the same oil price dynamics, across sample countries.

To perform an ipvar, all the right-hand side variables in the second and third equations in model (1) are interacted with the size of government, g_y. This changes the coefficients in the second and third equations to the following deterministically-varying coefficients,

$$b_{jk,l} = b_{jk,l}^{1} + b_{jk,l}^{2} . g\_y_{it}, \qquad j = 2,3;\ k = 1,2,3. \qquad (2)$$

---

[3] For details on data, please refer to Appendix I.

[4] The exogeneity assumption for oil prices is standard in the literature. See, for example, El Anshasy & Bradley (2012) and Pieschacon (2012).

Since spending-to-non-oil output ratio is continuous, employing the ipvar approach results in a range of impulse responses which makes it possible to compare any pair of impulse responses from that range, instead of a random selecting an ad hoc threshold for government size to determine the cutoff point between large and small. On the downside, the ipvar method does not fully address the slope heterogeneity inherent in macro panels, although introducing an interaction term that varies across countries should alleviate the bias in the slope estimates.[5]

III. Estimation

Under the assumption that innovations in equation (1) are uncorrelated with the lagged variables and with each other, parameters of the model can be estimated consistently using equation-by-equation least squares. The number of lags is set to one, since data frequency is annual. Furthermore, standard unit root tests, such as Augmented Dicky-Fuller and Phillip-Perron, suggest that one lag is sufficient to summarize the dynamics of the system.[6]

To construct confidence intervals for the impulse responses, Monte Carlo simulation is used.[7] The intervals are adjusted to the panel and make use of the interaction terms. The procedure can be described in the following way: (a) Estimate model (1) equation by equation using least squares. (b) Draw $\hat{\omega}_{i.t}$ residuals from a normal distribution $N(0.\hat{\Sigma})$ where $\hat{\Sigma}$ is the estimated covariance matrix. (c) Use $\hat{\omega}_{i.t}$ and the initial observations of the sample and the estimated $\hat{b}$'s to simulate the variables recursively.[8] (d) After the first period is simulated for all variables in the system, the variables are interacted with the interaction terms and then steps 2 and 3 are repeated as many times as there are errors. (e) The artificial sample, together with the interaction variables, is then used to re-estimate the coefficients of the model and IRFs are computed.
(f) The procedure (steps b to e) is repeated 500 times. The 95 percent confidence interval is drawn from the simulated estimates.

[5] According to Pesaran and Smith (1995), imposing homogeneity restriction on coefficients in a panel setup can bias the estimates. To correct this, they propose the mean group estimator, which is an arithmetic average of estimates over countries. Studies show that mean group estimator is a viable solution only when panel is longer than a typical macro dataset. See, for example, Rebucci (2003).

[6] Results do not change by increasing the number of lags.

[7] This method was introduced by Runkle (1987) and expanded by Sims and Zha (1999).

[8] The simulation is performed for each country and then the simulated data are stacked to rebuild the panel.

The ipvar method has been successfully applied to various areas of empirical macroeconomics. Towbin and Weber (2013) investigate the transmission of external shocks where the responses vary with foreign currency debt and import structure of the sample economies. Sa, Towbin, and Wieladek (2014) study the impact of shocks on capital inflows in the housing market in OECD countries allowing the coefficients to vary with the structure of mortgage market and the degree of mortgage securitization. Nickel and Tudyka (2014) analyze the growth impact of fiscal stimulus at different levels of government debt-to-GDP ratio for 17 European countries.

IV. RESULTS

This section presents the response of government expenditure and non-oil output to oil price shocks for small and large governments. Results are presented for 3 cases: (i) when government size is defined as the size of **total** government expenditure relative to non-oil GDP, (ii) government size as the ratio of **current** expenditure (public consumption) to non-oil GDP, and (iii) government size is defined as the ratio of **capital** expenditure (public investment) to non-oil GDP. Current and capital expenditure add up to total expenditure.

To explore the role of government size in how endogenous variables of the model respond to oil price shocks, the distribution of spending-to-(non-oil) GDP ratio[9] is divided into 20-percentage-point parts beginning at the 10th percentile (Table 1) and the impulse responses that refer to those points are compared. Small and large government are represented by the 30th and the 70th percentiles of the distribution of government size with respect to each type of expenditure, total, current, and capital expenditure.

Table 1. Cut Points for each Type of Government Expenditure

	Total expenditure	Current expenditure	Capital expenditure
10th percentile	20	14	2
30th percentile (Small government)	29	22	6
50th percentile	36	29	8
70th percentile (Large government)	46	38	13
90th percentile	58	49	22

[9] The distribution of government size for each type of government expenditure is shown in Appendix I.

According to Table 1, a government is considered small if its total expenditure is less than or equal to 29 percent of non-oil GDP and is considered large if its total expenditure surpasses 46 percent of non-oil GDP. The cutoff points for small (large) government are 22 (38) and 6 (13) percent of non-oil GDP with regards to current and capital expenditure.

Instead of presenting the simulations for all expenditure types across the full range of impulse responses, Figure 3 and Figure 4 depict the impulse responses and the cumulative impulse responses of government spending and non-oil GDP to a unit positive oil price shock. Charts on the left show the responses of government expenditure and on the right the responses of non-oil output to a unit positive oil price shock. Each chart illustrates two impulse responses, one for small government and one for large.[10]

According to Figure 3, an unexpected increase in oil prices causes a surge in government expenditure and, to a lesser extent, in non-oil output. In the first year, total government expenditure expands 2.5 percent, in response to a 10 percent increase in oil prices, and non-oil output increases around 0.8 percent. The expansion in capital expenditure turns out to be larger than current expenditure increase, 2.9 percent vs. 1.7 percent. However, non-oil growth is larger when oil price shock works through current expenditure, i.e. when current expenditure is used in the model, instead of capital expenditure. Growth impact of the shock is 0.8 percent when shocks pass through current expenditure and 0.6 percent when shocks affect through capital expenditure.

The findings support the proposition that government size is important in explaining the transmission of oil price shocks to non-oil GDP. The immediate impact of the shock on non-oil output and government expenditure seems to be the same for small and large governments. However, the size of the government turns out to make a big difference in how government expenditure and non-oil output evolve over time, in response to an oil price shock. This is clearer in Figure 4, where cumulative impulse responses are shown.

The finding that an oil price shock has a larger impact on non-oil output, when it passes through current expenditure, is consistent with previous studies. For example, Espinoza and Senhadji (2011) find a larger short-term fiscal multiplier for current expenditure, in comparison with capital expenditure multiplier, in oil-exporting countries. A possible interpretation of the lower non-oil growth, in response to a positive oil price shock, when the shocks is transmitted through capital expenditure, is that capital expenditure takes usually several years to turn into productive capacity.

[10] Impulse responses for a wider range of percentiles are reported in Appendix II.

Figure 3. Impulse Response of Government Spending and Non-Oil Output to a Unit Oil Price Shock

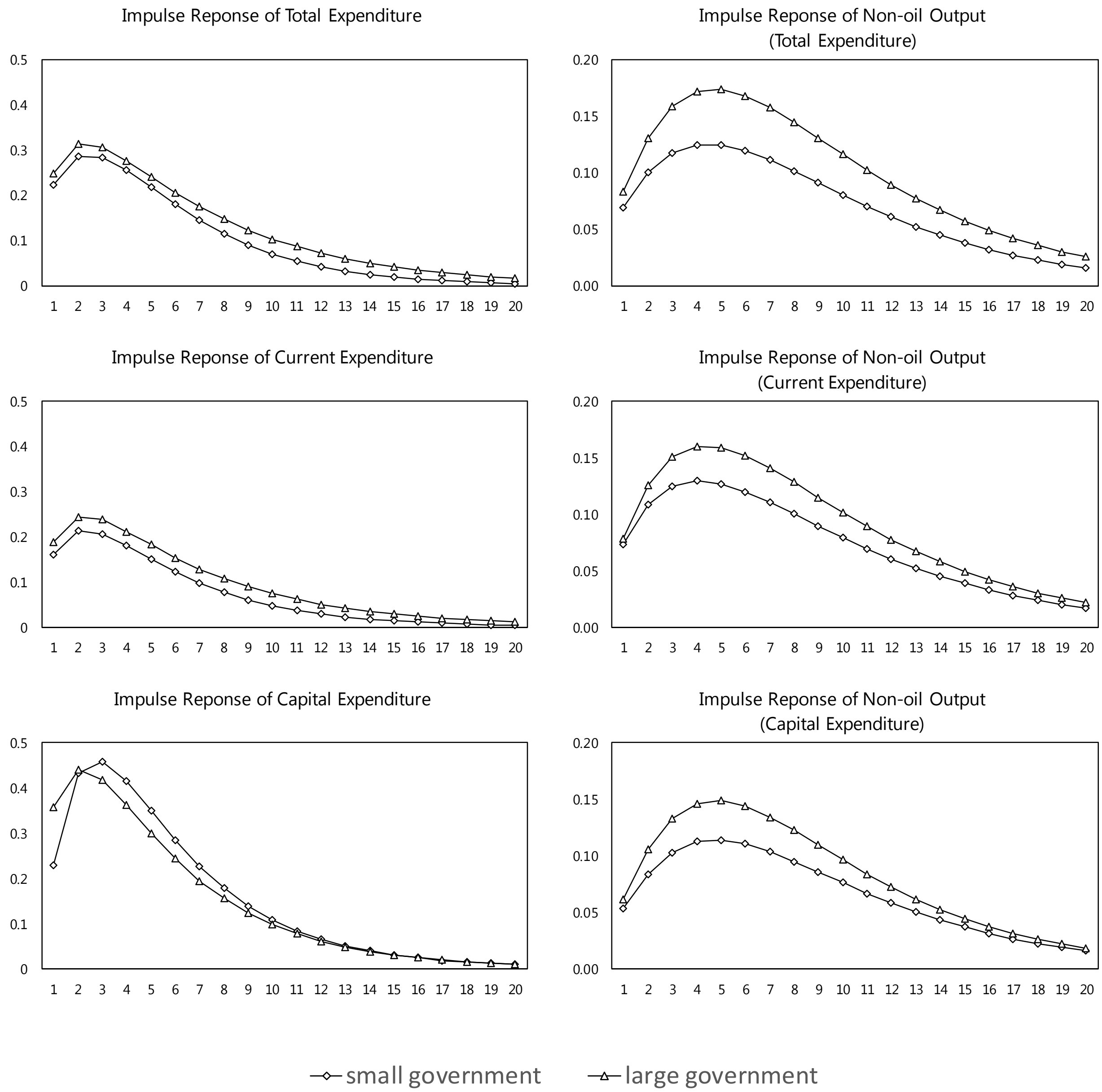


Figure 4 reports cumulative impulse responses for government expenditure and non-oil output to a unit positive oil price shock. The results support previous findings that government size is an important source of nonlinearity in response of non-oil output and government expenditure to oil price shocks. The increase in non-oil output and government expenditure is larger, the larger is the government.

Figure 4. Cumulative Impulse Response of Government Spending and Non-Oil Output to a Unit Oil Price Shock

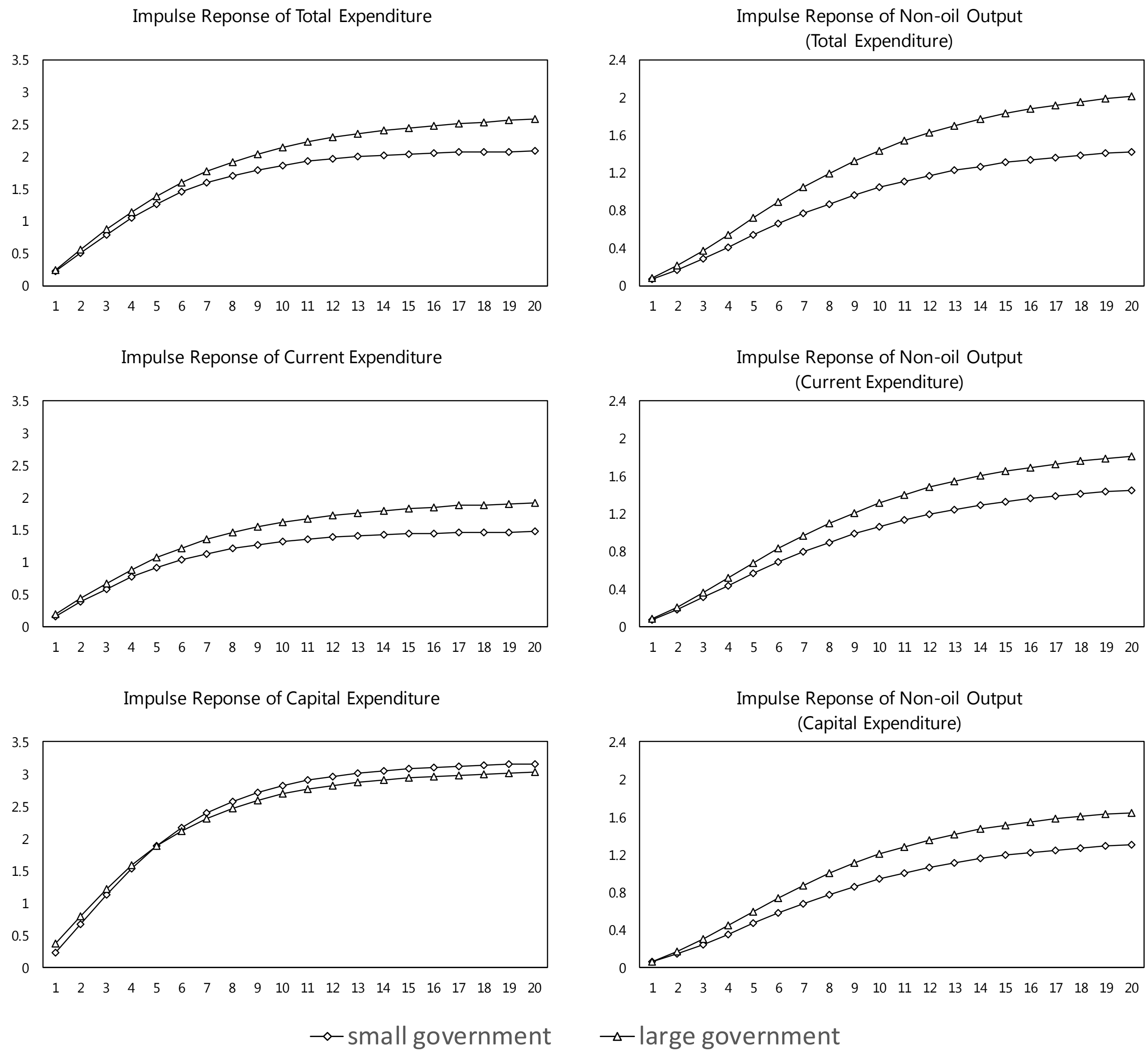


Table 2 reports the difference between small and large government expenditure and non-oil output responses to a unit positive oil price shock.[11] In the short run, the expansion in total and current expenditure, due to an unexpected increase in the oil price, are not significantly different between large and small governments, while the increase in capital expenditure is larger, the larger is the government. In the medium to long run, current and total expenditure grow significantly larger, the larger the government, while the difference between large and small government capital expenditure disappears.

According to bottom panel, the immediate response of non-oil output to a positive oil price shock is the same between small and large government. The size of the government, however, turns out to make a big difference in how non-oil output evolves over time.

Table 2. The Difference in Cumulative Impulse Response to a Unit Oil Price Shock,
Small vs. Large Government

The Fiscal Channel:	Total Expenditure	Current Expenditure	Capital Expenditure
Gov't Expenditure:			
1st year	-0.01*	-0.01*	-0.03***
2nd year	-0.01*	-0.01*	-0.04***
3rd year	-0.02*	-0.02**	-0.03**
5th year	-0.03**	-0.03***	-0.02*
10th year	-0.06***	-0.06***	0.00
20th year	-0.11***	-0.10***	0.00
Non-oil Output:			
1st year	0.00*	0.00	0.00*
2nd year	-0.01**	-0.01*	-0.01**
3rd year	-0.02***	-0.01*	-0.02***
5th year	-0.04***	-0.03**	-0.03***
10th year	-0.10***	-0.07***	-0.07***
20th year	-0.14***	-0.09***	-0.09***

1/ *,**,*** indicate that at least 68, 90, and 95 percent of IRFs (difference in IRFs) lie above zero.
2/ Numbers are the median of the differences between 500 simulated impulse responses for small and large governments. Statistical significance of impulse responses is calculated as percentage of differences being positive or negative.

[11] To test whether interactions with government size has a statistically significant effect on the dynamics of the variables, I look directly at the empirical distribution of impulse response differences and evaluate which fraction lies above zero. The bootstrap procedure automatically accounts for cross correlation between the impulse responses.

Table 3 reports the variance decomposition of non-oil output due to oil price shocks. The correlation between non-oil output forecast errors and oil price disturbances seem to be stronger, the larger is the government. In the first year, oil price shocks can explain between 5–8 percent of non-oil output forecast error variance for small and 6–10 percent for large governments. Three years ahead, volatility in oil price explains 20–28 percent of non-oil output volatility when government is large and 14–21 percent of volatility when government is small.

Consistent with the previous finding that oil price shocks have larger impact on non-oil output when transmitted through current expenditure, oil price shocks seem to explain a greater portion of volatility in non-oil output when transmitted through current expenditure instead of capital.

Table 3. Non-Oil Output Variance Decomposition Attributable to Disturbances in Oil Price (%)

The Fiscal Channel:	Total Expenditure	Current Expenditure	Capital Expenditure
Small Government:			
1st year	7	8	5
2nd year	13	15	9
3rd year	19	21	14
5th year	28	29	23
10th year	39	39	35
20th year	42	42	39
Large Government:			
1st year	10	9	6
2nd year	20	17	13
3rd year	28	26	20
5th year	40	38	33
10th year	53	50	46
20th year	56	53	49

V. CONCLUSION

In this paper, I examined the impact of *government size* on how non-oil output and government expenditure respond to oil price shocks in 28 oil-exporting countries between 1990 and 2016. Results suggest that government size is important in explaining the transmission of oil price shocks to oil-exporting economies. Government expenditure and non-oil output increase, in response to an unexpected increase in oil prices, and the increase is larger, the larger is the government. Furthermore, oil price volatilities explain a greater portion of volatility in non-oil output when government is large. Capital expenditure increases more than does current expenditure, in response to a positive oil price shock. Non-oil growth, however, is higher when an oil price shock is transmitted through current expenditure than when it works through capital expenditure. Similarly, oil price shocks explain a greater portion of volatility in non-oil output when transmitted through current expenditure.

This paper does not address the issue of asymmetry in non-oil output response to negative vs. positive oil price shocks as it assumes that impulse responses are symmetric. Future work could examine if non-oil growth picks up, because of an unexpected increase in oil prices, as much as it drops, when oil prices drop.

Appendix I: Data

Sample

Full sample contains data for 28 oil-exporting countries from 1990–2016, all of whom have been oil exporters for the past 10 years, except Syria, Yemen, and Sudan. Data for Syria and Yemen stop at 2010 and 2014, respectively, on account of ongoing conflict in the country. Data for Sudan stop at 2014 because of the separation of South Sudan, where major oil fields are located. Total number of observations is equal to 590.

Table A1. List of the country-years included in the sample.

Country	**Year**	**Country**	**year**
Algeria	1990-2016	Kazakhstan	2002-2016
Angola	1998-2016	Kuwait	1992-2016
Azerbaijan	1994-2016	Nigeria	2000-2016
Bahrain	1990-2016	Norway	1990-2016
Brunei Darussalam	2005-2016	Oman	1990-2016
Cameroon	2000-2016	Qatar	1990-2016
Chad	2004-2016	Saudi Arabia	1990-2016
Colombia	2000-2016	Sudan	1999-2014
Congo, Republic of	1990-2016	Syria	1990-2010
Ecuador	2000-2016	Trinidad and Tobago	1990-2016
Equatorial Guinea	1996-2016	Turkmenistan	1997-2016
Gabon	1990-2016	United Arab Emirates	1991-2016
Iran	1996-2016	Venezuela	1990-2016
Iraq	2006-2016	Yemen	1997-2014

There are other oil-exporting countries, such as Russia and Canada, who do not report non-oil GDP and are excluded from this analysis. Furthermore, oil-exporters who are net oil importer, whose oil export is worth less than 10 percent of their total export, and for whom oil export counts less than one percent of their GDP are removed.

Finally, the following outliers are dropped from the sample: Equatorial Guinea, 1992–95; Iraq, 2004–05; Kuwait, 1990-91. Furthermore, we remove Venezuela and Trinidad and Tobago completely when studying capital expenditure, because their value for capital expenditure, as percent of non-oil GDP, is almost zero. This reduces the number of countries to 26 and total number of observations to 543.

Variables and Data source

All variables are from IMF WEO database. Oil price is simple average of three spot prices: Brent, West Texas Intermediate, and the Dubai Fateh, in U.S. dollar deflated by US CPI. Non-oil GDP is deflated by non-oil GDP deflator, and Government expenditure by consumer price index.

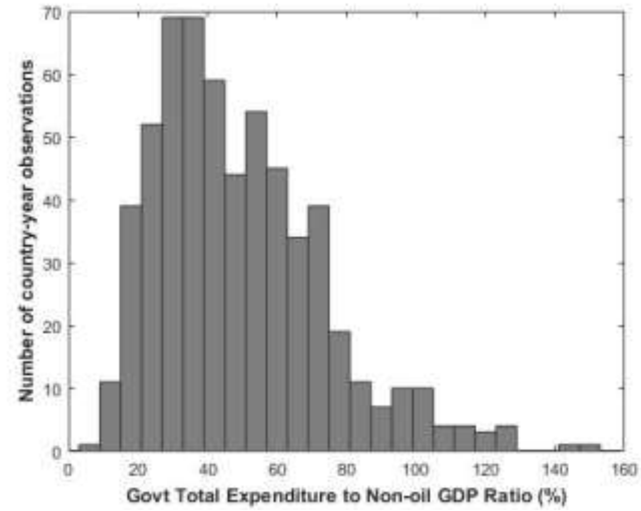
The interaction terms - government expenditure (as percent of non-oil GDP)
To choose the interaction values, I grid the space of spending-to-GDP ratio beginning at the 10th percentile and proceeding in 20-percentage-point steps. Then choose the 30th and the 70th percentiles as small and large government sizes with respect to each type of expenditure.

Table A2. Statistics table for the interaction terms (government expenditure, as percent of non-oil GDP)

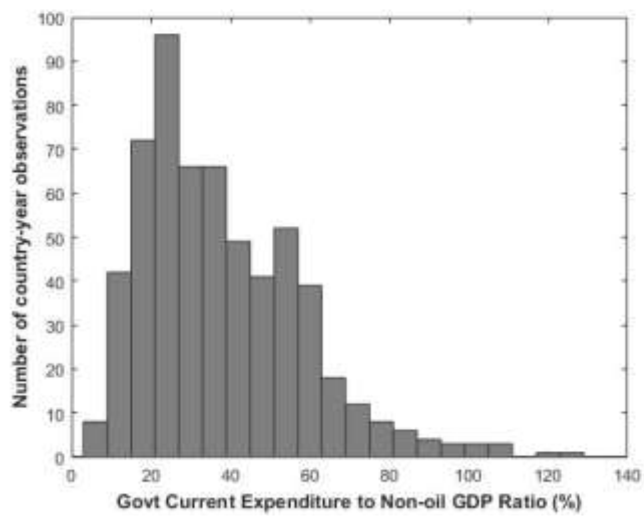
Type of expenditure:	**Min**	**Max**	**Mode**	**(small gov't) 30th percentile**	**(large gov't) 70th percentile**
Total	8.7	151.2	38.0	28.9	46.0
Current	7.4	126.7	23.8	21.9	38.2
Capital	0.9	90.4	6.0	5.9	12.8

Figure A1. Distribution of Government Expenditure as Percent of Non-Oil GDP

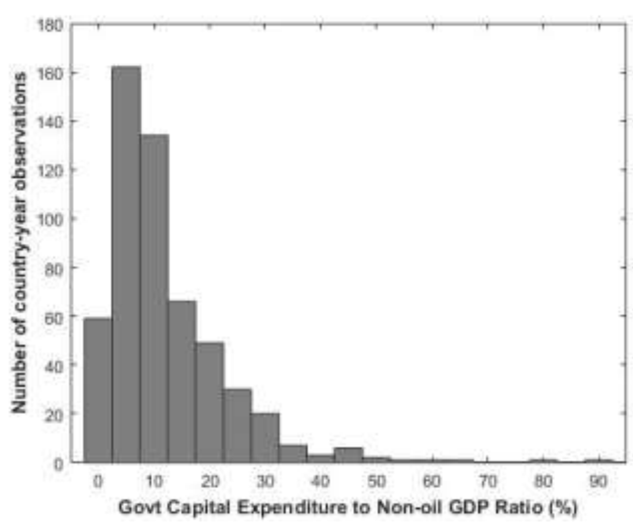
Total expenditure:



Current expenditure:



Capital expenditure:



APPENDIX II: IMPULSE RESPONSES

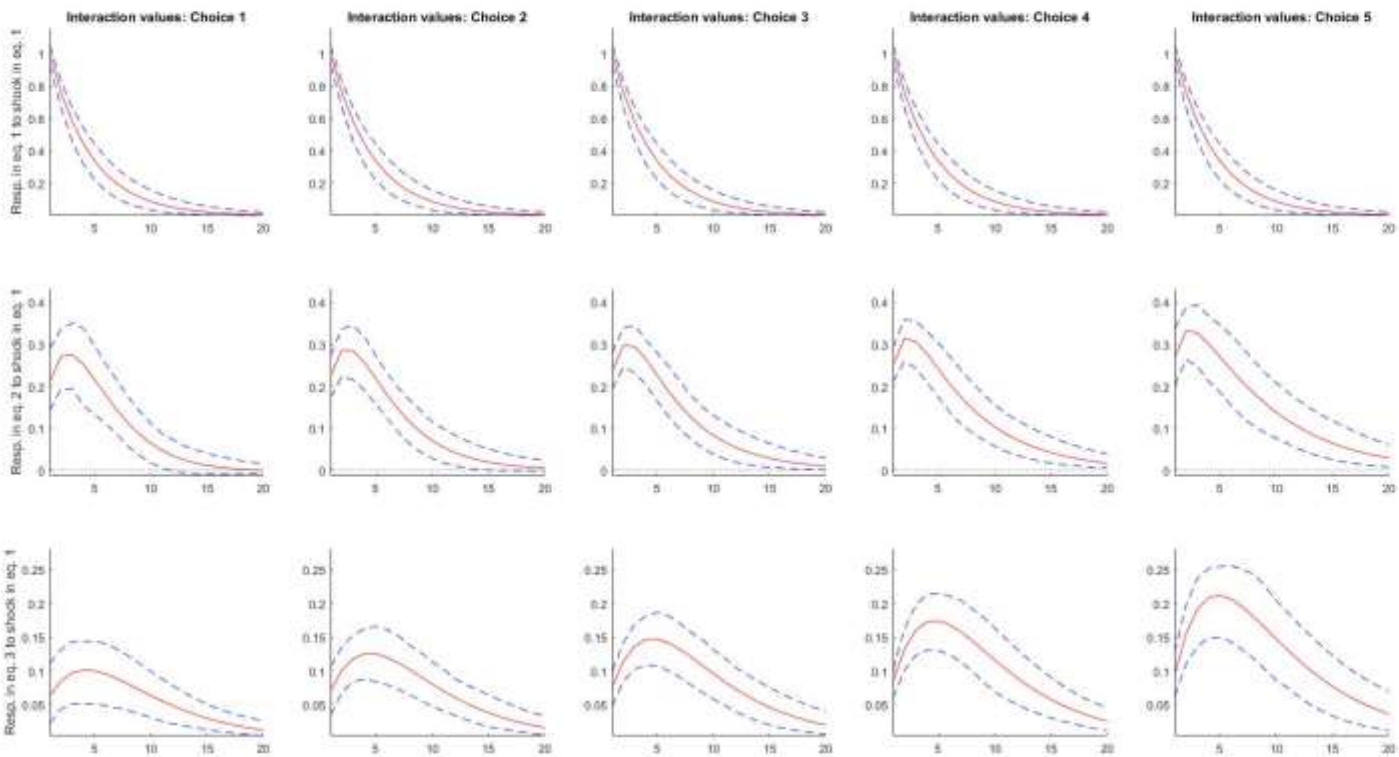


Figure A2. Impulse Responses of Government **Total Spending** and Non-oil GDP to one standard deviation oil prcie shock (rows) at various levels of government spending to GDP ratios (columns): G/Y equal to 20 percent, 29 percent, 36 percent, 46 percent, and 58 percent. Horizontal axes indicate years after shocks and vertical axes are in percent.

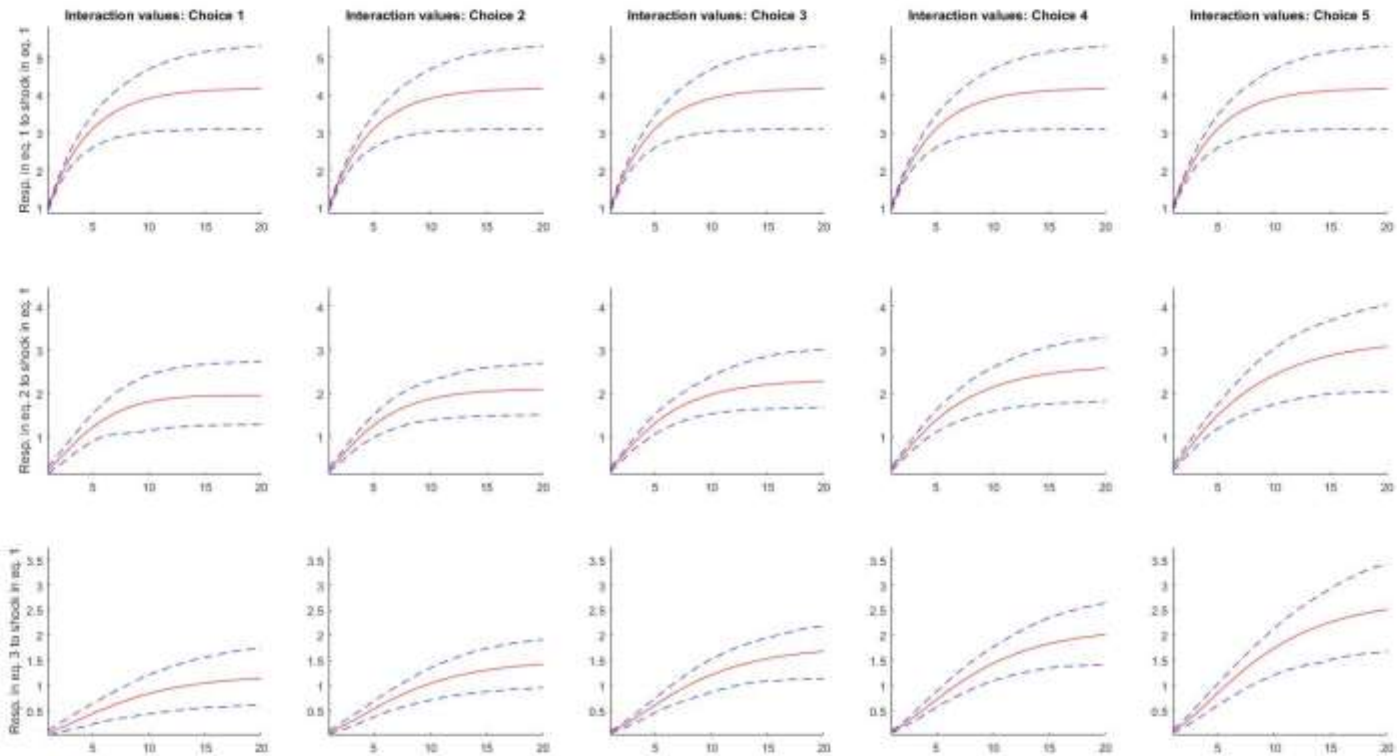


Figure A3. Cumulative Impulse Responses of Government **Total Spending** and Non-oil GDP to one standard deviation oil prcie shock (rows) at various levels of government spending to GDP ratios (columns): G/Y equal to 20 percent, 29 percent, 36 percent, 46 percent, and 58 percent. Horizontal axes indicate years after shocks and vertical axes are in percent.

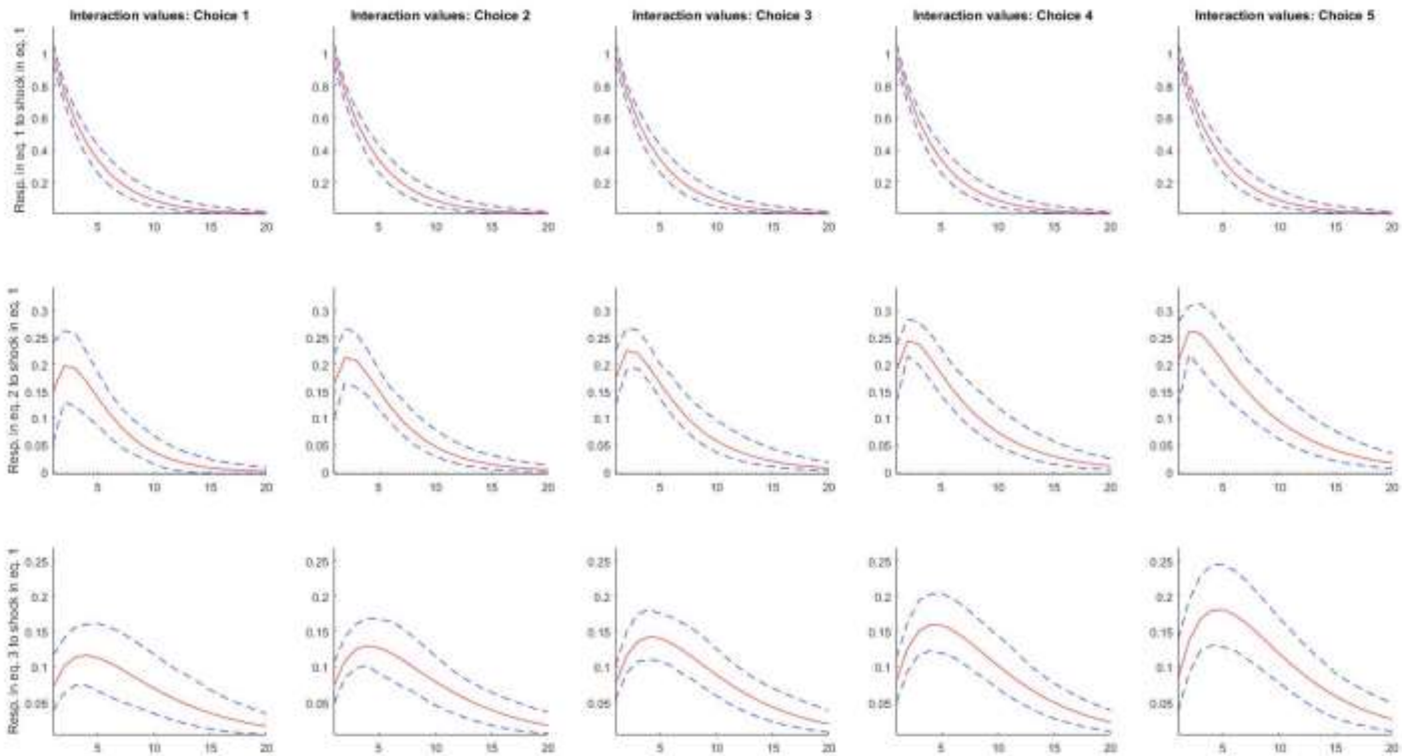


Figure A4. Impulse Responses of Government **current spending** and Non-oil GDP to one standard deviation oil prcie shock (rows) at various levels of government spending to GDP ratios (columns): G/Y equal to 14 percent, 22 percent, 29 percent, 38 percent, and 49 percent. Horizontal axes indicate years after shocks and vertical axes are in percent.

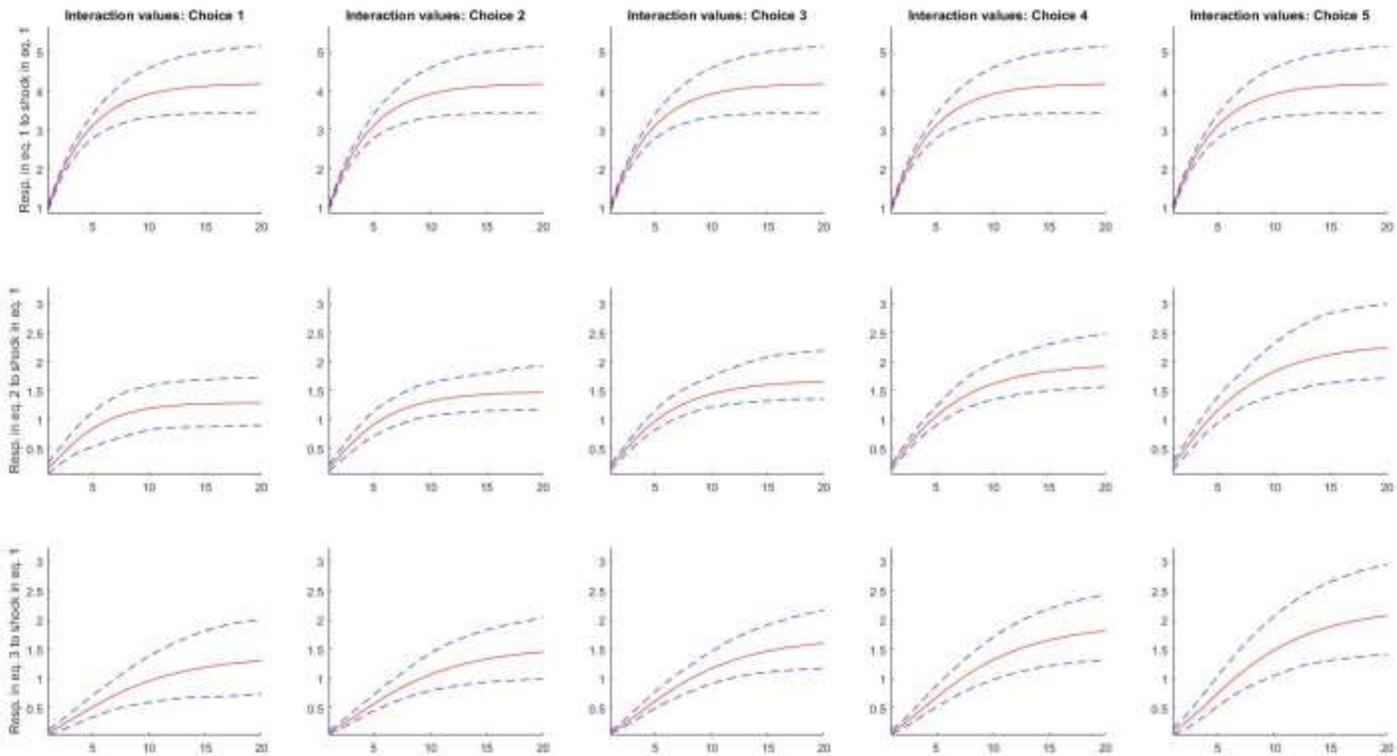


Figure A5. Cumulative Impulse Responses of Government **current spending** and Non-oil GDP to one standard deviation oil prcie shock (rows) at various levels of government spending to GDP ratios (columns): G/Y equal to 14 percent, 22 percent, 29 percent, 38 percent, and 49 percent. Horizontal axes indicate years after shocks and vertical axes are in percent.

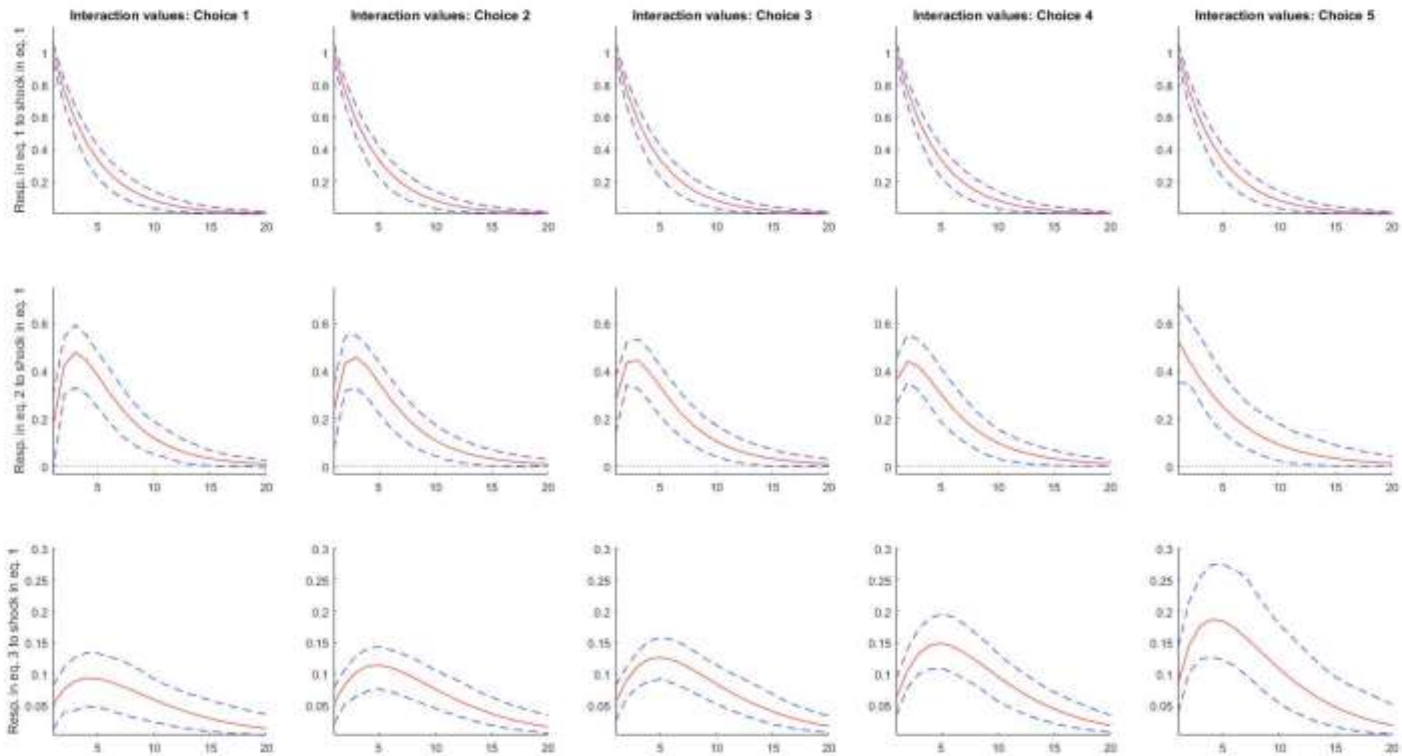


Figure A6. Impulse Responses of Government **capital spending** and Non-oil GDP to one standard deviation oil prcie shock (rows) at various levels of government spending to GDP ratios (columns): G/Y equal to 2 percent, 6 percent, 8 percent, 13 percent, and 22 percent. Horizontal axes indicate years after shocks and vertical axes are in percent.

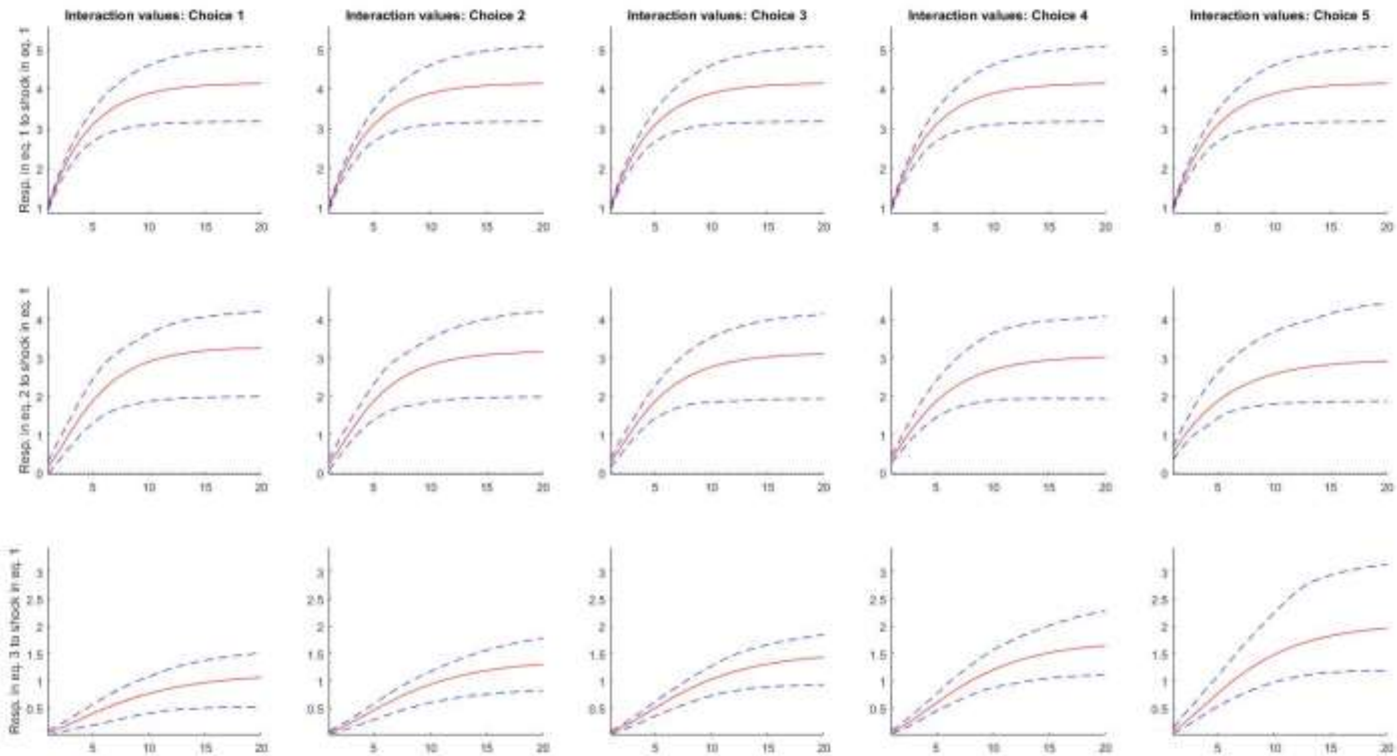


Figure A7. Cumulative Impulse Responses of Government **capital spending** and Non-oil GDP to one standard deviation oil prcie shock (rows) at various levels of government spending to GDP ratios (columns): G/Y equal to 2 percent, 6 percent, 8 percent, 13 percent, and 22 percent. Horizontal axes indicate years after shocks and vertical axes are in percent.

REFERENCES

Arezki, Rabah and Kareem Ismail, (2010), "Fiscal Policy Responses of Oil Producing Countries to the Recent Oil Price Cycle," IMF Working Paper No.10/28, (International Monetary Fund: Washington).

Auerbach, Alan and Yuriy Gorodnichenko, (2012), "Measuring the Output Responses to Fiscal Policy," *American Economic Journal: Economic Policy*, No. 4 Vol. 2, pp.1–27.

Ayadi, O.F. (2005), "Oil Price Fluctuations and the Nigerian Economy", *OPEC Review* No. 29 Vol. 3, pp. 199–217.

Berument, M.H., N.B. Ceylan, and N. Dogan, (2010), "The Impact of Oil Price Shocks on the Economic Growth of Selected MENA Countries", *The Energy Journal* No. 31, Vol. 1, pp. 149–176.

Blanchard, O. and J. Gali, (2007), "The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so Different from the 1970s," NBER Working Paper, No. 13368, (National Bureau of Economic Research: Cambridge, Massachusetts).

——— and D. Leigh, (2013) "Growth Forecast Errors and Fiscal Multipliers", *The American Economic Review*, No. 103 Vol. 3, pp. 117-120.

Cashin, Paul, Kamiar Mohaddes, Maziar Raissi, and Mehdi Raissi, (2014), "The Differential Effects of Oil Demand and Supply Shocks on the Global Economy," *Energy Economics*, No. 44, pp. 113-34.

El Anshasy, Amany A. and Michael D. Bradley, (2012), "Oil Prices and the Fiscal Policy Response in Oil-Exporting Countries", *Journal of Policy Modeling*, No. 34, pp. 605-20.

Eltony, M.N. and M. Al-Awadi, (2001) "Oil Price Fluctuation and their Impact on the Macroeconomic Variables of Kuwait:A Case Study Using aVAR Model," *International Journal of Energy Research*, No. 25, 939–59.

Esfahani, H.S., Mohaddes, K. and Pesaran, M.H., (2012), "An Empirical Growth Model for Major Oil Exporters," *Journal of Applied Econometrics* No. 29 Vol. 1, pp. 1–21. doi: 10.1002/jae.2294.

Espinoza, R. and Abdelhak Senhadji, (2011), "How Strong are Fiscal Multipliers in the GCC? An Empirical Investigation", IMF Working Papers 11/61, (International Monetary Fund: Washington)

Farzanega, M., and G. Markwardt, (2009), "The Effects of Oil Price Shocks on the Iranian Economy," *Energy Economics* No. 31 Vol. 1, pp. 134–51.

Hamilton, J. D., (2003), "What is an Oil Shock?" *Journal of Econometrics*, No. 113, pp. 363–98.

———, (2011), "Nonlinearities and the Macroeconomic Effects of Oil Prices," *Macroeconomic Dynamics*, No. 15, pp. 472–97.

Husain, A., Kamilya Tazhibayeva, and Anna Ter-Martirosyan, (2008), "Fiscal Policy and Economic Cycles in Oil-Exporting Countries," IMF Working Paper No. 08/253, (International Monetary Fund: Washington).

Ilzetzki, Ethan and Carlos Vegh, (2008), "Procyclical Fiscal Policies in Developing Countries: Truth of Fiction?", NBER Working Paper 14,191, (National Bureau of Economic Research: Cambridge, Massachusetts).

———, Enrique G. Mendoza, and Carlos Vegh, (2013), "How big (small?) are fiscal multipliers?" *Journal of Monetary Economics*, No. 60, pp. 239–54.

International Monetary Fund, World Economic Outlook, 1997–2016, (International Monetary Fund: Washington).

Kilian, Lutz, (2009), "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market," *American Economic Review*, No. 99 Vol. 3, pp. 1053–69.

———. and Helmut Lütkepohl, (2017), "Structural Vector Autoregressive Analysis," Cambridge University Press.

———, and Robert J. Vigfusson, (2011), "Are the Response of The U.S. Economy Asymmetric in Energy Price Increases and Decreases?" *Journal of Quantitative Economics*, No. 2, pp. 419–53.

———, and Robert J. Vigfusson (forthcoming), "The Role of Oil Price Shocks in Causing U.S. Recessions," forthcoming at *Journal of Money, Credit, and Banking*.

Moshiri, Saeed, (2015), "Asymmetric Effects of Oil Price Sshocks in Oil-exporting Countries: the Role of Institutions," *OPEC, Energy Review*, PP. 222–46.

Nickel, C. and A. Tudyka, (2014), "Fiscal Stimulus in Times of High Debt: Reconsidering Multipliers and Twin Deficits," J. of Money, Credit, and Banking, No. 46 Vol. 7, pp. 1313–44.

Pesaran, M. Hashem, and Ron Smith, (1995), "Estimating Long-run Relationships from Dynamic Heterogeneous Panels," *Journal of Econometrics*, No. 68 Vol. 1, pp. 79–113.

Pieschacon, Anamaria, (2012), "The Value of Fiscal Discipline for Oil-exporting Countries," *Journal of Monetary Economics*, No. 59, pp. 250–68.

Raguindin, C.E., and R.G. Reyes, (2005), The Effects of Oil Price Shocks on the Philippine Economy: a VAR approach, Working Paper, University of the Philippines School of Economics.

Rebucci, Alessandro, (2003), "On the Heterogeneity Bias of Pooled Estimators in Stationary VAR Specifications," IMF Working Papers 03/73, (International Monetary Fund: Washington).

Riera-Crichton, Daniel, Carlos Vegh, and Guillermo Vuletin, (2016), "Tax multipliers: Pitfalls in Measurement and Identification", *Journal of Monetary Economics*, No. 79, pp. 30-48.

Runkle, David E., (1987), "Vector Autoregressions and Reality," Staff Report 107, Federal Reserve Bank of Minneapolis.

Sa, F. G., P. Towbin, and T. W. Wieladek, (2014), "Capital Inflows, Financial Structure and Housing Booms," *Journal of the European Economic Association*, No. 12, pp. 522–46.

Sims, C.A. and T. Zha, (1999), "Error Bands for Impulse Responses," *Econometrica* No. 67, pp. 1113–56.

Towbin, P. and S. Weber, (2013) "Limits of Floating Exchange Rates: The Role of Foreign Currency Debt and Import Structure," J. of Development Economics, No. 101, pp. 179–94

Villafuerte, M. and P. Lopez-Murphy, (2010), "Fiscal Policy Responses of Oil Producing Countries to the Recent Oil Price Cycle", IMF Working Paper No.10/28, (International Monetary Fund: Washington).