Do Sovereign Wealth Funds Dampen the Negative Effects of Commodity Price Volatility?

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Motivation

- Commodity-dependent countries are a heterogenous mix of high-, middle-, and low-income countries that possess a large share of the world's natural resources (90 percent of crude oil reserves for example), and represent close to 20 percent of world GDP and global exports.

- Natural resource wealth has enabled some of these countries to accumulate substantial assets (placed in Sovereign Wealth Funds in a growing number of countries), and provided a buffer against commodity-price shocks in several cases.

- However, not all resource-rich countries have been able to leverage their assets to raise long-term economic growth due to a number of factors, including:
  - pro-cyclical fiscal policies (especially in the Middle East),
  - underdeveloped public financial management frameworks,
  - and fragile political systems.

Motivation

- Frankel et al. (2013) show that **quality of institutions** can play an important role in making fiscal policy less pro-cyclical, hence turning commodity wealth into a blessing rather than a curse.

- Moreover, when governments rely heavily on revenues derived from commodities, they are subject to **commodity price volatility**, which if not managed properly, can result in higher **GDP growth volatility** and disappointing long-term economic performance.

- For instance, over the 1981-2014 period GDP growth volatility in the Gulf Cooperation Council region (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) has been at least three times higher than that of Chile and Norway.

Motivation

- We study the impact of **commodity price volatility** on long-term economic growth in a sample of 69 commodity-dependent countries over the period 1981–2014, and we then assess the role of **SWFs** and **quality of institutions** in shaping the growth performance of these countries in the face of the extreme volatility in resource revenues that they have experienced over time.

- IMF's *Fiscal Monitor* (2015) argues that strong institutions and appropriate stabilization buffers can increase the chances of a successful public investment scale-up, while Bahal et al. (2015) show that higher government spending on infrastructure facilities (like roads, highways, and power) and/or health and education may have a complementary impact on private sector investment by raising the marginal productivity of private capital.

- We therefore also study the possible **growth channels**—i.e. total factor productivity (TFP) and physical capital accumulation— through which CToT volatility (and SWFs) affect long-term economic growth.

Literature

- We are certainly not the first ones to emphasize the importance of volatility for economic growth. Ramey and Ramey (1995) discuss the consequences of excess volatility for long-run growth.

- Blattman et al (2007) investigate the impact of terms of trade volatility on the growth performance of 35 commodity-dependent countries between 1870 and 1939.

- Aghion et al. (2009), using data on 83 countries over 1960–2000, show that higher levels of exchange rate volatility can stunt growth, especially in countries with relatively under-developed capital markets.

- Bleaney and Greenaway (2001) estimate a model for 14 sub-Saharan African countries over 1980–1995 and show that growth is negatively affected by terms of trade volatility, and investment by real exchange rate instability.

Literature

- van der Ploeg and Poelhekke (2009, 2010) find that the volatility of unanticipated GDP growth has a negative impact on economic growth, conditional on the country's level of financial development.

- Most closely related to our paper is Cavalcanti et al. (2015), who investigate the effects of CToT volatility (σ_{CToT}) on long-run economic growth of both commodity exporters and importers.

- However, we rely on a higher frequency (and exogenously determined) measure of σ_{CToT}, use a different estimation technique, and most importantly, have a different focus: namely the role of SWFs and quality of institutions in mitigating the negative growth effects of σ_{CToT}.

- While we do not explicitly control for other determinants of real GDP growth, the country-specific intercepts, different short-run slope coefficients and error variances, as well as cross-sectional averages of all the variables (as proxies for unobserved common factors) in the CS-ARDL regressions capture the effects of such unobserved variables/factors.

Data

- To empirically test the relationship between economic growth and commodity terms of trade (CToT) growth, g_{CToT}, and volatility, σ_{CToT}, we use annual data from **1980 to 2014** on: real GDP per capita, TFP, physical capital accumulation, and a CToT index based on the prices of **45 primary commodities**.

- The CS-ARDL method employed in this paper requires a sufficient number of time periods for consistent estimation of country-specific coefficients. To ensure this, we include only countries in our sample for which we have **at least 25 consecutive annual observations** on real GDP and CToT.

- Furthermore, we only focus on countries that are **commodity dependant**—those for which the ratio of primary commodities to total exports exceeds 50%.

- Subject to these requirements, we end up with **69 countries in our sample**—listed in Table 1.

Table 1: List of the 69 Primary Commodity Exporters Included in the Sample

Algeria[12]	Egypt	Madagascar[2]	Qatar[1]
Angola[12]	Ethiopia[2]	Malawi[2]	Russia[1]
Argentina	Gabon[1]	Mali[2]	Saudi Arabia[1]
Armenia	Gambia[2]	Moldova	Senegal[1]
Australia[1]	Ghana[12]	Mongolia[1]	Sierra Leone
Azerbaijan[12]	Guatemala	Mozambique	Sudan
Bahrain[1]	Guinea[2]	Myanmar[2]	Syria[2]
Bolivia[1]	Guinea-Bissau[2]	Namibia	Togo
Botswana[1]	Honduras	New Zealand[1]	Trinidad and Tobago[1]
Brunei Darussalam[12]	Iceland	Nicaragua	Tanzania
Burkina Faso	Indonesia[1]	Niger	Uganda[2]
Cameroon	Iran[1]	Nigeria[1]	United Arab Emirates[12]
Chile[1]	Iraq	Norway[1]	Uruguay
Colombia	Jamaica	Oman[12]	Venezuela[1]
Congo[2]	Kazakhstan[1]	Panama[1]	Yemen[2]
Côte d'Ivoire	Kenya	Paraguay	Zambia[2]
Cyprus	Kuwait[1]	Peru[1]	Zimbabwe
Ecuador			

Notes: Countries are classified as commodity exporters if primary commodities constitute more than 50 percent of their exports. [1] indicates that the country has a Sovereign Wealth Fund (SWF). The 20 countries which could not be included in the TFP and Physical Capital accumulation regressions due to unavailability of data are denoted by [2].

Data

- We define a **country-specific measure** of the CToT index as:

$$CToT_{i\tau} = \prod_j \left(\frac{P_{j\tau}}{MUV_\tau} \right)^{X_{ij}} / \prod_j \left(\frac{P_{j\tau}}{MUV_\tau} \right)^{M_{ij}}, \quad (1)$$

where MUV_τ is a manufacturing unit value index used as deflator, X_{ij} (M_{ij}) is the share of exports (imports) of commodity j in country i's GDP, and $P_{j\tau}$ is the individual commodity price in month τ.

- We construct this **monthly index** based on data (on the prices of **45 primary commodities**) obtained from the IMF *IFS* databases. Note that by construction, the movements in the CToT index are due to changes in commodity prices as the export and import shares are taken to be constant over time (i.e. long-term averages).

- The CToT index allows countries to be influenced by changes in commodity prices differently, depending on the composition of their export and import baskets.

- This is in contrast to the "standard" commodity price indices most commonly used in the literature, such as the "All Primary Commodities Index" in IMF IFS, which attaches the **same weight** to each country in the regression analysis.

Data

- Equation (1) is then used to construct two important variables. The first is an annual CToT growth series, $g_{CToT,it}$, which is calculated in two steps: (i) year-on-year growth rate of the monthly CToT index is taken, and (ii) the average over the year is calculated.

- The second is a measure of realized CToT volatility for year t, $\sigma_{CToT,it}$, which is constructed as the standard deviation of the year-on-year growth rates of $CToT_{i\tau}$ during months $\tau = 1, ..., 12$ in year t.

- Therefore, in contrast to most studies in the growth literature which employ time-invariant measures of volatility, **we construct a time-varying measure of commodity price volatility**, $\sigma_{CToT,it}$.

SWFs

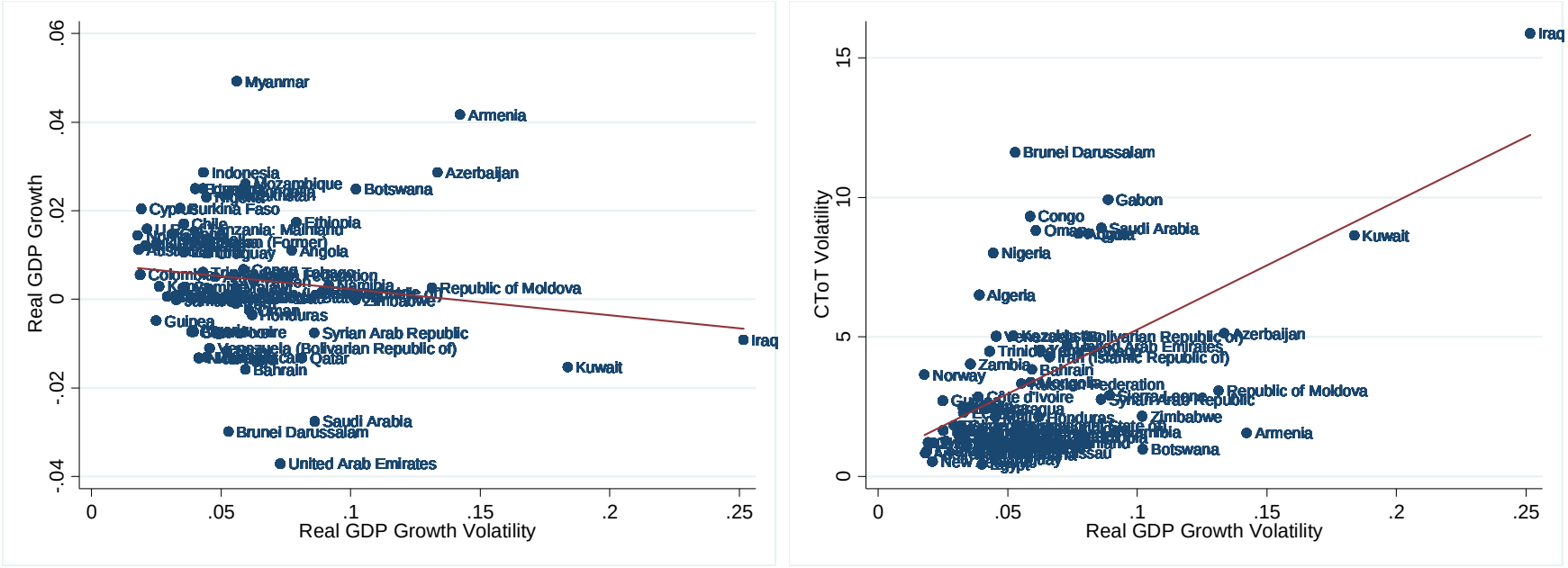
- We end up with 29 countries with SWFs in our sample, with the majority of these SWFs (19) set-up using revenues from exports of crude oil and gas.
- A large portion (10 out of 29) are established in countries that are major oil exporters and are members of the OPEC.
- Note that it usually takes years (if not a decade) to set-up a SWF, as prior to inception, parliament needs to debate the architecture of the fund; for instance, the amount transferred to the SWF in each fiscal year and whether there are any provisions for withdrawing from the fund to finance public expenditure as opposed to just using interest income from the endowment for the budget.
- Nevertheless, the fact that a country has established a SWF provides a valuable signal, as it indicates that the government and the legislature would like to manage the resource wealth efficiently and are concerned with (and willing to deal with) macroeconomic stabilization as well as intergenerational equity.

Table 2: Sovereign Wealth Funds by Origin and Inception

Country	Origin	Inception	Country	Origin	Inception
Algeria*	Oil and Gas	2000	Mongolia	Minerals	2011
Angola*	Oil	2012	New Zealand	Non-Commodity	2003
Australia	Non-Commodity	2006	Nigeria*	Oil	2012
Azerbaijan	Oil	1999	Norway	Oil	1990
Bahrain	Oil	2006	Oman	Oil and Gas	1980
Bolivia	Non-Commodity	2012	Panama	Non-Commodity	2012
Botswana	Minerals	1994	Peru	Non-Commodity	1999
Brunei Darussalam	Oil	1983	Qatar*	Oil and Gas	2005
Chile	Copper	2006	Russia	Oil	2008
Gabon*	Oil	1998	Saudi Arabia*	Oil	1952
Ghana	Oil	2011	Senegal	Non-Commodity	2012
Indonesia	Non-Commodity	2006	Trinidad and Tobago	Oil and Gas	2000
Iran*	Oil and Gas	1999	United Arab Emirates*	Oil	1976
Kazakhstan	Oil	2000	Venezuela*	Oil	1998
Kuwait*	Oil	1953			

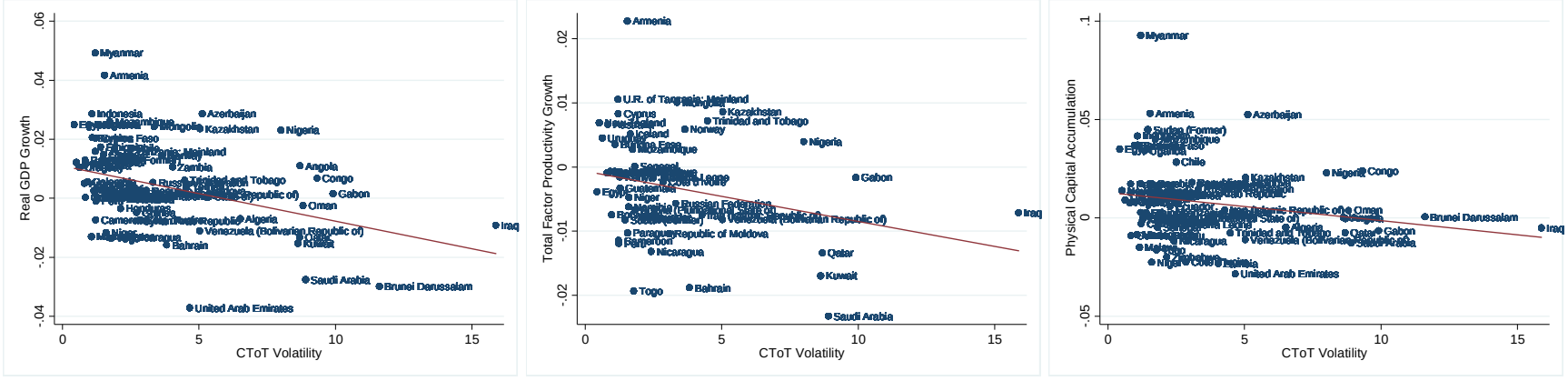
Notes: Some countries have more than one fund, here we have taken the inception year to be that of the first fund, which tends to be the main one. * indicates that the country is a member of the Organization of the Petroleum Exporting Countries (OPEC). Source: Sovereign Wealth Fund Institute.

Figure 1: Scatter Plots of GDP Growth and Volatility of CToT against Volatility of GDP Growth, 1981-2014



Source: Authors' calculation based on data from *Penn World Table Version 9.0* and International Monetary Fund *International Financial Statistics* databases. These are cross-sectional averages over 1981-2014.

Figure 2: Scatter Plots of CToT Volatility against Real GDP growth, TFP Growth and Capital Accumulation, 1981-2014



Source: Authors' calculation based on data from *Penn World Table Version 9.0* and International Monetary Fund *International Financial Statistics* databases. These are cross-sectional averages over 1981-2014.

The Econometric Model and Methodology

- When panels of data are available, there exist a number of alternative estimation methods that vary on the extent to which they account for **parameter heterogeneity**.

- At one extreme is the Mean Group (MG) approach in which **separate equations are estimated for each country** and the average of estimated coefficients across countries is examined.

- At the other extreme are the traditional estimators in which **dynamics are simply pooled and treated as homogeneous**, i.e. FE, RE, and GMM.

- In between the two extremes is the pooled mean group (PMG) estimator of Pesaran and Shin (1999), which is **an intermediate case between the averaging and pooling methods of estimation**, and involves aspects of both.

- It restricts the long-run coefficients to be homogenous over the cross-sections, but allows for heterogeneity in intercepts, short-run coefficients (including the speed of adjustment) and error variances.

The Econometric Model and Methodology

- We employ the Cross-Sectionally augmented Autoregressive Distributive Lag (CS-ARDL) approach for estimation to account for (i) joint endogeneity of explanatory variables, (ii) cross-country heterogeneity, and (iii) cross-sectional dependence.

- Accounting for these factors is particularly important in our panel data analysis as the effect of commodity price volatility on growth varies across cross-section units and depends critically on **country-specific factors** (such as quality of institutions, level of economic and financial development, strength of public financial management frameworks, and type of stabilization buffers) as well as **feedback effects** from determinants of GDP growth.

- Moreover, controlling for observed characteristics specific to countries alone need not ensure error cross-section independence. Neglecting such dependencies can lead to biased estimates and spurious inference, particularly given the rapid increase in globalization and exposures to global shocks.

The Econometric Model and Methodology

To examine the long-run effects of CToT volatility on output growth, we estimate the following panel CS-ARDL model:

$$\Delta y_{it} = c_{yi}^{*} + \sum_{l=1}^{p} \phi_{il} \Delta y_{i,t-l} + \sum_{l=0}^{p} \boldsymbol{\beta}_{il}^{'} \mathbf{x}_{i.t-l} + \sum_{l=0}^{q} a_{il} \overline{\Delta y}_{t-l} + \sum_{l=0}^{q} \mathbf{b}_{il}^{'} \overline{\mathbf{x}}_{t-l} + \varepsilon_{it}, \qquad (2)$$

where Δy_{it} is the growth rate of real GDP per capita for country i and year t, $\mathbf{x}_{it}$ is a 2×1 vector of explanatory variables, namely the growth rate of the CToT index, $g_{CToT,it}$, and its volatility, $\sigma_{CToT,it}$. The terms $\overline{\Delta y}_t$ and $\overline{\mathbf{x}}_t$ denote the simple cross-section averages of Δy_{it} and $\mathbf{x}_{it}$ in year t.

Moreover, to determine the channel(s) through which GDP growth is negatively affected by CToT volatility in our sample, we investigate two possible sources which are acknowledged in the literature, namely, TFP and physical capital investment. We therefore also estimate the following regressions:

$$\Delta w_{it} = c_{wi}^{*} + \sum_{l=1}^{p} \phi_{il} \Delta w_{i,t-l} + \sum_{l=0}^{p} \boldsymbol{\beta}_{il}^{'} \mathbf{x}_{i.t-l} + \sum_{l=0}^{q} a_{il} \overline{\Delta w}_{t-l} + \sum_{l=0}^{q} \mathbf{b}_{il}^{'} \overline{\mathbf{x}}_{t-l} + \varepsilon_{it}, \qquad (3)$$

where $\Delta w_{it} = \ln W_{it} - \ln W_{it-1}$ is the growth rate of $W_{it} = \{\text{TFP or physical capital per capita for country } i \text{ and time } t\}$, while $\overline{\Delta w}_t$ is the simple cross-sectional average of Δw_{it}, with all other variables as defined in equation (2).

Table 3: Estimates of the Long-Run Effects on Real GDP, TFP and Physical Capital Growth (1981-2014)

Dependant variable is the growth rate of:	Real GDP per capita			Total Factor Productivity			Physical Capital		
Lags	1	2	3	1	2	3	1	2	3
(a) Baseline Regressions									
CToT Growth	0.0015†	0.0028‡	0.0041‡	0.0023†	0.0033‡	0.0041‡	-0.0009	0.0010	0.0022†
	(0.0008)	(0.0009)	(0.0010)	(0.0010)	(0.0011)	(0.0011)	(0.0007)	(0.0009)	(0.0010)
CToT Volatility	-0.0021	-0.0020	-0.0047†	-0.0054†	-0.0085‡	-0.0124‡	-0.0044†	-0.0045*	-0.0079‡
	(0.0017)	(0.0018)	(0.0021)	(0.0026)	(0.0025)	(0.0020)	(0.0022)	(0.0026)	(0.0028)
CD Test Statistic	-2.30	-1.57	-0.34	-0.46	0.17	0.37	-2.01	-1.34	-0.20
No Countries	69	69	69	49	49	49	49	49	49
No Observations	2,218	2,149	2,080	1,577	1,528	1,479	1,577	1,528	1,479
(b) Regressions with the Interactive Sovereign Wealth Fund (SWF) Dummy									
CToT Growth	0.0015*	0.0027‡	0.0038‡	0.0022†	0.0033‡	0.0041‡	-0.0009	0.0011	0.0023†
	(0.0008)	(0.0009)	(0.0010)	(0.0010)	(0.0011)	(0.0011)	(0.0007)	(0.0009)	(0.0010)
CToT Volatility	-0.0039*	-0.0043*	-0.0067†	-0.0061*	-0.0078†	-0.0113‡	-0.0057†	-0.0075†	-0.0117‡
	(0.0023)	(0.0024)	(0.0028)	(0.0033)	(0.0032)	(0.0025)	(0.0026)	(0.0031)	(0.0036)
Interactive SWF Dummy	0.0041	0.0064*	0.0073*	0.0022	-0.0025	-0.0047	0.0060	0.0112†	0.0110†
	(0.0033)	(0.0034)	(0.0038)	(0.0052)	(0.0051)	(0.0045)	(0.0048)	(0.0051)	(0.0051)
CD Test Statistic	-2.38	-1.68	-0.37	-0.46	0.14	0.33	-2.06	-1.38	-0.22
No Countries	69	69	69	49	49	49	49	49	49
No Observations	2,218	2,149	2,080	1,577	1,528	1,479	1,577	1,528	1,479

Notes: The CS-ARDL specifications are given by equations 11 and 12. Symbols ‡, †, and * denote significance at 1%, 5%, and 10% levels, respectively. CD is the cross-section dependence (CD) test of Pesaran (2004, 2015).

Empirical Results

- Once we allow for long enough lags, **to fully account for short-run dynamics**, the results suggest that economic growth is adversely linked to commodity price volatility in the long-term.

- Overall, while **commodity price booms significantly increase economic growth, volatility affects it negatively**.

- This finding can be partly explained by the fact that fiscal and current account balances of commodity-exporting countries are affected by swings in resources revenues with destabilizing effects on the macroeconomy.

- Note that the **positive growth effect of g_{CToT} provides evidence against the traditional resource curse hypothesis**, which argues that it is the level of resource abundance that affects economic growth negatively, and is in line with results obtained recently in the literature; see, for instance, Alexeev and Conrad (2009), Cavalcanti et al. (2011b, 2011a, 2015), El-Anshasy et al. (2015), and Esfahani et al. (2013).

Empirical Results

- The results also indicate that both commodity terms of trade growth and **volatility have significant effects on TFP and physical capital accumulation** for commodity abundant countries, with the coefficient of $\sigma_{CToT,it}$ being negative and significant across all lag orders.

- The negative association between CToT volatility and TFP growth lends itself to the argument that natural resource abundant countries have **fewer possibilities for technological progress**.

- Moreover, while a commodity price boom increases the physical capital stock, higher volatility of commodity prices significantly reduces it. Therefore, **capital accumulation seems to be another important channel through which volatility affects GDP per capita growth**; which is in line with what is argued in Gylfason and Zoega (2006) and Esfahani et al. (2014) among others.

Empirical Results

- A possible explanation for this finding is that economic agents tend to save less in commodity abundant countries because they perceive the revenues from primary commodity exports to be a permanent stream of future income.

- Another possibility is that the uncertainty arising from commodity price volatility might suppress the accumulation of physical capital by risk averse investors.

- Moreover, as noted by Catão et al. (2009), terms of trade volatility adversely affects capital accumulation and growth by raising the country's default risk, hence widening the country spreads, and lowering its borrowing capacity.

Empirical Results

- As we expect the long-run growth effects of CToT volatility for primary commodity exporters to be different from those **countries that are not dependant on a handful of primary products**, we run the same regressions as in (2) but for a sample of 61 countries that have a more diversified export basket.

- The results for these 61 countries show that CToT volatility is not significantly related to economic growth in the long-run.

- This is mainly because these countries have a more diversified basket of exports, especially manufacturing or service-sector goods, and so they are expected to grow faster and be **better insured against price fluctuations in individual commodities**.

The Role of SWFs and Institutional Quality

- While many SWFs have existed for over half a century (such as the Kuwait Investment Authority which was founded in 1953), a large number of funds have been established (by major commodity exporters in particular) over the last two decades.

- These SWFs accumulated large assets during the most recent oil-price boom (2002–2008), have played a major role in reserve management of commodity revenues, and **contributed to macroeconomic stabilization in several cases**.

- SWFs have been established for a variety of reasons, ranging from **fiscal stabilization** (that is to help smooth the impact on government spending of revenues that are large and volatile), to **long-term saving** for future needs of the economy, or of specific groups such as pensioners, or for future generations.

- One of the main short-term objectives of SWFs is to **counter the adverse macroeconomic effects of commodity price volatility**.

The Role of SWFs and Institutional Quality

- We identify 29 countries in our sample as having established SWFs. 19 of these are funded by revenue from exports of crude oil and gas, of which ten are members of the Organization of the Petroleum Exporting Countries (OPEC), and seven are located in the Persian Gulf.

- It is estimated by the *Sovereign Wealth Fund Institute* that in late 2016 the total assets of SWFs were around $7.5 trillion with over 60% of these being funded by oil and gas exports.

- The prominent examples are Norway's Government Pension Fund ($830), Abu Dhabi Investment Authority ($773), Saudi Arabia's Fund (SAMA) ($685), Kuwait Investment Authority ($592), and Qatar Investment Authority ($256), with the number in brackets referring to their market values in billions in June 2015.

- Note that given the objective of these funds, on average 65% of the SWF assets are held in public and private equities (61% Norway; 72% SAMA; 65% Kuwait; 68% Qatar; 62% Abu Dhabi–figures based on 2014). See Mohaddes and Pesaran (2017) for more details.

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Dependant variable is the growth rate of:	Real GDP per capita			Total Factor Productivity			Physical Capital		
Lags	1	2	3	1	2	3	1	2	3
(a) Baseline Regressions									
CToT Growth	0.0015†	0.0028‡	0.0041‡	0.0023†	0.0033‡	0.0041‡	-0.0009	0.0010	0.0022†
	(0.0008)	(0.0009)	(0.0010)	(0.0010)	(0.0011)	(0.0011)	(0.0007)	(0.0009)	(0.0010)
CToT Volatility	-0.0021	-0.0020	-0.0047†	-0.0054†	-0.0085‡	-0.0124‡	-0.0044†	-0.0045*	-0.0079‡
	(0.0017)	(0.0018)	(0.0021)	(0.0026)	(0.0025)	(0.0020)	(0.0022)	(0.0026)	(0.0028)
CD Test Statistic	-2.30	-1.57	-0.34	-0.46	0.17	0.37	-2.01	-1.34	-0.20
No Countries	69	69	69	49	49	49	49	49	49
No Observations	2,218	2,149	2,080	1,577	1,528	1,479	1,577	1,528	1,479
(b) Regressions with the Interactive Sovereign Wealth Fund (SWF) Dummy									
CToT Growth	0.0015*	0.0027‡	0.0038‡	0.0022†	0.0033‡	0.0041‡	-0.0009	0.0011	0.0023†
	(0.0008)	(0.0009)	(0.0010)	(0.0010)	(0.0011)	(0.0011)	(0.0007)	(0.0009)	(0.0010)
CToT Volatility	-0.0039*	-0.0043*	-0.0067†	-0.0061*	-0.0078†	-0.0113‡	-0.0057†	-0.0075†	-0.0117‡
	(0.0023)	(0.0024)	(0.0028)	(0.0033)	(0.0032)	(0.0025)	(0.0026)	(0.0031)	(0.0036)
Interactive SWF Dummy	0.0041	0.0064*	0.0073*	0.0022	-0.0025	-0.0047	0.0060	0.0112†	0.0110†
	(0.0033)	(0.0034)	(0.0038)	(0.0052)	(0.0051)	(0.0045)	(0.0048)	(0.0051)	(0.0051)
CD Test Statistic	-2.38	-1.68	-0.37	-0.46	0.14	0.33	-2.06	-1.38	-0.22
No Countries	69	69	69	49	49	49	49	49	49
No Observations	2,218	2,149	2,080	1,577	1,528	1,479	1,577	1,528	1,479

Notes: The CS-ARDL specifications are given by equations 11 and 12. Symbols ‡, †, and * denote significance at 1%, 5%, and 10% levels, respectively. CD is the cross-section dependence (CD) test of Pesaran (2004, 2015).

The Role of SWFs and Institutional Quality

- As before, the long-run effects of $\sigma_{CToT,it}$ is negative for real GDP per capita growth and the channels of impact are lower TFP and physical capital accumulation. Note also that the coefficient of CToT volatility is negative and statistically significant for all lag orders.

- More importantly, the estimated coefficient of the interactive SWF dummy is positive and statistically significant in the first and third blocs.

- In other words, countries that have a SWF in our sample have, on average, performed better when it comes to **mitigating the negative growth effects of CToT volatility** and managed to sustain a higher level of capital accumulation in the face of the extreme volatility in resource revenues.

- Our results, therefore, suggests that one is better able to dampen the negative long-run growth effects of CToT volatility with a well-functioning SWF that can **effectively deal with the adverse effects of (excess) commodity price volatility**—add to the fund when commodity prices are high and transfer less to it or even withdraw from it when prices are low to smooth expenditure.

The Role of SWFs and Institutional Quality

- For instance, oil exporters in the Persian Gulf, enjoyed a large increase in their SWFs assets while oil prices were high for most of the past decade, but more recently many of them have dipped into their SWFs following the collapse in oil prices since 2014.

- Rather than cutting back on public expenditure (social welfare programs, public salaries, and infrastructure spending), many governments either withdrew money from their funds (such as Russia and Saudi Arabia) or alternatively transferred less revenue to these funds.

- To give a concrete example, since 1976 the Kuwaiti government has by law transferred a minimum of 10 percent of all state revenues to the Future Generation Fund (FGF). However, with oil prices having been high for almost a decade it was announced in March 2013, following an Amir budgetary decree, that the minimum contribution is to be increased to 25 percent. But the following year oil prices fell sharply and remained low, and so the decision was reversed and the contribution to the FGF was cut back to 10 percent from fiscal year 2015/16.

The Role of SWFs and Institutional Quality

We next check the robustness of our results to the definition of SWF and re-estimate our growth regressions excluding the seven countries whose SWFs are mainly funded by non-commodity revenues (Australia, Bolivia, Indonesia, New Zealand, Panama, Peru, and Senegal).

Table 4: Estimates of the Long-Run Effects on Real GDP Growth when Considering Institutions and Different SWF Groupings, (1981-2014)

	Excluding Non-Commodity SWFs Full sample (69 Countries)			Role of Institutions 29 Countries with SWF		
Lags	1	2	3	1	2	3
CToT Growth	0.0014*	0.0025‡	0.0035‡	0.0025†	0.0020	0.0026*
	(0.0008)	(0.0009)	(0.0010)	(0.0012)	(0.0013)	(0.0014)
CToT Volatility	-0.0056†	-0.0069‡	-0.0124‡	-0.0283*	-0.0364†	-0.0527‡
	(0.0023)	(0.0024)	(0.0027)	(0.0161)	(0.0169)	(0.0167)
Interactive SWF Dummy	0.0080†	0.0127‡	0.0167‡	-	-	-
	(0.0033)	(0.0035)	(0.0038)			
Interactive Institutional Term	-	-	-	0.0004*	0.0005†	0.0007‡
				(0.0002)	(0.0002)	(0.0002)
CD Test Statistic	-2.49	-1.82	-0.53	1.06	0.54	-0.06
No Countries	69	69	69	29	29	29
No Observations	2,218	2,149	2,080	927	898	869

Notes: The dependant variable is the growth of real GDP per capita. See also notes to Table 3.

The Role of SWFs and Institutional Quality

- Our results are in line with a number of recent papers that investigate the role of oil/stabilization funds in (i) reducing fiscal pro-cyclicality and (ii) smoothing government consumption:

- Coutinho et al. (2013) argue that resource funds tend to dampen fiscal pro-cyclicality.

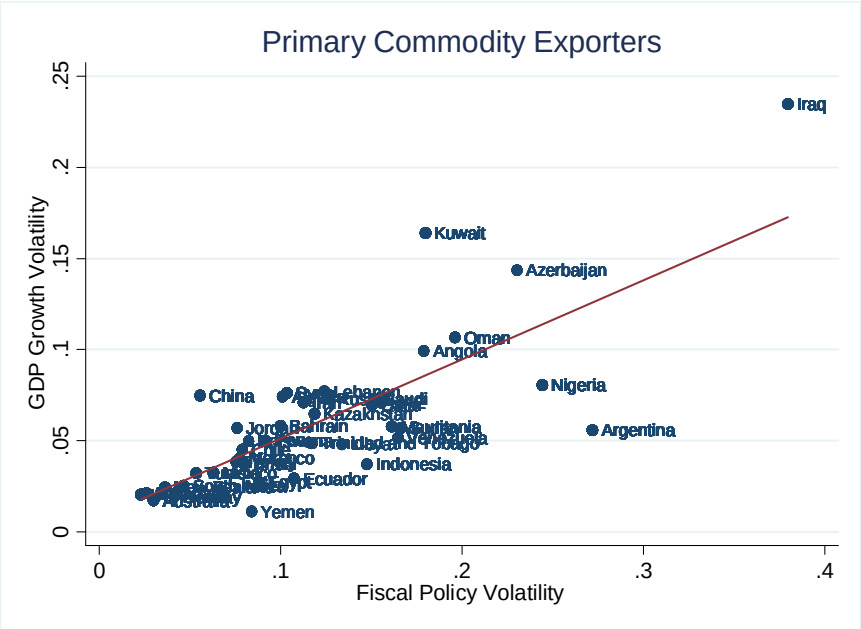
- Sugawara (2014) shows that government expenditure volatility is lower in countries with stabilization funds.

- Koh (2016) illustrates that fiscal policy becomes more counter-cyclical after the establishment of oil funds, and that these funds are typically associated with smoother government consumption.

- Moreover, Shabsigh and Ilahi (2007) argue that oil funds help reduce macroeconomic volatility in oil exporting countries, more specifically, the volatility of broad money, prices, and (to some extent) the real exchange rate.

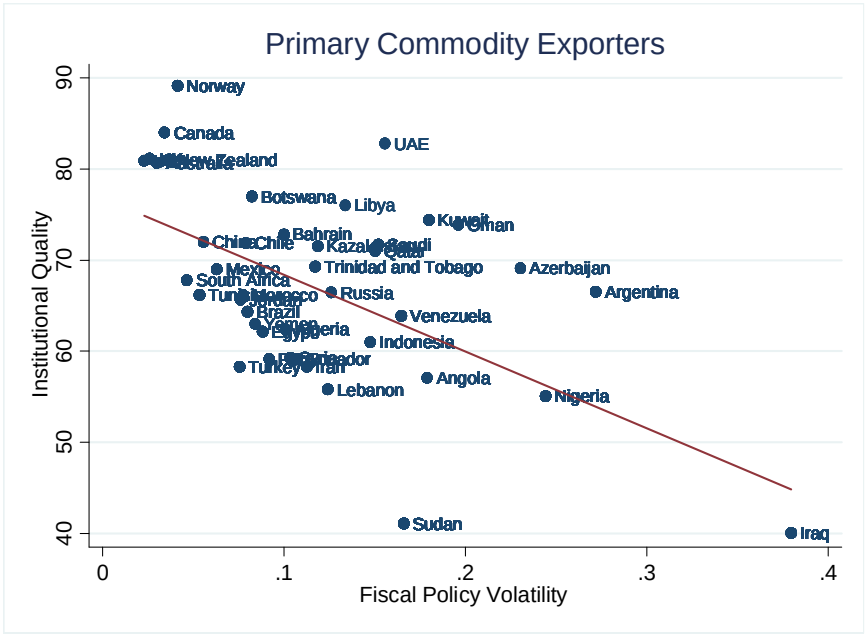
The Role of SWFs and Institutional Quality

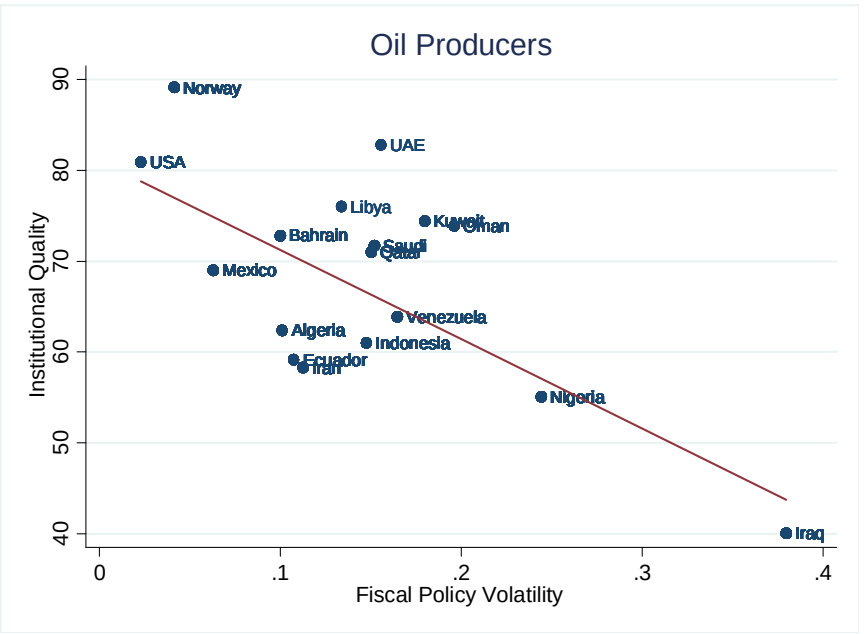
Given the large heterogeneity within the 29 SWF countries in our sample, a follow-up question is the potential **role of institutions and policy frameworks**, and in particular **fiscal policy**, in dampening the negative effect of CToT volatility.



Source: K. Mohaddes, J.B. Nugent, and H. Selim (2018), *Institutions and Macroeconomic Policies in Resource-Rich Arab Economies*, Oxford University Press.

Scatter Plots of Institutional Quality against Fiscal Policy Volatility, 1961-2013





Source: K. Mohaddes, J.B. Nugent, and H. Selim (2018), *Institutions and Macroeconomic Policies in Resource-Rich Arab Economies*, Oxford University Press.

Notes: This volatility is interpreted as the component of discretionary policy which is not related to smoothing the business cycle, such as changes in political preferences or the decision by the politicians to generate a short-term boom so as to keep the population happy–as was seen in the GCC following the Arab Spring.

Table 4: Estimates of the Long-Run Effects on Real GDP Growth when Considering Institutions and Different SWF Groupings, (1981-2014)

	Excluding Non-Commodity SWFs Full sample (69 Countries)			Role of Institutions 29 Countries with SWF		
Lags	1	2	3	1	2	3
CToT Growth	0.0014*	0.0025‡	0.0035‡	0.0025†	0.0020	0.0026*
	(0.0008)	(0.0009)	(0.0010)	(0.0012)	(0.0013)	(0.0014)
CToT Volatility	-0.0056†	-0.0069‡	-0.0124‡	-0.0283*	-0.0364†	-0.0527‡
	(0.0023)	(0.0024)	(0.0027)	(0.0161)	(0.0169)	(0.0167)
Interactive SWF Dummy	0.0080†	0.0127‡	0.0167‡	-	-	-
	(0.0033)	(0.0035)	(0.0038)			
Interactive Institutional Term	-	-	-	0.0004*	0.0005†	0.0007‡
				(0.0002)	(0.0002)	(0.0002)
CD Test Statistic	-2.49	-1.82	-0.53	1.06	0.54	-0.06
No Countries	69	69	69	29	29	29
No Observations	2,218	2,149	2,080	927	898	869

Notes: The dependant variable is the growth of real GDP per capita. See also notes to Table 3.

The Role of SWFs and Institutional Quality

- The results, not surprisingly, illustrate that within the SWF sample, countries with stronger institutions, have been better able to mitigate the negative growth effects of CToT volatility.

- These results are in line with Frankel et al. (2013), who argue that the better institutions in developing countries are, the more likely they are to pursue less procyclical or more countercyclical fiscal policy, as well as Sugawara (2014) who shows that the two significant factors in reducing government expenditure volatility are stronger institutions and fiscal rules.

- Overall, our results suggest that while **volatility represents a fundamental barrier to economic prosperity**, the establishment of SWFs, as well as appropriate institutions, can help mitigate the negative effects.

- Therefore, creating a mechanism of short-term management of commodity price volatility through stabilization funds should be a priority for commodity dependant countries, complemented by well-functioning public financial management systems.

Concluding Remarks

- We contributed to the literature by examining empirically the effects of commodity price booms and CToT volatility on GDP per capita growth and its sources.
- We created an annual panel dataset and used the CS-ARDL approach to account for endogeneity, cross-country heterogeneity, and cross-sectional dependence which arise from unobserved common factors.
- The main finding was that while CToT growth enhances real output per capita, CToT volatility exerts a negative impact on economic growth operating through lower accumulation of physical capital and lower TFP.
- Our econometric results also showed that, on average, having a SWF can mitigate such negative growth effects, especially in countries that enjoy higher-quality institutions (and hence less pro-cyclical fiscal policies).

Policy Implications

- The undesirable consequences of commodity price volatility can be avoided if resource-rich countries are able to improve the management of volatility in resource income by setting up forward-looking institutions such as Sovereign Wealth Funds, or adopting short-term mechanisms such as stabilization funds with the aim of saving when commodity prices are high and spending accumulated revenues when prices are low.

- The government can also intervene in the economy by increasing public capital expenditure when private investment is low, using proceeds from the stabilization fund.

- Alternatively the government can use these funds to increase the complementarities of physical and human capital, such as improving the judicial system, property rights, and human capital. This would increase the returns on investment with positive effects on capital accumulation, TFP, and growth.

- Improving the functioning of financial markets is also a crucial step as this allows firms and households to insure against shocks, decreasing uncertainty and therefore mitigating the negative effects of volatility on investment and economic growth.