Fiscal Policy in Oil and Gas-Exporting Economies: Good Times, Bad Times and Ugly Times

Olivier Durand-Lasserve and Fatih Karanfil

June 2023
About KAPSARC

KAPSARC is an advisory think tank within global energy economics and sustainability providing advisory services to entities and authorities in the Saudi energy sector to advance Saudi Arabia's energy sector and inform global policies through evidence-based advice and applied research.

*This publication is also available in Arabic.*

Legal Notice

© Copyright 2023 King Abdullah Petroleum Studies and Research Center (“KAPSARC”). This Document (and any information, data or materials contained therein) (the “Document”) shall not be used without the proper attribution to KAPSARC. The Document shall not be reproduced, in whole or in part, without the written permission of KAPSARC. KAPSARC makes no warranty, representation or undertaking whether expressed or implied, nor does it assume any legal liability, whether direct or indirect, or responsibility for the accuracy, completeness, or usefulness of any information that is contained in the Document. Nothing in the Document constitutes or shall be implied to constitute advice, recommendation or option. The views and opinions expressed in this publication are those of the authors and do not necessarily reflect the official views or position of KAPSARC.
Revenues from oil and gas exports represent an important source of government budgets in some emerging countries. At the same time, these revenues fluctuate considerably due to changing global economic conditions and energy prices. Economic theory prescribes that governments should try to stabilize their economies by saving windfall oil and gas revenues and spending them in periods of price downturns. However, oil- and gas-exporting countries often run procyclical policies, that is, they increase spending during windfall periods and reduce it in the event of a shortfall, which may result in severe recessions. Understanding what drives the response of fiscal policy to oil and gas revenue shocks is important as it helps to explain what makes the economies of commodity exporters more or less vulnerable to commodity price shocks, and how they can adjust to price volatility and to the long-term energy transition.

In this paper, we investigate how fiscal policy reacts differently when prices decrease or increase across different periods of low and high commodity price regimes. We develop a framework for analyzing the asymmetrical effects of commodity revenues and understand the influence of financial constraints, fiscal rules, exchange rate flexibility, and institutional quality. For the purpose of this study, we build a unique oil and gas fiscal revenue database for 30 countries that compiles information drawn mostly from International Monetary Fund country reports and official country-level statistical sources. We use panel data models to examine the response of governments’ discretionary expenditure to oil and gas revenue windfalls and shortfalls.

Our preliminary analysis shows that fiscal policy is procyclical in oil- and gas-exporting countries, with an almost 100% pass-through of additional oil and gas revenues from governments’ total expenditure. When covariates are included in our model, we find that financial openness increases procyclicality. The results also show that fiscal rules and higher quality institutions reduce procyclicality.

After the preliminary analysis, we hypothesize that governments’ responses to revenue shocks may not be symmetrical. More specifically, we argue that governments would tend to have differentiated fiscal policy responses depending on both the variation (whether the revenue shock is negative or positive) and the position (whether the revenues are higher or lower than what is perceived as the baseline level when the shock occurs). We find evidence that position asymmetry explains fiscal procyclicality better than variation asymmetry.

In situations we call bad times, with negative shocks and revenue below the baseline, we find that fiscal contraction is particularly pronounced. However, in ugly times, that is, when the commodity outlook is mixed, with negative (positive) shocks and revenue above (below) the baseline, our results suggest that governments tend to be optimistic and prioritize spending over saving.

When additional variables are accounted for, the results indicate that during good times, the situation when revenue is already above the baseline and increases further, financial openness tends to boost government investment but not current expenditure. This contributes to limiting the drop in investment during bad times. We also find in ugly times, institutional quality is associated with less optimistic fiscal policy and governments moderating spending. The exchange rate flexibility is found to generate more fiscal procyclicality, except for during good times when fiscal rules reduce procyclicality.

Our findings provide practical implications for policymaking in oil- and gas-exporting countries. Governments need to develop financial reserves that can be used in bad times. For this, limiting

Summary

Revenues from oil and gas exports represent an important source of government budgets in some emerging countries. At the same time, these revenues fluctuate considerably due to changing global economic conditions and energy prices. Economic theory prescribes that governments should try to stabilize their economies by saving windfall oil and gas revenues and spending them in periods of price downturns. However, oil- and gas-exporting countries often run procyclical policies, that is, they increase spending during windfall periods and reduce it in the event of a shortfall, which may result in severe recessions. Understanding what drives the response of fiscal policy to oil and gas revenue shocks is important as it helps to explain what makes the economies of commodity exporters more or less vulnerable to commodity price shocks, and how they can adjust to price volatility and to the long-term energy transition.

In this paper, we investigate how fiscal policy reacts differently when prices decrease or increase across different periods of low and high commodity price regimes. We develop a framework for analyzing the asymmetrical effects of commodity revenues and understand the influence of financial constraints, fiscal rules, exchange rate flexibility, and institutional quality. For the purpose of this study, we build a unique oil and gas fiscal revenue database for 30 countries that compiles information drawn mostly from International Monetary Fund country reports and official country-level statistical sources. We use panel data models to examine the response of governments’ discretionary expenditure to oil and gas revenue windfalls and shortfalls.

Our preliminary analysis shows that fiscal policy is procyclical in oil- and gas-exporting countries, with an almost 100% pass-through of additional oil and gas revenues from governments’ total expenditure. When covariates are included in our model, we find that financial openness increases procyclicality. The results also show that fiscal rules and higher quality institutions reduce procyclicality.

After the preliminary analysis, we hypothesize that governments’ responses to revenue shocks may not be symmetrical. More specifically, we argue that governments would tend to have differentiated fiscal policy responses depending on both the variation (whether the revenue shock is negative or positive) and the position (whether the revenues are higher or lower than what is perceived as the baseline level when the shock occurs). We find evidence that position asymmetry explains fiscal procyclicality better than variation asymmetry.

In situations we call bad times, with negative shocks and revenue below the baseline, we find that fiscal contraction is particularly pronounced. However, in ugly times, that is, when the commodity outlook is mixed, with negative (positive) shocks and revenue above (below) the baseline, our results suggest that governments tend to be optimistic and prioritize spending over saving.

When additional variables are accounted for, the results indicate that during good times, the situation when revenue is already above the baseline and increases further, financial openness tends to boost government investment but not current expenditure. This contributes to limiting the drop in investment during bad times. We also find in ugly times, institutional quality is associated with less optimistic fiscal policy and governments moderating spending. The exchange rate flexibility is found to generate more fiscal procyclicality, except for during good times when fiscal rules reduce procyclicality.

Our findings provide practical implications for policymaking in oil- and gas-exporting countries. Governments need to develop financial reserves that can be used in bad times. For this, limiting
Summary

Procyclicality in *good times* would be the optimal solution, and fiscal rules can support such a policy. Reducing expenditures when revenue is high but a downturn is on the horizon would serve the same objective. Governments should also avoid premature hikes in expenditure at the first sign of an improvement in the oil and gas revenue outlook. Optimal management of surges in capital inflows during *good times* is key for every economy, and, in those periods, governments need to prioritize investments that drive economic diversification and long-term economic growth.
Emerging and Developing (ED) commodity-exporting countries face large terms of trade variations that may destabilize their economies. In this situation, neo-classical (Chari et al. 1991) and neo-Keynesian models (Christiano et al. 2011) prescribe that fiscal policy should be countercyclical or neutral to stabilize the economy and avoid welfare losses. As is well known, conducting countercyclical fiscal policy means making budget contractions (reducing expenditure or increasing tax rates) during booms and carrying out budget expansions (increasing expenditure or reducing tax rates) during busts. Fiscal policies are neutral when budgets do not adjust to booms and busts. Despite countercyclicality or neutrality being prescribed, the empirical literature shows that ED commodity-exporting countries run procyclical fiscal policies. They spend windfall commodity revenues during booms and cut expenditures during busts. In this paper, we propose a new approach to analyzing the cyclical behavior of fiscal policies, specifically in ED oil and gas-exporting economies. Our premise is that governments plan their budgets based on an expected (baseline) level of oil and gas revenues, which they predict from revenues realized in the past. They then adjust discretionary spending to the gap between the actual oil and gas revenues and their predicted value. A positive gap corresponds to a windfall revenue that the government can decide to either spend to stimulate the economy, or save for later use as a precaution. A negative gap is a shortfall that will lead the government to either cut spending to preserve the budget’s balance, or to increase spending to support the economy. Overall, we consider that fiscal policy is procyclical to oil and gas revenue if there is a positive correlation between the variation of the oil and gas revenue gap and the variation of discretionary spending. In addition, positive or negative variations of the revenue gap come with different obstacles and trigger different budget responses. If buffers have been accumulated (public debt has been reduced or fiscal reserves increased) thanks to windfall oil and gas revenues in previous periods, governments have greater leeway to increase spending when they face negative oil and gas revenue shocks. If, however, in previous periods the revenue gap was negative, governments may have limited buffers and, therefore, fewer opportunities to respond with higher spending to negative oil and gas revenue shocks. At the same time, previous revenue shortfalls may have already triggered budget consolidation, with socially costly spending cuts and, in the case of revenue improvement, an increased pressure to raise public expenditure. In order to measure the dependence of the response of fiscal policies to the history of government spending and buffer accumulation, we consider revenue shocks in two dimensions. The first determines whether the revenue gap is improving or deteriorating. The second considers whether the revenue gap was initially positive or negative, which allows for an assessment of the initial state of the fiscal buffers. In such a two-dimensional framework, the most favorable case corresponds to the period where the revenue gap is initially positive and increasing. We call this situation good times. In the worst case, revenues are below the baseline and decreasing. We dub this situation bad times. Intermediate cases between these two polar cases are called ugly times, as they present a mix of good and bad signals for the government (i.e., revenues are above the baseline but decreasing, or vice versa). To our knowledge, this paper is the first to approach the fiscal cyclicality problem from a multi-dimensional, asymmetrical perspective.

Drawing on International Monetary Fund (IMF) country reports as well as national sources, we have compiled a unique dataset of 30 countries’ fiscal oil and gas revenues from 1995 to 2019. We decompose each country’s oil and gas revenues series to obtain the revenue gap and then determine
whether the country goes through *good times*, *bad times*, or *ugly times*. Based on a panel data framework that accounts for asymmetry, we assess how government expenditure behaves during these specific periods. Since, as in the literature, fiscal policy cyclicality can be affected by countries’ structural and economic conditions, we extend our analysis to incorporate several additional variables as well as their interactions with oil and gas revenues. The variables we expect to influence cyclicality include countries’ degrees of financial openness, institutional quality, exchange rate flexibility, the presence of fiscal rules, and whether the country is under an IMF arrangement.

The outline of the paper is as follows. In the next section, we provide a review of previous studies focusing on the cyclicality of fiscal policies and discuss their theoretical aspects. In the third section, we look into different considerations of the measurement of shocks to oil and gas fiscal revenues which inform our econometric model specification. Our cyclicality models with no asymmetries are described and estimated in the fourth section. In the fifth section, we introduce the shock asymmetries and study the fiscal responses to different configurations of oil and gas revenue shocks. The sixth section concludes with a summary of our findings and their policy implications.
The literature on the procyclicality of fiscal policies in ED countries overall (including both commodity exporters and importers) has produced some consistent findings. First, unlike advanced countries, ED countries tend to be procyclical (Gavin and Perotti 1997; Talvi and Végh 2005; Ilzetzki and Vegh 2008). Second, their procyclicality is largely characterized by fiscal contractions in periods of recession (Gavin and Perotti 1997). Third, their current spending increases in booms, while capital spending is cut in busts (Ardanaz and Izquierdo 2021). Last, ED economies are becoming less procyclical (Frankel et al. 2013).

Some studies focus on a particular subgroup of ED commodity-exporting countries, but their conclusions do not differ significantly from those of the literature cited above. In general, they tend to be procyclical (Kaminsky 2010; Coutinho et al. 2021), and in periods of commodity price downturns they cut investments more than current expenditures (Arezki and Ismail 2013). Like ED economies in general, ED commodity-exporting countries were becoming less procyclical before the 2007-2008 financial crisis (Céspedes and Velasco 2014; Villafuerte and Lopez-Murphy 2010a). However, there are signs that procyclicality has resumed in the aftermath of the oil price downturn of 2013 (Richaud et al. 2019).

The empirical literature is less conclusive about the reasons for commodity-exporting ED economies being procyclical. Some studies have invoked the role of financial constraints: terms of trade improvements stimulate capital inflows to the economy, and governments seize the opportunity to improve financial conditions to increase spending (Kaminsky et al. 2004; Riascos and Vegh 2003). In times of negative term-of-trade shocks, capital outflows deteriorate the financial conditions and may eventually prompt abrupt fiscal contractions (Kaminsky 2010). However, financial constraints should, in principle, motivate precautionary savings in windfall periods in preparation for the expected deterioration of financial conditions when a shortfall occurs (Ilzetzki 2011). Moreover, investors should be able to price the risk and limit their own exposure and the exposure of the country to a deterioration in the terms of trade.

Other approaches that consider the causes of fiscal procyclicality are based on political economy explanations. Generally speaking, they relate to the resource curse literature initiated by Auty (1993) which links resource endowment to lower institutional quality. When institutions are weak, fiscal policy fails to shelter the economy from commodity revenue shocks. For Talvi and Végh (2005), fiscal procyclicality originates in the competition between various groups of interest who attempt to capture fiscal resources from a common pool, putting more pressure on the government to spend in times of budget surplus. They show that if a budget surplus creates pressure to increase spending, it is optimal for the government to run procyclical policies. This is particularly the case in countries with volatile tax bases. In the same vein, Arezki and Ismail (2013) introduce adjustment costs for current fiscal spending. They argue that cutting current spending has lower social acceptability than reducing investment expenditure, as it immediately impacts household revenues. Their study further illustrates how commodity revenue shocks are buffered by variations in investment spending. Alesina and Tabellini (2008) model the budget process as an imperfect contract between households that do not observe the stock of debt, and a government that trades off between

---

**Literature Review and Theoretical Arguments**

The empirical literature is less conclusive about the reasons for commodity-exporting ED economies being procyclical. Some studies have invoked the role of financial constraints: terms of trade improvements stimulate capital inflows to the economy, and governments seize the opportunity to improve financial conditions to increase spending (Kaminsky et al. 2004; Riascos and Vegh 2003). In times of negative term-of-trade shocks, capital outflows deteriorate the financial conditions and may eventually prompt abrupt fiscal contractions (Kaminsky 2010). However, financial constraints should, in principle, motivate precautionary savings in windfall periods in preparation for the expected deterioration of financial conditions when a shortfall occurs (Ilzetzki 2011). Moreover, investors should be able to price the risk and limit their own exposure and the exposure of the country to a deterioration in the terms of trade.

Other approaches that consider the causes of fiscal procyclicality are based on political economy explanations. Generally speaking, they relate to the resource curse literature initiated by Auty (1993) which links resource endowment to lower institutional quality. When institutions are weak, fiscal policy fails to shelter the economy from commodity revenue shocks. For Talvi and Végh (2005), fiscal procyclicality originates in the competition between various groups of interest who attempt to capture fiscal resources from a common pool, putting more pressure on the government to spend in times of budget surplus. They show that if a budget surplus creates pressure to increase spending, it is optimal for the government to run procyclical policies. This is particularly the case in countries with volatile tax bases. In the same vein, Arezki and Ismail (2013) introduce adjustment costs for current fiscal spending. They argue that cutting current spending has lower social acceptability than reducing investment expenditure, as it immediately impacts household revenues. Their study further illustrates how commodity revenue shocks are buffered by variations in investment spending. Alesina and Tabellini (2008) model the budget process as an imperfect contract between households that do not observe the stock of debt, and a government that trades off between
revenue predation and the need to stimulate the economy for reelection. For Ilzetzki (2011), greater polarization of opinion on where to spend public money, combined with larger chances of political alternation, tends to make policies more procyclical. He corroborates his models with simulations for the United States and Argentina, and finds patterns of procyclicality consistent with the levels of polarization and political alternation in both countries. For Céspedes and Velasco (2014), the fragmentation of the budget decision framework, with multiple stakeholders who maximize their particular objectives under a common budget constraint, leads to procyclical fiscal policies. The authors find empirically that political stability, the rule of law and institutional quality indicators contribute to reducing procyclicality in commodity-exporting countries.

Various empirical studies have attempted to identify institutional factors that influence procyclicality. Frankel et al. (2013) find that improved institutional quality has reduced procyclicality in developing economies. Arezki and Ismail (2013) show that fiscal rules tend to increase public investment procyclicality. While some studies conclude that fiscal rules reduce fiscal procyclicality (Céspedes and Velasco 2014; Richaud et al. 2019), others are inconclusive on this point (Bova et al. 2014; Coutinho et al. 2021). However, recent contributions stress that well-designed fiscal rules reduce the fiscal procyclicality of public investment (Guerguil et al. 2017; Ardanaz et al. 2021).
Here we present the details of the oil and gas fiscal revenue database we compiled for the purpose of this study. We also explain and motivate our definition of the cyclicality of fiscal policy to oil and gas revenue.

The Oil and Gas Fiscal Revenue Database

The studies that focus on the procyclicality of fiscal policies to commodity revenues, such as Céspedes and Velasco (2014), Richaud et al. (2019) or Arezki and Ismail (2013) have used commodity price indexes to proxy commodity-related fiscal revenues. Nevertheless, this approach has serious drawbacks. First, some countries may have more or fewer commodity exports as a proportion of their gross domestic product (GDP) or fiscal revenue than others. Thus, commodity prices poorly reflect the size of the fiscal revenue shocks. Second, commodity-exporting countries have very different production costs. Therefore, the tax base, which depends largely on revenue net of costs, does not have the same sensitivity to the changes in commodity prices. Third, commodity taxation and royalty schemes vary across countries, which implies non-linearities between oil and gas prices and fiscal revenues. Fourth, oil and gas production may vary significantly over time, which indeed influences fiscal revenues. In Chad, for example, oil production was close to zero but ramped up after the year 2000. Other countries, such as Timor-Leste have seen a decline in their production due to the exhaustion of their resources. At the same time, OPEC countries regularly adjust their production to manage oil price fluctuations. Fifth, oil and gas revenues mostly come from exports, whereas domestic energy prices are often administered and set at levels below international prices. Economic circumstances may affect domestic consumption, which in turn affects the quantity of oil available to be exported, and in fine, governments’ oil and gas fiscal revenues. In some cases, sanctions or geopolitical events may also affect production or exports, and decouple energy commodity revenues and energy commodity prices.

For the reasons outlined above, we choose to assess procyclicality using oil and gas fiscal revenues and not commodity price indexes. But this choice brings up a data issue, as oil and gas fiscal revenues are not systematically published by any organization. Therefore, we build a unique country-level oil and gas fiscal revenue database for the 30 countries that we classify as oil and gas exporters. The database compiles information drawn mostly from IMF country reports and country-level official statistical sources. Where data were unavailable from those sources, we have proxied the oil and gas revenue series or part of the series based on an assessment of the oil and gas tax basis that we compute using the IEA’s (2022b) oil and gas export data, oil and gas prices from the IMF’s (2022a) commodity data portal, and production costs obtained from various sources. The sources used for building fiscal revenue time series for each country are presented in Appendix A.
Behavioral Assumptions and the Definition of Cyclicality as the Response of Discretionary Expenditure to the Oil and Gas Revenue Gap

We consider that when governments plan their budgets, they adjust spending to target a given level of fiscal balance (that can be a surplus or a deficit) against a baseline that represents expectations for long-term oil and gas revenues.\(^6\) The baseline revenue is extrapolated from past years’ revenues. External shocks create gaps between the realized oil and gas revenue and the baseline. A positive gap corresponds to a windfall and a negative gap corresponds to a shortfall. The government then has to decide whether it adjusts its fiscal balance or its expenditure. We define cyclicality as the sensitivity of the discretionary part of government spending to oil and gas revenue windfalls or shortfalls, as measured by the gap between actual and baseline fiscal revenues. To isolate the gap component in the oil gas revenue series from the baseline level, we use the Hamilton (2018) filter. With this method, we obtain the unanticipated shocks on oil and gas fiscal revenues using the residuals of a linear regression of the series at time \(t + h\) on a constant, and on their four most recent values as of time \(t\), as suggested by Hamilton (2018).\(^6\) Statistical reasons why we prefer a Hamilton filter over a more traditional Hodrick-Prescott (HP) filter is that, first, for a nonstationary series, the HP filter may not accurately remove the trend (Hamilton 2018). Second, as pointed out by Jönsson (2020), the HP filter presents relatively higher recursive instability, i.e., the previously estimated trend and cyclical components change significantly as more data are added. The economic reason why we choose to employ the Hamilton filter is that it reflects our assumption that governments form their oil and gas revenue baseline based on past observations. The HP filter, on the other hand, uses both the past and future values of the series to decompose it into trend and cyclical components. Therefore, the HP filter takes into account information (e.g., unanticipated shocks) unavailable at the time the budget decisions were made.

We use data from the IMF’s World Economic Outlook (IMF 2022b), which provides governments’ total, capital and current consumption expenditures. For each of the three categories, we define the discretionary part of spending as the gap between actual spending and a trend based on previous years’ spending. Here, we also use the same Hamilton filter approach as described above for the oil and gas revenues series. This definition of discretionary spending is close to the one used by Attinasi and Klemm (2016), except that, instead of reflecting spending and inflation during the previous year only, our trend is based on the historical spending trajectory.
To analyze the cyclicality of the ED oil and gas exporters’ fiscal policy, we run panel data regressions over the period 2000-2019 for 30 ED oil and gas exporting countries. The regressions take into account observed and unobserved country-specific characteristics that can influence budget decisions.7 We estimate the following model:

\[ \Delta \text{EXP}_{it} = \alpha_{i} + \beta \Delta \text{RENT}_{it} + \gamma X_{it} + \lambda \Delta \text{RENT}_{it} \times X_{it} + \epsilon_{it}, \]  

where \( \Delta \text{EXP} \) is the variation in discretionary government expenditure, investment expenditure, or current consumption expenditure and \( \Delta \text{RENT} \) is the variation in the oil and gas revenue gap, all obtained using the Hamilton filter.8 The coefficient \( \beta \) estimates whether and to what extent changes in oil and gas revenues (either windfalls or shortfalls) lead to changes in discretionary expenditure. A positive (negative) \( \beta \) denotes procyclicality (countercyclicality).

Eq. (1) includes additional explanatory variables in a vector \( X_{it} \) that we also interact with \( \Delta \text{RENT} \). A positive (negative) coefficient \( \lambda \) means that variable \( X_{it} \) amplifies (reduces) procyclicality.

The first variable we have in \( X_{it} \) is financial openness \( (FO) \), represented by the index of Chinn and Ito (2006), which is a continuous variable that measures countries’ degrees of capital account openness. The more open the country is to cross-border capital flows, the higher its index values. A significative and positive coefficient associated with this index would mean that countries that are more open to international capital flows are more procyclical. As explained in Section 1, the financial constraint hypothesis states that capital inflows in times of boom and outflows in times of bust cause fiscal procyclicality. Therefore, if the financial constraint hypothesis holds, the countries that are most open to capital flows should be the most procyclical, and we should have a positive coefficient for the interaction term with the Chinn-Ito index.

To assess the role of political economy factors, we include the institutional quality (IQ) index as another explanatory variable. As in Céspedes and Velasco (2014) and Arezki and Brückner (2012), a negative value for the interaction term with this variable would mean that better institutions reduce procyclicality.

We also test the influence of fiscal rules \( (FRL) \) on the fiscal response to changes in oil revenue by including a dummy in our regressions equal to one if the country has a fiscal rule. This dummy is calculated using the fiscal rule database in Davoodi et al. (2022). The dataset covers four types of rules, namely budget balance rules, debt rules, expenditure rules, and revenue rules, which apply to the central or general government. These rules mainly aim to restrain overspending. We expect that the fiscal rule makes fiscal policy more neutral and, therefore, that the interaction term is negative.

Moreover, we include an indicator that measures the exchange rate flexibility \( (ERF) \) (Ilzetzki et al. 2021). A priori, the sign of the interaction term with the flexibility of the exchange rate regime should be positive. In the case of fixed exchange rates, fiscal policy has less influence on economic activity than monetary policy. Therefore, from a normative perspective, if the exchange rate is flexible, a government that aims to stabilize its economy is expected to make less use of countercyclical fiscal policies. Moreover, another effect of flexible exchange rates is that they transmit the oil and gas revenue shocks to domestic prices through imported goods prices. Negative shocks lead to exchange rate depreciation. If domestic prices increase, governments may respond to inflation.
with tighter monetary or fiscal policy. On the other hand, positive oil and gas revenue shocks lead to exchange rate appreciation, which curbs inflation, thus creating favorable conditions for expansionary macroeconomic policies. Hence, exchange rate flexibility may make the fiscal policy more procyclical.

Last, some countries may receive financial support during periods of oil and gas revenue downturns, and this may be reflected in their level of procyclicality. In order to capture this effect, we include a dummy variable \((\text{IMF})\) that equals one if a country has been under an IMF arrangement for at least five months in a given year (Dreher 2006).\(^9\) The money disbursed in turbulent times may buffer the revenue drop and help avoid fiscal contraction, making fiscal policies less procyclical. The advice given by the IMF may also influence the government, which will save more windfall commodity revenue. On the other hand, IMF disbursements may come with conditions such as deficit reductions that could prompt fiscal consolidation during oil and gas revenue shortfalls.

Table 1 presents the fixed effects estimation results of Eq. (1). Our estimates of the impacts

<table>
<thead>
<tr>
<th>(\Delta\text{RENT} \times \text{IMF})</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.676*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.332)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.755***</td>
<td>0.037***</td>
<td>0.391***</td>
<td>-4.246</td>
<td>-1.164</td>
<td>-4.281</td>
</tr>
<tr>
<td>(0.096)</td>
<td>(0.005)</td>
<td>(0.050)</td>
<td>(4.430)</td>
<td>(1.877)</td>
<td>(3.078)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>584</td>
<td>546</td>
<td>546</td>
<td>485</td>
<td>477</td>
<td>477</td>
</tr>
<tr>
<td>Number of countries</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>R²</td>
<td>0.333</td>
<td>0.247</td>
<td>0.326</td>
<td>0.536</td>
<td>0.304</td>
<td>0.492</td>
</tr>
</tbody>
</table>

Source: Authors.  
Notes: Robust standard errors are in parentheses. Coefficients of control variables are not reported for brevity.  
*, ** and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Fewer countries (27 instead of 30) are included in regressions (4) to (6) because of missing Chinn and Ito financial openness index values.
of variations in oil and gas revenues on public expenditure without control variables (columns 1 to 3) show that governments’ total, investment and current consumption expenditures are procyclical. The value of the coefficient we obtain for ΔRENT in the total expenditure regression is only very slightly below one, which means that there is almost a 100% pass-through of additional oil and gas revenue on total expenditure. In other words, government expenditure reflects almost entirely the variations in oil and gas revenues. The value close to one is somehow higher than in Villafuerte and Lopez-Murphy (2010a), who find a value closer to 0.5 during the 2004-2008 period, and up to 0.75 for low-income oil exporters. Note that the revenue and expenditure variables used in the regressions are expressed in monetary values. The lower coefficients of investment are due to a size effect: On average, over the sample, investment expenditure is smaller than total or current expenditure (see Table B.1).

When adding the interaction terms to the regression (columns 4 to 6 in Table 1), we capture some of the factors that influence cyclicality. First, greater financial openness leads to more procyclicality of total and consumption expenditures. This finding tends to validate the financial constraint hypothesis. However, financial openness does not influence the cyclicality of government investment, suggesting that the foreign exchange inflows serve to finance current, rather than investment expenditure. We also find in these regressions that greater institutional quality makes total and current expenditure less procyclical, which tends to validate the resource curse hypothesis and is consistent with Frankel, Vegh, and Vuletin (2013) and Céspedes and Velasco (2014). Moreover, our results show that fiscal rules make total and consumption expenditures less procyclical. However, the fiscal rules have no influence on investment expenditure, in line with the finding of Bova et al. (2014) and Coutinho et al. (2021). In addition, there is a sign that exchange rate flexibility increases the procyclicality of total and current expenditure. This finding is in line with Richaud et al. (2019), who obtained results where a flexible exchange rate increases the procyclicality of total expenditure. The exchange rate may exacerbate the procyclicality because it makes contracyclical policies less efficient (and, therefore, there is less ground for using countercyclical policies). Another reason may be that, with exchange rate flexibility, higher oil and gas revenues make the local currency appreciate, which reduces imported inflation. In low inflation conditions, fiscal expansion has a greater effect on activity and therefore becomes more appealing for policymakers.

We conclude this section by discussing potential endogeneity issues. We believe that there should be no reverse causality from government expenditures to oil and gas revenues. The reason for this is that revenues from oil and gas exports are mostly determined by other factors than public spending, such as international prices, world oil demand, or existing production capacity. However, we still cannot rule out the possibility of endogeneity as there might be a correlation between government expenditure and oil and gas revenues arising from an endogenous determination of oil and gas revenues. If there are omitted variables that impact government expenditure and oil and gas revenues simultaneously, the latter and the country-specific error terms will be correlated, which would lead to biased coefficient estimates.

To address any potential endogeneity problem, we apply the two-step system generalized method of moments (GMM) estimator (Blundell and Bond 1998). The results are given in Table 2 and are consistent with our estimates of fixed effects. We
find that when no control variables are included, government expenditure remains procyclical with a pass-through of additional oil revenue from total expenditure of close to 100%. When interaction terms are considered, as above, financial openness and exchange rate flexibility are associated with more procyclicality of total and consumption expenditures, whereas fiscal rules make those expenditures less procyclical. However, interacting institutional quality and IMF programs with oil and gas revenues yield non-significant coefficient estimates, which implies that the impacts of these two variables on procyclicality estimated with fixed effects are not robust.

Table 2. Cyclicality of government expenditure: GMM results.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tot</td>
<td>Inv</td>
<td>Cur</td>
<td>Tot</td>
<td>Inv</td>
<td>Cur</td>
</tr>
<tr>
<td>ΔEXPt-1</td>
<td>-0.322***</td>
<td>-0.257***</td>
<td>-0.392***</td>
<td>-0.413***</td>
<td>-0.023</td>
<td>-0.575***</td>
</tr>
<tr>
<td></td>
<td>(0.101)</td>
<td>(0.036)</td>
<td>(0.068)</td>
<td>(0.043)</td>
<td>(0.121)</td>
<td>(0.049)</td>
</tr>
<tr>
<td>ΔRENT</td>
<td>0.999**</td>
<td>0.175***</td>
<td>0.981***</td>
<td>-0.058</td>
<td>0.235</td>
<td>-0.431</td>
</tr>
<tr>
<td></td>
<td>(0.400)</td>
<td>(0.041)</td>
<td>(0.330)</td>
<td>(1.748)</td>
<td>(0.276)</td>
<td>(1.721)</td>
</tr>
<tr>
<td>ΔRENT × FO</td>
<td>1.310*</td>
<td>-0.045</td>
<td>0.979**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.733)</td>
<td>(0.133)</td>
<td>(0.475)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔRENT × IQ</td>
<td>-0.619</td>
<td>0.096</td>
<td>-0.447</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.734)</td>
<td>(0.479)</td>
<td>(1.912)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔRENT × FRL</td>
<td>-2.938***</td>
<td>-0.146</td>
<td>-1.984***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.607)</td>
<td>(0.225)</td>
<td>(0.612)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔRENT × ERF</td>
<td>0.836***</td>
<td>0.046</td>
<td>0.742***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.179)</td>
<td>(0.074)</td>
<td>(0.187)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔRENT × IMF</td>
<td>9.278</td>
<td>1.161</td>
<td>5.748</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7.8)</td>
<td>(1.444)</td>
<td>(4.319)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.66</td>
<td>0.035</td>
<td>0.407</td>
<td>9.419</td>
<td>1.846</td>
<td>10.53</td>
</tr>
<tr>
<td></td>
<td>(0.46)</td>
<td>(0.02)</td>
<td>(0.24)</td>
<td>(16.17)</td>
<td>(4.14)</td>
<td>(9.37)</td>
</tr>
<tr>
<td>Observations</td>
<td>554</td>
<td>516</td>
<td>516</td>
<td>460</td>
<td>452</td>
<td>452</td>
</tr>
<tr>
<td>Number of countries</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Hansen</td>
<td>0.239</td>
<td>0.125</td>
<td>0.351</td>
<td>0.162</td>
<td>0.360</td>
<td>0.279</td>
</tr>
<tr>
<td>AR (2)</td>
<td>0.227</td>
<td>0.026</td>
<td>0.199</td>
<td>0.131</td>
<td>0.129</td>
<td>0.109</td>
</tr>
</tbody>
</table>

Source: Authors.
Notes: Heteroscedasticity-consistent standard errors are in parentheses. Windmeijers’s (2005) finite sample correction for standard errors is used. Year dummies are included as instruments in the regressions. Coefficients on control variables are not reported for brevity. p-values are reported for the Hansen over-identification test and the Arellano-Bond test for second-order serial correlation in the errors. *, ** and *** indicate significance at the 10%, 5%, and 1% levels, respectively.
In this section, we introduce various configurations of oil and gas revenue shocks. We investigate asymmetric responses of fiscal policies and explore how they are influenced by the covariates introduced in the previous section.

**Variation and Position of Oil and Gas Revenues: The Good, the Bad and the Ugly Times**

In the face of commodity revenue fluctuations, we consider that the way governments decide to adjust their fiscal response depends on two dimensions that define their assessment of the situation. First, the fiscal response may depend on the variation in fiscal oil and gas revenues, i.e., on whether the revenues improve or deteriorate. While increases in commodity revenues may have clear positive effects on government expenditure, declines in those revenues may not have the opposite proportional effect. Governments are usually reluctant to implement austerity measures, especially when they require reductions in current consumption spending. Therefore, one would expect that fiscal responses are less procyclical in the case of negative fiscal revenue shocks than in the case of positive revenue shocks.

Our second testable hypothesis here is that governments’ fiscal policy reactions in the face of a revenue shock may differ depending on whether the shock comes during a period above or below the long-run baseline oil and gas revenue. The hypothesis is tested using specification (2b) where \( \Delta R\text{ENT}_h \) is the variation in commodity revenues while they are higher than the baseline (high revenue regime). Similarly, \( \Delta R\text{ENT}_l \) stands for the variations in revenues while they are lower than the baseline, i.e., there is a gap between the long-term trend and actual revenues (low revenue regime). If fiscal responses are asymmetrical with respect to the position, then we should have \( \delta_1 \neq \delta_2 \). Although it is very relevant to fiscal decision-making in oil- and gas-exporting economies, to our knowledge, there is no study that takes this type of asymmetry into account when dealing with the cyclicality.

\[
\Delta \text{EXP}_{it} = \alpha_{2i} + \mu_1 \Delta^+ \text{RENT}_{it} + \mu_2 \Delta^- \text{RENT}_{it} + \epsilon_{it}, \tag{2a}
\]

\[
\Delta \text{EXP}_{it} = \alpha_{2i} + \delta_1 \text{RENT}_{hi,t} + \delta_2 \text{RENT}_{hl,t} + \epsilon_{it}, \tag{2b}
\]

\[
\Delta \text{EXP}_{it} = \alpha_{2i} + \theta_1 \Delta^+ \text{RENT}_{hi,t} + \theta_2 \Delta^- \text{RENT}_{hi,t} + \theta_3 \Delta^+ \text{RENT}_{li,t} + \theta_4 \Delta^- \text{RENT}_{li,t} + \epsilon_{it}. \tag{2c}
\]
of commodity prices. All the studies that have investigated asymmetric fiscal responses only consider oil price variations (Arezki and Brückner 2012; Arezki and Ismail 2013; Céspedes and Velasco 2014).

We consider a third type of asymmetry: one that combines the variation and the position of fiscal oil and gas revenues. As mentioned above, variation indicates that the fiscal oil and gas revenues either improve or deteriorate, whereas position represents whether the revenues are higher or lower than what is perceived as their baseline level. Figure 1 illustrates the four possible combinations of position and variation. The two extreme situations are dubbed good times, when the revenues are high and improve, and bad times when they are low and deteriorate. Between those two situations, ugly times present a conflicting picture of the government’s oil and gas revenues. To further illustrate the above point, we plot the trend and the cyclical component of Saudi Arabia’s oil and gas fiscal revenues in in Appendix C, Figure C.1, in which we identify the periods of good, bad, and ugly times.

To test the hypothesis that governments respond differently to an increase or decrease in revenues, depending on whether they are navigating good, bad, or ugly times, we use the specification (2c), which allows for testing several asymmetry hypotheses. For example, the asymmetric fiscal responses during good times and ugly times can be tested by $q_1 \neq q_2$. Similarly, if $q_3 \neq q_4$, the fiscal responses are asymmetrical between bad times and ugly times.

**Figure 1.** The 4 possible configurations of oil and gas fiscal revenues.

---

Source: Authors.
Notes: $\Delta^+$ and $\Delta^-$ stand for positive and negative variations in oil and gas revenues (RENT) during high (H) or low (L) oil and gas revenues regimes, respectively.
Results of the Models With Asymmetries

Table 3 presents the results from the fixed effect estimates of eqs. (2a–c). All the significant coefficients are positive, denoting procyclical expenditures, in line with the conclusions of tables 1 and 2. However, as can be seen from the Wald test results, symmetrical relationships are rejected in five out of the nine models estimated. Except for investment expenditure, governments’ fiscal policy responses differ depending on their oil and gas revenues’ position and variation, as described above.

The results from our estimations regarding the role of variation (columns 1 to 3) show that asymmetry exists for consumption expenditure, which adjusts slightly more in times of revenue improvement than when oil and gas revenues deteriorate (the Wald test is significant in column 3). However, there is no evidence of asymmetry for investment expenditure (the Wald test is not significant in column 2). In other words, government investment does not respond differently to deteriorations or improvements in oil and gas fiscal revenues. In this respect, the results do not confirm Arezki and Ismail (2013), who find that current expenditure is sticky to the downside and that reduced oil and gas revenues mostly impact investment.

The results of Table 3 also show that position asymmetry is more pronounced than variation asymmetry. In low oil and gas revenue regimes, the pass-through of oil and gas fiscal revenue to total and current expenditure is about three times higher than during high revenue regimes (see columns 4 and 6). However, investment expenditure does not present any position asymmetry (column 5).

A further look at the results of asymmetries within the low and high revenue regimes (columns 7 to 9) gives more insights. A negative shock in a low revenue regime leads to a procyclical fiscal response with a decrease in expenditure (the coefficients of $\Delta REN_L$ are positive). In a low oil revenue environment, the fiscal balance will tend to be in a bad position, leaving less room to buffer further price drops. In such a scenario, most of the fiscal adjustment has to be done through spending cuts.

During a high oil and gas revenue regime, governments tend to maintain a neutral fiscal stance in ugly times, as we see that $\Delta REN_H$ is not correlated with any of the expenditure types. In other words, during ugly times with high revenue regimes, governments do not reduce expenditure even if they identify an oil and gas revenue setback. Various possible reasons can explain this optimistic behavior. First, the period of high revenue may have helped build a fiscal buffer (reserves) sufficient to absorb possible price downturns. Second, governments may consider that negative revenue shocks are transitory, and therefore they do not require a shift in public expenditure.

The results also show that when revenue improves, governments are procyclical in both the low and the high revenue regimes. However, the expenditure increase is less pronounced in good times than in ugly times (in columns 7 and 9 of Table 3, the coefficient of $\Delta REN_H$ is much lower than $\Delta REN_L$). There are possible reasons for why $\Delta REN_H$ is relatively low. First, windfall commodity revenues tend to correspond to periods of higher levels of spending. In such circumstances, there is less pressure on governments to increase expenditure. Moreover, with high spending, there is limited institutional capability to direct the new revenue toward new expenditure. At the same time, a possible reason why $\Delta REN_L$ is relatively high is that a low revenue environment often corresponds
to a low level of expenditure. In this environment, the pressure to increase expenditure is high. Therefore, once the commodity revenue outlook improves, governments may be tempted to make up for the reduction in expenditure and decide to spend more.

Models With Asymmetries and Covariates

We now extend the model with asymmetries of Eq. (2c) to assess how, in each particular configuration of the variation and position of oil and gas revenues...
(as presented in Figure 1), covariates studied in the fourth section influence fiscal cyclicality. We estimate the following model:

\[
\Delta \text{EXP}_{i,t} = \alpha_{i} + \theta_{1}\Delta \text{RENT}_{i,t} + \theta_{2}\Delta \text{RENT}_{i,t} + \theta_{3}\Delta \text{RENT}_{i,t} + \theta_{4}\Delta \text{RENT}_{i,t} + \theta_{5}\Delta \text{RENT}_{i,t} + \theta_{6}\Delta \text{RENT}_{i,t} + \gamma X_{i,t} + (\lambda_{1}\Delta \text{RENT}_{i,t} + \lambda_{2}\Delta \text{RENT}_{i,t}) \times X_{i,t} + \epsilon_{i,t},
\]

where \(X_{i,t}\) is the vector of covariates of Eq. (1).

The results presented in Table 4 show that during low revenue regimes, higher financial openness leads to more procyclicality of current and total expenditure (the coefficients of \(\Delta \text{RENT}_{i,t} \times \text{FO}\) and \(\Delta \text{RENT}_{i,t} \times \text{FO}\) in columns 1 and 3 are positive). In other words, the financial constraints hypothesis validated in the fourth section (see Tables 1 and 2) holds only when countries are in a low revenue regime. This suggests that financial openness does not create spending booms in periods of high revenue. Likewise, in high revenue regimes, financial openness does not lead to more contraction of spending in the case of falling revenues. A possible explanation for this, as oil and gas revenues are initially higher than their baseline, financial conditions may not be sensitive to revenue shocks.

The effect of financial openness is different for investment than for current and total expenditure. First, more financial integration leads to more investment during good times (the coefficient of \(\Delta \text{RENT}_{i,t} \times \text{FO}\) in column 2 is positive), supporting the idea that capital inflows exaggerate investment booms. However, in bad times, financial openness seems to limit the drop in investments, as the negative coefficients of \(\Delta \text{RENT}_{i,t} \times \text{FO}\) in column 2 suggest.

Institutional quality makes expenditure either procyclical or countercyclical depending on the configuration of oil and gas revenue in terms of position and variation. Institutional quality makes current expenditure more procyclical in ugly times during high revenue regimes (the coefficients \(\Delta \text{RENT}_{i,t} \times \text{IQ}\) are positive in columns 1 and 3). It means that higher institutional quality makes governments more prone to reducing expenditure when a commodity cycle downturn is on the horizon. On the other hand, during low revenue regimes, institutional quality limits the expansionary response of total and current expenditure to improvements in fiscal revenue (the coefficients of \(\Delta \text{RENT}_{i,t} \times \text{FO}\) in columns 1 and 3). All in all, when the revenue outlook is mixed (ugly times), institutional quality moderates governments’ tendency to increase spending.

Fiscal rules appear to reduce the procyclicality of total and current expenditure during good times (the coefficients \(\Delta \text{RENT}_{i,t} \times \text{FRL}\) in columns 1 and 3 are negative and significant). This indicates that fiscal rules eventually serve their main purpose of moderating expenditure during booms. However, the results also show that in ugly times during low but improving oil and gas revenues (bottom right of Figure 1) fiscal rules increase total and current expenditure procyclicality (the coefficient of \(\Delta \text{RENT}_{i,t} \times \text{FRL}\) in columns 1 and 3 are positive). This may reflect the influence of rules that limit budget deficits. With such rules, an increase in oil and gas fiscal revenue makes room for higher spending, and governments use this opportunity to stimulate the economy when they are passing through low revenue regimes. Table 4 also shows that fiscal rules reduce procyclicality during bad times (the coefficients of \(\Delta \text{RENT}_{i,t} \times \text{FRL}\) are all negative and significant). This finding suggests that fiscal rules help governments spend to avoid contractions during the most difficult economic situations.

Table 4 also shows that the positive relationship between exchange rate flexibility and procyclicality
Models with Asymmetries in Fiscal Responses

shown in Table 1 is validated during three of the four configurations (the coefficients of $\Delta RENT_t \times ERF$, $\Delta RENT_t \times ERF$ and $\Delta RENT_t \times ERF$ in columns 1 and 3 are positive). The only configuration in which this relationship is not validated is *good times*, where more exchange rate flexibility is associated with less procyclicality (the coefficients of $\Delta RENT_t \times ERF$ are significant and negative in columns 1 and 3). Therefore, during *good times*, exchange rate flexibility seems to play a stabilizing role (like fiscal rules do).

Table 4. Controlling for structural and economic conditions.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta EXP$</td>
<td>Tot</td>
<td>Inv</td>
<td>Cur</td>
</tr>
<tr>
<td>$\Delta RENT_t$</td>
<td>1.582***</td>
<td>0.008</td>
<td>1.764***</td>
</tr>
<tr>
<td></td>
<td>(0.35)</td>
<td>(0.07)</td>
<td>(0.41)</td>
</tr>
<tr>
<td>$\Delta RENT_t$</td>
<td>-1.730***</td>
<td>0.381*</td>
<td>-2.434***</td>
</tr>
<tr>
<td></td>
<td>(0.36)</td>
<td>(0.19)</td>
<td>(0.5)</td>
</tr>
<tr>
<td>$\Delta RENT_t$</td>
<td>-0.025</td>
<td>0.339***</td>
<td>-0.034</td>
</tr>
<tr>
<td></td>
<td>(0.30)</td>
<td>(0.10)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times FO$</td>
<td>0.254</td>
<td>0.111***</td>
<td>0.082</td>
</tr>
<tr>
<td></td>
<td>(0.16)</td>
<td>(0.03)</td>
<td>(0.17)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times FO$</td>
<td>0.622**</td>
<td>-0.069</td>
<td>0.689***</td>
</tr>
<tr>
<td></td>
<td>(0.24)</td>
<td>(0.07)</td>
<td>(0.19)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times FO$</td>
<td>0.699*</td>
<td>-0.069*</td>
<td>0.717*</td>
</tr>
<tr>
<td></td>
<td>(0.39)</td>
<td>(0.04)</td>
<td>(0.38)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times IQ$</td>
<td>1.951**</td>
<td>-0.583</td>
<td>1.611**</td>
</tr>
<tr>
<td></td>
<td>(0.90)</td>
<td>(0.53)</td>
<td>(0.78)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times IQ$</td>
<td>-2.037***</td>
<td>-0.108</td>
<td>-1.81***</td>
</tr>
<tr>
<td></td>
<td>(0.65)</td>
<td>(0.15)</td>
<td>(0.56)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times FRL$</td>
<td>-1.080***</td>
<td>-0.023</td>
<td>-1.007***</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.05)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times FRL$</td>
<td>1.692***</td>
<td>-0.131</td>
<td>2.005***</td>
</tr>
<tr>
<td></td>
<td>(0.32)</td>
<td>(0.15)</td>
<td>(0.59)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times FRL$</td>
<td>-0.773**</td>
<td>-0.186*</td>
<td>-0.872**</td>
</tr>
<tr>
<td></td>
<td>(0.33)</td>
<td>(0.10)</td>
<td>(0.33)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times ERF$</td>
<td>-0.414**</td>
<td>-0.000</td>
<td>-0.516**</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td>(0.02)</td>
<td>(0.21)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times ERF$</td>
<td>0.890**</td>
<td>-0.340</td>
<td>0.675**</td>
</tr>
<tr>
<td></td>
<td>(0.35)</td>
<td>(0.25)</td>
<td>(0.30)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times ERF$</td>
<td>0.222**</td>
<td>-0.026</td>
<td>0.279***</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.03)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times ERF$</td>
<td>0.295***</td>
<td>0.006</td>
<td>0.305***</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.03)</td>
<td>(0.08)</td>
</tr>
<tr>
<td>$\Delta RENT_t \times IMF$</td>
<td>0.615*</td>
<td>0.099</td>
<td>0.187</td>
</tr>
<tr>
<td></td>
<td>(0.34)</td>
<td>(0.11)</td>
<td>(0.37)</td>
</tr>
</tbody>
</table>
Models with Asymmetries in Fiscal Responses

The IMF programs are found to be countercyclical in ugly times during low revenue regimes (the coefficients of $\Delta RENT_i \times IMF$ in columns 1 and 2 are negative and significant) and procyclical during bad times (the coefficients of $\Delta RENT_i \times IMF$ are positive and significant). This result suggests that, during low revenue regimes, the IMF programs mostly target tightening governments’ budget constraints, which leads to a contraction in spending regardless of the improvement or degradation in oil and gas fiscal revenues.

<table>
<thead>
<tr>
<th>$\Delta RENT_i \times IMF$</th>
<th>-0.743</th>
<th>1.667**</th>
<th>-1.123</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1.28)</td>
<td>(0.77)</td>
<td>(0.95)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Delta RENT_i \times IMF$</th>
<th>-4.228*</th>
<th>-1.631*</th>
<th>-2.178</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2.20)</td>
<td>(0.89)</td>
<td>(1.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Delta RENT_i \times IMF$</th>
<th>4.135***</th>
<th>0.487**</th>
<th>3.774***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1.28)</td>
<td>(0.19)</td>
<td>(1.09)</td>
</tr>
</tbody>
</table>

Observations: 485 477 477
Number of countries: 27 27 27
$R^2$: 0.69 0.39 0.68

Source: Authors.
Notes: Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The table shows results only for the coefficients that are significant. The full table, with all the coefficient estimates, is available on request.
Conclusion and Policy Implications

This paper investigated the cyclical behavior of fiscal policy in emerging and developing oil- and gas-exporting countries. For this purpose, we built a unique oil and gas fiscal revenue database for 30 countries. We used panel data models to examine the response of governments’ discretionary expenditure to oil and gas revenue windfalls or shortfalls. Our preliminary analysis showed that fiscal policy is procyclical in oil- and gas-exporting countries with an almost 100% pass-through of additional oil and gas revenues to governments’ total expenditure. We found that financial openness increases procyclicality. The results also stressed that fiscal rules and higher-quality institutions reduce procyclicality.

We then hypothesized that governments’ responses to revenue shocks may be asymmetrical. More specifically, we argued that governments would tend to have differentiated fiscal policy responses depending on both the variation (whether the revenue shock is negative or positive) and the position (whether the revenues are higher or lower than what is perceived as the baseline level when the shock occurs). The results indicate that the position has a greater influence on cyclicity than the variation. The pass-through to expenditure is the same whether the variation in revenue is positive or negative. But for the position, we saw that the pass-through is three times higher when the revenues are below the baseline than when they are above.

In a framework that combines variation and position, we found that there are significant asymmetries in fiscal responses. We showed that in high revenue regimes, governments usually opt for an optimistic view and do not reduce their expenditure, even if they identify an oil and gas revenue setback. In low revenue regimes, they tend to increase spending dramatically in response to an improvement in revenues.

Results further suggest that, during good times, financial openness tends to increase investment, but not current expenditure, booms. However, it also contributes to limiting the investment drop during bad times. We also found that when the revenue outlook is mixed (ugly times), institutional quality is associated with less optimistic fiscal policy, with governments moderating their spending. The exchange rate flexibility was generally found to generate more fiscal procyclicality, except during good times. Last, the results showed that, during good times, fiscal rules reduce procyclicality.

Several policy implications can be drawn from these findings. First, the priority for governments should be to avoid procyclicality in the worst scenario (i.e., bad times). In such turbulent times financial openness and IMF programs, instead of helping smooth fiscal policies, accentuate the procyclicality. Therefore, countries need to rely on their own financial reserves in bad times. Limiting procyclicality in good times would be the optimal solution. Our results show that fiscal rules can support such a policy.

Expenditure may be adjusted quickly in ugly times when revenue is high but a downturn is on the horizon. Although this type of response would increase procyclicality, it would help build up the government’s reserves. Given that the contraction would happen during a period of relatively high expenditure, the effect on households would be limited. A way to introduce such a mechanism would be to make the baseline oil and gas revenue projections more downward flexible during high revenue regimes.

In addition, in ugly times when revenue is low but improving, procyclicality needs to be reduced. In order to avoid premature hikes in expenditure at the first sign of an improvement in the oil and gas revenue outlook, the upward adjustment of baseline scenarios should be limited.
Last, but not least, higher oil and gas revenues followed by an increase in energy prices can bring about an expansion in domestic credit creation and trigger large capital inflows. As the IMF (2022) notes, rapid growth in capital inflows can be particularly challenging if not invested in the right direction, as demonstrated by the Latin American debt crises during the 1980s. Given the findings of this study, during good times, policymakers need to prioritize investments that drive economic diversification and long-term economic growth.
In this paper, in accordance with World Bank (2018), we label “commodity-exporting countries” those whose shares of crude oil and natural gas represent at least 20% of their total exports. Details of this classification are given later.

Similar terminologies are utilized in the relevant literature with distinct meanings. Terms throughout this paper in italics refer to the cases specified in our analysis.

Villafuerte and Lopez-Murphy (2010b) have used oil and gas fiscal revenue data, but they have covered a very short time period (2004-2009) and do not disclose their fiscal revenue sources. Moreover, their conclusions are based on descriptive statistics only with no inferential analysis.

In line with The World Bank (2018), a country is classified as an oil and gas exporter if, between 2012 and 2014, exports of crude oil and natural gas accounted for at least 20% of its total exports. The 30 countries that satisfy this condition and are included in the analysis are Algeria, Angola, Azerbaijan, Bahrain, Bolivia, Brunei Darussalam, Cameroon, Chad, Colombia, Ecuador, Equatorial Guinea, Gabon, Ghana, Iran, Iraq, Kazakhstan, Kuwait, Malaysia, Myanmar, Nigeria, Oman, Qatar, the Republic of Congo, Russia, Saudi Arabia, Sudan, Timor-Leste, Trinidad and Tobago, Turkmenistan, and the United Arab Emirates.

For the purposes of this study, we do not consider governments’ non-oil and gas revenues.

Given the yearly frequency and length of our data, we use $h = 2$.

Descriptive statistics of the variables we use are given in Table B.1 in Appendix B.

To increase the accuracy of the Hamilton filter, we use data starting from 1990 although there is a large number of missing data prior to 2000.

The IMF programs include stand-by arrangements, an extended funds facility, and a structural adjustment facility or poverty reduction and growth facility.

To check the stationarity of the variables, we apply the Im, Pesaran, and Shin (2003) panel unit root test. As our panel is unbalanced, critical values cannot be calculated for some variables. For others, the (unreported) results indicate that they are stationary.

Note that outcomes from the investment models should be considered with caution, as the estimates of the investment equation in column (2) fail to reject the second order serial correlation (AR[2]) hypothesis.

However, in periods of revenue shortfall, governments may also be less prone to using fiscal policies since, in emerging economies, the fiscal multipliers tend to be low or even negative than during busts (Gomes et al. 2022).

The approach closest to ours is proposed by Ardanaz and Izquierdo (2021), Guerguil et al. (2017) and Afonso and Jalles (2020), who specify asymmetry in terms of position (positive or negative output gap). However, they study the cyclicity of fiscal responses to GDP, not to fiscal oil and gas revenues.
References


———. 2022b. “Oil Information.”


International Monetary Fund (IMF). 2022a. “IMF Primary Commodity Prices Database.”

———. 2022b. “World Economic Outlook Database.”


Appendix A. Sources Used to Construct the Oil and Gas Fiscal Revenue Time Series

The time series of oil and gas fiscal revenues are based on a very large number of country reports. Instead of putting all the country reports in references, we detail in the list below how they were utilized to build yearly country times series of the oil and gas fiscal revenues used in this paper. We also indicate, where needed, the national sources used, and the missing points extrapolated using oil and gas price and export data.

Many IMF country reports have been used to build the oil and gas fiscal revenue series. In our notations, Art. IV refers to the IMF Article IV report, whereas CR refers to any IMF Country Report other than Article IV.

In the below list, we indicate the date of publication after the type of report or data source. Then, we put in brackets the year(s) for which the oil and gas revenue information is contained in the report or the data sources that are utilized to construct the time series. For instance, for any given country, IMF CR 1998 [1993-1996] means that the IMF country report published in 1998 is the data source for the oil and gas revenues of the years from 1993 to 1996.


**Bahrain**: Ministry of Finance and National Economy of Bahrain (2022) [2009-2020]; Extrapolation from IEA (2022b) oil exports and IMF (2022a) prices [1990-2008].


Appendix A. Sources Used to Construct the Oil and Gas Fiscal Revenue Time Series


Appendix A. Sources Used to Construct the Oil and Gas Fiscal Revenue Time Series


Saudi Arabia: SAMA (2022) [1993-2020].


### Appendix B

#### Table B.1. Descriptive statistics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXP\textsubscript{Tot}</td>
<td>44.80</td>
<td>95.71</td>
<td>0.226</td>
<td>793</td>
</tr>
<tr>
<td>EXP\textsubscript{Inv}</td>
<td>10.06</td>
<td>17.43</td>
<td>0.010</td>
<td>119.3</td>
</tr>
<tr>
<td>EXP\textsubscript{Cur}</td>
<td>34.12</td>
<td>79.79</td>
<td>0.057</td>
<td>699.1</td>
</tr>
<tr>
<td>Rent</td>
<td>19.15</td>
<td>32.60</td>
<td>0.00</td>
<td>207.7</td>
</tr>
<tr>
<td>FO</td>
<td>0.32</td>
<td>1.59</td>
<td>-1.92</td>
<td>2.32</td>
</tr>
<tr>
<td>IQ</td>
<td>-0.57</td>
<td>0.66</td>
<td>-1.89</td>
<td>0.74</td>
</tr>
<tr>
<td>FRL</td>
<td>0.88</td>
<td>0.32</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>ERF</td>
<td>1.79</td>
<td>1.23</td>
<td>1.00</td>
<td>6.00</td>
</tr>
<tr>
<td>IMF</td>
<td>0.18</td>
<td>0.38</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Source: Authors.

Notes: EXP\textsubscript{Tot} = total expenditure; EXP\textsubscript{Inv} = investment expenditure; EXP\textsubscript{Cur} = current expenditure; std. dev. = standard deviation.
Appendix C

Figure C.1 shows that throughout the period from 2006 to 2014, the Saudi government’s revenues were above their long-term trend with increasing (good times) or decreasing (ugly times) revenues. Government revenues then declined sharply due to oil prices dropping by 72% from $112 per barrel in June 2014 to $32 per barrel in January 2016 (nominal Brent crude oil prices obtained from the IMF [2022a] Primary Commodity Prices Database). The following years are mostly characterized by bad times.

Figure C.1. Asymmetries of variation and position: illustration using Saudi Arabia.

Source: Authors.
Notes: Oil and gas revenues are in millions of US$. In Panel (A), the trend (predicted values of oil and gas revenues) is depicted in red. The blue line depicts the sum of the trend and cyclical component (i.e., the predicted values) of the oil and gas revenues. If the latter is above (below) the former, the cyclical component is positive (negative), indicating a good (bad) time. This relation is further illustrated in Panel (B) where the difference between the predicted values of revenues and the trend is shown in a straight line (position), whereas variation in the cyclical component of revenues is given by a dashed line (variation).
About the Authors

Olivier Durand-Lasserve

Olivier is a fellow at KAPSARC. Previously, he was an economist at the OECD and at the International Energy Agency (IEA) in Paris, where his activities covered macroeconomic policy analysis and applied general equilibrium modeling. He contributed to various modeling studies on the assessment of the macroeconomic, environmental and distributional consequences of energy and environmental policies. He also worked on the land-water-energy nexus and the economic consequences of air pollution. Before he joined the OECD, Olivier worked at ENGIE, in Paris, where he developed an in-house modeling framework for quantifying global long-term energy-economy scenarios. While completing his Ph.D., he was a research assistant at the Center for Operations Research and Econometrics (CORE) in Louvain-la-Neuve, Belgium.

Fatih Karanfil

Fatih has been a fellow at KAPSARC since December 2017. Before joining KAPSARC, he was a research fellow at EconomiX-CNRS and an associate professor of economics at the University of Paris Nanterre. He received his Ph.D. in economics from the University of Paris 1 Panthéon-Sorbonne in 2008. Fatih’s current work mainly focuses on developing economic frameworks to provide insights into energy policymaking in oil-producing countries, particularly Saudi Arabia. His research has been published in general interest economics journals, as well as leading journals in energy economics.
About the Project

This study is part of the ongoing project, Revisiting Fiscal Breakeven Oil Prices. The project aims to provide a better understanding of how oil-exporting countries adjust their fiscal policies in response to variations in oil prices, and what the short-term and possible long-term consequences are for economic growth.