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Macroeconomic Stability in Resource-Rich Countries: The Role of Fiscal Policy

by Elva Bova, Paulo Medas, and Tigran Poghosyan

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Resource Revenue Volatility and Macroeconomic Stability in Resource-Rich Countries: The Role of Fiscal Policy[1]

Prepared by Elva Bova, Paulo Medas, and Tigran Poghosyan

Authorized for distribution by Bernardin Akitoby

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Abstract

Resource-rich countries face large and persistent shocks, especially coming from volatile commodity prices. Given the severity of the shocks, it would be expected that these countries adopt countercyclical fiscal policies to help shield the domestic economy. Taking advantage of a new dataset covering 48 non-renewable commodity exporters for the period 1970-2014, we investigate whether fiscal policy does indeed play a stabilizing role. Our analysis shows that fiscal policy tends to have a procyclical bias (mainly via expenditures) and, contrary to others, we do not find evidence that this bias has declined in recent years. Adoption of fiscal rules does not seem to reduce procyclicality in a significant way, but the quality of political institutions does matter. Finally, non-commodity revenues tend to respond only to persistent changes in commodity prices.

JEL Classification Numbers: O13, H30, C33

Keywords: commodity prices, resource-rich countries, procyclical fiscal policy

Author's E-Mail Address: Elvabova@gmail.com, Pmedas@imf.org, Tpoghosyan@imf.org.

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I. INTRODUCTION

The recent dramatic turnaround in energy prices once again shifted the attention of policymakers to commodity price shocks and their impact on macroeconomic stability in resource-rich countries. Movements in commodity prices affect these economies directly through the external trade balance (commodity exports) and the public sector budget (governments receive a large share of commodity sector revenues). There are also indirect channels, such as changes in borrowing conditions, asset prices, and investment. Given the high dependence on budgetary commodity revenues and exports, the large price fluctuations imply these countries are exposed to large external risks.

A key policy objective for resource-rich countries is to shield the economy from the high volatility of commodity prices. The traditional advice is for countries to develop stabilizing (countercyclical) fiscal policies towards helping smooth the business cycle (IMF 2015b). This is a more complex and critical challenge for non-renewable resource-rich economies. A central issue is that the economic cycle tends to be closely linked to unpredictable fluctuations in commodity prices. These can be very large and persistent and lead to disruptive large swings in the domestic economic activity, exacerbated (as has been seen in the past) by large increases in public expenditures during commodity booms and large fiscal contractions once prices fall. Furthermore, if fiscal policy is heavily procyclical during upswings—that is, governments spend a large (or all) share of temporary commodity revenue windfalls—this will have an impact on fiscal sustainability as these are exhaustible resources.

This paper aims to assess whether fiscal policy has helped manage high volatility of commodity prices. We contribute to the literature by: (i) using a new dataset starting from 1970; (ii) assessing the importance of fiscal channel in the transmission of commodity price shocks; and (iii) applying a comprehensive set of indicators to study fiscal cyclicality in resource-rich countries, which also encompass the cyclicality of non-commodity revenue.

Our results show that fiscal policy in resource-rich countries has been procyclical during the last decades. We also find no evidence of reduced procyclicality during the latest resource windfall, contrary to other studies (see below). Regression analysis also suggests that the adoption of fiscal rules does not have, on its own, a significant impact on reducing procyclicality, unless supported by strong political institutions. Through the examination of the impact of commodity prices on non-commodity revenues, we find that the revenue mobilization efforts decline with rising commodity prices. Non-commodity revenues adjust only in response to persistent changes in commodity revenues as this adjustment tends to be sluggish.

The remainder of the paper is structured as follows. Section II reviews the related literature. Section III describes the dataset. Section IV assesses the direct impact of commodity price fluctuations on the economy. Section V presents evidence on fiscal cyclicality and on the role of fiscal rules and institutions. Section VI analyzes the response of non-commodity revenues to commodity revenue shocks. The final section concludes.

II. Related Literature

A growing empirical literature analyzes fiscal policy responses to output fluctuations in advanced and emerging economies. Several approaches have been taken to assess fiscal cyclicality. For instance, the Fiscal Monitor (IMF 2015b) looks at the overall fiscal balance to GDP ratio and interprets the response to output fluctuations as a measure of fiscal stabilization (the sum of automatic stabilizers and discretionary fiscal policy). Similar measures have been used by Gavin and Perotti (1997) and Alesina and others (2008). Other studies have used the cyclically adjusted fiscal balance to GDP ratios and interpreted the response to output fluctuations as discretionary fiscal policy reaction to economic shocks (e.g., Gali and Perotti, 2003). Some have focused on cyclically adjusted government spending as a measure of discretionary government spending, taking into account that automatic stabilizers mostly work on the revenue side (Kaminsky and others, 2004; Frankel and others, 2013). The most popular measure of output fluctuations is the output gap (e.g., Kaminsky and others, 2004). However, given the difficulty in measuring potential output, some studies have also used real GDP growth as a measure of output fluctuations (IMF 2015b) or used co-integration methodology to assess both long-run and short-run association between government spending and output (Akitoby et al., 2006).

These studies find that fiscal policies tend to be more successful in smoothing the impact of economic shocks in advanced economies than in developing or emerging economies (e.g., IMF, 2015b; Akitoby et al., 2006), even though some emerging economies have recently improved (Frankel and others, 2013).

Only a few studies analyze fiscal policy cyclicality in resource-rich countries. Given the high dependence on commodity revenues, the standard methods mentioned above cannot be directly applied to resource-rich countries. The main difficulty is that in resource-rich countries both fiscal policy indicators and output fluctuations are affected by movements in commodity prices. For instance, a positive shock to commodity prices would result in higher output and would simultaneously improve the fiscal balance. In a regression framework, the automatic response to commodity price changes could result in a spurious association between the fiscal variable and output fluctuations.

To overcome these issues, two approaches have been proposed in the literature. One is based on measuring the reaction of government spending to changes in commodity prices (Arezki and others, 2011; Céspedes and Velasco, 2014). Acyclical fiscal policy implies that government spending dynamics should be delinked from movements in commodity prices, while procyclical fiscal policy implies a positive association between the two. Given that automatic stabilizers are mostly working on the revenue side, positive association between government spending and commodity prices can be interpreted as a procyclical discretionary policy.

Another approach is based on assessing the fiscal stance over the economic cycle after correcting for the impact of commodity prices (Villafuerte and others, 2010). This approach looks at the relationship between the non-resource fiscal balance and the output gap of the non-

resource economy.[2] A positive association between cyclically adjusted non-resource balance and non-resource output gap indicates countercyclical reaction of discretionary fiscal policy (excluding its commodity component) to disturbances in the non-commodity part of the economy.

Evidence from these studies suggests that fiscal policies do tend to be procyclical, but appear to have become less procyclical in recent years. Using a sample of 32 countries, Céspedes and Velasco (2014) argue that while fiscal policy was procyclical in many countries in the 1970s-80s, this was not the case in the latest resource windfall (2000s). They attribute this to improvements in institutional quality. However, their sample includes a variety of countries, and goes beyond large non-renewable commodity exporters covered in our sample. In addition, some of the results are influenced by using the overall fiscal balance (and other indicators) as a share of nominal GDP, which can distort the analysis. Abdih and others (2010) argue that policies in 28 oil-exporting countries were procyclical on average, but many countries adopted countercyclical policies in response to the international crisis in 2009. Villafuerte and others (2010), using a similar approach for a sample of Latin American countries, also find evidence of procyclicality. Erbill (2011) finds that between 1990 and 2009 political stability and higher quality of institutions combined with less binding financial constraints are associated with lower procyclicality of fiscal policy in oil exporters.

Our analysis contributes to the literature in several directions. First, we study whether policies have been procyclical using alternative approaches. Second, we take advantage of a longer time period, including the latest period of high commodity prices (1970-2014), and a larger sample of non-renewable resource-rich countries (both oil/gas and metals). Third, our focus is on countries which are more dependent on commodity resources and, as such, likely to be more affected by volatility in commodity prices.[3] Finally, our dataset includes data on non-resource fiscal balances and non-resource GDP allowing a more robust assessment of the fiscal stance than some of the previous work.

III. THE SIZE AND IMPACT OF COMMODITY PRICE FLUCTUATIONS

Resource-rich countries face large and unpredictable commodity price fluctuations. Following Cashin and others (2002), we find that the average duration of commodity price upswings

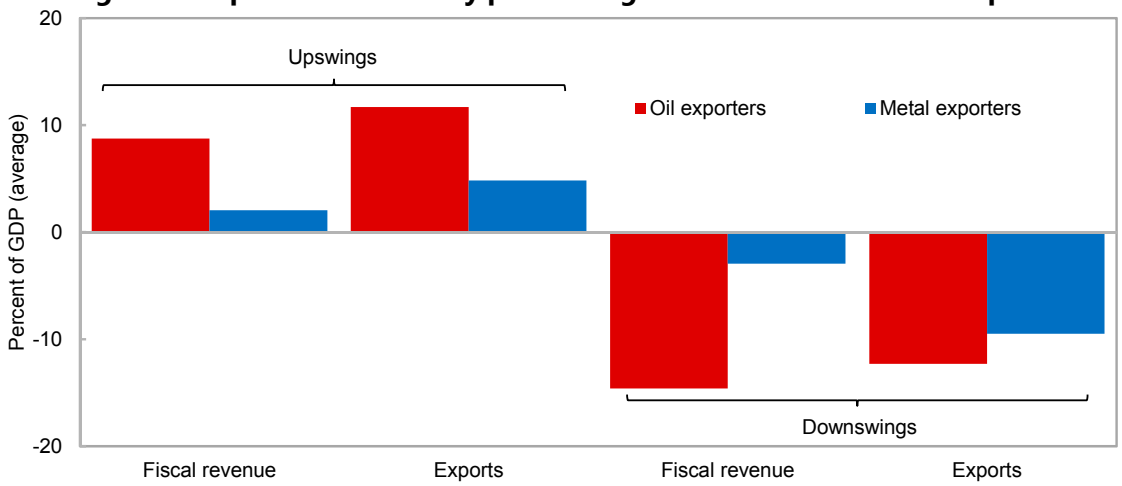
[2] The non-resource fiscal balance is measured as the difference between overall balance and commodity revenues, while non-resource GDP excludes the commodity sector/production. The output gap is measured as the difference between the actual and potential output.

[3] More specifically, we selected countries with the share of commodity exports in total exports and the share of commodity revenues in total government revenues of at least 15 percent on average for a five year period (either 2007-11 or 2009-13, depending on data availability).

(downswings) is 2-4 years,[4] but the standard deviation is large and some periods of price expansion (contraction) can last up to 10 years (Table 2). The average amplitude of changes in real commodity prices during periods of booms (percentage change from trough to peak) and busts (percentage change from peak to trough) is large, ranging from 40-50 percent (e.g., for iron ore) and 80 percent (e.g., for natural gas) for booms and 35-80 percent for busts (Table 3). Some of the booms (busts) are characterized by much larger amplitude of price changes (sometimes exceeding 200 percent). The duration of booms and busts in the metals, minerals, and oil sectors tends to be relatively longer because of the longer lags between investing in new capacity and the eventual increase in supply (World Bank, 2009).

The volatility in commodity prices can have a large impact on the external current and fiscal accounts. The average direct impact can be estimated based on the average amplitude of commodity price changes and applying it to fiscal revenues (exports) of resource-rich countries. As shown in Figure 1, the impact is large, ranging from 8-13 percent of GDP for fiscal revenues and 2-10 percent of GDP for exports. The relatively larger impact on fiscal revenues in oil exporters suggests that transmission of commodity price shocks to the economy mostly works through the fiscal channel. This is in line with results of Husain and others (2008). There is also evidence of asymmetry across phases of the commodity price cycle, with the impact being stronger in downswings compared to upswings.

Figure 1. Impact of commodity price swings on fiscal revenues and exports

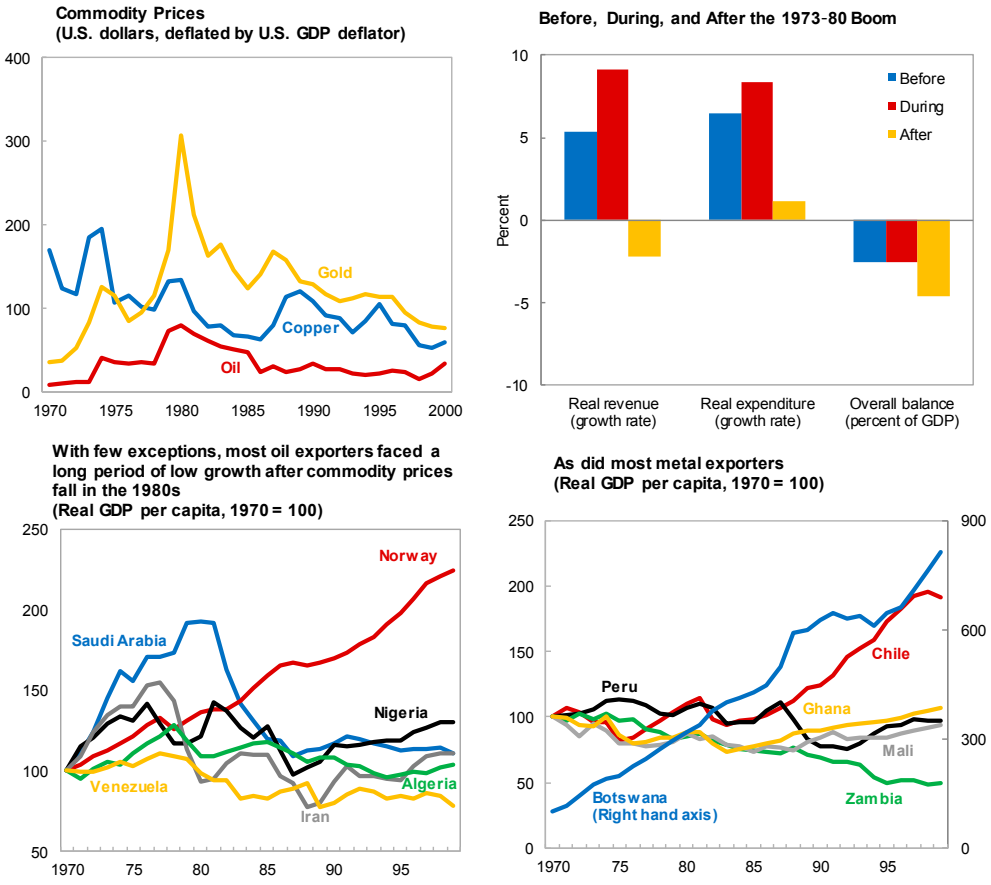


Source: IMF World Economic Outlook and authors' estimates.
Note: For upswings (downswings), the impact is estimated by multiplying fiscal revenue and exports as a share of GDP during the most recent trough (peak) by the average percentage change of commodity prices from trough to peak (peak to trough). Following Cashin and others (2002), the following parameters are used to date commodity cycles for the period 1957-2015: minimum duration of each phase = 12 months, minimum duration of a complete cycle = 24 months.

[4] Table 1 provides descriptive statistics of commodity prices. The analysis is based on commodity prices in USD by the U.S. GDP deflator.

Past and recent experiences also show that shocks can be very large for the budget and the economy. Typically, economic activity and external and fiscal balances deteriorate (improve) during commodity price downswings (upswings).[5] These price fluctuations can have a significant impact on growth. For example during the 1970s-80s boom and bust, many countries experienced revenue increases of close to 10 percent a year in real terms during the boom and subsequent large falls in the bust (Figure 2). This led to large increases in public expenditures and economic activity. But, after the bust, many commodity exporters experienced a long period of negative or stagnant growth. Similarly, many commodity exporters—after experiencing large revenue windfalls in the 2000s—are now having to manage a large fall in commodity prices. Many countries will need to endure large fiscal contractions at a time of weak economic activity.

Figure 2. The 1970s - 80s boom-bust had a long-lasting negative impact on growth for commodity exporting countries



Sources: IMF staff estimates.
Note: For panel 2, before = 1971–72, during = 1973–80, after = 1982–83.

[5] See April 2012 IMF World Economic Outlook.

IV. FISCAL CYCLICALITY

As shown in the literature, by exacerbating output volatility, procyclical fiscal policy could dampen economic growth. Fatas and Mihov (2003) show that aggressive use of discretionary fiscal policy adds to economic volatility and lowers economic growth. The Fiscal Monitor (IMF 2015b) finds that an increase in fiscal stabilization (equivalent to one standard deviation of the sample) would boost long-run annual growth rates of developing economies by 0.1 percentage points. Van der Ploeg and Poelhekke (2008) also show that volatility hurts growth among commodity exporters, with the former partially explained by volatile government expenditures.

Resource-rich countries should benefit from countercyclical policies to a greater extent than other countries. As the large volatility in prices is transmitted to the economy, this could lead to large swings in the economy. Fiscal policy can help stabilize the economy, especially as the government usually receives a large share of commodity receipts. However, evidence seems to suggest that fiscal policy, in many cases, has not been helpful. This is something that Gelb and associates (1998) already stressed during the 1970s-80s boom and bust. Some argue policies have become less procyclical (or even countercyclical) in recent years (Frankel and others, 2013; Céspedes and Velasco, 2014). However, many countries have raised expenditures massively during the latest revenue windfall and are now being forced to large procyclical expenditure cuts (IMF 2015a).

Taking advantage of our new dataset for non-renewable resource-rich countries, we revisit the evidence on fiscal cyclicality and whether it has changed over time, especially during the latest resource boom. The analysis is based on two alternative approaches: (i) the first measures the responsiveness of public expenditure growth rates to year-to-year changes in commodity prices; and (ii) the second looks at the extent to which fiscal policy is reacting to the business cycle in the non-resource sector.

A. Measure 1: Commodity prices and government spending

The first approach looks at the relation between commodity prices and government expenditures. A positive association indicates that fiscal policy is procyclical, as government spending would increase in periods of economic expansion fueled by growing commodity prices (Arezki, Hamilton, and Kazimov, 2011; Céspedes and Velasco, 2014). The advantage of this approach is that commodity prices are exogenous to domestic economic cycles and spending policies, which alleviates endogeneity issues. In addition, as historical experience shows, fiscal policy tends to react to movements in commodity prices mainly via expenditures. The drawback is that while commodity price cycles are a key determinant of the domestic economy cycle, they are not perfectly correlated.

The empirical specification takes the following form:

$$\Delta \log(RG_{it}) = \alpha_i + \beta \Delta \log(P_{it}) + \varepsilon_{it}, \quad (1)$$

in which *RG* is the real government spending. *P* is the country-specific commodity price index, measured as:

$$P_i = \sum_{j \in J} P_{ij} * w_{ij}, \quad (2)$$

in which *i* is the country, *j* is the commodity type (oil, gas, gold, tin, zinc, lead, aluminum, nickel, copper, and silver), *P* is the real commodity price (deflated by the U.S. consumer price index, CPI), and *w* is the commodity weight (commodity export share in GDP).

By using changes of government spending and commodity price variables we are abstracting from the long-run correlation of their levels. In addition, we found no evidence of a long-term relationship between the two.[6]

Changes of these variables proxy cyclical movements and positive association between changes is an indication of procyclicality; thereby government spending expands (contracts) domestic demand in good (bad) times, exacerbating non-commodity business cycles in a procyclical fashion. We also assess whether there are differences in procyclicality across expansionary and contractionary phases of the cycle, by interacting commodity price changes with a dummy variable indicating the cyclical phase.

The results suggest that commodity prices have a positive impact on government spending (Table 4), implying a procyclical fiscal policy. A 10 percent increase (fall) in commodity prices leads to a 1.2 percent increase (fall) in real expenditure growth.[7] This means that, for example, if oil prices fall by 50 percent, as in the second half of 2014, expenditures would need to contract by 6.5 percent on average—this at a time when economic growth is rapidly decelerating. The results are robust when we control for the degree of dependence on resource revenue. When distinguishing between different stages of the cycle, the results suggest that procyclicality is stronger during commodity price expansions.

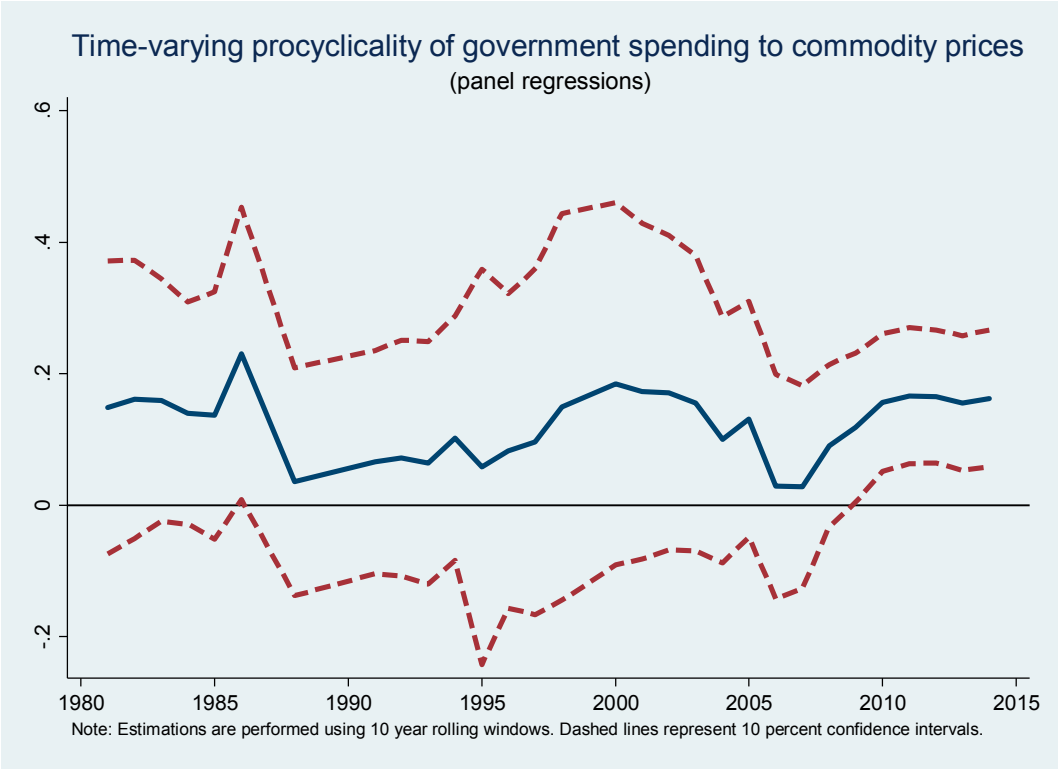
The analysis also indicates that procyclicality has not changed significantly over time. There are some country examples that suggest they saved more during the latest windfall and were able to adopt countercyclical fiscal policies in 2009 in response to the international crisis (e.g., Abdid and others, 2010). However, this was only a very temporary fall in prices and after a massive revenue windfall—as such, it would be risky to assess fiscal policy only based on that episode. In addition, Céspedes and Velasco (2014)'s assessment that the fiscal stance was countercyclical in recent years is problematic as it (in part) relies on using fiscal indicators that are not appropriate for resource-rich countries, like the overall fiscal balance as a share of total GDP (we address this

[6] The long-term relationship could be positive as countries could afford higher (lower) spending when prices are higher (lower). However, panel cointegration tests (Westerlund, 2007) suggest the two series are not co-integrated, which further supports our empirical approach of focusing on changes in expenditures and prices.

[7] Capital spending is even more procyclical compared to total spending (the coefficient is 0.15 and increases to 0.17 when controlling for dependence on resource revenue).

issue below). In fact, we do not find strong evidence that average procyclicality has declined since 1970. In particular, the regressions based on 10-year rolling windows show that average procyclicality in recent years is similar to levels seen in past decades (Figure 3). Our result is consistent with the evidence that many resource-rich countries accelerated significantly public expenditures during the 2000s, at a time when commodity prices were exceptionally high (or rising fast). In some countries public expenditures (in real terms) more than tripled during that period (IMF 2015a).

Figure 3. The degree of procyclicality appears to have been stable over time



B. Measure 2: The cyclically-adjusted non-resource balance

The second approach looks at a more traditional measure of cyclicality. In particular, the relationship between output gap and cyclically adjusted fiscal balances. If this relationship is negative, then fiscal policy is procyclical. However, as mentioned above, for resource-rich countries, a more appropriate indicator of the fiscal stance is the non-resource fiscal balance as a share of the non-resource GDP instead of the overall balance. This avoids the positive bias when measuring fiscal cyclicality (Villafuerte and others, 2010).[8] The empirical specification takes the following form:

[8] Overall fiscal balances and GDP are heavily influenced by movements in commodity prices and as such should not be used to assess how policies are changed in response to prices. For example, an improvement in fiscal

$$\frac{CA\_BAL\_NC_{it}}{GDP\_NC_{it}} = \alpha_i + \beta GAP\_NC_{it} + \varepsilon_{it}, \quad (3)$$

in which *CA_BAL_NC* is the cyclically adjusted non-resource balance (assuming elasticities of 1 for revenues and 0 for expenditures), *GDP_NC* is the non-resource GDP, and *GAP_NC* is the non-resource GDP gap. Coefficient β captures the degree of fiscal cyclicality (a negative coefficient implies procyclicality). The equation is estimated using the fixed effects estimator. In order to assess robustness of the results, non-resource GDP growth is used instead of the non-resource output gap, given the high uncertainty when measuring output cycles.

The results suggest that governments tend to loosen the fiscal stance when the domestic non-resource economy strengthens, and tighten the fiscal stance when the economy weakens (Table 5), confirming the procyclical bias of fiscal policy. A 1 percentage point improvement in the non-resource output gap leads to a 1 percentage point deterioration of the cyclically adjusted non-resource balance as a share of potential non-commodity GDP. Replacing output gap with real GDP growth rates (for the non-resource economy) does not alter the negative association. Moreover, commodity exporters tend to be more procyclical than other emerging economies. Notably, IMF (2015b) found that emerging markets and developing economies also tend to act procyclically in expansions, but with a coefficient half of the size of the figure found here for commodity exporters (around 0.5).

C. Can institutions help reduce procyclicality?

Why fiscal policies tend to be procyclical if this leads to volatility and potentially much weaker growth? Given that commodity price shocks can be very persistent, public expenditures may be increased significantly if revenues are expected to remain high for long. Once prices disappoint, there is a need for expenditure cuts. While the decision to respond in a procyclical fashion to movements in prices may be consistent with affordability arguments (if richer, it could be optimal to raise spending), it is not so when considering stabilization objectives. As the commodity windfall is likely to boost the domestic economy, accelerating public spending may be destabilizing.[9] Furthermore, countries may expand spending beyond what is feasible under affordability considerations. For example, Manzano and Rigobon (2001) argue that the problems faced by resource-rich countries mainly reflect debt overhang as countries borrow during booms and need to adjust during busts. This, at least in part, reflects the weak political institution

balances when commodity prices rise does not imply there was a tightening of the fiscal stance (the opposite may be true). Similarly, governments may react to a rise in prices by boosting expenditures and lead to a strong fiscal impulse to the domestic economy, even when the overall fiscal balance improves—thanks to a large increase in commodity revenue (originated from export receipts).

[9] The large scaling up of public spending could also have a negative impact on its quality and effectiveness. See IMF (2015a) for more discussion on this.

argument which identifies these economies as more prone to rent-seeking in the face of large commodity windfalls (Tornell and Lane, 1999).

In an attempt to restrict fiscal policy, many countries have adopted fiscal rules and resource funds, more generally defined as special fiscal institutions. Special fiscal institutions collect a large number of rules, mechanisms and devices specifically aimed at the management of commodity revenues from a fiscal perspective.[10] In this section we look at the impact of these rules and resource funds on procyclicality.

For our analysis, we consider only rules that have been strictly designed to regulate the accumulation or use of resource revenues, including rules that are established for the functioning of a fund (either saving or stabilization fund). At times funds have been established without a legally binding rule for the accumulation and withdrawal of assets. Hence, the estimation below features both a dummy for fiscal rules and a dummy for when a fund is in place (with or without a rule). To complement the analysis, we will also look at the impact of broader political institutions. We selected some institutional variables from the World Governance Indicators and the International Risk Group databases; notably bureaucratic quality, corruption, political risk and strength of the institutional and legal setting. The Polity variable comes from the Polity IV dataset and captures the quality of democratic institutions and rule of law.

To analyze the impact of institutional characteristics and fiscal rules and resource funds, the commodity price index is interacted with respective measures of institutional quality and fiscal rules/resource funds. The empirical specification takes the following form:

$$\Delta \log(RG_{it}) = \alpha_i + \beta \Delta \log(P_{it}) + \gamma \Delta \log(P_{it}) * I_{it} + \varepsilon_{it}, \quad (4)$$

in which *I* stands for the index of institutional quality (a continuous variable) and the existence of a fiscal rule or a resource fund in place (a dummy variable). Coefficient γ measures the extent to which institutions and rules/funds can affect procyclicality (a negative coefficient would imply a reduction in procyclicality in countries with better institutions and fiscal rules/resource funds).

The estimation results suggest that experience with resource funds and fiscal rules has been mixed (Table 6). While the interaction term is negative, consistent with the hypothesis of a reduction in procyclicality following the adoption of fiscal rules/resource funds, it is not significant. The econometric findings match with the widespread empirical evidence where with the exception of notable successes in Botswana, Chile, and Norway, many other countries are still

[10] These fiscal rules are different from the more common rules aimed at restricting fiscal policy at large and adopted also by countries other than resource rich (for a description of the latter see Schaechter and others, 2012, and the IMF database http://www.imf.org/external/datamapper/FiscalRules/map/map.htm). Other types of special fiscal institutions include stabilization funds, saving funds, and investment funds when the latter are related to the investment of resource receipts (see Table 9 in the appendix with the rules and institutions considered in this paper).

struggling to improve compliance and efficacy of their special fiscal institutions. Reasons for this lack of success are varied.

The existence of a fiscal rule or fiscal fund does not necessarily indicate *a de facto* compliance with the rule. As evidence shows many rules tend to be breached especially in bad times. Lack of compliance could be due to several factors, such as lack of political will, poor design of the rule and absence of monitoring and enforcement bodies. In Nigeria, for example, the rule was repeatedly undermined by weak enforcement. In other countries, like Chad, Ecuador, and Timor Leste, rules were breached as they became incompatible with budget and developmental priorities of the authorities. In some other cases, due to the rule design, governments embarked in extra-budgetary operations which made the rules ineffective and weakened budgetary control (Mongolia, Azerbaijan, Kazakhstan and Libya). In some cases, lack of *coordination* between the activities related to a resource fund and ordinary budgetary operations resulted in accumulation of financial assets in funds at times when governments had to borrow expensively to finance deficits (Ghana and Trinidad and Tobago).[11]

There is empirical support, however, that the quality of political institutions helps limit the procyclical bias in spending.[12] In some cases the impact can be highly significant (Table 7). For example, procyclicality would be eliminated in countries with the degree of bureaucratic quality or quality of institutional and legal setting around two standard deviations above the mean. In part, this reflects the fact that the average quality of institutions tends to be weaker in resource-rich countries than in other countries (Figure 4). This evidence also suggests that the lack of success of rules and funds in some countries may owe more to the underlying weaknesses of their institutional frameworks than to the rules themselves.

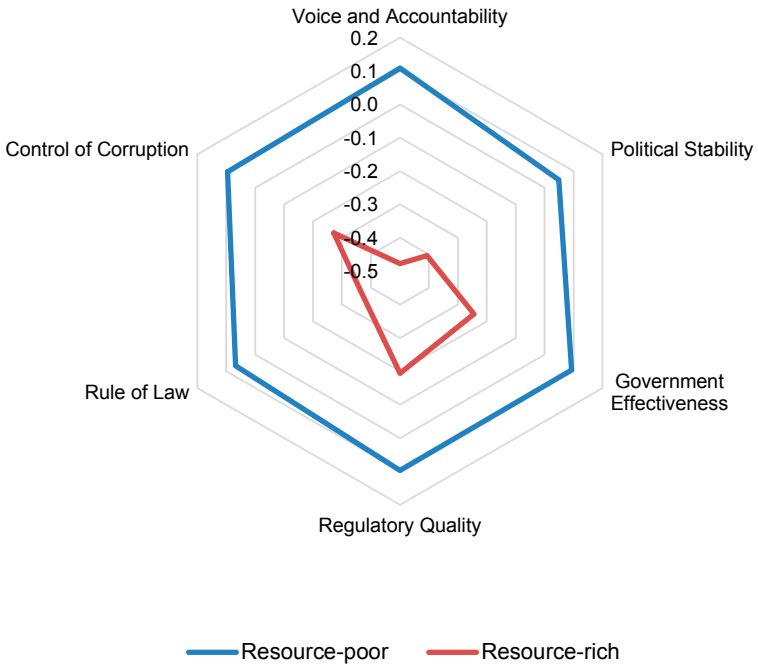
Some countries have been successful in limiting the negative impact of the commodity prices volatility and promote sustainable economic growth. Namely, the quality of institutions in Norway, Chile, and Botswana is higher than among their peers, which helped support fiscal policy and achieve stronger and higher long-term growth (see Figure 2). They also show that fiscal rules or resource funds can help achieve policy objectives if they are supported by strong institutions and political commitment, are well-designed, and are closely linked to broader policy objectives. The examples of Chile and Norway show that the rules can both help discipline policies and allow

[11] See Ossowski and others (2008) and Sugawara (2014) for a review.

[12] These results are similar to those found in earlier studies (Ossowski and others, 2008). Frankel and others (2013) also stress the importance of quality of institutions, while Akitoby and others (2004) argue strengthening checks and balances can also help reduce the cyclicality of government expenditures.

for flexibility to respond to economic conditions—thanks to large financial buffers built during resource booms and strong market credibility.[13, 14]

Figure 4. Institutional quality in resource-rich countries is weaker than in other countries



Source: Worldwide Governance Indicators (World Bank) and authors' estimates.
Note: The chart shows average levels of institutional quality for resource-rich and resource-poor countries with the same level of GDP per capita (sample average for resource-rich countries). Larger numbers indicate higher institutional quality. Sample period: 1996-2014.

[13] The strong institutional framework allowed Chile to react in a countercyclical fashion to the sudden and large 2008-09 commodity price fall. During the commodity boom, Chile increased net financial assets significantly. This allowed a large easing of fiscal policy in 2008-09 in response to the global financial crisis (went from a 8 percent overall surplus in 2007 to a 4 percent fiscal deficit in 2009). See also Frankel (2011) for further discussion on Chile.

[14] The Norwegian fiscal framework is anchored on a strong political commitment to a non-oil balance target. Oil/gas revenue is saved in an oil fund and only the returns from financial investments are used to fund the budget. Under the framework, the non-oil deficit should average 4 percent of the assets in the oil fund over the economic cycle. The rule allows to insulate the budget from yearly movements in the oil and gas prices. Norway's framework has not only resulted in the buildup of large financial savings, but also helped sustain GDP per capita growth above most other resource-rich countries over the last 4 decades.

V. How Do Non-Resource Revenues Respond to Commodity Revenue Shocks?

In this section we analyze how non-resource revenues react to fluctuations in commodity revenues (heavily influenced by commodity prices). Most of previous studies on how resource-rich countries react to commodity price shocks has focused on expenditures—as, indeed, it tends to be the main channel. However, countries can also respond to shocks by changing their tax effort.

The existing studies assess the reaction of non-resource revenues to persistent changes in commodity revenues in oil/gas exporters (see Bornhorst and others, 2009; Thomas and Trevino, 2013; Crivelli and Gupta, 2014). They find that countries tend to offset rising commodity revenue by a reduction in non-resource tax effort.[15]

We expand the analysis in two main directions: (i) we use a broader set of commodity exporters and scale the commodity and non-commodity revenues by the non-commodity GDP to alleviate the endogenous impact of commodity price changes on the denominator, and (ii) we analyze both long-run and short-run reaction to changes in commodity revenues using the Pooled Mean Group (PMG) estimator of Pesaran and others (1999). The empirical specification is:

$$\Delta\left(\frac{R_{it}^{NC}}{Y_{it}}\right) = \phi_i\left[\frac{R_{it}^{NC}}{Y_{it}} - \alpha - \beta\frac{R_{it}^{C}}{Y_{it}}\right] + \delta_i\Delta\left(\frac{R_{it}^{C}}{Y_{it}}\right) + \mu_i + \varepsilon_{it}, \quad (5)$$

in which *i* and *t* indexes denote country and time, *Y* is the nominal GDP (non-commodity), *R* is government non-commodity (*NC*) and commodity (*C*) revenues, μ is the country-specific fixed effect, and ε is an *i.i.d.* error term. The term in the squared bracket is the error-correction term measuring the extent of the deviation of the non-commodity revenue from its long-run equilibrium value. β measures the *long-run* reaction of non-commodity revenues to a permanent change in commodity revenues and corresponds to the coefficient estimates in Bornhorst and others (2009), and Crivelli and Gupta (2014). Similarly, δ measures the *short-term* effect of non-commodity revenue to a temporary change in non-commodity revenue. ϕ is the speed of adjustment of non-commodity revenue to its long-run equilibrium: the larger is the coefficient (in absolute terms), the faster is the adjustment. Finally, the country-specific fixed effects included in the specification capture unobserved heterogeneity of non-commodity revenue across different countries.

Our results suggest that resource-rich countries adjust tax effort in response to persistent changes in commodity revenues, but there is limited reaction to temporary changes. Table 8 shows that a permanent increase in commodity revenues by 1 percent of non-commodity GDP tends to reduce non-commodity revenues by 0.03-0.04 percent of non-commodity GDP. Temporary changes in commodity revenues (up to three years lag) do not have a significant

[15] A 1 percent of GDP increase in hydrocarbon revenues leads to about 0.2 percent reduction of non-hydrocarbon revenues over the long-run (Bornhorst and others, 2009).

impact on non-commodity revenues. Countries do not seem to change non-commodity revenue effort in response to temporary commodity revenue shocks, letting the automatic stabilizers work. In addition, half of the deviation from the long run association between commodity and non-commodity revenues is corrected in four years, providing further evidence on the sluggish adjustment of non-commodity revenues.

VI. CONCLUSIONS

Fiscal policy in resource-rich countries tends to be highly procyclical and more so than for other economies. Contrary to other studies, we do not find evidence that procyclicality has declined over time. We also find that adoption of fiscal rules or resource funds do not have a significant impact on fiscal cyclicality, but general political institutions do help. The lack of progress on these likely partly explains why fiscal procyclicality, on average, has not declined in recent years.

Our results have important policy implications. First, more efforts are needed to establish a comprehensive fiscal policy framework in resource-rich countries that can help cope with heightened uncertainty and volatility. These frameworks should be based on a solid long-term anchor to guide fiscal policy and should explicitly incorporate commodity price uncertainty. This means putting more emphasis on building precautionary savings during good times to help weather shocks in a countercyclical fashion. Next, further efforts to improve the institutional framework are needed, including enhancing transparency and accountability. Tax policies aimed at diversifying the revenue base would reduce government's overdependence on commodity revenues and improve its ability to run countercyclical policies. Finally, efforts to diversify the economy beyond the commodity sector are also critical.

ANNEX 1. DATA

The primary data sources for the analysis are the IMF's *International Financial Statistics* (IFS), *Balance of Payments Statistics*, *Direction of Trade Statistics*, World Economic Outlook database, and fiscal rules databases; the World Bank's *World Development Indicators* and *World Governance Indicators*; the Macro Data Guide Political Constraint Index Dataset (POLCON); POLITY IV and *International Country Risk Guide* data. Data for all variables of interest are collected on an annual basis from 1970 to 2013, where available. We also use monthly data on commodity prices over 1957-2015 period.

The sample is comprised of 48 countries that are exporters of oil, gas, and metals (such as copper, gold, iron, and silver), where these commodities represent a large share of exports (20 percent or more of total exports) or fiscal revenues (15 percent or more) over a large part of the period under consideration. The countries are: Algeria, Angola, Australia, Azerbaijan, Bahrain, Bolivia, Botswana, Brunei Darussalam, Cameroon, Canada, Chad, Chile, Colombia, Democratic Republic of Congo, Republic of Congo, Côte d'Ivoire, Ecuador, Gabon, Ghana, Guinea, Guyana, Indonesia, Iran, Iraq, Kazakhstan, Kuwait, Libya, Mali, Mauritania, Mexico, Mongolia, Nigeria, Norway, Oman, Papua New Guinea, Peru, Qatar, Russia, Saudi Arabia, South Africa, Sudan, Suriname, Syria, Trinidad and Tobago, United Arab Emirates, Venezuela, Yemen, and Zambia. The sample varies for each analysis depending on data availability.

Tables

Table 1. Descriptive statistics: Commodity price growth rates

	Sample	Obs.	Mean	Median	St. Dev.	Skewness	Kurtosis
Aluminium	Feb 1957-Jan 2015	696	-0.133	-0.188	4.66	-0.504	8.380
Copper	Feb 1957-Jan 2015	696	-0.009	0.084	6.63	-0.477	6.351
Gold	Feb 1957-Jan 2015	612	0.254	-0.199	4.69	1.091	11.563
Iron ore	Feb 1975-Jan 2015	480	0.145	-0.295	5.56	3.812	36.452
Gas (EU)	Feb 1985-Jan 2015	360	0.033	-0.206	6.43	-0.635	18.460
Gas (US)	Feb 1991-Jan 2015	288	0.063	-0.310	13.34	-0.042	3.950
Tin	Feb 1957-Jan 2015	696	0.008	-0.107	4.98	-0.474	6.719
Oil (Brent)	Feb 1957-Jan 2015	696	0.146	-0.243	8.38	4.354	65.932
Oil (Texas)	Feb 1957-Jan 2015	696	0.099	-0.279	7.11	2.088	34.853

Source: IMF World Economic Outlook.

Note: Reported are descriptive statistics for real m-o-m growth rates.

Table 2. Duration of commodity price expansions and contractions

		Mean	Median	St. Dev.	Freq.	Min	Max
Alluminium	Expansions	29.3	18.0	24.4	11	11	86
	Contractions	34.1	34.0	14.6	11	12	65
Copper	Expansions	38.5	24.5	33.0	8	17	112
	Contractions	43.2	44.0	26.9	9	12	81
Gold	Expansions	36.4	26.0	38.7	8	3	125
	Contractions	40.3	33.5	22.1	8	17	79
Iron ore	Expansions	29.2	13.0	34.6	6	12	99
	Contractions	43.7	47.0	20.9	7	11	72
Gas-EU	Expansions	30.8	24.5	23.9	6	7	76
	Contractions	29.3	27.0	13.6	6	15	53
Gas-US	Expansions	23.8	19.0	15.9	6	13	55
	Contractions	20.9	15.0	14.5	7	6	47
Tin	Expansions	25.1	23.0	8.8	11	12	38
	Contractions	35.1	19.0	46.5	12	14	179
Oil-Brent	Expansions	28.3	21.0	20.5	11	12	79
	Contractions	32.2	23.5	30.3	12	8	107
Oil-Texas	Expansions	28.3	22.5	21.3	10	12	78
	Contractions	37.6	23.0	35.1	11	8	115

Source: IMF World Economic Outlook and authors' calculations.

Note: Phases of expansions and contractions are defined using the Harding and Pagan (2002) algorithm. Sample period: January 1957-March 2015.

Table 3. Amplitude of commodity price expansions and contractions

		Mean	Median	St. Dev.	Freq.	Min	Max
Alluminium	Expansions	40.9	52.4	35.0	11.0	1.6	107.1
	Contractions	-51.6	-49.6	42.2	11.0	-140.0	-6.2
Copper	Expansions	78.6	70.2	45.6	8.0	25.2	172.0
	Contractions	-72.4	-85.4	34.5	9.0	-113.1	-17.1
Gold	Expansions	63.3	28.9	64.3	8.0	7.3	166.1
	Contractions	-47.5	-48.5	24.4	8.0	-91.1	-9.9
Iron ore	Expansions	50.4	14.4	96.0	6.0	0.9	245.6
	Contractions	-35.9	-27.3	35.5	7.0	-107.6	-5.9
Gas-EU	Expansions	63.6	54.2	58.7	6.0	3.0	168.8
	Contractions	-63.4	-58.7	30.5	6.0	-113.0	-21.5
Gas-US	Expansions	80.1	84.3	25.1	6.0	33.7	110.5
	Contractions	-78.9	-69.5	49.3	7.0	-154.9	-14.4
Tin	Expansions	50.6	49.3	34.2	11.0	9.0	117.1
	Contractions	-47.8	-44.6	48.2	12.0	-192.2	-12.3
Oil-Brent	Expansions	63.0	57.3	51.5	11.0	4.2	175.4
	Contractions	-57.8	-51.2	43.6	12.0	-162.7	-2.9
Oil-Texas	Expansions	65.5	63.0	50.6	10.0	0.4	166.7
	Contractions	-51.8	-45.7	40.1	11.0	-138.6	-9.3

Source: IMF World Economic Outlook and authors' calculations.

Note: Phases of expansions and contractions are defined using the Harding and Pagan (2002) algorithm. Sample period: January 1957-March 2015.

Table 4. Estimation results: Government spending and commodity prices

	I	II	III	IV	V	VI	VII	VIII
	Dependent variable: total expenditure growth rate				Dependent variable: capital expenditure growth rate			
Δ log of commodity prices	0.119**		0.121**		0.147*		0.169**	
	[0.052]		[0.057]		[0.081]		[0.086]	
Δ log of commodity prices*Dummy (=1 for commodity price expansions)		0.148**		0.157**		0.205**		0.223**
		[0.059]		[0.065]		[0.095]		[0.101]
Δ log of commodity prices*Dummy (=1 for commodity price contractions)		0.073		0.070		0.074		0.102
		[0.068]		[0.072]		[0.103]		[0.108]
Share of commodity sector value added in GDP			0.004***	0.004***			0.006***	0.006***
			[0.001]	[0.001]			[0.001]	[0.001]
Constant	0.124**	0.038	-1.193	-1.198	0.055	0.017	0.029	0.034
	[0.058]	[0.045]	[1.281]	[1.245]	[0.058]	[0.054]	[1.145]	[1.153]
Observations	902	902	824	824	1346	1346	1239	1239
Number of countries	41	41	41	41	38	38	38	38
R^2	0.079	0.080	0.107	0.109	0.079	0.080	0.102	0.103

Note: Dependent variables are real total expenditure (Columns I-IV), and capital expenditure (Columns V-VIII) growth rates. Estimations are performed using the fixed effects estimator with AR(1) residuals and time effects. Robust standard errors are in brackets. *, **, and *** denote significance at 10, 5, and 1 percent levels, respectively.

Table 5. Estimation results: Non-commodity output gap and cyclically-adjusted non-commodity balance

	I	II
Non-commodity output gap	-0.945***	
	[0.225]	
Non-commodity GDP growth		-0.215***
		[0.011]
Constant	-0.266***	-0.254***
	[0.039]	[0.039]
Observations	770	765
Number of countries	41	41
R^2	0.14	0.279

Note: Dependent variable is cyclically-adjusted non-commodity balance. Estimations are performed using the fixed effects estimator with time effects. Robust standard errors are in brackets. *, **, and *** denote significance at 10, 5, and 1 percent levels, respectively.

Table 6. Impact of fiscal rules on fiscal procyclicality

	I	II	III	IV	V
Δ log of commodity prices	0.119**	0.143**	0.164**	0.151**	0.176**
	[0.052]	[0.066]	[0.069]	[0.063]	[0.070]
Δ log of commodity prices*Savings fund dummy		-0.022			
		[0.071]			
Δ log of commodity prices*Stabilization fund dummy			-0.058		
			[0.064]		
Δ log of commodity prices*Fiscal rule dummy				-0.078	
				[0.088]	
Δ log of commodity prices*Fiscal rule or savings/stabilization fund dummy					-0.075
					[0.063]
Constant	0.124**	0.123*	0.125*	0.125*	0.128*
	[0.058]	[0.073]	[0.073]	[0.073]	[0.073]
Observations	902	718	718	718	718
Number of countries	41	34	34	34	34
R^2	0.079	0.083	0.084	0.084	0.085

Note: Dependent variable is real expenditure growth rate. Estimations are performed using the fixed effects estimator with AR(1) residuals and time effects. Robust standard errors are in brackets. *, **, and *** denote significance at 10, 5, and 1 percent levels, respectively.

Table 7. Impact of institutions on fiscal procyclicality

	I	II	III	IV	V	VI
Δ log of commodity prices	0.119**	0.142*	0.341***	0.214**	0.609***	0.266**
	[0.052]	[0.076]	[0.090]	[0.095]	[0.178]	[0.115]
Δ log of commodity prices*Polity		-0.008				
		[0.006]				
Δ log of commodity prices*Bureaucratic quality			-0.087***			
			[0.029]			
Δ log of commodity prices*Corruption				-0.027		
				[0.024]		
Δ log of commodity prices*Political risk					-0.007***	
					[0.002]	
Δ log of commodity prices*Institutional and legal setting						-0.003*
						[0.001]
Constant	0.124**	0.155*	0.05	0.039	0.034	0.127**
	[0.058]	[0.086]	[0.055]	[0.056]	[0.028]	[0.060]
Observations	902	464	805	805	804	716
Number of countries	41	22	41	41	41	33
R^2	0.079	0.101	0.089	0.079	0.088	0.092

Note: Dependent variable is real expenditure growth rate. Estimations are performed using the fixed effects estimator with AR(1) residuals and time effects. Robust standard errors are in brackets. *, **, and *** denote significance at 10, 5, and 1 percent levels, respectively.

Table 8. Impact of commodity revenue shocks on non-commodity revenues

	I	II	III
Long-run coefficients			
Commodity revenue/non-commodity GDP (lagged)	-0.033***	-0.035***	-0.040***
	[0.007]	[0.008]	[0.007]
Constant	19.576***	19.829***	20.006***
	[0.412]	[0.463]	[0.380]
Short-run coefficients			
Speed of adjustment	-0.156***	-0.150***	-0.169***
	[0.042]	[0.044]	[0.045]
Δ Commodity revenue/non-commodity GDP	-0.072	-0.046	-0.085
	[0.075]	[0.102]	[0.150]
Δ Commodity revenue/non-commodity GDP (1 lag)		-0.057	-0.071
		[0.132]	[0.207]
Δ Commodity revenue/non-commodity GDP (2 lags)			-0.244
			[0.175]
Observations	744	703	676
Log likelihood	-1545.3	-1432.0	-1321.0
Half life (years)	4.1	4.3	3.7

Note: Dependent variable is the change in non-commodity revenue ratio. Estimations are performed using the Pooled Mean Group (PMG) estimator. *, **, and *** denote significance at 10, 5, and 1 percent levels, respectively.

Table 9. Resource funds and rules

	SWF 1/	Saving Fund		Stabilization Fund		Fiscal Rule	
	Yes=1; No=0	Yes=1; No=0	Dates	Yes=1; No=0	Dates	Yes=1; No=0	Dates
Algeria	1	0		1	2000	0	
Angola	1	1	2012	1	2012	0	
Azerbaijan	1	1	1999	1	1999	1	1999
Bahrain	1	0		1	2000	0	
Bolivia	0	0		0		0	
Botswana	1	1	1993	1	1972	1	1994
Brunei Darussalam	0	0		0		0	
Cameroon	0	0		0		0	
Chad	1	1	2008	1	2008	0	
Chile	1	1	1985	1	1985	1	2006
Colombia	1	0		1	1995	0	
Congo	0	0		0		0	
Congo DRC	0	0		0		0	
Cote D'Ivoire	0	0		0		0	
Equatorial Guinea	1	1	2002	0		1	2002
Ecuador	1	1	2005	1	1999-2007	1	2002
Gabon	1	1	1998	0		1	1998
Ghana	1	1	2011	1	2011	1	2011
Guinea	0	0		0		0	
Guyana	0	0		0		0	
Indonesia	0	0		0		0	
Iran	1	0		1	2000	0	
Iraq	0	0		0		0	
Kazakhstan	1	1	2000	1	2000	1	2000
Kuwait	1	1	1960	1	1960	0	
Libya	1	1	1995	0		0	
Mali	0	0		0		0	
Mauritania	1	0		1	2000	0	
Mexico	1	0		1	2000	0	
Mongolia	1	0		1	2011	0	
Mozambique	0	0		0		0	
Niger	0	0		0		0	
Nigeria	1	1	2011	1	2004	0	
Norway	1	1	1985	1	1985	1	2002
Oman	1	1	1980	0		0	
Papua New Guinea	1	0		1	1974-2001	0	
Peru	1	0		1	1999	0	
Qatar	1	0		1	2000	0	
Russia	1	0		1	2004	1	2008
Saudi Arabia	0	0		0		0	
Sudan	1	0		1	2002	0	
Suriname	0	0		0		0	
Syria	0	0		0		0	
Timor Leste	1	1	2005	1	2005	1	2005
Trinidad and Tobago	1	1	1999	1	2005	1	2007
UAE	0	0		0		0	
Venezuela	1	1	1999	0		1	2000
Yemen	0	0		0		0	
Zambia	0	0		0		0	

Note: 1/ Sovereign Wealth Funds (SWF) here capture only saving and stabilization funds.

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